LIVING ARCHITECTURE MONITOR®

A GREEN ROOFS FOR HEALTHY CITIES PUBLICATION

VOLUME 18 / ISSUE 4 / WINTER 2016

THE BUSINESS CASE ISSUE

- On the Roof With: Two award winning design experts, Paul Kephart and Jeffrey Bruce, share their secrets on avoiding value engineering.
- The Philadelphia Story: Former Commissioner of Philadelphia Water, Howard Neukrug, PE, speaks of transforming the public utility into a green infrastructure leader.
- Mandating Green Roofs in San Francisco: Jeff Joslin on the new cutting edge requirements.
- How Green Roofs Increased Condominium Values by more than 5% in Portland, Oregon by Lauren Bloomquist.

2016 AWARDS OF EXCELLENCE

PROFILES OF THE BEST GREEN ROOF AND WALL PROJECTS FROM ACROSS THE CONTINENT AND MORE.

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VOLUME 18
ISSUE 4
WINTER 2016

INSIDE

On the Cover: Located on the far west side of Manhattan, the Jacob K. Javits Convention Center is New York City's primary venue for trade shows and conventions. A 6.75-acre extensive green roof—the second largest in the country—proved to be more cost-effective than a conventional roof system due to the green roof's lighter weight, which avoided costly structural reinforcement. Learn more about this impressive green roof on page 22. Photo: David Sundberg-Esto.

LIVING ARCHITECTURE MONITOR

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LIVING ARCHITECTURE MONITOR IS PUBLISHED FOUR TIMES PER YEAR IN PRINT AND DIGITAL BY GREEN ROOFS FOR HEALTHY CITIES (GREENROOFS.ORG)

GREEN ROOFS FOR HEALTHY CITIES

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PS PERKINS SERVICES INC.

A YEAR OF FIRSTS!

It has been a year of firsts for Green Roofs for Healthy Cities and our charitable arm, the Green Infrastructure Foundation. I am quite proud of the team here that has accomplished so much with such great dedication, and of the many volunteer board members, general members and Green Roof Professionals who dedicate their time and resources to building the green roof and wall industry. Here is an overview of our collective firsts over the course of 2016:

San Francisco became the first U.S. jurisdiction to require green roofs and/or solar panels on new buildings as part of their Better Rooftops Ordinance. Since *CitiesAlive*® 2013 in San Francisco, GRHC has spurred and supported this effort (pages 28-29).

Congratulations to the 2016 Awards of Excellence Winners profiled in this Winter Issue of the LAM for their inspiring and innovate work in research, business, policy and design (pages 11-24).

On the heels of *CitiesAlive* in New York City last year, a new group of dedicated citizens co-founded Living Architecture New York. The group is currently raising seed funding to develop organizational capacity to improve the use of living architecture technology in New York City and the surrounding region and are currently seeking charter members. Contact Melissa Daniels, Melissa@myplantconnection.com for more information.

We published the first North American *Green Wall Industry Survey*, which sets a benchmark for the size, quantity, type and location of green wall installations across North America. Check out a summary on page 33 or contact Blaine Stand, bstand@greenroofs.org for a copy.

We 'stormed' the annual StormCon Conference in Indianapolis with multiple presentations on various aspects of green roof design, stormwater retention and policy. Thanks to StormCon organizers for working with us to bring the benefits of green roofs to civil engineers.

An Association Partnership Agreement was forged with the American Society of Civil Engineers and GRHC attended the Low Impact Development Conference in Portland, Maine with a booth and presentations.

More people are reading the *Living Architecture Monitor*™ magazine than ever! Digital and print readership of the *Living Architecture Monitor* magazine now reaches over 40,000 readers per issue. Thanks for your readership and advertising support. Advertising rates are frozen for 2017 and back issues are available online at www.livingarchitecturemonitor.com.

We held *CitiesAlive: 14th Annual Green Roof and Wall Conference* in Washington, DC. It was a huge success thanks to our sponsors, exhibitors and local host committee. More than 35 hours of conference recordings are now available for purchase to earn CEUs at CitiesAlive.org.

GRHC introduced the Stormwater Technical Workshop at *CitiesAlive*. More than 150 professionals attended this workshop which was developed by a team of corporate leaders as a product neutral, science based course for those wanting to understand the nuts and bolts of green roofs and stormwater retention and policy.

GRHC participated in the first South American World Green Infrastructure Congress in Bogotá, Colombia where more than 350 attendees gathered from more than 20 countries to work to advance the use of living architecture. See worldgreenroof.org for more information about the World Green Infrastructure Network.

This year we welcomed new board members to both Green Roofs for Healthy Cities and the Green Infrastructure Foundation. Congratulations Elizabeth Hart, Sustainability Program Development Manager, Tremco and new GRP Committee Co-chair; Christian Mahlstedt, President, Ginkgo Sustainability; Melissa Daniels, Co-owner, Plant Connection and Green Walls Committee Co-Chair, all of whom have joined the GRHC board. David Yocca, Principal, Conservation Design Forum; Wendi Goldsmith, Co-Founder, The Center for Urban Watershed Renewal; and Lois Vitt Sale, Chief Sustainability Officer, Wight and Company have all recently joined the Green Infrastructure Foundation board. An even stronger team for 2017!

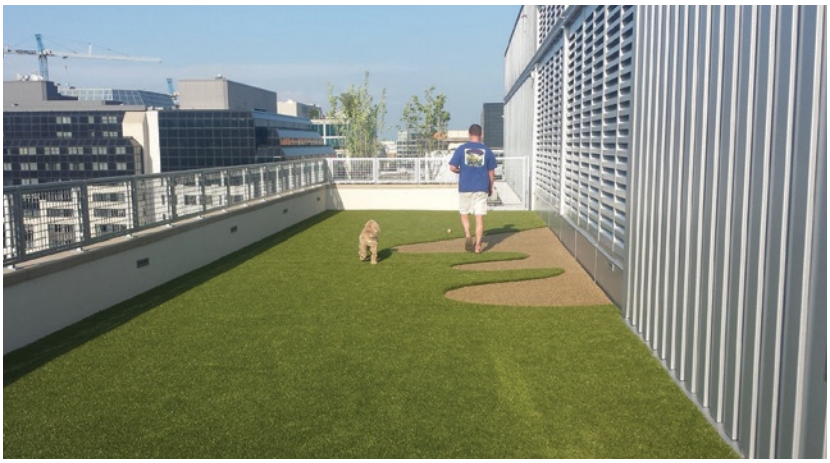
Every year the business case for living architecture grows stronger, both from a public and private perspective, as we sharpen our analysis of the many social, economic and health benefits these technologies provide building owners and communities. In the future, cities that do not embrace policies and programs that result in the massive deployment of living architecture will likely suffer. For they will increasingly become places where intelligent and creative people, the human 'engines' of our economy, will no longer choose to live. So let's continue on our journey and work together to ensure we future-proof our buildings and communities and make them as healthy, equitable and prosperous as we can!

Sincerely yours,

Steven W. Peck,
Founder and President

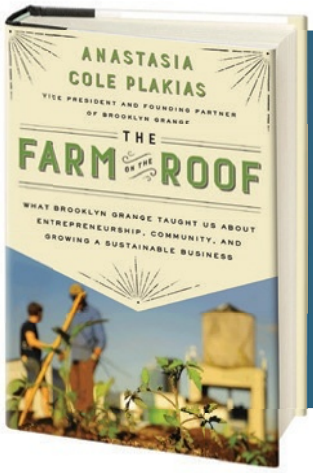
LIVING ARCHITECTURE
DOCTOR

Many green roofs and walls require a 'trip' to the doctor. This 'living wall' is in trouble! Diagnose the problem and emailing editor@greenroofs.org. Your response could be featured in the next LAM.



FALL ISSUE
The green roof is dead... what happened to it?

TREATMENT
The 'green' roof pictured in the previous issue and below was in fact made from fossil fuels because it is artificial turf. The roof is designed for dogs that need to relieve themselves, thereby taking the negative impact off other accessible roof areas in the condominium complex.



BOOK REVIEW: THE FARM ON THE ROOF
ANASTASIA COLE PLAKIAS

In their effort to build the world's first and largest commercial green rooftop farm, the founders of Brooklyn Grange learned a lot about building and sustaining a business while never losing sight of their mission — to serve their community by providing delicious organic food and changing the way people think about what they eat. Their story is about more than just farming. It serves as an inspirational and instructional guide for anyone looking to start a business that is successful while making a positive impact. For more details and to purchase this book, visit www.brooklyngrangefarm.com/rooftop-farm-book/.

CITIESALIVE

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SAVE THE DATES!

Photo: GRHC Awards of Excellence Winner 2011. Recipient: Plant Architect Inc. & Perkins + Will Canada

GREY TO GREEN

Toronto | May 8-10, 2017

Quantifying Green Infrastructure Performance

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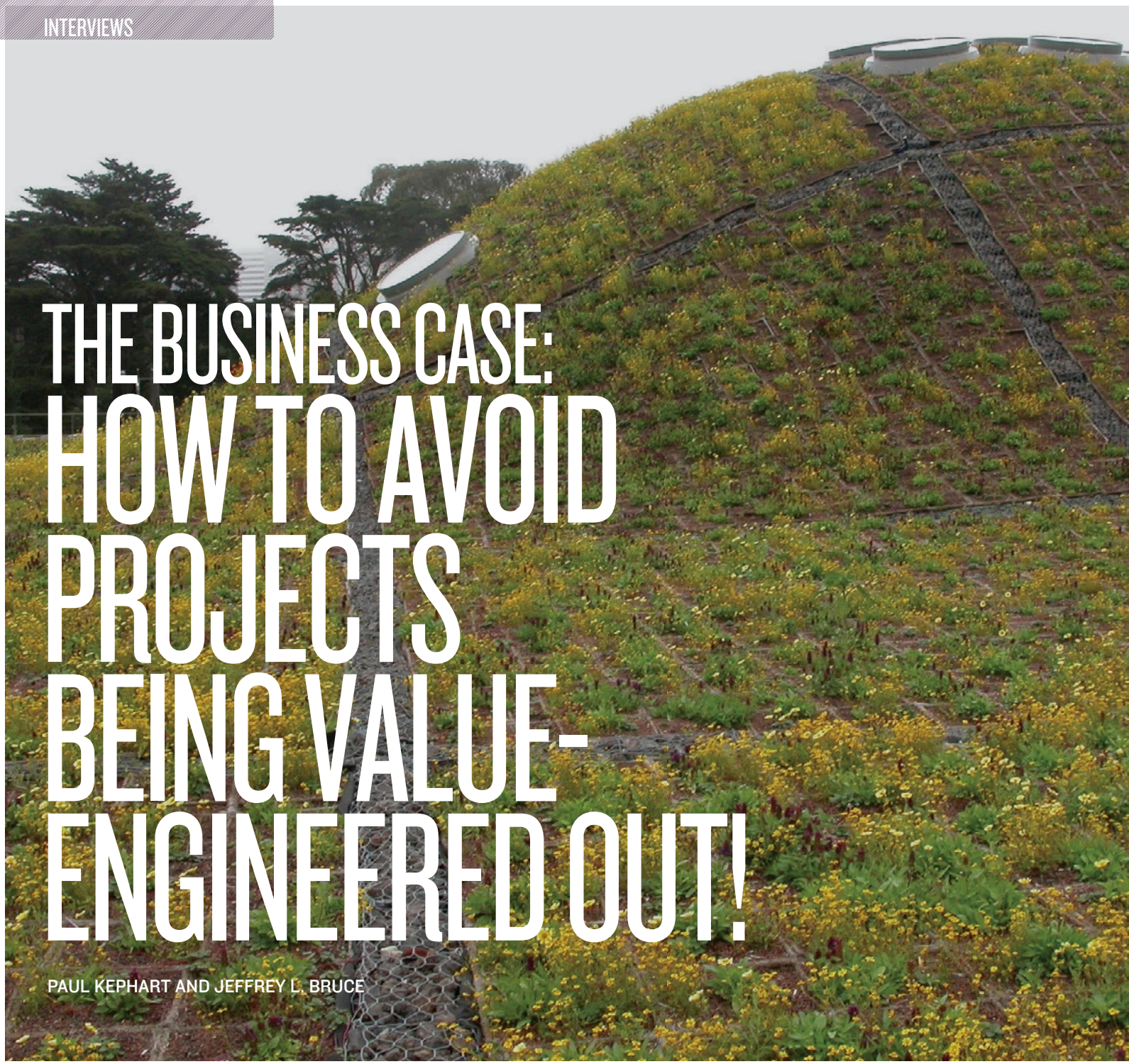

THE BUSINESS CASE: HOW TO AVOID PROJECTS BEING VALUE-ENGINEERED OUT!

PAUL KEPHART AND JEFFREY L. BRUCE

We asked two multiple award winning green roof and wall designers about the business case for their work, and how to avoid the value engineering out of green roofs and wall projects on new buildings. Here Paul Kephart and Jeffery Bruce share their insights into how to avoid losing projects before they commence; how best to firmly anchor living architecture into projects.

Responses edited for length and clarity.

Photo courtesy of California Academy of Sciences, Rana Creek Living Architecture

ON THE ROOF WITH:

Paul Kephart, GRP, ASLA CPESP Landscape Ecologist and CEO of Rana Creek Design has completed many successful award-winning green roof and wall projects, among them the California Academy of Sciences.

Jeffrey L. Bruce, GRP, FASLA, ASIC, LEED, is the Principal of Jeffrey L. Bruce and Co., a multi-award winning firm recognized for its green infrastructure design work.

LAM: *What do you think causes green roofs and walls to be value engineered out of new building projects?*
Jeffrey Bruce (JB): Green roofs are often removed because new buildings are often over budget from the get go. The performance and amenities desired are often beyond the available budget. Various building professionals have different strategies to deal with this pressure, one being the value engineering of the green roof and other green infrastructure elements. Construction professionals are concerned primarily with on time and on budget, and often don't care about the green roof.

LAM: *What motivates your clients to choose to implement a green roof? What is the business case?*

Paul Kephart (PK): Our clients are under the assumption that green roofs and other forms of green infrastructure provide more opportunities than "business as usual". We work with our clients to help them recognize their projects can perform better environmentally, garner community support and effectively manage the sociopolitical risks of development. Our clients are presented with green roof opportunities which are typically designed to fulfill a specific need, such as storm water retention, thermal performance, habitat creation, or carbon sequestration, while often offering location-specific and valuable co-benefits, such as public space, food production, and gardens. The business case looks at regulatory compliance costs, capital costs, inputs and maintenance costs and evaluates the financial return for a suite of benefits such as increases in a development footprint, a decrease in potable water and energy use, or a public garden that enhances creativity, health and employee productivity.

LAM: *What do you recommend designers do to try to avoid the all too often, value engineering removal of a green roof or wall on a new construction project?*

JB: There are a number of ways to avoid the value engineering removal of projects.

First off, designers need to be competent in understanding the economic benefits of a green roof or wall and be able to estimate the first costs and return on investment in the time frames provided by the owner/developer. It is important to demonstrate early on the financial benefit to the project in as many ways as possible, most of which will be operational in nature.

If you can, link the green roof to compliance requirements or building performance. In some jurisdictions, this is related to stormwater management or green space requirements. In other jurisdictions, you can even have the green roof approved as stormwater management utility. So if the green roof is taken out, designers have to come up with another approach to compliance which may not be cost-effective, given how advanced the project is.

IT IS ALL IN CRAFTING THE MESSAGE, UNDERSTANDING THE OWNER, DOING THE MATH, AND DELIVERING THE PROMISED PERFORMANCE.

- JEFFERY L. BRUCE

Demonstrate the value of the green roof by integrating it into the overall building design. For example, pre-conditioning the air going into the building and thereby saving money on heating and ventilation costs. If you take the roof out then you have to buy larger mechanical equipment, so the cost savings is not there. Integrating the green roof with solar panels for ballast and improved energy production is another strategy. Using green roofs to manage grey water, air conditioning condensate, stormwater water or other types of water will achieve cost savings in terms of using other systems. Integrated design also contributes to scoring better on various green building rating systems, which are often a component in the overall branding and sale of the building, or even a compliance issue, depending on the jurisdiction or client.

Work towards having an owner-advocate. It is hard to talk an owner into a green roof if they don't want one. There may be a lack of understanding about green roofs from the maintenance people in the organization, or simply the inertia of doing the same type of building over and over again. Try to reach out to the owner to educate them about the multiple benefits a green roof has so they will be less likely to agree to its removal. Engaged owners act as the gatekeepers so if they don't see the value of the green roof then it is more likely to be removed. If the roof or wall is a visible component of the project, which links the building to its surroundings, this can help maintain it.

The final way to anchor the green roof or wall is to change

Photo courtesy of California Academy of Sciences, Rana Creek Living Architecture

the pro forma of the project by generating revenue from the roof. This could be a subsidy, like an annual stormwater credit, or a revenue stream from weddings, food production, or rentals, etc.

It is all in crafting the message, understanding the owner, doing the math, and delivering the promised performance.

PK: We want our clients to understand under what circumstances it is cost effective to include green infrastructure in its projects. We advise the organizations we work with to build fit-for-purpose green infrastructure integrating the areas of strategy, innovation, business creation, project economics, engineering, environmental sustainability, and beauty. When value engineering occurs, it usually happens because we failed to include one of more of these values into the design process.

THE PHILADELPHIA STORY

INSIGHTS INTO PHILADELPHIA'S GREEN INFRASTRUCTURE TRANSFORMATION

HOWARD NEUKRUG, PE, BCEE, HON. D. WRE AND FORMER COMMISSIONER, CEO OF PHILADELPHIA WATER

INTERVIEWED BY STEVEN PECK, GRP

Howard Neukrug is one of my heros. He is the main architect of Philadelphia's Green City, Clean Waters $2.5 billion, 25 year plan to transform the health of the City's creeks and rivers through the adoption of widespread green infrastructure investment and development. In response to the US EPA's requirements to reduce storm sewer overflows, Philadelphia Water explored various grey infrastructure options. They found they would have to build a pipe 30 to 34 feet in diameter and more than 30 miles long under the Delaware River to manage stormwater flows. The estimated cost of the project would be almost $10 billion, far too much money for the City and its ratepayers.

Under Howard Neukrug's leadership, they switched gears and adopted a bold plan to invest in converting more than 10,000 acres of impervious surfaces to green infrastructure. Recently retired from public service as the Commissioner and CEO of Philadelphia Water, Mr. Neukrug is now an advisor to the US EPA and the National Science Foundation, and an adjunct professor at the University of Pennsylvania where he teaches the course: The Water Industry in the 21st Century and Sustainable Cities. I caught up with Mr. Neukrug at the Low Impact Development Conference in Portland this summer, and asked him to share his insights on how to achieve the green infrastructure transformation now fully underway in Philadelphia. Here's what he had to say.

SWP: *Thanks for the interview, Howard. Green infrastructure has a wide variety of community benefits beyond stormwater management. What do you think the pros and cons are of public water utilities incorporating considerations like jobs, health and well being into their traditional mandate to manage stormwater and drinking water?*

HN: The water sector is changing. More and more, we are recognizing that the cost and complexity of our water environment challenges – floods, scarcity, emerging contaminants, runoff, overflows, clean drinking water, rising tides – requires us to seek "collective impact" solutions – that is, we must look toward other utility sectors, governments, private companies and community to support us if we are to advance achievable,

cost-effective, long-term solutions to our water concerns. In our cities and towns, we are finding new allies with whom we can leverage our needs with those of our communities – creating jobs, improving property value, supporting education and the livability of our neighborhoods. Working together, we can make our cities greener, more vibrant and more sustainable.

SWP: *The monetization of stormwater through utility fees requires political and bureaucratic courage. What advice would you have for jurisdictions that are considering this?*

HN: Raising government or utility fees or taxes never improves your standing in the community. And yet, when a commodity such as rainwater has no value, how can you justify doing anything with it other than dumping it down the drain as a waste product? In the past, as our cities and towns were developing, we did not consider the impacts of our actions on our environment. Today, we all want safe, accessible and attractive rivers and streams. We can only get there by placing the true cost (or price) of managing rainfall on the consumer (the landowner) and hope that education and economics will change behavior and how we manage and use our land. This takes a strong local leader who can provide the community the vision and the wherewithal to establish utility fees. And we should all work with such a leader to see that strong political will does not result in the loss of this person's job!

SWP: *Philadelphia is working towards implementing 10,000 green acres in the City, replacing impervious surfaces? How do green roofs factor into this equation?*

HN: Green roofs are a real benefit for the developer trying to maximize usable square footage and meet a building's requirements for stormwater management. The trend towards green roofs has been growing exponentially of the past decade in the US, especially in dense cities like Philadelphia where re-development of existing built spaces require consideration of stormwater management. Given the power of the private sector, the design, construction, operation and maintenance of green roof systems has improved dramatically in recent years and is now among the most popular means to meet stormwater development requirements,

"OUR GOAL IS NOT JUST TO MAKE OUR RIVERS AND STREAMS FISHABLE AND SWIMMABLE AS REQUIRED UNDER THE CLEAN WATER ACT, BUT ALSO MAKE OUR WATER RESOURCES DRINKABLE, SAFE, ATTRACTIVE, ACCESSIBLE, ABUNDANT AND AVAILABLE."

- HOWARD NEUKRUG, PE, BCEE, HON. D. WRE

provide an amenity to the building occupants, increasing usable square footage, increase property value and meet market-driven forces to make our new structures sustainable and even, perhaps, LEED certifiable.

SWP: *Do green walls factor into the mix of green infrastructure programs?*

HN: Sorry, Steve, but not really at this point … it may be the lack of data on the stormwater retention benefits.

SWP: *How have you been working to address the issue of maintenance of green infrastructure? Do you think that utilities should factor in other, non-stormwater benefits, into their calculations of investment potential in green infrastructure and why?*

HN: In the highways sector, sustainable often means how long can you make the concrete last. The same can be said for the water sector. It is hard to get past the fact that hard, grey, centralized water systems worked for the Romans and that many of our cities are operating well today with pipes and facilities that are well over a century old. Green infrastructure needs the support of a strong maintenance program; there is no getting around that. But if you look at the schoolyards of many of the US city's public school systems, you can quickly see the extreme result of a philosophy of grey over green – broken up asphalt surfaces, with little left to the imagination for hope or future. At some point, a society needs to confront what is important and recognize that bringing nature into our cities is not free, but should not be therefore excluded from consideration. As we get better at understanding the true "triple bottom line" values of green infrastructure, we are finding that its costs compare very favorably with its alternatives. But this will require a change in our thinking, our values and our expectations from government and other large landholders.

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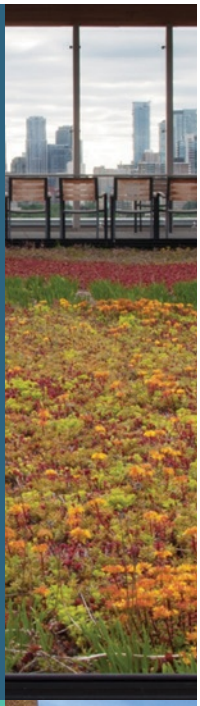
2016 AWARDS OF EXCELLENCE

The Green Roof & Wall Awards of Excellence was held on November 3rd at the *14th Annual CitiesAlive* in Washington, DC. 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 actively increasing biodiversity in major urban centers and rehabilitating brownfield sites with native landscaping. These awards acknowledge excellence in innovative green roof and wall design; raise awareness of the multiple benefits that green infrastructure provides; honors 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 and wall industry.

We invite everyone to submit projects now to be considered for the 2017 Awards which will be presented at *CitiesAlive* in Seattle, WA. Submission details can found at greenroofs.org or citiesalive.org.

CONGRATULATIONS TO ALL OF OUR WINNERS



JUDGE'S TABLE

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

Jeffrey Bruce, GRP, FASLA, ASIC, LEED
Jeffrey L. Bruce and Co. LLC & Chair, GRHC Board of Directors

Amy Falder
New York Green Roofs

Terry Guen, FASLA
Terry Guen Design Associates

Michael Krause
Kandiyo Consulting

Monica Kuhn, GRP, O.A.A
Monica E. Kuhn, Architect Inc.

Christopher Lyon, MBA
Tournesol Siteworks

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

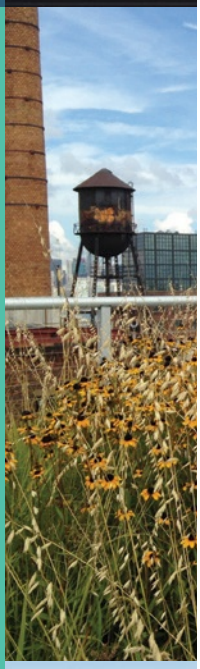
Ishi Buffam
Assistant Professor, University of Cincinnati

Reid Coffman
Associate Professor, Kent State University

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

Youbin Zheng
Environmental Horticulture Chair, University of Guelph

Peter Lowitt, FAICP
Director, Devens Enterprise Commission



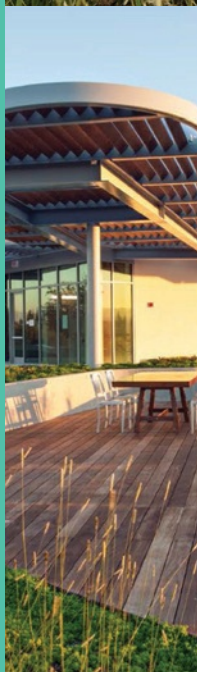


Photo courtesy of Kerry Ross

DESIGN AWARD CATEGORY
Extensive Industrial/Commercial

PROJECT
Alberta Eco-Roof Initiative

LOCATION
Calgary, AB

TEAM MEMBERS

Designer
Kerry Ross, GRP, Green T Design
Bob Thornton, Studio T Design

Supplier
Marie-Anne Boivin, Soprema
Trevor Sziva, Soprema

Contractor
Stephen Teal, GRP, Flynn Canada

Building Owner
Neil Ubi, Innovate Calgary
Dave MacKillop, Innovate Calgary

A SHOWPIECE OF RESEARCH AND FUNCTION

An organization and building that houses a mixture of tech start-ups and likens itself to an ecosystem sprouts green roof habitat to deliver ecosystem services. The project serves as a key component to Innovate Calgary's commitment to reducing its carbon footprint, but also serves as an example of clean technology. The green roof provides a tangible example to educate staff and visitors and it acts as a tangible resource for peers in the field of living architecture.

It was ten years ago this summer that the first phase of planting was undertaken on top of the link building that connects two wings of the Alastair Ross Technology Centre in the University of Calgary Research Park.

This project distinguishes itself from other green roof projects as it is the only known green roof in Alberta to feature different systems side by side, varying by type and depth of growing medium, and plant species selection. In addition to the various systems trialed here, a two year stormwater study was performed which demonstrated the effectiveness of green roofs to retain runoff.

By using a variety of planting systems and monitoring their progress, we have been identifying types of systems and species that thrive in the Calgary climatic region, noting successful outcomes as well as shortcomings. The installations serve as a green roof botanical garden.

The data that is obtained provides information for future installations in the region, which will help make wise decisions in designing, fine-tuning and maintaining projects. The performance data serves to help create useful and supportive policy.

The purpose of this project has been to exhibit leadership in this emerging green building practice, to remove barriers and start the process of greening tens of thousands of feet of environmental and social assets. The overall goal is to quantify the environmental functions and economic benefits and estimate the costs of green roof adoption in Calgary. The judges praised this project for its research applications and outcomes, as well as its use of local plantings.

The Alberta Ecoroof Initiative project is the green roof that I have worked most with. It has evolved over time and my understanding of its characteristics and benefits has grown. I intentionally call it an ecoroof because it is not green all of the time; the changes in the colours, the varying blend of plant species over the seasons and the habitat it created has been an interesting wonder to observe.

- Kerry Ross, GRP, Green T Design

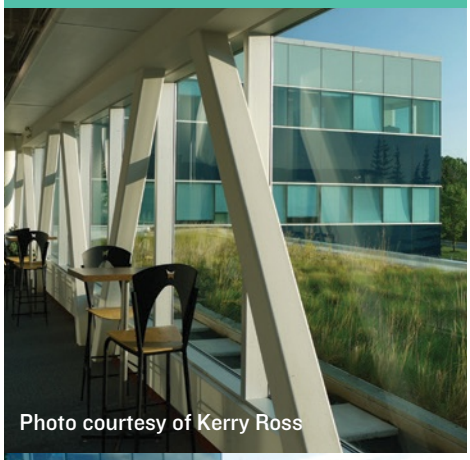


Photo courtesy of Kerry Ross

Photo courtesy of Bob Thornton

DESIGN AWARD CATEGORY
Extensive Institutional

PROJECT
Bridgepoint Active Healthcare

LOCATION
Toronto, ON

TEAM MEMBERS

Planning, Design, & Compliance
Stuart Elgie, Stantec Architects
Mitch Hall, KPMB Architects

Design, Build, Finance, & Maintain
Rodel Misa, HDR Architecture
Greg Colucci, Diamond Schmitt Architects

Landscape Consultant
Brad Keeler, MBTW Group

Structural Engineer/LEED Consultant
Kathryn Edwards,
Halsall Associates/WSP Canada

Contractor
Darius Zaccak, PCL Constructors Canada

Mechanical Consultant
Brad Bull, Smith + Anderson

Electrical Consultant
Brandon Hayes, Smith + Anderson

Building Envelope Consultant
Mark Brook, Brook Van Dalen & Associates

Developer & Equity Investor
Brian Budden, Plenary Group

Client
Marian Walsh, Bridgepoint Active Healthcare

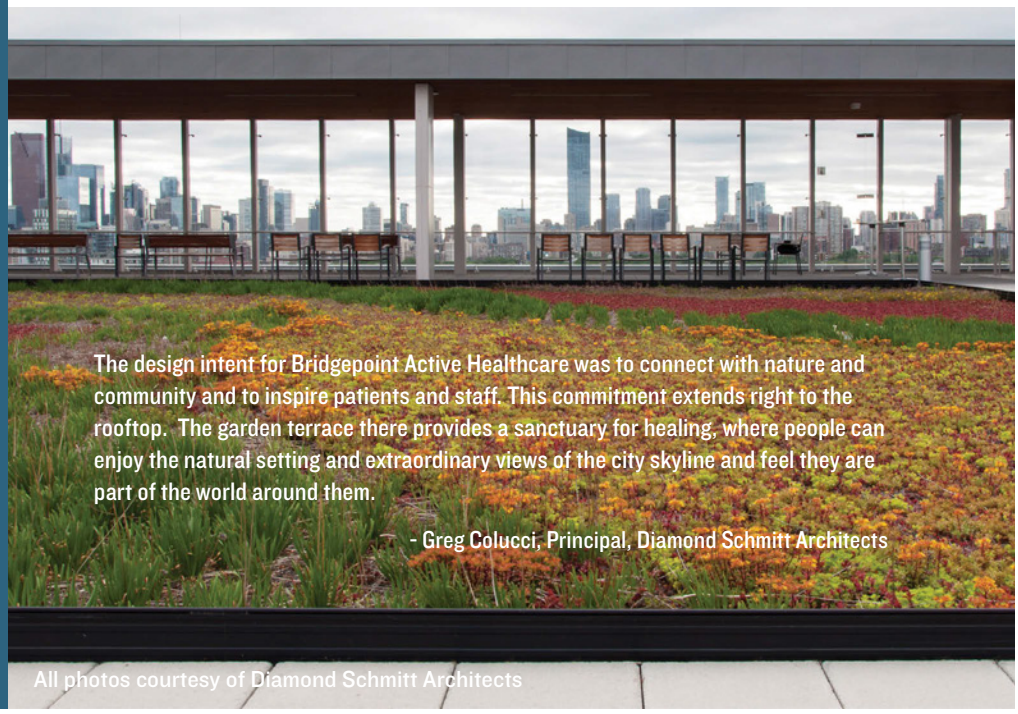
THE RESTORATIVE POWER OF GOOD DESIGN

Bridgepoint's goal is to teach, coach and inspire chronic care patients to "live well" and to be active participants in shaping their own treatment and health outcomes. With an average patient stay of three months, there was strong impetus to design a built environment that facilitates recovery and wellness. Bridgepoint Active Health Care is the manifestation of the belief in the restorative power of good design.

From animated public spaces to intimate private ones, the building connects community and landscape with patients and staff. Panoramic views of the Don River Valley within every patient room, open terraces at the roof level, mid-tower and at grade levels provide broad visual engagement with the surrounding community, parklands and landscape.

Spaces for rest and therapy include the large ground floor terrace adjacent to food services, a therapy pool with picture-windows overlooking the park and a wheelchair-accessible meditative labyrinth patterned on the one at Chartres Cathedral. An accessible, therapeutic green roof terrace on the 10th floor extends the therapeutic benefits of nature vertically and offers active horticultural therapy. Patients can participate in a gardening program of engage in self-directed rehabilitation. People practice walking on the gentle slope, build strength in wheelchairs by moving up the gently sloped ramp or by climbing stairs.

A four-year post occupancy evaluation was specifically developed to evaluate the impact of the design on patient health and well being. By blurring the distinction between private and public property and providing public circulation continuously around a fully glazed exterior, the facility is highly permeable. Staff and patients feel connected to nature, to the city and consider the hospital to be a place of wellness. Patients feel safer, are more cheerful, are comforted and are more satisfied with their stay. They feel they have more opportunities to visit with others, perceive improvements in their mental health and are more confident in their mobility. The judges praised this project's use of green roofing for patient recovery and human health treatment and accessibility as well as the use of deeper root profile plants in the meadow roof and integration of small trees.



The design intent for Bridgepoint Active Healthcare was to connect with nature and community and to inspire patients and staff. This commitment extends right to the rooftop. The garden terrace there provides a sanctuary for healing, where people can enjoy the natural setting and extraordinary views of the city skyline and feel they are part of the world around them.

- Greg Colucci, Principal, Diamond Schmitt Architects

All photos courtesy of Diamond Schmitt Architects

Bright, playful plant palettes and awe-inspiring views of the Manhattan skyline and Brooklyn's industrial past instill the vaulted courtyard and rooftop of this condominium with a sense of environmental connection and quiet beauty.

- Adam Schatz, GRP, New York Green Roofs

All photos courtesy of New York Green Roofs

DESIGN AWARD CATEGORY
Extensive Residential Award

PROJECT
Williamsburg Condominium

LOCATION
Brooklyn, NY

TEAM MEMBERS

Head Designer, Installation Project Manager
Adam Schatz, GRP, New York Green Roofs

Co-Creation Direction
Chad Gessin, Condo Board

Waterproofing Provider
Michael Balaban, Siplast Engineered Roofing Systems

A RETURN OF WILLIAMSBURG'S NATURAL SYSTEMS

Williamsburg, Brooklyn, is currently a hotbed of real estate development. Most of the neighborhood suffers from a serious lack of green infrastructure. In 2011, New York Green Roofs (NYGR) was contacted by the condominium board of a large complex at 125 North 10th Street and asked to follow up a major waterproofing rehabilitation to transform the existing rooftop spaces into something of a dream for the residents. Two distinctive six story buildings on the north and south sides of the property are connected by a vaulted courtyard walkway so that the condo works as a whole. With 86 units of owners to please, NYGR kicked-off the design phase by setting up a "co-creative" public meeting to hear about goals and desires for the green roof. A short list of elements to be included in the overall functional program was produced based on feedback and distributed to the tenants. Common themes included the importance of integrating the green roof with the existing garden sculptures, organizing plenty of space for entertainment and meals, creating sitting/lounge areas, and retaining open spaces for children and dogs to play. Surveys showed that the most important aspect of the renovation was to simultaneously create a greener environment and increase the property value of the residence with the project.

The resulting semi and intensive green roofs provide a beautiful, ecological experience when moving between buildings and when gathering together. On the south roof a series of gently rolling mounds and a colorful palette grasses and flowering perennials mimic landscapes that look and function as in the wild: robust, diverse, and visually harmonious, with views of the Williamsburg Bridge and sunsets over the Manhattan skyline to boot. The vaulted courtyard pass-through is a hybrid of both wild and cultivated plant communities.

Industrialization drove most nature out of cities years ago. This project brings back Williamsburg's natural systems that thrive within our built world. The judges praised the beauty of this project and its maintenance strategy to ensure continued project health and viability. The judges also highly praised the plant palette variety used in this installation.

Bringing Green Design to Life

ON ROOFS AND WALLS

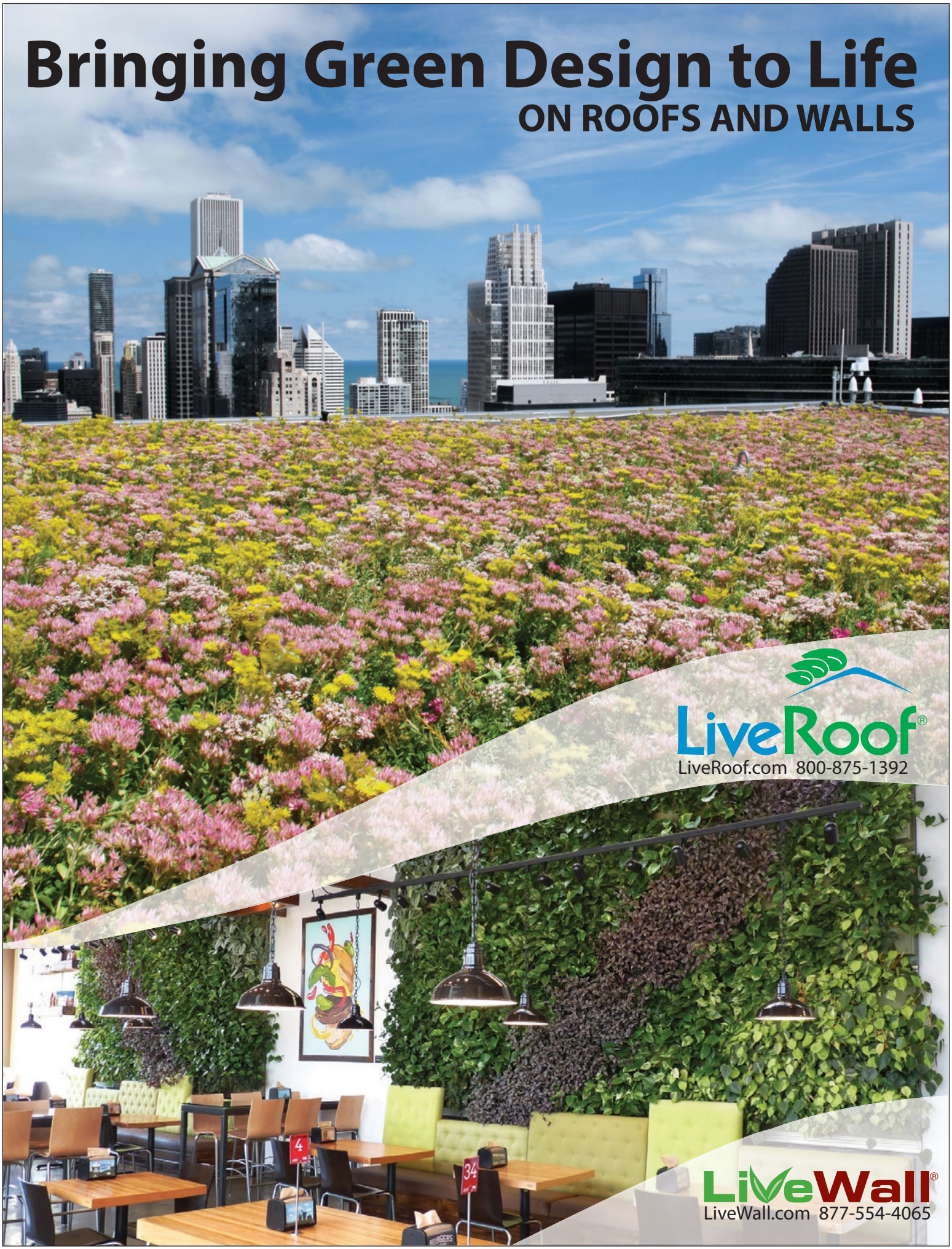


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Photo courtesy of Bionic Landscape Architecture

Landscapes on structures are complex. Invention is the best design strategy to engage the technical drivers and rise above all of the constraints.

- Marcel Wilson, Bionic Landscape Architecture

DESIGN AWARD CATEGORY
Intensive Industrial/Commercial

PROJECT
Tech Deck

LOCATION
Mountain View, CA

TEAM MEMBERS

Landscape Architect
Marcel Wilson, Bionic Landscape

Architect
Rob Zirkle, Brick LLP

Living Roof Contractor
Marta Kephart, Rana Creek Design

General Contractor
Jordan Drake, Nibbi Brothers

Structural Engineer
Crosby Group

Electrical Engineer
Rexmoore

Plumbing
Nicodemus Plumbing

Waterproofing
Aquatech Consultancy

Civil Engineer
Chad Browning, Sandis

Mechanical Engineer
Mechanical Design Studio

A NEW PARADIGM FOR INFILL WORKPLACES

This project – a four-story lot line-to-lot line office building in Mountain View, CA – began in 2010 when no one was building anything, especially office space. But Mountain View, CA in Silicon Valley was an anomaly to this national trend with an office vacancy rate at a scant four per cent. There was a strong financial will to build on this site given its central location downtown. With high visibility and immediate access to commuter rail, the project had the ability to create density and attract a critical mass of workers that would benefit the local businesses. These contextual influences compelled the developer and the city to seek a more evolved model of infill development for Silicon Valley.

The requirements for the project were formed through this greater potential and resulted in a scope of work including a 16,000 sf green roof, a 5,500 sf streetscape, and an overall design objective of a LEED platinum designation. The green roof became an important component in the overall equation because the site was maxed out for leasable space. Everything else – stormwater treatment, amenities, common areas, building systems, open space, and habitat – had to be accommodated and coordinated on the roof. The requirements to achieve high performance on a tight site generated the Tech Deck, and this contemporary model of a Silicon Valley workplace where the image of the company, the health of its workers, their productivity, and their retention are core underlying values.

Designed for a global information technology company, the Tech Deck employs a large shade structure, a custom paving system, walls, decks, a bocce ball court, planting, and green roof systems that create a new paradigm for infill workplaces in Silicon Valley enabling collaboration, social interaction, and ecological performance.The judges praised the look and feel of this project, as well as the location, having been installed in a region which is otherwise under-represented for green roof installations.

Photo courtesy of Bionic Landscape Architecture

Photo courtesy of Meriko Reed

HANDS-ON FOOD PRODUCTION AND LEARNING AT TRENT UNIVERSITY

This project is located on the Trent canal in Peterborough, Ontario. The roof garden was specifically designed for urban farming and is situated over the biology wing of the Environmental Science Building of Trent University. Through the efforts of Dr. Tom Hutchinson, Professor Emeritus, this intensive green roof also provides ongoing research into the deleterious effects of ground level ozone on crop production and provides students with an opportunity to study the potential of plants to filter out air pollutants. The food produced on the roof provides organic produce to The Seasoned Spoon, a student run, fair trade, vegetarian campus café, as well as providing a measure of food security to local citizens through the Peterborough chapter of Food Not Bombs.

The vegetable garden plots are located on the outside strips of the roof. The center strip is planted with a pallet of native perennials specifically chosen for pollinators like butterflies and bees. This rooftop urban farm employs organic principles and highlight native plants, indigenous agricultural techniques, permaculture techniques and practice seed saving.

The judges were impressed by this projects vibrancy and apparent dedication and enthusiasm of the participants in its development and maintenance. They also praised the project for its high human ecological factor, providing invaluable hands-on experience for university students and future generations.

DESIGN AWARD CATEGORY
Intensive Institutional

PROJECT
Urban Farming on the Trent

LOCATION
Peterborough, ON

TEAM MEMBERS

Green Roof Provider
Jelle Vonk, ZinCo Canada Inc

Building Architect
Royden Moran, Royden Moran Architect

Roofing Contractor
Joe Battisti, Roma Building Restoration

Design & Installation
Nate Torenvliet, Environmental Design Group

Leak Detection System
Chris Eichhorn, International Leak Detection

Waterproofing Supplier
Tremco

Plant Material
Mark Vanderkruk, Connon NVK

With this Urban Roof Top Farm, Trent University was ahead of the curve as they were one of the first ones successfully growing crops on the roof on a larger scale. It is a great example for future Urban Roof Top Farms in North America and especially in northern colder climates.

- Jelle Vonk, ZinCo Canada

All photos courtesy of ZinCo Canada

As well as being an aesthetic element, this biofilter is also a functional piece of machinery, improving indoor air quality. It actively removes pollutants from the air, generating over 1,500 cfm (700 litres per second) of virtual fresh air. That's enough 'fresh' air to supply two thirds of the needs of over 150 people. And this virtual fresh air is generated using up to 90 per cent less energy than conventional air treatment systems.

- Dr. Alan Darlington, Nedlaw Living Walls

All photos courtesy of Kasian/Nedlaw Living Walls

DESIGN AWARD CATEGORY
Interior Green Wall

PROJECT
Edmonton Federal Building

LOCATION
Edmonton, AB

TEAM MEMBERS

Product Supplier & Designer
Dr. Alan Darlington,
Nedlaw Living Walls
Randy Walden, Nedlaw Group

Designer
Peter Streith,
Kasian Architecture

Principal
Oliver San Agustin, Kasian Architecture

Job Captain
Les Poon, Kasian Architecture

Contract Administration
Susana Lui, Kasian Architecture

Principal Design
Bill Chomik, Kasian Architecture

LEED Coordinator
Esther Rivard-Sirois, GRP
Kasian Architecture

Project Manager
Rob Mulyk, Kasian Architecture

Project Administration
Jennifer Tucker, Kasian Architecture

A CASE STUDY IN HIGH EFFICIENCY

The Bio-filter Living Wall system at the Edmonton Federal Building is the focal point of the large glass public atrium, the newly added grand entranceway into this rejuvenated historic building. The living wall and associated water feature provide a calm and serene environment in the busy public space. The vibrant layered and organic pattern of the plants makes the wall a work of art, and provides a foil for the otherwise angular and clean-lined space.

In the Edmonton Federal Building project, landscape and urban design were extremely important. The exterior of the building features numerous green roofs and an extensively landscaped plaza featuring local and native plant species. Utilizing a green wall within the building seemed the next logical step to ensure that the objectives so carefully considered on the exterior of the building also translated into the interior. However, this living wall is not only aesthetic; it is also a working element of the building's mechanical system. Air is actively drawn through the wall of plants, where biological components degrade pollutants such as formaldehyde and benzene into harmless constituents of water and carbon dioxide. The living wall also filters fine particles such as dust and spores. Once these processes have occurred the air is distributed back to the space mechanically. The living wall also contributes to the humidity levels of the atrium space contributing innovation points to the LEED Gold certification goal.

The judges felt that this project presented an excellent integration of living wall technology into the public space of the building in both a functional and beautiful way.

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Photo courtesy of Dave Mead

DESIGN AWARD CATEGORY
Small Scale Residential

PROJECT
Edgeland Residence

LOCATION
Austin, TX

TEAM MEMBERS

Environmental Designer – Green Roof and Surrounding Prarie
John Hart Asher, Ecosystem Design Group/Lady Bird Johnson Wildflower Center

Architect/Installer
Dan Loe, Bercy Chen Studio

THE INTERSECTION OF NATURE AND STRUCTURE

Edgeland House is located on a rehabilitated brownfield site in Austin, Texas. It is a modern re-interpretation of one of the oldest housing typologies in North America, the Native American Pit House. Like the Pit Houses of the past, Edgeland's insulative green roof and seven-foot excavation into the ground keeps it cooler in the summer and warmer in the winter.

The Edgeland project is about healing the land and ameliorating the scars of the site's industrial past. The project raises awareness about a diminishing natural landscape and its finite resources by creating a balance between the surrounding industrial zone and the natural river residing on the opposite side of the site. The surrounding four acres were restored back to a climax Blackland prairie consisting of native grass and wildflower species replacing the former dominant invasive plants that occupied the site. The simple act of pushing the landscape back to this former ecological condition provides habitat for local fauna, water cleansing, carbon sequestration, and improves air quality. The design team extended the prairie right onto the roof so that landscape and building merge into a seamless condition that eliminates the traditional figure/ground concept. Over 75 species of native grasses and forbs occupy the roof and include a mix of pioneer and later successional species. Many green roofs have failed in Texas' semi-arid sub-tropical climate due to extreme temperature swings, sparse rainfall and the use of inappropriate non-native sedum species. Edgeland's herbaceous species mix and green roof media were developed through 10 years of green roof research by the green roof designer. The prairie species chosen for this project can deal with the harsh Texas climate and the growing media possesses materials that promote water retention and regulate temperature to prevent spikes during both summer and winter months. The green roof growing media also consists of recycled local materials. The judges praised this project for its incredible architecture and fantastic integration of green roof as critical component of building operation and aesthetics. They were impressed by its integration into the local landscape and ecosystem, with a contrast of modern design and natural setting.

Image courtesy of Ecosystem Design Group/ Lady Bird Johnson Wildflower Center

Photo courtesy of Dave Mead

The most exciting thing about this project was the merger of the green roof with the surrounding landscape. Often times green roofs serve more as an experiential nod to nature, but Edgeland blurred the lines so that the house and landscape were truly one. If we, as designers, embrace such opportunities when they present themselves we can create a real positive change in our urban environments and actively thread ecosystems throughout our cities.

- John Hart Asher, Ecosystem Design Group/
Lady Bird Johnson Wildflower Center

Image courtesy of Ecosystem Design Group/
Lady Bird Johnson Wildflower Center

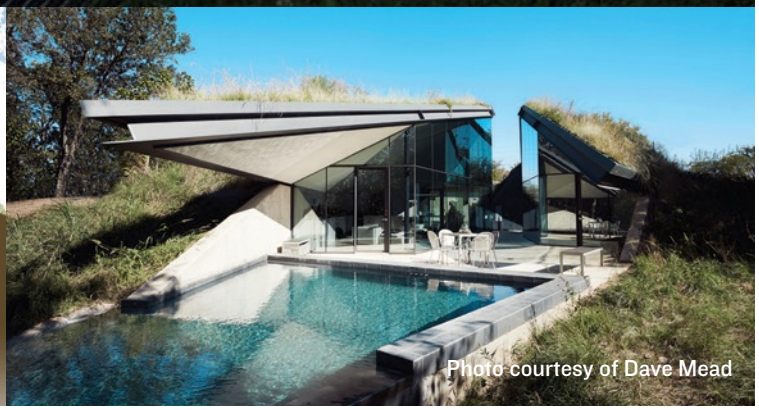


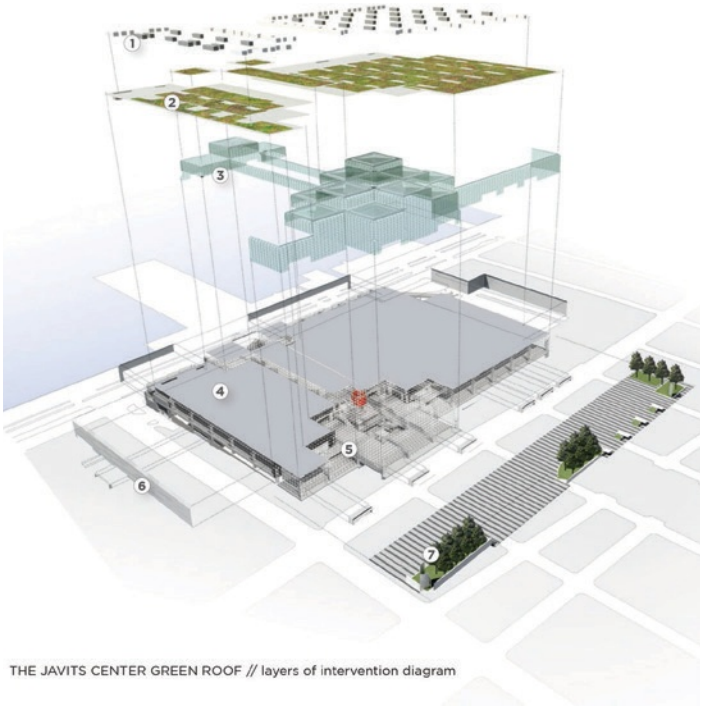
Photo courtesy of Dave Mead

Our goal was to retain the integrity and vision of the original design while capitalizing on opportunities to reinvent, revitalize, and sustain this dynamic, world-class facility. The green roof created a fifth façade in clear view of surrounding high-rises, stormwater retention, reduced energy consumption, lower heat-island effect, a wildlife habitat, and membrane protection—all at minimal cost.

- Bruce Fowle, FAIA, LEED AP, Founding Principal, FXFOWLE

Photo courtesy of David Sundberg/Esto

A FLOURISHING HABITAT IN MIDTOWN MANHATTAN



THE JAVITS CENTER GREEN ROOF // layers of intervention diagram

Image courtesy of FXFOWLE/Epstein

Located on the far west side of Manhattan, the Jacob K. Javits Convention Center (known as the Javits Center) is New York City's primary venue for trade shows and conventions. The 6.75-acre extensive green roof—the second largest in the country—proved to be more cost-effective than a conventional roof system due to the green roof's lighter weight, which avoided costly structural reinforcement. The Javits Center green roof is equipped to prevent approximately 6.8 million gallons of stormwater runoff per year, improving the quality of life for the surrounding community.

Overall the site retains 72% of the rainfall that falls on it. Storms of less than six millimeters are wholly retained, and storms that are greater than ten millimeters are about 60% retained.

The roof also allows for restoration of habitat area, and provides aesthetic values of urban open space—the fifth façade of the building seen from many emerging adjacent high-rises. It conserves energy by moderating the temperature of the roof, helping to reduce temperature extremes inside the building and reducing the local heat island effect. To quantify the positive impact on the building's interior environment and the neighborhood, the renovation scope includes a scientific research study conducted by Drexel University.

Together, the Javits Center's new curtain wall, mechanical system, and green roof contribute to an estimated energy consumption savings of 26 per cent over the pre-renovation performance, which had been functioning 10 per cent under code. The judges praised this project's scale, profile and impact. They felt that its ability to expose thousands of residents and employees to otherwise absent green space, as well as the tremendous impact on local ecology and biodiversity in such an iconic urban location were more than worthy of special recognition. They also praised the interplay of urban and natural environment and the multi-faceted impact on the city.

DESIGN AWARD CATEGORY
Special Recognition

PROJECT
The Javits Center Green Roof

LOCATION
New York, NY

TEAM MEMBERS

Architect
Bruce Fowle, FXFOWLE
Larry Dalziel, Epstein

Construction Manager
Glen Johnson, Tishman Construction

Structural Engineer
Daniel Sesil, Leslie E Robertson & Associates

Landscape Architect
Ken Smith, Ken Smith Landscape Architect

MEP Engineer
David Cooper, WSP
Flack + Kurtz, Inc

Green Roof Supplier
XeroFlor America

Site, Civil, and Geotechnical Engineer
Marc Hallagher, Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C.

Lighting Consultant
Charles Stone, Fisher Marantz Stone, Inc

Roofing Consultant
Rainer Gerbatsch, Commercial Roofing Solutions, Inc

Exterior Wall Consultant
Robert Heintges, R.A. Heintges & Associates

Daylighting Consultant
Carpenter Norris Consulting, Inc

Waterproofing
Siplast


Photo courtesy of David Sundberg/Esto

CIVIC AWARD

Hamid Karimi, PhD, Deputy Director, Natural Resources Administration, DC Department of Energy & Environment

Leadership in Green Roof Installations

The Washington, DC metropolitan area has been the North American leader in green roof installations for the last five years. Part of this success is due to the civic leadership of Dr. Hamid Karimi, Deputy Director of Natural Resources at the District of Columbia Department of Energy and Environment. He has more than 30 years of experience in environmental management and has served as chair of the GRHC Policy Committee for the past four years. He manages programs in DC that administer the MS4 stormwater permit; regulate and manage wetlands and groundwater; conduct construction inspections and enforcement; and partner with other jurisdictions to restore the Chesapeake Bay and Anacostia River. Dr. Karimi has worked on development of regulatory processes for stormwater utilities and pollution control and is a long standing commissioner on the Interstate Commission on the Potomac River Basin. He leads a team that has developed a comprehensive stormwater management regulation for DC and an innovative stormwater retention credit trading market.

CHAIR'S AWARD FOR CORPORATE LEADERSHIP

Oscar Warmerdam, Sempergreen/Purple-Roof

Outstanding Business Leadership

Oscar Warmerdam is the President of Sempergreen USA and a long-time supporter of the development and advancement of the green roof industry. For years Oscar provided guidance on the Green Roofs for Healthy Cities Board of Directors, and served as advisor on policy and corporate member initiatives. In 2016 he served as the co-chair of the *CitiesAlive* Local Host Committee as well as the chair of the inaugural Stormwater Technical Workshop Committee. With Sempergreen's new Purple-Roof concept, Oscar has championed the development and distribution of stormwater performance testing methods for green roof assemblies to improve the recognition of green roofs as a stormwater best management practice.

RESEARCH AWARD

Richard K. Sutton, PhD

Green Roof Research Stalwart

Richard K. Sutton teaches at the University of Nebraska-Lincoln in both the landscape design and landscape architecture programs and was the editor of the seminal book Green Roof Ecosystems. His design consulting includes projects in small communities, residences, and landscape management of native plant communities. Keenly interested in rural landscapes, native ecosystems and visual quality, he combines those in his teaching, research and practice. Currently he is an accredited Green Roof Professional and is developing a short grass prairie model for ultra-thin extensive green roofs. He is also interested in preserving the openness and visual quality of Nebraska's landscape in the face of impending energy development.

ADVERTISING AWARD

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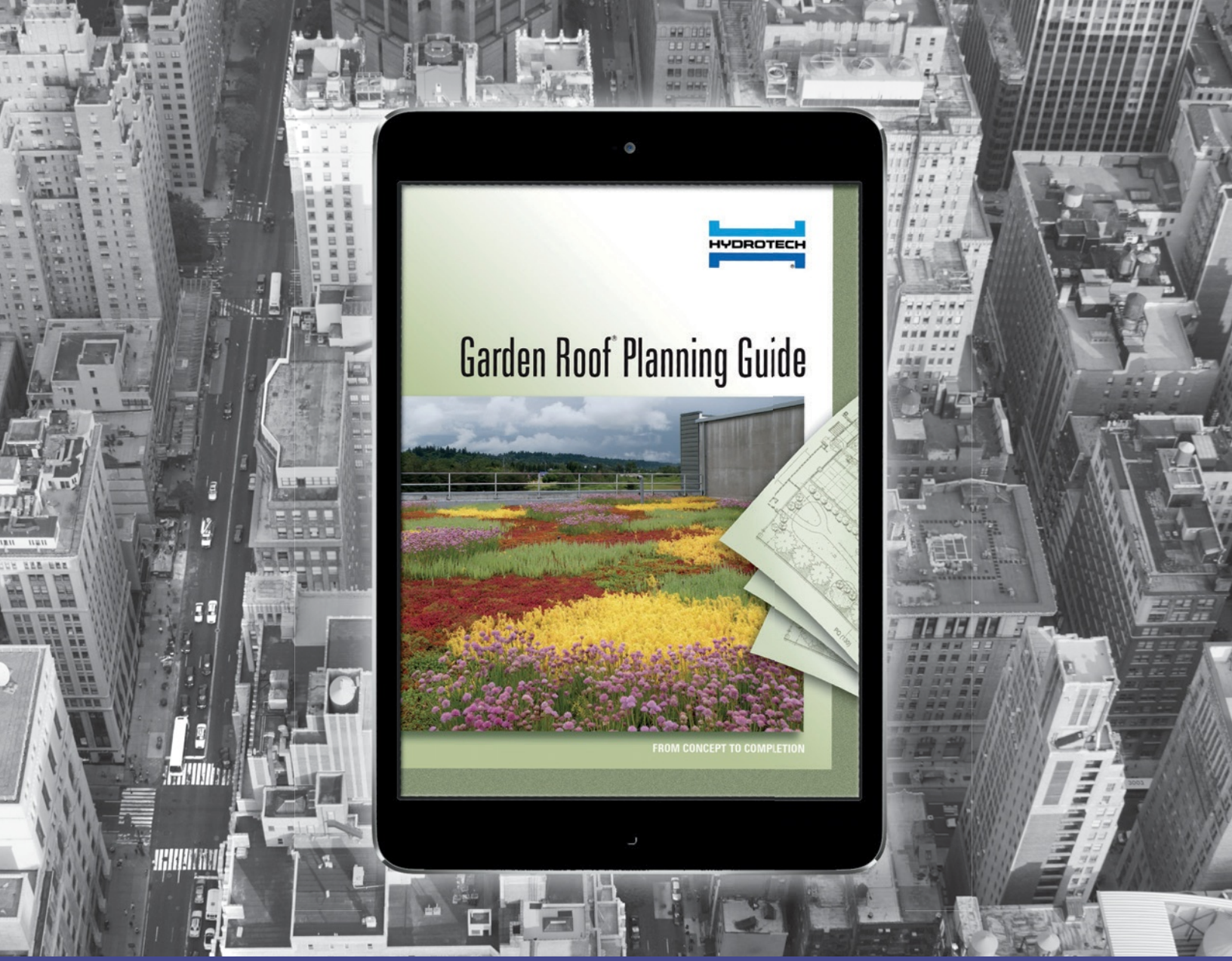

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COST-BENEFIT STUDY SUPPORTS SAN FRANCISCO GREEN ROOF POLICY & QUANTIFIES BIOPHILIC/TAX BENEFITS

BY KIRSTIN WEEKS AND ROHAN LILAUWALA

The public benefits of green roofs are wide-ranging and serve to improve the quality of life of people living in the communities in which they are built, especially when these communities are as dense and urban as San Francisco.

The exact nature of the public and private benefits will of course vary from community to community. Arup conducted a detailed study on the benefits of green roofs for the City of San Francisco in advance of its mandatory *Better Roof Ordinance*. This article provides a brief summary of the Arup study which compared the life-cycle costs and benefits of a green roof and a white (reflective) roof over a 25-year time period. The results of their analysis show that the increased installation and maintenance costs of a green roof are almost completely offset by the reduced stormwater and energy costs – both standard benefits that are included in life cycle cost-benefit analysis. However, Arup also broadened its method to include biophilic benefits, as well as a green roof's effect on a building's cap rate and real estate value. This approach captures much larger potential sources of value to building owners. The study found that the public environmental benefits of green roofs have a net present value (NPV) of $5.80 per square foot, and the increase in taxes generated (see chart on page 27) had at a NPV of $22.30 per square foot. By refining the Better Roof Ordinance to include green roofs as a compliance option, the City of San Francisco has taken an important step towards realizing these public benefits and more, while increasing flexibility for developers, all at a minimal cost to the City. It is expected that Arup's study of green and white roofs in San Francisco will be made public soon.

A thorough cost-benefit analysis is an important step towards implementing supportive policies for green roofs and other forms of green infrastructure. The Green Infrastructure Foundation's Green Infrastructure Charrette Program helps stakeholders reimagine their communities using green infrastructure. It includes an aggregate cost-benefit analysis that sheds light on many of the benefits achievable, and can form the basis for more detailed study.

For more information, visit greeninfrastructurefoundation.org/Charrette.

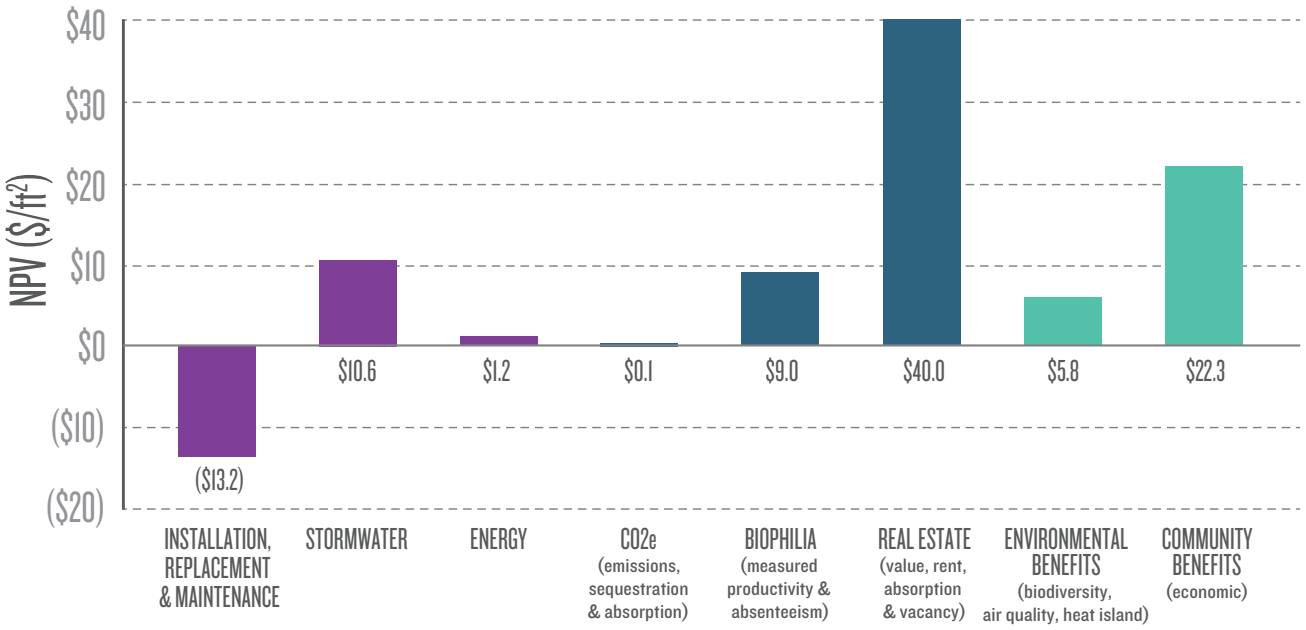
Innovative methods used to quantify real estate and biophilic benefits

To quantify real estate and biophilic benefits of green roofs, Arup used a novel approach. This involved using a well-established average green building rental premium of 4.5 per cent. This premium was then multiplied by a hypothetical contribution of a green roof—derived by using the per cent-age of related LEED points from the green roof relative to all other measures, and a comparison of green building cost premiums to green roof cost premiums. These two together yielded a "green roof premium" of 0.96 per cent of the 4.5 per cent rental premium. Using this number, market specific metrics such as average cap rate, rent, etc., were modified and the annual financial contribution was estimated. The end result was a real estate NPV of $40 per square foot over the study period for having a green roof (see page 30 for the impact of green roofs on condominium value in Portland).

Studies have supported views of nature and plants improving mood and stress level, increasing worker productivity, and decreasing absenteeism. The study documented these biophilic benefits in two ways. An office building tenant gains worker productivity benefits for their own employees – Arup estimated these benefits conservatively based on an assumption that only 10 per cent of workers access the green roof during the day and experience a one-hour bump in productivity as a result. This small increase in productivity is estimated to be worth a 25-year NPV of about $9 per square foot of roof to the tenant (see graph below).

GRAPH 1:
LIFE-CYCLE COSTS AND BENEFITS FOR A MODEL MEDIUM OFFICE BUILDING GREEN ROOF IN SAN FRANCISCO

Source: "San Francisco Living Roof Cost-Benefit Study", 2016. Arup.



Similarly, surrounding building tenants gain worker productivity benefits for upper floors that view the green roof, which were estimated for the portions of four floors facing the green roof for four neighboring buildings (based on an average height of seven floors and a three storey study roof). The biophilic view is also assumed to increase the value of the neighboring real estate. Both values are conservatively assumed to accrue to the city only via the payroll and property taxes respectively, both less than two per cent. The total public benefit value from property and payroll taxes to the City is thus estimated at a NPV of $22.30 per square foot, a figure that provides a strong rationale for supportive green roof policy in San Francisco.

Kirstin Weeks, GRP, CEM, LEED AP, WELL AP is a Senior Building Ecology Specialist at Arup.
Rohan Lilauwala, GRP is Senior Researcher at Green Roofs for Healthy Cities.

FIND OUT MORE

Tools and Resources for Green Roofs in San Francisco http://sf-planning.org/san-francisco-living-roofs

JEFF JOSLIN AND ANNE BRASK, ARCHITECTS OF SAN FRANCISCO'S NEW GREEN ROOF ORDINANCE.

Photo courtesy of Jeff Joslin

MANDATORY SAN FRANCISCO LIVING ROOF REQUIREMENTS TAKE ROOT

BY JEFF JOSLIN

San Francisco will soon add to its legacy a new contribution to the ensemble of great green roofs of the world (the Trans Bay Center), to join another renowned roof of that stature (the Academy of Sciences). However, it has lagged behind other major cities in overall deployment of green roofs. This is likely to change with the recent implementation of its pioneering Better Roofs Ordinance, which mandates the use of roofs for solar or living roofs (the City's chosen this terminology, as it's green roofs are not always so green) for future new development in the City.

The Better Roof Ordinance requires that roofs for all projects subject to the new rules dedicate either a minimum of 15 per cent of the roof area to solar, 30 per cent for living roofs in lieu of solar, or a combination of the two. The legislation was unanimously approved by the City's Board of Supervisors in October, and will take effect January 1st. San Francisco will then be the first city in the U.S. to require green roofs and/or solar panels on new construction projects.

A Patient Path To Success

This legislation was a direct result of the international green roof conference, *CitiesAlive*, which San Francisco co-hosted in the fall of 2013. Anticipation of the conference catalyzed supportive representatives from interested agencies and professions to gather and investigate means to advance a green roofs initiative. The result was a series of policy recommendations, issued by the San Francisco Planning and Urban Research Association (SPUR): Greener and Better Roofs: A Roadmap for San Francisco.

Following the conference, the San Francisco Planning Department began work on a number of implementation tools in anticipation of a prospective future ordinance. Local installations were visited and documented, contributing to the development of an active *Living Roof Map of San Francisco*. Best practices were captured in a *Living Roof Manual*. And a cost benefit tool was developed to assess the economic efficacy of various roof and building types, as well as to inform the calibration of the Living Roof requirement to the solar requirement.

San Francisco's solar mandate, approved in April 2016 and also the first of its kind, made use of a requirement in the California Building Code that requires 15 per cent of the roof area to remain "solar ready". The City of San Francisco took the next step of requiring that this area actually be used for solar. Developed in tandem with the Solar Ordinance, the Planning Department worked in concert with the sponsoring Supervisor Scott Weiner, the City's

Department of the Environment, and the San Francisco Public Utilities Commission to refine the Better Roof Ordinance to encompass Living (Green) Roofs as an alternative compliance path for the solar requirement. Hence, owners may choose between the two, or employ them in concert (two square feet of living roof may substitute for each square foot of required solar not provided).

The solar requirement applies to all new development greater than 2,000 square feet in building area. The living roof option is allowed when contributing to meeting storm water treatment requirements, on all construction with a disturbance area of more than 5,000 square feet and ten stories in height or less.

The marriage of these two requirements made sense technically and strategically. In San Francisco's climate, if projects make use of the blended requirement, plants will benefit from prospective shading from solar installations and require less irrigation, and the cooler roofs resulting from planting will enhance the efficiency of energy generation of co-located photovoltaics. As a strategic matter, the flexibility afforded the already-established solar requirement resulted in universal support for the living roof alternative: it was not a free-standing new requirement with additional associated costs. The economic analysis was also key, quantifying the benefit for respective projects, as well as economic benefits to the public that result from: enhanced views, minimizing the need for stormwater infrastructure, reduced heat island effect, job creation, and augmented biodiversifying habitat.

Next steps include updating the City's *Living Roof Manual* to incorporate the new requirements, and establishing internal processing procedures for the next generation of Living Roofs in the City.

We can only speculate as to just when the City can lay claim to being a leader in green roof proliferation. But with the magnitude of ongoing and anticipated new development, it's likely to be not too far down the road. Additional information on the City's Living Roof efforts, and the tools identified above, can be found on the Planning Department's Living Roof web page.

Jeff Joslin is the Director of Current Planning, San Francisco Planning Department.

FIND OUT MORE

Find the Greener and Better Roofs: A Roadmap for San Francisco here: goo.gl/YpVMUJ
The City of San Francisco's Living Roof web page is: http://sf-planning.org/san-francisco-living-roofs

GREEN ROOFS DELIVER PROPERTY VALUE PREMIUMS IN PORTLAND, OREGON

BY LAUREN BLOOMQUIST

Photo courtesy of Alan Proffitt

What is the economic value of a green roof? I studied sale prices within the Portland, Oregon condominium market from 2000 to 2011, and found that green roofs significantly increased condo sale prices by 5.5 per cent, or almost $19,000US in today's dollars, even after adjusting for many other factors like square-footage, building age, proximity to city amenities, and neighbourhood. This correlates many other studies that have found increases in property values because of their proximity to green infrastructure, such as trees and parks.

Since its first large-scale green roof project in 1999, the city of Portland, Oregon has seen significant growth in both the number of green roofs and overall acreage of green roofs. The City of Portland offered robust subsidies and financial incentives from 2008 to 2012. These included the now-retired Ecoroof Incentive program, which provided a subsidy from the City of Portland's Bureau of Environmental Services of up to $5 per square foot; a density bonus for high-rise developers that allowed them to build taller buildings with more units if they also built a green roof; and stormwater runoff discounts as part of the Clean River Rewards program. In 2005, the City of Portland also committed to building green roofs on all new public buildings, which increased visibility of green roof initiatives throughout the city.

These city-sponsored programs, combined with Portland residents' strong preference for eco-friendly amenities, helped Portland reach 11.5 acres of green roofs spanning 241 buildings by 2010, with construction continuing to increase each year. For example, in 2013, over three acres of green roofs across 41 buildings were built in the city.

Measuring Demand for Green Roofs

In a typical market for a product, pricing and sales data can reveal whether demand for that product is high or low, and how much consumers value the product. For example, sales data from a grocery store can tell you how much consumers are willing to pay for apples and how many apples they buy. But the market for green roofs isn't as simple. In general, housing developers buy green roofs directly, not home buyers. While we can look at sales data to try to assess the market price for a green roof, that only tells us how much developers value green roofs and what developers are willing to pay. What about home/condo buyers? How much do they value green roofs?

Answering the question is further complicated because most consumers tend to purchase or rent housing with green roofs, rather than buying green roofs directly in the market. But looking at housing sales data at face value can only reveal so much. There are dozens of characteristics that factor into demand for a house or apartment. In addition to whether a home has a green roof, housing characteristics can vary widely, in terms of size, age, location, amenities, and neighbourhood, to name a few and all of these characteristics factor into purchase decisions -- but how much does any one characteristic matter? While priorities and values in home purchases naturally vary from buyer to buyer, we can all agree that most people are willing to pay more for a larger, newer home in a desirable neighbourhood. What about green roofs? How can we assess how much green roofs affect what a prospective buyer is willing to pay for a home?

For my research, I used the hedonic price method, which looks at a product (in this case, condominiums) as a bundle of measurable characteristics that influence its sale price (unit square footage, building age, whether the condo building has a green roof, etc.). Across many sales with a variety of characteristics, the statistical method of regression analysis helps us better understand the correlation between sale prices and each individual characteristic. By comparing prices, we are able to isolate the effect of the green roof on the overall value of the condominium units.

Case Study: Green Roof Property Value in the Portland Condo Market: 2000-2011

Data: Using data from the Portland Bureau of Planning and Sustainability, I studied almost 15,000 condo unit sales in the city of Portland from January 2000 to September 2011. Of the 15,000 sales, 10 per cent (about 1,500) had green roofs. Looking only at sales of condos built in 2000 or after, when green roofs began to gain popularity in Portland, that figure rises to 21 per cent. The average sale price of a condo in this time period was $361,160 in today's dollars. Condos with green roofs were sold across eight Portland neighbourhoods, but were most common in three Portland neighborhoods surrounding Downtown Portland: South Portland, the Pearl District, and Goose Hollow.

Methods: I created a model of condo sale prices based on the theory that several measureable characteristics ultimately influence final sale prices. The model included condo unit-specific characteristics, availability of amenities (including whether the building has a green roof), and neighborhood characteristics (all listed in Table 1). Then, I used regression analysis to evaluate how much each of these characteristics influenced sale prices individually, if at all, across all 15,000 condo sales.

TABLE 1: LIST OF VARIABLES INCLUDED IN A MODEL OF CONDO UNIT SALE PRICES.

Category	Variables Included
Unit-specific characteristics	• Condo unit's square-footage • Condo building's age • Whether the unit is owner-occupied
Availability of amenities	• Whether the building has a green roof • Distance to Downtown Portland • Distance to the nearest light-rail station • Distance to the nearest river
Neighborhood characteristics	• Proportion of vacant dwellings in the area • Proportion of white residents in the area • Indicators for the 80 major neighborhoods in the Portland metropolitan area
Control variables	• Indicators for month and year of sale (to adjust for market ups and downs, including the 2007-2008 financial crisis)

Results: As many studies have also proven, higher square-footage, newer buildings, and closer proximity to Downtown strongly correlated with higher sale prices, among others. Most importantly, green roofs significantly increased condo sale prices by 5.5 per cent. In today's dollars, this corresponds to an almost $19,000 increase compared to units with no green roof. The green roof price premium was evident before and after the 2007-2008 U.S. financial crisis. Green roofs increased sale prices by 4.2 per cent before the financial crisis, with this figure increasing to 6.3 per cent after the financial crisis. This suggests that the value of green roofs in the Portland market may be on the rise. While this is a case study of the Portland condo market, it nonetheless suggests that home buyers value green roofs and are likely willing to pay significantly more for condominiums with green roofs.

Lauren Bloomquist completed this research as part of her undergraduate degree in Economics at Reed College in Portland, Oregon. A full copy of her thesis can be found at http://tinyurl.com/pdxecoroofs. You may contact her at labloom@alumni.reed.edu.

INAUGURAL GREEN WALL MARKET SURVEY REPORT FOR 2015

BY BLAINE STAND

The Green Wall Industry Survey Report represents the first time GRHC has conducted a survey of its green wall developers, manufacturers and installers in order to collect data on the state and composition of the green wall industry across North America. This survey has been developed and produced with the assistance and advisement of the Green Roofs for Healthy Cities Green Wall Committee, composed of corporate members who design and install green walls across North America.

In 2015, participants of the survey reported that the North American green wall industry installed 658,731 square feet of green walls across 44 US States and four Canadian Provinces, and more than 271 individual projects. As this is the first report of its kind in North America, there is no historical data to compare this to.

The Survey collected a variety of data on North American green wall installations, including size, location, wall structure, type of green wall system, and whether or not the installation qualified for LEED credits. Due to the nature of green wall installations and the quantities of installations across the continent, projects are reported as the quantity of installations per state and the total size installed within that state, rather than by metropolitan region.

This first annual Green Wall Industry Survey, though limited by the amount of submitted data, provides some useful insights on green wall installation trends in the North American green wall market. The green wall industry still represents a growing and developing market sector which still requires policy support and conclusive data to support growth and development. Further research and valuation needs to occur for green wall installations so benefits can be more easily quantified and communicated.

Green Roofs for Healthy Cities would like to thank all the participants of this inaugural survey, and invites all green wall companies to participate next year so more concrete data and conclusions can be drawn. Access the survey by emailing Blaine Stand at bstand@greenroofs.org.

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For more information or to become a GRHC Member, email Blaine Stand, Membership Coordinator at bstand@greenroofs.org.

BEWARE THE PUBLISHED COSTS OF STORMWATER BMPs. DIG A LITTLE DEEPER, ENGINEERS!

BY RICK SCAFFIDI

EQR has been estimating and installing stormwater water quality and quantity BMPs (best management practices) in the Washington, DC to Baltimore corridor for over 20 years. Since we construct the projects, our philosophy is to be as precise as possible and detail the cost of activities and design elements to lower our risk on a project. I am always asked "how much does it cost to construct X type of BMP?" and my first response is to ask if this is for a budget or an actual project.

We budget projects on design-build and P3 contracts, so the concept design and the BMP selection process is more difficult than just choosing BMPs based on cost rankings per cubic foot retained or treated, which can be highly misleading. Our experience indicates when projects are located in commercial, industrial or urban centers, green roofs can outperform ground level BMPs in terms of their cost-effectiveness. Especially when infrastructure retrofits and architectural elements are required. Once a design is past 60 per cent, most of the details will emerge and the actual costs can be estimated. But do you know all the construction and contract details necessary to accurately estimate or 'budget' the project?

We reviewed the costs on over 150 different LID/ESD/BMP projects and developed a list of items to watch out for when comparing the true costs of various BMPs. These include:

1. Know what site conditions affect the cost of a project. Ground level BMPs can double or triple in price in urban or commercial applications.
   a. Determine if road weight restrictions limit the amount and size of delivered materials and equipment, and any required Maintenance of Traffic for vehicle, bicycle and pedestrian safe movement. Pricing can vary from 1 to 40 per cent of a project, especially along major highways and in cities, or lane closures requiring flaggers.
   b. Establish the protection or replacement of architectural elements and/or existing infrastructure. Most contracts treat this as incidental repairs and under budget replacing roads, parking lots, curbing, sidewalks, or protecting architectural features.
   c. Understand how known and unknown utilities will affect the project. More than 20 per cent of the drainage invert elevations that tie-in to an existing storm drain structure is incorrect and requires a redesign. EQR has an in-house policy to check all existing inverts before mobilizing on a site to minimize downtime.
2. Are the access and staging areas large enough to manage the materials and equipment on the site? Poor access and staging can easily add 10 per cent or more to a project cost. Crews spend 20 to 30 per cent of their time managing materials for the installation where an efficient layout can have a substantial impact on costs. Having to oversize a crane because of poor positional constraints can have a substantial impact on costs.
3. When developing a predesign or concept budget, know the BMP budget conditions and adjust the price to meet the design intent. Most BMP models only give costs based on a standard detail so design modifications and site specific conditions will adjust costs. For example, most green roof modeling systems assume a 1" retention value but there are designs that will easily retain 5" substantially lowering the cost per cubic foot of water retained or treated. Conversely, bioretention facilities in urban areas may require splitter boxes, trash collectors or other utility and architectural elements that double or triple the construction costs.
4. Understand the owner's contract conditions. The owner may require wage rates, warranty conditions or subcontractor requirements significantly increasing construction costs.
5. Review the whole costs of a BMP retrofit project. Our experience has shown that a third of the retrofit projects have extensive infrastructure and architectural modifications where any bmp could have been effectively used in the design but were thrown out because 'they were too expensive' contrary to final costs.

So making a business decision on what type of BMPs to use needs to address a variety of issues, and not rely on models that understate the performance of green roofs and under estimate the costs of alternatives.

Rick Scaffidi is the Vice President of Sales and Estimating, Environmental Quality Resources LLC.

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