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A GREEN ROOFS FOR HEALTHY CITIES PUBLICATION

VOLUME 17 / ISSUE 4 / WINTER 2015

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Confessions of A Green Scientist – Cynthia Rosenzweig Peers Into NYC’s Challenging Future
From Florida to Alberta – Details on the Incredible 2015 Award Winning Projects and People
14 Great Reasons to Increase Public Investment in Green Infrastructure



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WINTER 2015

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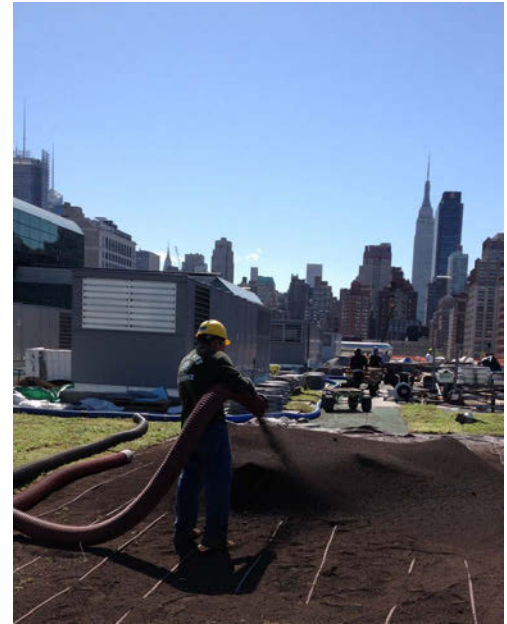
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Correction: Fall 2015's article titled: Many Residential Roofs Opt for Food Production was written by George Irwin. All photos included in the article are credited to George Irwin & Green Living Technologies International, LLC.

ON THE COVER: Award winning intensive industrial/commercial project from Savino & Miller Design Studio (see page 18)

Photo Credit: Paul Morris



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MISSION

Green Roofs for Healthy Cities' mission is to develop and
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nomic, social and environmental benefits of green roofs,
green walls, and other forms of living architecture through
education, advocacy, professional development and celebra-
tions of excellence.

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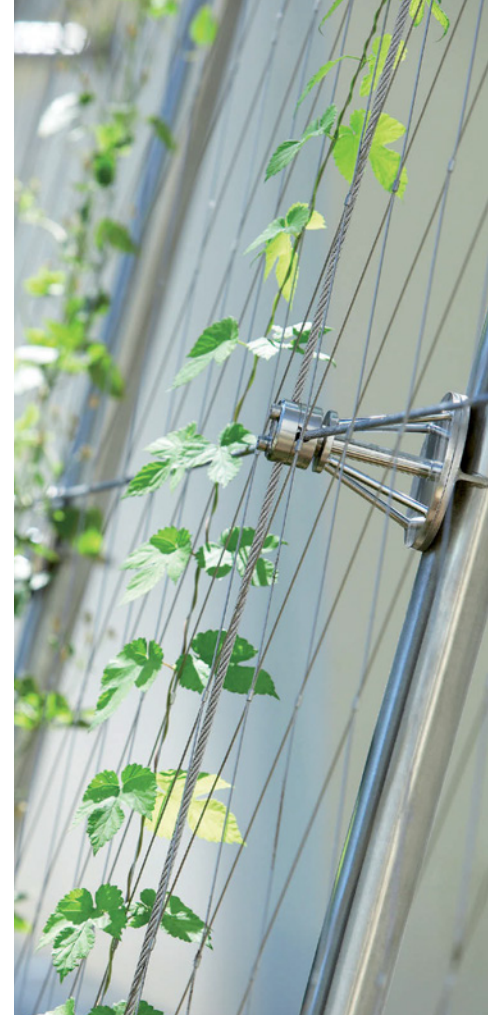
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THE CHALLENGE: TWENTY-FIVE MILLION SQUARE FEET OF GREEN ROOFS FOR NEW YORK CITY BY 2022!

At our 10th Anniversary *CitiesAlive* in Chicago in 2012 we proposed to work together to increase the amount of green roofs installed in the U.S. and Canada by 1 billion square feet by 2022. This aspirational goal represents a significant increase over the approximately 100,000 million square feet installed in our first 10 years. In order to attain this goal, we need to work really hard to convince even more policy makers to include green roof regulations and incentives as part of their ongoing efforts to manage stormwater, save energy, reduce the urban heat island effect, generate employment opportunities, reduce air pollution and create healthy new green spaces – all of which contribute to more resilient, healthy, livable, happy and sustainable communities.

At *CitiesAlive* New York in October 2015, we issued a challenge to New York's public and private sector leadership to work towards the goal of contributing their portion of our 1 billion square foot goal, on a per capita basis, or 25 million square feet of green roofs installed by 2022. Significant green roof and wall progress has been made in New York, to be sure, but the Region

still falls far behind its full potential of implementing these technologies. In 2014, Metropolitan New York installed approximately 350 thousand square feet in total. In order to reach 25 million square feet by 2022, they would need to install an average of 3 million square feet every year. Given the climate change challenges it faces (see interview with Cynthia Rosenzweig in this issue), green roof implementation has the potential to not only help make the city become more resilient, but also contribute to all of the growth, equity, sustainability and resiliency goals of Mayor de Blasio.

During the conference, we identified new opportunities to focus green roof and wall incentives and regulations in areas, such as specific neighborhoods, where they will provide the greatest public benefit: communities that experience regular flooding or more intensive urban heat island effects. Additional research is needed to fine tune policies no doubt, but in the meantime fixing an ineffective tax incentive and significantly expanding grant programs would go a long way to helping improve implementation in the short term.

Meanwhile, other cities, such as Portland,

Oregon and San Francisco, California are now developing mandatory green roof requirements that may become law in 2016. Countries such as France and Ireland are also in the midst of considering either mandatory requirements or financial incentives for all new buildings. Public sector investment brings a tremendous opportunity to deliver a multitude of public benefits from widespread green roof and wall implementation, (see OTRW... In Pursuit of Happiness) and also the opportunity to become extremely creative in designing and implementing entirely new building envelopes. In this, the Awards of Excellence Issue, we bring you details of some of these incredible projects, from Northern Alberta to Southern Florida.

Thank you all for your support, and happy holidays.

Steven W. Peck, GRP
Founder & President, GRHC

LAM INDEX

Amount of NYC committed investment in housing/infrastructure by 2018:
\$17 Billion

Construction jobs from 25 million ft² created: **15,000**
Annual maintenance costs of 25 million ft: **\$26 million**
Number of maintenance jobs: **900**

Estimated cost of 25 million ft² (70% extensive/30% intensive/10% food):
\$628 Million

Selected annual public and private benefits resulting from 25 million ft² (energy, stormwater, urban heat island, tax revenue): **\$75 Million**

STRATA

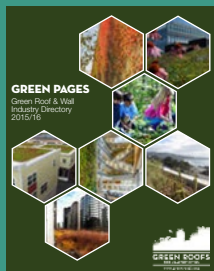


LIVING ARCHITECTURE DOCTOR

Many green roofs and walls suffer from design and maintenance issues, creating an emerging market for diagnosis and treatment. The Living Architecture Doctor is a new feature that challenges you to figure out what went wrong and how to fix it. Test your skills – tell us what went wrong on this interior green wall (left)? Diagnose the problem by emailing editor@greenroofs.org. Your response could be featured in the next issue of the Living Architecture Monitor magazine.



THE TREATMENT LAST ISSUE:
“These plants failed likely due to being exposed to too much water and not enough natural light. They need to be replaced.”



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JOURNAL

OF LIVING ARCHITECTURE - VOL. 2, ISSUE 2

The Journal of Living Architecture (JOLA) is the official, peer-reviewed journal of Green Roofs for Healthy Cities.

The JOLA is written, reviewed, and edited by living architecture research professionals, sharing with their colleagues: successful educational applications, original research findings, scholarly opinions, educational resources and challenges on issues of critical importance to living architecture professionals and educators.

The JOLA is published exclusively on the *Living Architecture Monitor* magazine website. The magazine publishes the abstracts of each published JOLA manuscript, with a link to the full paper online.

FEATURE

Green Roof Plant Trials for the Central Great Plains, Richard K. Sutton

Forty-three taxa representing native and adaptable plants were trialed for 4 years on an irrigated (as needed) 15 cm (6 inch) deep extensive green roof in Lincoln, NE. Twenty-three of the taxa showed good performance with minimal maintenance. At the end of the trial in fall 2014, 32 of the taxa still had at least one specimen surviving. Drought impacts in the trial's second year eliminated several taxa. Presented here are results and the positive findings of four new extensive green roof taxa, *Festuca cinerea*, *Carex glauca*, *Eragrostis trichodes*, and *Distichilis spicata*.

Read the entire paper here: <http://goo.gl/oePdvR>

FEATURE

Observation of biodiversity on minimally managed green roofs in a tropical city, Yun Hye HWANG, Zi En Jonathan YUE

While much of the land in Singapore has been urbanized, green roofs have the potential to be part of an urban ecosystem where limited human interference can promote natural processes. This study observes the establishment of flora and fauna communities on two newly installed green roofs using a mix of seeding, transplantation and spontaneous colonization installation methods and operating under minimal management over a period of 16 months. Recorded here are plant compositions and spatial distributions of flora growth of 64 species over this period. The minimally managed green roofs in this study possess increased plant species richness, highlighting a way to enhance urban diversity in a tropical city.

Read the entire paper here: <http://goo.gl/oePdvR>



FOUR EXPERTS ON THE PURSUIT OF HAPPINESS

Happiness; its pursuit has not traditionally been a central focus of the green building movement, engineering, architectural and landscape design or planning professions. From the recent book, “Happy City” by Charles Montgomery to the new Well Building Standard, professionals are grappling with the often elusive concept of happiness, and how to best achieve it. So we asked the following experts to share their thoughts about happiness in the context of their professional work and what it means for them to ‘design’ for happiness.

LAM - What does happiness mean to you, from the perspective of your profession?

EFC - The architectural profession has an obligation to protect human health, safety and welfare. Promoting happiness through design is an important way to improve human welfare. My focus is incorporating nature, natural systems and processes directly and indirectly into the built environment – also known as biophilic design. 99% of human evolution occurred in a natural environment, yet we spend 90% of our time in human constructed environments. Humans often feel happier, a sense of peace and less stress when in a more natural environment. Therefore, designing WITH nature in the built environment promotes human welfare, happiness and well-being.

RF - In the big picture I think that my job allows me (mostly) to sleep restfully at night. As both an evangelist and activist for green infrastructure, I talk

the talk and walk the walk. From the caress of cooling shade by a verdant, vegetated wall in a ‘concrete jungle’, to the mitigation of urban heat island effects at macro scale, green walls are primary tools in our strategies to make a positive difference. The decision-makers who value the delivery of distinct, sustainable places that encourage social dynamics benefit not only by great landscape’s undoubted transformational qualities but also by projects that catalyze regeneration, private investment, increased desirability and happiness.

HK - For me, happiness means the ability to break free from the paradigm that green building is “good for us,” and, like medicine, something that we need to grin and bear in order to achieve a greater good for the environment. Happiness is about turning that paradigm on its head and designing green roofs and landscapes that, first and foremost, create spaces that sing to people and beckon them

THE EXPERTS



Elizabeth Freeman Calabrese (EFC) is a licensed architect, educator and biophilic design consultant.



Haven Kiers (HK) is a landscape architect from Northern California.



Peter Lowitt (PL), FAICP, Director/Land Use Administrator of the Devens Enterprise Commission.



Reuben Freed (RF) is a specialist in green walls, and advocates for their knowledge, research and use in the practice of restorative green infrastructure.

in, while simultaneously (and, frankly, secondarily) giving back to the environment in ways that are subtle and unobtrusive. No one wants to feel like they are being preached to.

PL - In a metric heavy world, that's a great question. We often try to relate happiness to things we measure in planning, like the amount of time spent commuting. Less time spent commuting generally means you will be happier. Planners focus on creating the live-work-play environment, one that balances work time, recreational time and family time. This is one way planners typically define happiness. Happiness in the context of planning is an evolving concept and there is work underway to look at new metrics, such as levels of civic participation, degree of walkability, and the level of both community physical and mental health.

LAM - How do you think happiness can be incorporated, in a practical sense into community planning and/or green building?

EFC - Our fondest moments in life usually consist of experiences with special people in special places. Designing more opportunities for people to interact under positive situations fosters more happiness. Humans are fond of striking vistas, sunrises, sunsets, celebrating the changing of the seasons, soothing sounds of water, beaches, lakes, mountains, gatherings with family and friends, a sense of community; feeling protected, safe,

and healthy. We have the ability to design spaces and settings that celebrate our connection to the world and to the people around us, and which offer us a sense of peace, harmony and balance.

RF - Issues energized, opportunities identified, the common good spoken for and stake holders assembled: a prospect of happiness is implicit in a community planning process. In our socially-conscious societies, developers respond to building codes, return-on-investment, image-consciousness, public pressure and financial /planning incentives. By proposing data-driven technology solutions that include realistic, politically feasible cost projections with achievable strategies to get there, the path to happiness is made accessible. In this way, when an under-achieving part of a city can be revitalized by a new park at its center, engaging the local community and drawing visitors from further afield, Green Dreams can come true.

HK - The best way to incorporate happiness into green building and community planning is to allow a certain amount of whimsy into the creative process. We take ourselves so seriously most of the time. I firmly believe that incorporating "kooky" or unexpected elements into projects can relieve tension and create unexpected moments of pure joy and, ultimately, sustained happiness.

PL - We need to try to create communities that enhance the

ability of residents to achieve happiness. For example, there are studies that show access to greenery, open space and vegetation produces better mental and physical health outcomes. Ensuring access to open space and greenery is one way planners can help people become happier. Planners need to use their regulatory authority to ensure that new development incorporates green building to help address human happiness.

LAM - Would you briefly describe one or two projects that stand out to you as exemplifying the incorporation of happiness as a successful goal which has been achieved and why?

EFC - Employees spend a majority of their waking hours in office buildings, yet the lighting and wall finishes are often uncomfortable. Windows are tinted and do not let in much of the sun's color spectrum, roofs go unused and there is often no sense of community offered. My designs propose the use of increased color spectrum glazing, views to the outdoors, high quality artificial lighting, natural interior finishes and details, vegetative ecosystems where employees can pause and de-stress, and accessible roofs that are park-like, promoting a sense of community while connecting employees to the outdoors... creating healthier and happier habits for people.

RF - The High Line by James Corner in NYC embodies the idea of bringing derelict public

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LeFrak Lakeside Center, Recreation Center. Source: Ari Baring

areas to life. This is accomplished through a vigorous community process, making theatrical arenas for people to connect by intertwining structure with nature to create human-scale green spaces. The High Line has transformed an unusual 1.2-mile long abandoned elevated railway into a new public open space and linear park along the west side of Manhattan, vitally connecting a gritty past with its sophisticated present. It is universally recognized as an important and distinctive asset to the city, attracting over four million visitors a year. It is a new model for the 'greening' of the urban environment and has re-imagined an industrial relic.

HK - The BedZED housing development in England is a great example of a project that incorporates happiness. The mixed-use development project,

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the UK's first and largest Zero Energy Development, boasts a huge list of accolades related to energy savings, water efficiency, material re-use, and inclusion of low-income housing, yet the thing that sticks in everyone's mind are the crazy rooftop ventilators in all the colors of the rainbow that stick up like rooster combs. That's happiness!

PL - The Japanese are doing a lot of work on incorporating happiness as a goal and improving happiness in their communities. This includes everything from promoting community gardening to encouraging exercise and focusing on local well-being. See the group web site, Japan for Sustainability. <http://goo.gl/8Kys9h>

LAM - Can happiness be a driver for positive change in the green building, green city move-

ment? If so, how?

EFC - If we create built environments where people feel connected, happy, healthy and less stressed, these environments will more likely be cherished, supported and maintained. Consider the most revered structures, plazas and parks in the world that have been cared for through the ages. Employers appreciate office environments where employees feel happier and more creative, with improved productivity and problem solving abilities, and less absenteeism. Our most vulnerable population, the elderly and infirmed, as well as children benefit from this design philosophy. We have the knowledge and ability to design such qualities and happiness into our everyday lives.

RF - As we propel ourselves

headlong into the inevitability of climate change we confront the primal conundrum of our age: are we able to mitigate these changes, survive and even thrive? Do we have a choice? I think not. From making a safe and comfortable harbor in a city park for a nursing mother (Dufferin Grove, Toronto) to imagining and enabling an enchanted sequence of riparian spaces spanning the ancient river Thames (The Garden Bridge by Thomas Heatherwick, London), it is our primal desire for happiness that drives these dreams, irrespective of their scale. In their pursuit, each of us holds as reward a unique vision that reflects our aspirations and the skills we bring to its creation.

HK - Yes. We need to move away from matrix driven, number crunching design for

green buildings and focus on creating spaces that people want to spend time in – whether to work, relax, wander through, or reflect. When design decisions are driven by human desires and needs rather than market forces and sales, the projects we devise will be inherently more delightful and playful. End-user happiness, not return-on-investment or environmental brownie points, should be the focal point for the green building, green city movement.

PL - Yes. It can be a driver for change. When communities start to measure happiness (local well-being index) they will realize that green buildings and better access to nature are great ways to produce greater happiness and they will plan for and require them.

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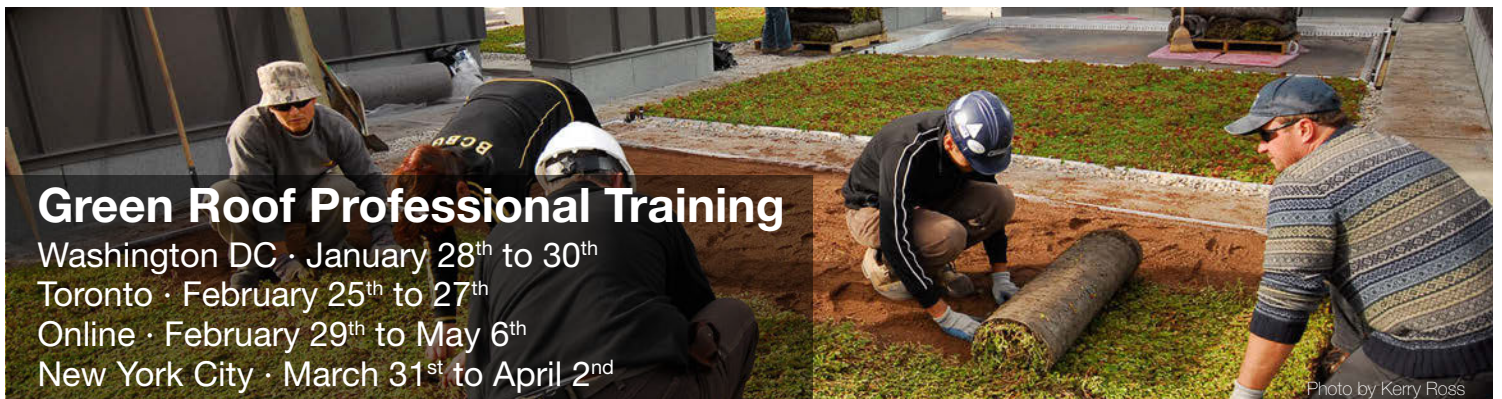


Photo by Kerry Ross

Whether you're designing a green roof or a rainwater harvesting system for your site, Green Roofs for Healthy Cities' professional development courses help you get it right, the first time. Learn in person or at your own pace online. Visit greenroofs.org/education to register.



BIOPHILIC SCIENCE AND LIVING ARCHITECTURE DESIGN

BY JOYCE MCLEAN

At *CitiesAlive* New York, Bill Browning, Principal, Terrapin Bright Green engaged the audience on the emerging science of biophilia and how it relates to design practice.

One of the many interesting points he raised had to do with the nature of the “visual connection to nature aspect” of biophilic design. If you can’t do a lot of green, even having a small green wall with many species of plants is able to capture and hold our attention much better than one with only one species of plants. Having more diverse plant species is even more important than increasing the size of the project. Even fake plants have some benefit, but real plants are superior in their positive effect on people. Connecting visually with nature can help reduce eye strain, lower blood pressure, increase rates of healing and heighten people’s focus and attention. These benefits can help reduce the costs to employers for staff working in office environments and have also been shown to hasten cognitive development in children and increase healing times in hospitals.

Mr. Brown spoke of the 14 patterns of biophilic design his firm has developed. In his New York office he shares with Cook Fox Architects, Mr. Browning talked about how the staff has become connected to the green roof there, which has evolved over time to support greater plant diversity and insects and birds. A pair of kestrels actually call that roof home. The staff is now planting vegetables on the roof and has even installed and supported a beehive. This connection to nature while in the office has multiple positive health benefits, far beyond the nutritional value of the food and honey production that their green roof will yield.

His presentation is available in the Conference Proceedings.

Joyce McLean is a freelance writer and consultant.

FIND OUT MORE

For more information on Biophilia visit:

www.terrapinbrightgreen.com

Conference proceedings are available at www.citiesalive.org

“Wall of Hope” by Kichiro Kuroki in Osaka, Japan



2015 AWARDS OF EXCELLENCE

WRITTEN AND COMPILED BY BLAINE STAND,
MEMBERSHIP COORDINATOR AT GREEN ROOFS FOR HEALTHY CITIES

Congratulations to all of our winners!

The Green Roof & Wall Awards of Excellence was held on October 7th at the 13th Annual *CitiesAlive* in Brooklyn, New York. We celebrated the most outstanding examples of green roof and wall design, policy, research, ad design, and corporate leadership.

This year's exceptional people and projects are doing everything from growing food on an urban home, to achieving net zero water usage in a public park. These awards acknowledge excellence in innovative green roof and wall design; raise awareness of the multiple benefits that green infrastructure provides; honor individuals who have made outstanding contributions to green roof research and supportive public policies; and highlight companies and people who have been champions of the green roof industry.

We invite everyone to submit your projects now to be considered for the 2016 awards to be presented at *CitiesAlive* in Washington D.C. on November 3rd. Submission details can found at greenroofs.org under awards.



Source: Joyce McClean

JUDGE'S TABLE

We would like to thank the judges who generously donated their time and expertise.

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Amy Falder - New York Green Roofs

David J. Yocca, FASLA, AICP, LEED AP - Conservation Design Forum

Virginia Russell, FASLA, RLA, LEED AP, GRP - Professor of Architecture, Horticulture Program Director, University of Cincinnati

Ishi Buffam - Assistant Professor, University of Cincinnati

Youbin Zheng - Environmental Horticulture Chair, University of Guelph

Reid Coffman - Associate Professor, Kent State University

Peter Lowitt, FAICP - Director, Devens Enterprise Commission

Dr. Hamid Karimi - Deputy Director, Office of Natural Resources, District Department of the Environment, Government of the District of Columbia

AWARD WINNERS (LEFT TO RIGHT)

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EDWARD JARGER AMERICAN HYDROTECH

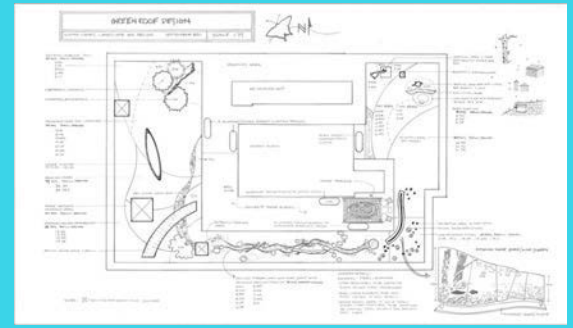
AMBER PONCE LIVEROOF



BERRY ARCHITECTURE, DOWNEY ROTH, HRYWKIWF IDEK OFFICE BUILDING EXTERIOR



BERRY ARCHITECTURE, DOWNEY ROTH, HRYWKIWF IDEK OFFICE BUILDING STREAM WITH LOCAL PLANTS



DESIGN AWARD

CATEGORY: EXTENSIVE INDUSTRIAL/COMMERCIAL

PROJECT: BERRY ARCHITECTURE, DOWNEY, ROTH, HRYWKIWF, IDEK OFFICE BUILDING

LOCATION: RED DEER, AB

“Doing what was right for the environment was the first goal of this redevelopment project for Berry Architecture + Associates. We wanted to create a pleasant oasis for our staff and our clients where they could be surrounded by a little bit of nature in a downtown urban setting.”

George Berry,
Owner, CEO, Berry Architecture + Associates

A LITTLE BIT OF NATURE IN A DOWNTOWN URBAN SETTING

Completed in 2011, the Berry Architecture + Downey Roth Hrywkiw Fidek LLP building was a complete revitalization and modernization of a run-down 1950's bowling alley in downtown Red Deer, Alberta. The green roof, planted in 2012, enhances this downtown neighborhood both aesthetically and environmentally adding a variety of flowering plants and grasses to the area including canada buffalo -berry, prairie onion, wild flax, and wild bergamot.

A unique feature of the green roof is the flowing stream which provides habitat and support for birds and insects. Staff and clients enjoy the pleasant setting of this natural retreat through a variety of social events including barbeques and green roof parties, as well as meetings and lunch time gatherings. Three raised planters provide fresh herbs and vegetables for the staff who take turns caring for the gardens. The gardens and stream

are watered exclusively through the grey water system. Stormwater is collected in holding tanks located in the mechanical room on the main floor. That stormwater is then used to water the garden planters, refill the stream as needed, and even provide water to on-site toilets. All non-vegetable plants are indigenous species which do not require watering. Since the renovation, the runoff discharge rate and quantity values have decreased by more than 25 percent.

One goal of the green roof was creating a bio-diverse habitat for wildlife with an emphasis on indigenous pollinators by providing food with a wide range of indigenous plant species, as well as flowing water and perching and nesting sites. Other goals were to decrease the impact of rainwater run-off on the municipal water system and to improve the air quality of the urban environment by installing the roof on a formerly plant-free site.



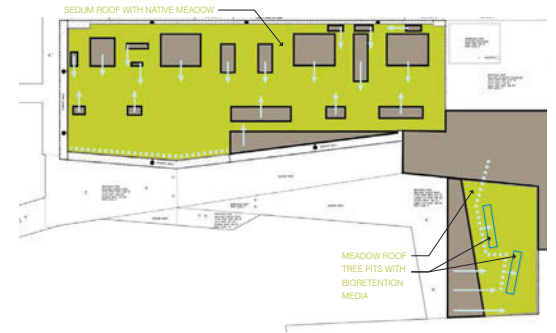
DESIGN LEADERSHIP

KRISHNA P. SINGH CENTER FOR NANOTECHNOLOGY EXTERIOR



PHILADELPHIA FROM THE KRISHNA P. SINGH CENTER FOR NANOTECHNOLOGY ROOF

GREEN ROOF PLAN WITH WATER FLOW



DESIGN AWARD

CATEGORY: EXTENSIVE INSTITUTIONAL
 PROJECT: MEADOW ROOF AT THE KRISHNA P. SINGH CENTER FOR NANOTECHNOLOGY
 LOCATION: PHILADELPHIA, PA

TEAM MEMBERS

Green Roof Consultant and Provider: Charlie Miller, Roofmeadow
 Property Owner: Iran Winston, University of Pennsylvania
 Architect/Landscape Architect: Todd Hoehn, WEISS/MANFREDI
 Civil Engineer: Omar E. Rosa, Stantec Consulting
 General Contractor: Kevin Kriebel, Gilbane Building
 Green Roof Construction/Maintenance: Karen Gibson, G.R.A.S.S.
 Roofing: Ed DeAngelis, E.D.A. Construction Company

A CROSS-DISCIPLINARY COLLABORATION

The Meadow Roof is a prominent feature of the University's first cross disciplinary building, attracting individuals and groups eager to enjoy time on the rooftop amenity space. Surrounded by floor to ceiling etched glass walls on three sides and a clear glass railing open to the city on the fourth side, the Meadow Roof is also visually accessible from corridors and conference rooms. A second larger green roof includes native perennials and grasses planted alongside the building's air handling and HVAC equipment. This larger sedum roof is a storm water management workhorse.

Both green roof areas feature a diversity of planting that includes a number of native species that attract a variety of birds and pollinators. During the first year after planting, completion annuals (*Gaillardia pulchella*) germinated among the pre-grown Sedum mats. In the second growing season, the annuals emerged again, this time

along with biennials and young perennials (*Echinacea pallida*).

Runoff water from the adjacent deck irrigates the Meadow Roof, which also is supplemented with a base-level capillary irrigation system during dry periods. The upper, non-greened roof runoff nourishes the two deep Meadow Roof bioretention tree pits, with supplemental irrigation during dry periods. The sedum roof manages the runoff from the adjacent rooftop HVAC equipment, the surrounding 15 foot parapet, and impervious paver walkways. The green roofs assure cost-effective compliance with Philadelphia's stormwater regulations, reducing stormwater site fees by 27 percent. Additionally, integrating hydraulically independent bioretention cells into the extensive Meadow Roof obviated the need to replace the ground level detention basins with a more costly ground measure to both pre-treat and detain runoff.



ROOFTOP GARDEN PLANTERS



ROOFTOP GARDEN TRELLISED PLANTERS

DESIGN AWARD

CATEGORY: SMALL SCALE RESIDENTIAL
PROJECT: URBAN ROOFTOP VEGETABLE GARDEN
LOCATION: TORONTO, ON

TEAM MEMBER

Designer, Gardener and Owner: Johanne Daoust

“We have pressing issues if we and our children are to survive - food, drinking water, climate, soil. Each of us will have to recognize that it is up to us as individuals to be the wind and not seek a weathervane. The winds bring change.”

Johanne Daoust,
Owner

A STUDY IN SUSTAINABILITY

A testament to the passion and commitment of one individual, this compact 430 sq ft vegetable garden on the roof of a residential home consists of six raised cedar beds, vertical trellises for climbing fruit and vegetables like cantaloupe and butternut squash and over 50 planters of various sizes, shapes and material.

A versatile aluminum framing system encompasses the raised beds and acts as a base for the trellises. It also enables the beds to be used as season extenders by a variety of covering such as

greenhouse plastic, shade cloth and wire mesh. The various covers protect the plants at critical stages of growth from critters and the environment i.e. strong winds, excessive rainfall, blistering sunshine, birds, squirrels and raccoons.

The raised beds and planters feature a sub-irrigation system that capitalizes on capillary action with no loss of water or fertilizer run-off. The system provides the plants with consistent water and oxygen at the root level and greatly contributes to their optimal growth in a challenging roof top environment.



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GREEN ROOF INTELLIGENCE

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DESIGN LEADERSHIP

BREATHE O2 WALL



BREATHE WALL AT NIGHT



DESIGN AWARD

CATEGORY: EXTERNAL GREEN WALL

PROJECT: BREATHE O2

LOCATION: GRAND RAPIDS, MI

TEAM MEMBERS

Designer, System Manufacturer, Plant Supplier, Installer:
Dave MacKenzie, LiveWall, LLC

Business Developer: Amber Ponce, LiveWall, LLC

“The largest graphic includes a windblown pattern of color in which white flowers spell Breathe O2 and symbolize the air. The green patterns, above and below, represent the forests and fields. And, the yellow in the upper right hand corner symbolizes the sun, which fuels photosynthesis, which yields oxygen. This vital process happens within the leaves, and therefore ‘Breathe’ also features leaf-shaped graphics of Michigan native trees, including catalpa, oak, beech and maple.”

Dave MacKenzie,
Artist.

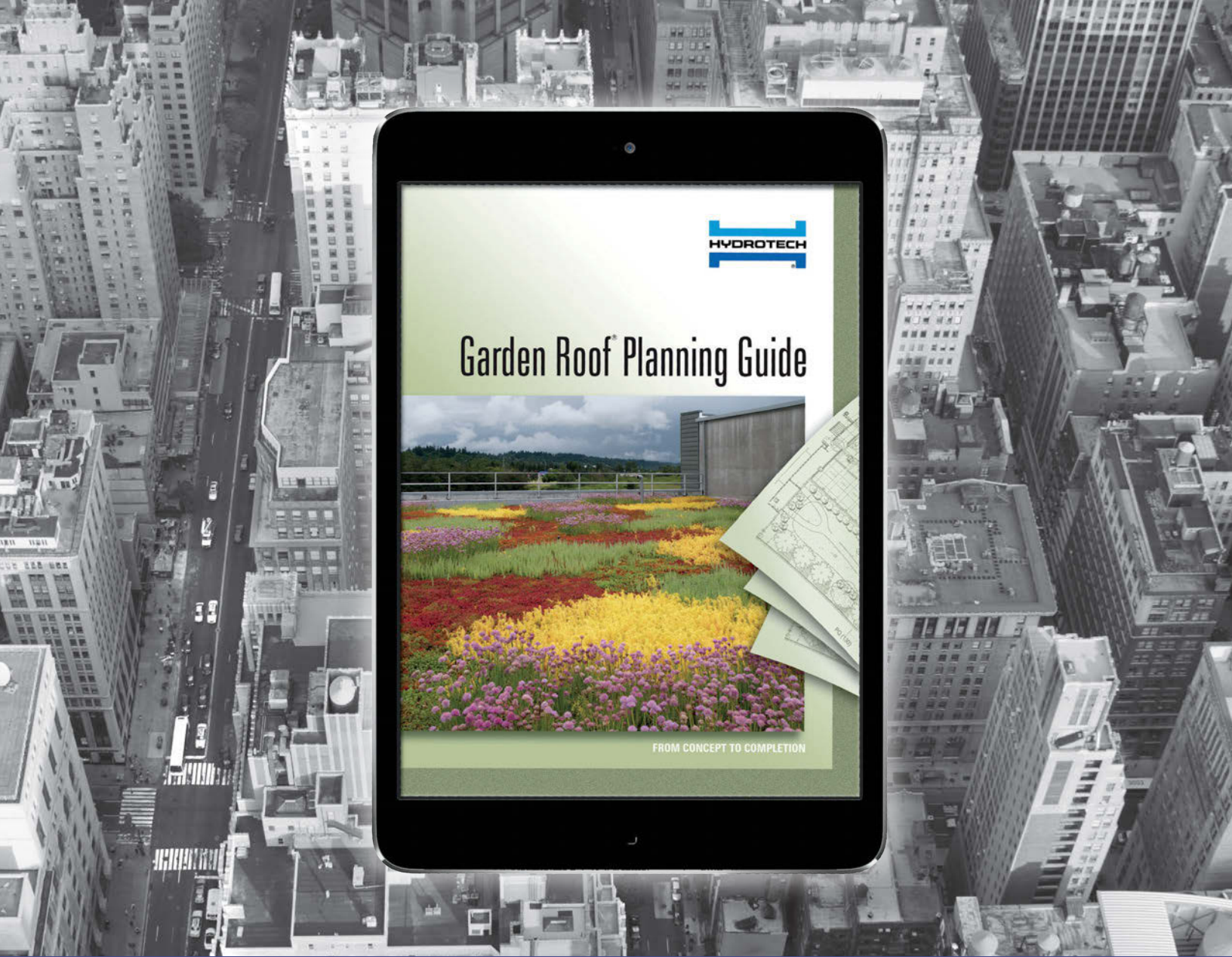
THE FUSION OF ART AND NATURE

Entitled ‘Breathe’, this living art project at ArtPrize®, the world’s largest publicly voted art contest, is home to more than 3500 plants and reaches over 20 feet tall at its peak and stretches 150 feet long.

Using the LiveWall® system as the canvas, the entry surrounds and buffers the noise and odors of the city around it. ‘Breathe’ was inspired by the idea of restoring the built environment to a more natural state and restore balance to urban settings by reintroducing vegetation lost during urbanization. 16” wide planters were serviced by a spray nozzle which delivered rain-like irrigation to the plants contained within across the 1500 square foot wall with drain holes at the bottom of each planter.

In the first summer, a palette of over 70 different species created an abstract art piece. After the annuals had been spent by colder temperatures, they were replaced with perennials. The following summer, sections of the wall were planted with 700 square feet of herbs, greens and vegetables.

That fall, the remaining edibles were harvested, and pre-fabricated panels were added to the wall to create curvilinear extensions again transforming the structure into a work of art. The installation was specifically designed to challenge and inspire each viewer to think differently about the constructed world—about how that world might look and feel if integrated with nature.



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CONFESSIONS OF A GREEN SCIENTIST

ON THE ROOF WITH CYNTHIA ROSENZWEIG, CO-CHAIR, NEW YORK CITY PANEL ON CLIMATE CHANGE, AMERICAN CLIMATOLOGIST AT THE NASA GODDARD INSTITUTE FOR SPACE STUDIES, COLUMBIA UNIVERSITY.

INTERVIEW BY STEVEN PECK



Cynthia Rosenzweig was a keynote speaker at *CitiesAlive* New York where she spoke eloquently and inspirationally about some of the challenges facing the City resulting from climate change and efforts to strengthen its resilience.

DR. ROSENZWEIG, WHAT KINDS OF CHALLENGES ARE YOU SEEING FOR NEW YORK RELATED TO CLIMATE CHANGE NOW AND IN THE COMING DECADES?

Climate change is a global problem and the global climate is already changing now, not at some point in the future as many people think. In most areas of the world, temperatures are warming world-wide and 2014 was the warmest year on record since 1880.

Our scientific understanding of climate change at a regional level is improving greatly. In the New York Metropolitan Region last summer the temperature was 2°F warmer than normal, with the longest streak of temperatures about 80°F (62 days

in a row) occurred. We also had three heat waves. Precipitation was well below average for New York Metropolitan Region, with abnormally dry conditions over much of the region. Intense rainfall from hurricanes, like Joaquin, which just missed New York in October, threaten to flood the city more often.

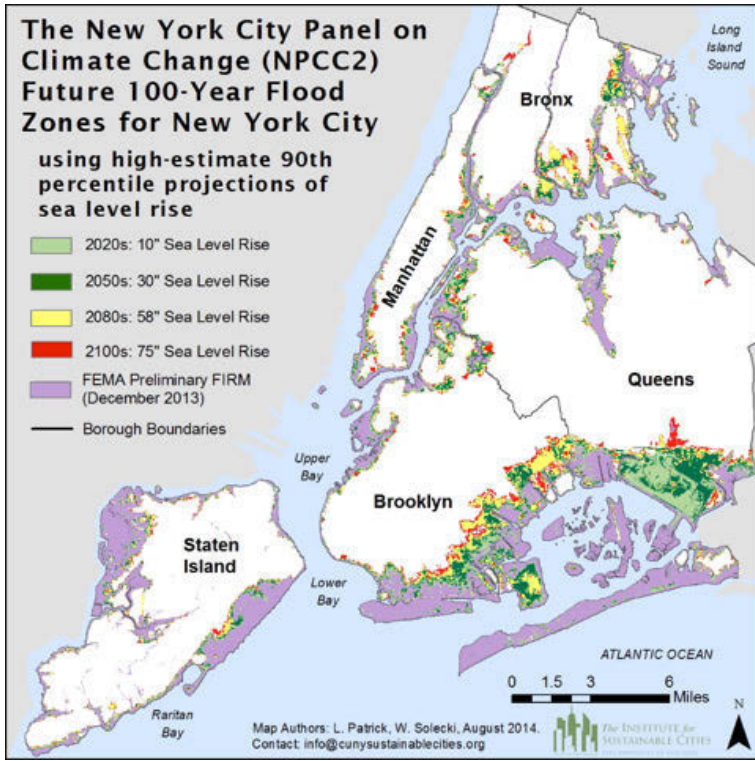
HOW IS THE CITY OF NEW YORK REACTING TO THESE CHALLENGES?

The city created the New York City Panel on Climate Change in 2008, which is made up of leading climate and social scientists and risk management experts. The Panel reports on the latest science of how climate change will impact the New

The New York City Panel on Climate Change (NPCC2) Future 100-Year Flood Zones for New York City

using high-estimate 90th percentile projections of sea level rise

- 2020s: 10" Sea Level Rise
- 2050s: 30" Sea Level Rise
- 2080s: 58" Sea Level Rise
- 2100s: 75" Sea Level Rise
- FEMA Preliminary FIRM (December 2013)
- Borough Boundaries



York Metropolitan Region. In 2015 the NPCC released its latest report which provided updated climate change projections and future coast flood maps for New York City (see figure above). The localized climate risk information developed by the NPCC is then used by the City's Climate Change Adaptation Task Force (CCATF) to understand the risks in different sectors such as Energy, Transportation, Policy, Water and Waste, and Communications. Each of these has a sector working group which utilizes the climate information provided by the NPCC for their adaptation planning,

and the CCATF issues a report to the Mayor every two years. The work of the task force includes the agencies, authorities and private stakeholders responsible for implementing required changes.

WHAT'S IN THE LATEST REPORT?

Our mean annual temperature has increased by .3°F per decade since 1900 in the New York Metropolitan Region, totaling 3.4°F. By the 2050's we project an increase by 4.1°F to 5.7°F and by 5.3°F to 8.8°F by 2080's. That will make New York a lot hotter in the future and measures we take to cool the city, like green roofs, will help us en-

sure future heat extremes.

Precipitation has already increased approximately .8 inches per decade to date, and the year to year variability is more pronounced. The projected increase is 4 to 11 percent increase by 2050 and 5 to 13 percent increase by the 2080s. Intense precipitation results in significant flooding in many areas of the city.

Sea level rise has averages 1.2 inches per decade since 1900 for a total of 1.1 feet, nearly twice the observed global rate over a similar period. Sea level rise is projected to rise 11 to 21 inches by the 2050's, 18 to 39 inches by the 2080's, and high estimates suggest up to 6 feet by 2100. The frequency and intensity of coastal flooding will increase from sea level rise alone, regardless of any change in extreme storms.

WHAT MEASURES ARE BEING IMPLEMENTED TO MAKE NEW YORK MORE RESILIENT?

New York City implements many measures to enhance resiliency from modifying building codes to ecosystem-based adaptations. Green infrastructure is a multi-purpose infrastructure solution for climate adaptation, versus single-purpose engineered resiliency. We need to focus on understanding the

many benefits of green roofs and other resiliency measures at a scale of individual buildings and neighborhoods. For example, if 25 million square feet of green roofs are installed in New York, scientists can study what areas within the city will receive the greatest benefits.

WHERE DO YOU GO FROM HERE?

New York City is a leader in sustainability and climate change, and many other cities are following its example. Through the Urban Climate Change Research Network (UCCRN), more than 550 scholars and practitioners from 100 developed and developing cities collaborate to share information about urban climate change mitigation and adaptation. Cities are learning from one another to implement solutions. UCCRN has over 100 case studies online of city actions and we are seeing that green roofs are well represented in the database.

FIND OUT MORE

Visit www.UCCRN.org for more information.

The NYC Climate Report can be found at <http://goo.gl/9Ys49U>

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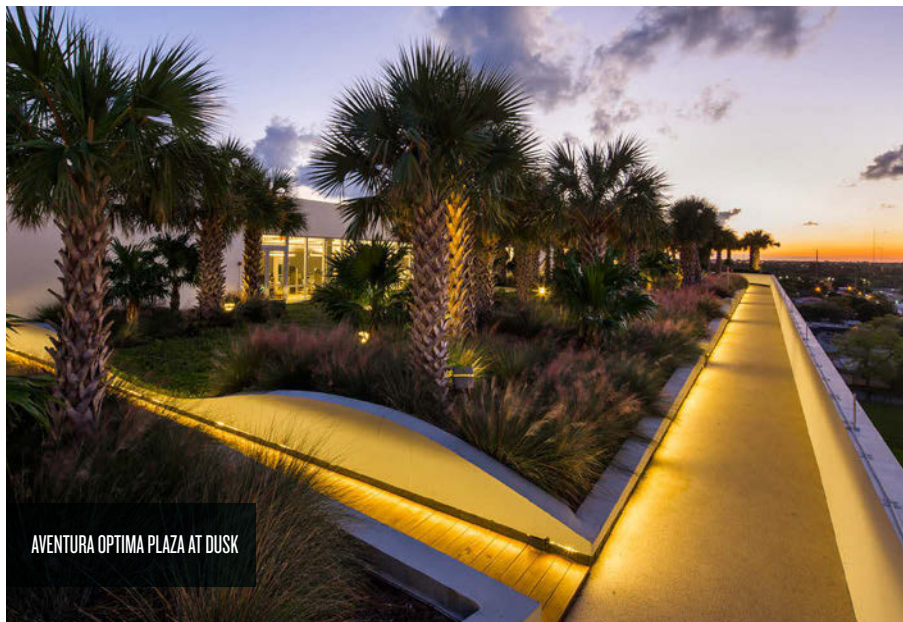


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DESIGN AWARD

CATEGORY: INTENSIVE INDUSTRIAL/COMMERCIAL

PROJECT: AVENTURA OPTIMA PLAZA

LOCATION: AVENTURA, FL

TEAM MEMBERS

Landscape Architect: Barry Miller, Savino & Miller Design Studio, PA

Architect: Javier Font, Behar Font & Partners

Landscape Contractor: Nick Falcone, All Green Landscaping

Green Roof Soil and Waterproofing: Rick Clark, Hydrotech

Irrigation Engineer: Connie Cummings, Cummings Irrigation

LEED Consultant: Rob Hink, Spinnaker Group

Project Design - Client: Ariel Bromber, Inmobiliaria Brom

Wood Supplier and Installer: Miles Black, Miles of Wood

“We designed the green roof as a natural garden setting, to enjoy, to exercise, and as a getaway from the office routine. In addition to the numerous environmental benefits associated with green roofs, we believe the simple act of getting up higher fulfills a fundamental desire. In South Florida, which is basically flat, we can imagine rooftops as our urban treetops, our watchtowers; all the more reason to include them in our basic building paradigm.”

Barry Miller,
Savino & Miller Design Studio

GREEN SPACE IN THE BALANCE

The green roof at the Aventura Optima Plaza professional building was conceived to balance the loss of green space caused by the building's construction, by essentially raising the landscape above the building, mitigating urban heat island effect.

It is unique in that it not only provides stormwater management benefits, but also invites office employees to use the space. The green roof's garden provides a tranquil space for relaxation and an opportunity to jog the running track at the green roof's perimeter. The rolling walls, designed in a bell wave pattern, offer a constantly changing perspective of the garden. Reclaimed Greenheart Wood is utilized for the crosswalks, which bisect the green roof gardens at regular intervals, connecting back to the running track.

In order to reduce water use, the landscape was designed with native and drought-tolerant plants, entirely eliminating the use

of sod/turf grass. In addition, the planting soil is a sand mixture with a higher water retention capability. A rain water collecting/harvesting cistern and system was installed in order to supply all irrigation requirements, totally eliminating the use of potable water.

The planting palette was selected by the ability to withstand harsh conditions such as wind and at the same time attract local fauna. The Sabal Palm and Thatch Palms are Florida Natives that are very adaptable to different soil conditions and windy sites. Additionally, their fruits, flowers and crown collect moisture and attract wildlife such as birds and insects. Muhly grass complements the use of the palms in the same fashion. Perennial peanut is ever-green in frost-free areas of the state. It is drought, nematodes, and pathogens resistant.



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ALBERTA FROM THE HELEN SCHULER
NATURE CENTRE



DESIGN AWARD

CATEGORY: INTENSIVE INSTITUTIONAL
PROJECT: HELEN SCHULER NATURE CENTRE
LOCATION: LETHBRIDGE, AB

TEAM MEMBERS

Landscape Architect/Green Roof Practitioner/Irrigation Design:
Michael Magnan, OZ Planning + Design Inc

Client/Program Design: Coreen Putman, Helen Schuler Nature Centre

Native Plant Ecologist: Steve Tannas, Eastern Slopes Rangeland

Architect: Cliff Swidley, OYA / Group2

Structural Engineer: Walter Kepczynski, BEI Engineering

“We saw the potential of the green roofs in providing endless opportunities for programming and education for our community. We imagined them as living classrooms and natural gathering spaces for our visitors. We knew they could demonstrate better ways of landscaping and inspire best practices for urban development. Every day we see new ways in which our visitors experience these spaces and learn from them.”

Coreen Putman,
Helen Schuler Nature Centre Coordinator

VERSATILITY & ADAPTABILITY IN AN UNLIKELY CLIMATE

Helen Schuler Nature Centre (HSNC) is an urban nature centre located in Lethbridge, Alberta with the goal of delivering diverse and dynamic interpretive nature programs through a team of volunteers, staff and partners. As part of HSNC’s expansion and renovation, roof gardens were constructed with the goal of creating a demonstration area for delivering interpretive programs and providing a living classroom for visitors.

While experiencing the green roofs, visitors are encouraged to learn about the versatility and adaptability of native plants, local ecology, plant pollination and intensive and extensive living roof systems. Due to Lethbridge’s harsh, arid climate, it was important to provide a demonstration area for alternatives to traditional, water

consumptive landscaping approaches. To maximize biodiversity on the roof, the design team and client developed a species list of 65 native species of perennial forbs and grasses for the intensive living roof. The extensive living roof species list comprised 27 species of sedum and seven species of forbs and grasses. A secondary benefit of developing the rich plant list was the ability to evaluate the suitability of a multitude of untested native species on the roof in one of Alberta’s most arid environments.

While aesthetic considerations were secondary to the project’s environmental and educational goals, visitors are overcome by the beauty of the living roofs, and leave with a greater appreciation of the prairie landscape.



SEATING AREA ON THE HELEN SCHULER NATURE CENTRE ROOF



GUESTS ENJOYING THE HELEN SCHULER NATURE CENTRE

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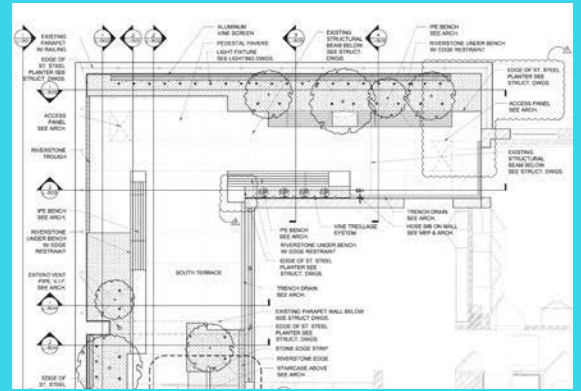
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TRIBECA LOFT ROOFTOP



DESIGN AWARD

CATEGORY: INTENSIVE RESIDENTIAL

PROJECT: TRIBECA LOFT

LOCATION: NEW YORK, NY

TEAM MEMBERS

Installation and Maintenance Contractor: Amy Falder, New York Green Roofs LLC

Landscape Architect: Aaron Booher, HM White Site Architecture

Architect: Steve Blatz, Steve E. Blatz Architect + Antonio Pio Saracino

ARCHITECTURE MEETS NATURE AMIDST MANHATTAN'S SKYLINE

Floating amidst lower Manhattan's skyline, architecture meets nature to transform a penthouse residence into the ultimate garden apartment. This project retrofits a nineteenth century loft building's rooftops into a series of dynamic and diverse gardens.

Cutting edge design incorporates a vast array of roof garden approaches to build up an undulating green roof meadow that softens topographical decking, geometrical forms that add interest to a turf lawn, and vertical vegetation that integrates seamlessly with water features and modulated flooring. Integrating maximum outdoor living areas off of the living room, kitchen, master bedroom and bath, and inner courtyard took extreme attention to transitional details as all areas incorporate green roofs and vertical plantings with sculptural and hardscaping elements. The juxtaposition of each element helps create distinct zones of refuge

while maintaining a cohesive outdoor amenity.

The roof's drainage system incorporates the sloping topography with EPS lightweight insulation and custom planters installed with intensive green roof build-up. The irrigation design uses a customized low flow automated drip irrigation system with moisture sensors which incorporate multiple zones across many microclimates over two different levels. Advanced water conservation practices and technologies keep the water below the surface of the vegetated roofs and container plantings so that evaporation, wind overspray and mist or surface run-off is mitigated.

The green roof achieves a harmonizing effect by taming and balancing architecture with ecology in an urban environment. The tranquility of the gardens blend fluidly with the interior to achieve an elegant outdoor living space that transcends the boundaries of traditional residential gardens.



MANHATTAN SKYLINE FROM THE TRIBECA LOFT ROOFTOP



ARCHITECTURE AND ECOLOGY BALANCED IN AN URBAN ENVIRONMENT IN TRIBECA



Source: Ari Baring



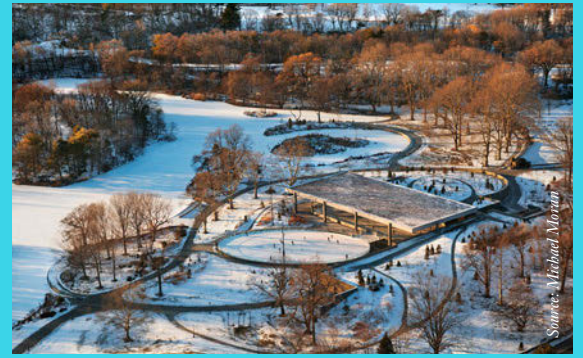
Source: Ari Baring



Source: Ari Baring



Source: Ari Baring



Source: Richard Morlan

DESIGN AWARD

CATEGORY: SPECIAL RECOGNITION

PROJECT: LEFRAK LAKESIDE CENTER AT PROSPECT PARK

LOCATION: BROOKLYN, NY

TEAM MEMBERS

Green Roof Designer, Green Roof Provider, Stewardship, Warranty Provider:
Charlie Miller, Roofmeadow

Architect: Andy Kim, Tod Williams Billie Tsien Architects

Civil Engineer: Theo Prince, Stantec Consulting – New York

Owner: Christian Zimmerman, Prospect Park Alliance

General Contractor: Marsha Bell, Sciame Construction Co

Irrigation Consultant: Gordon Holmes, National Lawn Sprinklers

Rainharvesting Consultant: Phil Reidy, Geosyntec Consultants Inc

Intensive Waterproofing Manufacturer: American Hydrotech

Mason: Marco Berardi, Berardi Stone Setting, Inc

INTEGRATING SUSTAINABLE DESIGN INTO A HISTORIC PARK

The LeFrak Center at Lakeside is a popular destination within the beloved Prospect Park, originally design by Frederick Law Olmstead. Neighborhood residents and tourists are attracted to the 75,000 square foot recreation facility which is considered to be the most ambitious capital project to date in the historic park. The twenty-first century insertion includes concessions and two skating rinks with seasonal programing. A 23-foot high canopy supports an extensive green roof above and a whirlwind of activity below. The concession buildings are buried in the land and covered by intensive green roofs allowing the structures to blend into the park landscape.

The intensive green roof areas connect to each other and to existing pathways and landscape grades, allowing visitors to explore the park's beauty on winding paths spanning the roof and ground

planes. The footpaths approaching from the east and north ascend gradually and imperceptibly over top of the 20,000 square-foot complex, eventually ending at an overlook of the facility and the scenic Prospect Park Lake beyond.

The intensive and extensive green roofs prevent over 900,000 gallons of rainwater from entering the sewer each year. This project demonstrates that a rich, forested roof landscape can be created and sustained without consuming the public potable water resource. As a zero discharge site, the Lakeside Center green roofs and ground landscape serve to infiltrate and reduce pollutants without burdening the local water treatment plants. Within Lakeside, high-efficient, low-water-use plumbing fixtures save over 205,000 gallons of water each year.

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PROTECTING SOUTHEASTERN WISCONSIN'S WATER

Kevin L. Shafer, P.E. is the Executive Director of the Milwaukee Metropolitan Sewerage District (MMSD) and is responsible for the overall leadership and direction for MMSD. He coordinates the strategic goals and objectives as well as their approval by the Commission; oversees the development of policies and operating plans; and represents MMSD to its customers, agencies, and the public.

He developed the Greenseams Program to capture and process stormwater through green infrastructure. The mission of Greenseams is to create enough green infrastructure in the Milwaukee region to capture 740 million gallons of water every time it rains by 2035. As of 2015, this initiative has installed 100 projects protecting 3,100 acres of flood-prone land across 28 communities in greater Milwaukee through the use of green roofs, bioswales and other forms of green infrastructure. Mr. Shafer also worked to help establish the Southeastern Wisconsin Watersheds Trust, a non-profit organization working to restore the Greater Milwaukee watersheds, improve water quality and reduce stormwater runoff pollution.

INDIVIDUAL AWARD

CATEGORY: CIVIC AWARD

AWARD WINNER: KEVIN L. SHAFER, P.E.



EDUCATING STUDENTS IN GREEN ROOF PERFORMANCE

Dr. Bill Retzlaff is a tenured professor at Southern Illinois University, joining the faculty in 1999 in the Department of Biological Sciences and the Environmental Sciences Program. He is currently a professor of biological sciences and serves as one of three associate deans in the College of Arts and Sciences.

Dr. Retzlaff earned a bachelor's in forest management and a master's in forestry from Auburn University. He earned a doctorate in forestry with a minor in plant physiology from Clemson University. His main areas of research interest include the evaluation of green roof and green wall technologies, sustainable green infrastructure, and sustainable use of residual waste products. Dr. Retzlaff is currently the research co-director of the St. Louis metropolitan area research collaboration (G.R.E.E.N. – Green Roof Environmental Evaluation Network) based at Southern Illinois University Edwardsville (SIUE), established to evaluate the performance of green roof technologies and other green infrastructure in the Midwestern United States. He has written numerous scientific articles on green roofs and mentored dozens of students.

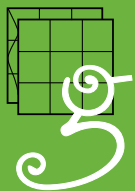
INDIVIDUAL AWARD

CATEGORY: RESEARCH AWARD

AWARD WINNER: DR. BILL RETZLAFF

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ORGANIZATION AWARD

CATEGORY: ADVERTISING AWARD
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STORMWATER PERFORMANCE AND INCENTIVE PROGRAMS: HOW THE LIVING ARCHITECTURE PERFORMANCE TOOL CAN STREAMLINE THE PROCESS

Lessons Learned from the CitiesAlive LAPT Workshop.

BY ROHAN LILAUWALA & DAVID YOCCA

Stormwater management is by far the most important force driving green roof incentive programs, with Environmental Protection Agency (EPA) consent decrees mandating Combined Sewer Overflow (CSO) reductions in many cities, and green roofs able to play an important part. Cities like New York and Washington D.C., for example, have developed incentive programs for green roofs if they can manage a 1" rain event.

At the recent Living Architecture Performance Tool (LAPT)

workshop held in New York City by the Green Infrastructure Foundation, we asked key stakeholders from across the living architecture spectrum an important question, "What are the most significant barriers to green roof implementation?"

There were a number of answers, but a couple of them stood out. The lack of incentives is one major barrier; many jurisdictions still do not incentivize green roof development at all. In some cases, existing incentive programs do not reduce costs enough to

make projects economically attractive on a voluntary basis, considering the cost premium for a green roof compared to a conventional roof, especially in markets where the technology is not as widespread.

Another important barrier was the complexity or ambiguity of incentive programs with respect to stormwater management. An issue for administrators of these programs is that in the absence of a standardized metric and testing method for stormwater performance on green roofs,

they must evaluate proposals on a case-by-case basis. Developers and designers must also prove the stormwater performance of their projects, particularly if they deviate from the norm, which can add further costs.

These issues reduce program uptake, are a strain on staff resources, and make it difficult for smaller municipalities without the same level of expertise to run incentive programs based on stormwater performance. One of the primary purposes of the Living Architecture Performance



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Tool (LAPT) is to align with municipal stormwater management goals and create metrics and test methods to clearly quantify and ensure a base level of performance. That way, instead of evaluating applications on a case-by-case basis, municipalities can have a tool they can rely on to help determine anticipated rainwater attenuation (and other benefits) from green roofs, and can provide incentives in line with the public benefits created.

An important discussion during the workshop revolved around the use of annual or event-based stormwater metrics. Both approaches have value; they are simply measuring rainfall attenuation in different contexts. Annual metrics, such as 50% retention of annual rainfall, reflect the unique hydrology of green roofs and ensure that their high performance during smaller

rain events is aggregated and quantified. Event-based metrics, such as capturing the first 1" of rain or the volume of rain from a 90th percentile rain event, align with what policy makers are already using and help fulfil the goal of complying with EPA consent decrees by reducing CSO events. They are however, more theoretical because antecedent moisture can vary the water holding capacity of green roofs. For example, three consecutive days of rain will likely diminish the water holding capacity of a green roof. Green roofs also delay stormwater that does leave the roof, an important performance contribution that neither metric captures.

After much deliberation, the consensus among workshop participants was that the future success of the LAPT is dependent on aligning with the needs of

policy makers. It also needs to be supportive of, and inform, other rating systems commonly in use, like LEED, as well as emerging performance rating systems such as SITES. LEED and SITES currently use event-based metrics and targets to measure stormwater management performance. If the LAPT uses a standard that dependably articulates how to measure the stormwater management performance of green roofs, it could simplify policy and be adopted by both incentive programs and rating systems.

Green roofs have a myriad of benefits, but their dynamic nature, variability, and complexity make it difficult to create a standardized, accurate quantification of these benefits. The purpose of the LAPT is simple: make it easier to measure the performance benefits of living architecture, and watch the mar-

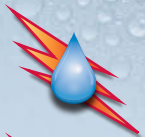
ket take off in North America as we have seen happen elsewhere. With your support, we will continue to work on the LAPT, with the goal of releasing a complete draft framework at CitiesAlive 2016 in Washington D.C.

Roban Lilauwala is a Senior Researcher at Green Roofs for Healthy Cities. David Yocca is the Principal Landscape Architect/Planner at Conservation Design Forum and Co-Chair of the LAPT Committee..

FIND OUT MORE

Learn more about the Living Architecture Performance tool at <http://greeninfrastructure-foundation.org/lapt>. If you have questions or would like to get involved in the development of the program, contact rlilauwala@greenroofs.org

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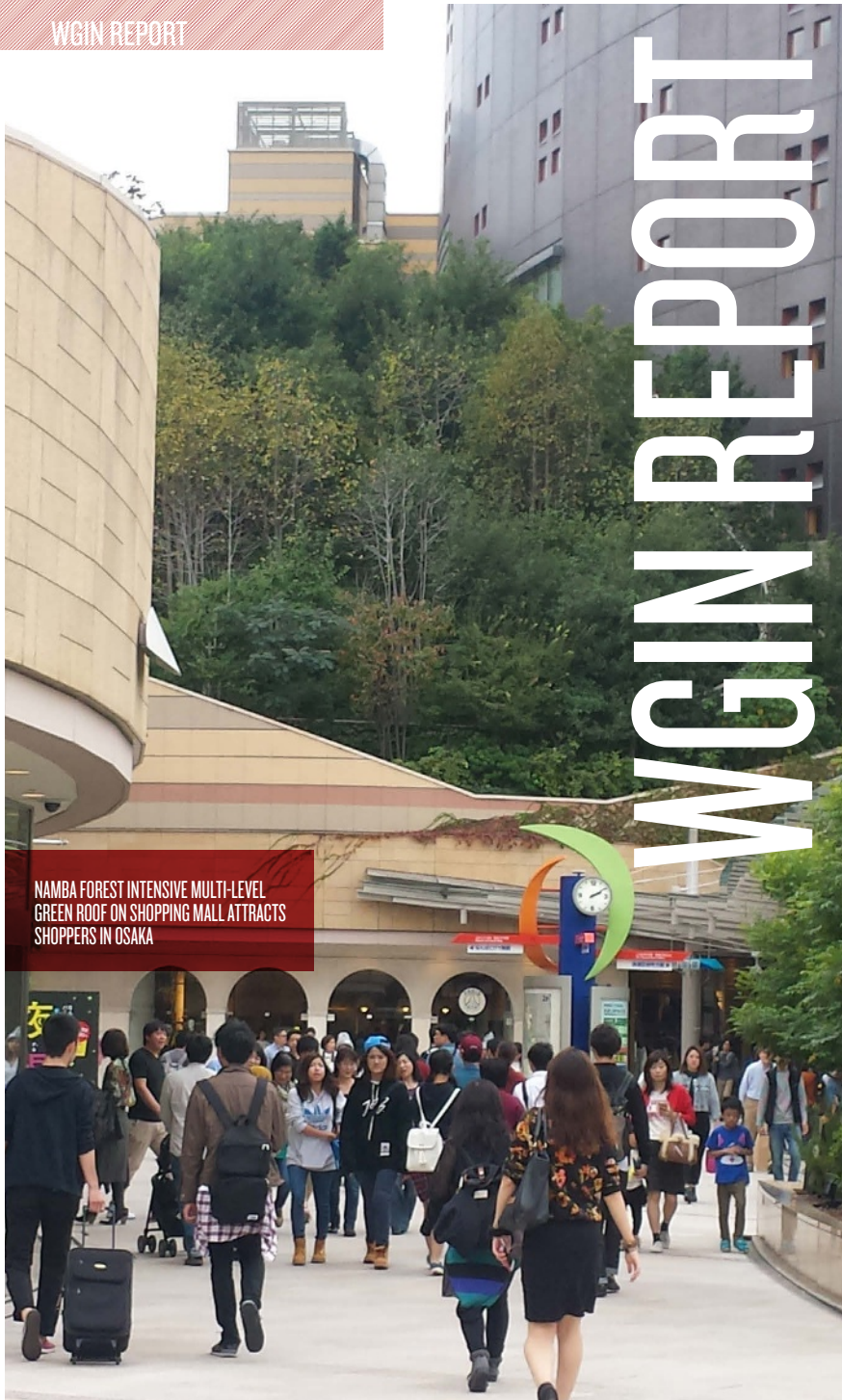


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NAMBA FOREST INTENSIVE MULTI-LEVEL GREEN ROOF ON SHOPPING MALL ATTRACTS SHOPPERS IN OSAKA

The World Green Infrastructure Congress was held in Nagoya, Japan from the 13-16, 2016, hosted by The Organization for Landscape and Urban Green Infrastructure. The conference featured a number of Japanese and International speakers. Japan has been building mainly intensive green roofs for several decades, and the use of a variety of green wall technologies is much more prominent than in North American cities. The photos and captions below capture some of the interesting project work being completed in Japan.



HAJIME KOSHIMIZU LEADS A GREEN ROOF TOUR IN NAGOYA



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2016 LAM Media Guide now available at <http://goo.gl/BzDEro>. Advertising rates are frozen for 2016.

TRAINING DATES

Only one more training event remains for 2015, so be sure to register. Training dates will resume in 2016 with our GRP boot camp in January. We are always rolling out new online training dates, so check greenroofs.org/training regularly for details.

NET ZERO WATER FOR BUILDINGS AND SITES

- San Francisco: December 3-4
- Online: February 29-May 6

GREEN ROOF PROFESSIONAL (GRP) TRAINING

- Washington DC: January 29-30
- Toronto: February 25-27
- Online: February 29-April 22
- New York: March 31-April 2

GRPs are required to earn 16 CEU's every two years and maintain their GRHC membership.

CALL FOR PAPERS



CitiesAlive: 14th Annual Green Roof and Wall Conference is coming back to Washington D.C. in 2016 November 1-4th. We'll be rising to the challenge of stormwater management.

The CitiesAlive 2016 call for papers has begun. Go to citiesalive.org for details and deadlines for Washington D.C.

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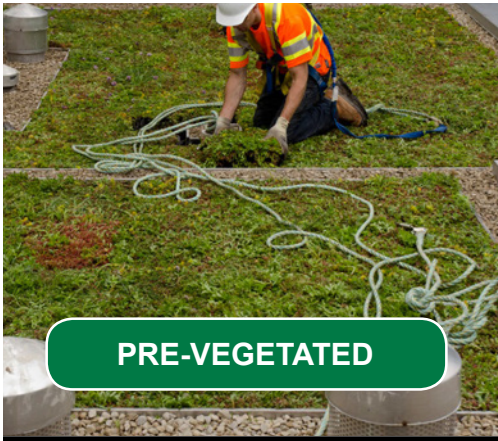
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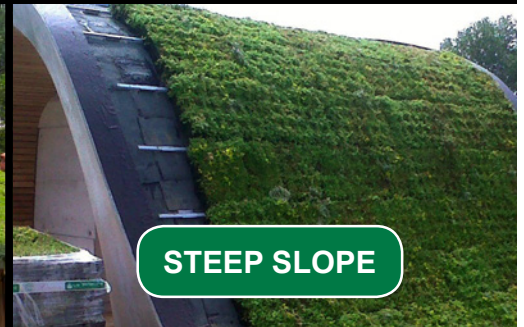
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**BRINGING NATURE
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14 REASONS TO INVEST NOW IN GREEN INFRASTRUCTURE

BY MICHELLE SAWKA

After years of neglect, infrastructure is again being discussed as a major priority for public investment. In the past, these investments were largely directed to grey infrastructure, the same type we have been building for decades. It is time for change!

Here are 14 reasons why living green infrastructure such as trees, green roofs and walls, rain gardens and others should command a much greater share of public infrastructure investment.

1. Green Complements Grey

The lifespan of roads, roofs and pipes can be extended when they are built in tandem with green infrastructure. Providing shade and reducing stormwater runoff show where grey and green investments function effectively together.

2. Fiscally Prudent

Green infrastructure reduces water pollution more cost effectively than grey infrastructure alone. New York City recently concluded that a green and grey infrastructure approach offered cost savings of more than \$1.5 billion over a grey infrastructure approach alone.

3. Better Return on Investment

Green infrastructure provides multiple, rather than single benefits. Green roofs can manage stormwater and save energy. Green infrastructure provides more benefits per dollar invested than single purpose grey infrastructure.

4. Food Security

Community gardens and green roofs

provide recreation, community building and better access to local, healthy food. Food grown close to home reduces costs and environmental impacts associated with long haul transportation.

5. Reduces Building Energy Use

Green roofs, walls and neighboring trees can make individual buildings more energy efficient and climate friendly by reducing heating and cooling demands and greenhouse gases.

6. Creates Jobs

Green infrastructure investment, installation and maintenance is labor intensive and thus a great local job creator - from plant nurseries to designers and contractors.

7. Reduces Urban 'Heat Island'

Cities are getting hotter and bigger. As we grow, buildings, roads and other grey infrastructure will continue to absorb and retain heat. To balance growth, living green infrastructure naturally cools cities.

8. Cleaner Air, Healthier People

Trees and vegetation directly remove air pollutants, as well as contribute to lowering stress and blood pressure. Lower air temperatures slow the formation of ground-level ozone or smog, which in turn can reduce asthma rates.

9. Cleaner Water

Pollutants captured in stormwater runoff contribute to water contamination in nearby lakes and rivers. When rainwater is absorbed where it falls, plants, soils and microbes break down many common

pollutants leaving our surface water cleaner.

10. Reduces Flooding

Vegetation, drainage layers and soils retain water and reduce stormwater volumes. This keeps the rain out of our drains, combined sewers and sewer systems and helps reduce pollution and floods.

11. Higher Property Values

Studies suggest that the mere presence of living green infrastructure can improve property values by as much as 30 per cent.

12. Active Transportation

Connected green spaces make cities more liveable, encouraging people to hike, bike, walk, and enjoy nature more often. New York's Highline is a great example.

13. Improved Biodiversity

Urban forests, green roofs, walls and wetlands which embrace species diversity creating habitat for bees, birds, butterflies and other species.

14. Happier People

Seeing green makes people happier, improves quality of life. It contributes to a greater sense of community, better academic performance and can reduce symptoms associated with attention deficit and hyperactivity disorders.

Michelle Sawka is the Project Coordinator for The Green Infrastructure Ontario Coalition.
www.greeninfrastructureontario.org



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