Getting the Green Out:

Key Findings and Recommendations from NRDC Workshops on Promoting Green Stormwater Infrastructure on Commercial Property

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Acknowledgments

About NRDC

The Natural Resources Defense Council is a international nonprofit environmental organization with more than 1.4 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment. NRDC has offices in New York City, Washington, D.C., Los Angeles, San Francisco, Chicago, Montana, and Beijing. Visit us at nrdc.org.

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BACKGROUND

Cities throughout the United States are embracing green stormwater infrastructure (GSI) as a means to reduce polluted stormwater runoff and satisfy the Clean Water Act, while also realizing public health, environmental, economic, and quality of life benefits of urban green space. GSI includes green roofs, rain gardens, cisterns, and other mechanisms that mimic natural hydrologic functions or that otherwise capture runoff on-site for productive use.

More and more communities are making major capital investments in GSI in the public right-of-way and on other public property. However, to fully protect and restore urban waterways, these cities will also need private landowners to manage more of the stormwater on their own properties. Therefore, many are actively seeking—or are already implementing—ways to motivate private landowners to implement GSI projects. To date, GSI implementation on private property has mostly been limited to (1) development projects held to local or regional regulatory requirements; (2) developers aiming to "do the right thing" or to capture the brand value associated with "green" development; or (3) on a more limited scale, retrofit projects motivated by local financial incentive programs.

To help accelerate GSI implementation in the private sector, NRDC previously published *The Green Edge: How Commercial Property Investment in Green Infrastructure Creates Value*. This piece reviewed the lucrative benefits green infrastructure can bring to owners and tenants of commercial properties, including office, retail, and multi-family residential buildings. That report was widely circulated among leaders in the commercial real estate industry, with the aim of educating property owners about the potential benefits of GSI.

As a follow-up to The Green Edge, NRDC has engaged with interested representatives of the commercial real estate sector to further explore how property owners and developers think about GSI; its economic benefits and challenges; and the information, data, or strategies needed to increase adoption. NRDC convened two all-day workshops on this topic with commercial developers, property owners and managers, appraisers, GSI designers (e.g., engineers, landscape architects), municipal and utility representatives, trade associations, and others. One workshop was held in Philadelphia in late 2014, and the other was held in San Francisco in early 2015.

KEY WORKSHOP FINDINGS AND RECOMMENDATIONS

NRDC worked with participants to develop and prioritize recommendations for implementing GSI at commercial development sites. Table S-1 summarizes the top four consensus recommendations from each workshop.

The recommendations generally fall within three broad programs of action: (1) developing or refining effective government regulations and incentives, (2) filling in data gaps, and (3) communicating the value of GSI.

Developing and refining effective government regulations and incentives

Two of the top priority recommendations from the East Coast workshop, and the top priority recommendation from the West Coast workshop, were directly related to this topic. Specifically, East Coast participants identified the need to research and develop recommendations to improve government incentives. Participants noted that the public sector needs to better understand incentives and other drivers that have catalyzed investments in GSI throughout

the United States and internationally. East Coast participants also recommended the development of guidelines and best practices to help local governments remove barriers to implementation. On the West Coast, the highest priority recommendation focused on developing and revising stormwater regulations to facilitate creative, cost-effective design to meet volume-based performance standards. This recommendation was made, in part, in response to one of the key barriers identified during workshop discussions: inflexible design standards associated with some state and local stormwater regulations.

Filling information gaps, and providing analytical tools, concerning the benefits and costs of GSI

Participants identified a shortage of hard data on the benefits and costs of GSI as a key barrier to implementation. For example, on the West Coast, the second top priority recommendation was to create tools to help assess and quantify the "total" (i.e., aggregate) value of GSI improvements. This includes benefits not always accounted for in calculations of return on investment (ROI), such as increased rents and occupancy rates, energy and water savings, reduced or avoided "grey" infrastructure costs, lifecycle costs (including operations, maintenance, and replacement), and personal and public health benefits from the vegetated elements of GSI (i.e., "biophilic" designs that reconnect people to nature). West Coast participants also prioritized developing hard data on how GSI can increase property values to educate appraisers about its value. This would allow appraisers to develop comparable value

estimates when establishing financing, thereby enabling financing terms that provide a market-based incentive for GSI implementation. At both workshops, participants identified the need to use hard data from a diverse set of actual projects representing a range of market segments. These recommendations all require additional data—or improved accessibility of existing data—on the benefits and costs of GSI. East Coast participants also expressed a need to understand how GSI can help to increase resiliency and manage extreme rain events expected to increase with climate change.

Communicating the value of GSI through case studies, peer testimonials, and other networks

At both workshops, the development of case studies to communicate the value of GSI was frequently discussed. Participants stressed the importance of basing case studies on monitored results and actual built projects, as well as diverse representation by geography, types of GSI, and building and development types. Participants also noted the power of peer testimonials or stories from developers to educate those less familiar with GSI and inspire healthy competition for implementation. Participants agreed that case studies and peer testimonials should be provided in a non-advocacy format and should be published in widely circulated publications and newspapers, as well as in the trade press. Participants also generally favored creating formal venues for the exchange of GSI-related information (e.g., through existing trade associations).

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Mixed-use development at Hill Center Green Hills, Nashville, Tennessee.

Table S-1. Top four priority recommendations from the East and West Coast workshops		
	East Coast workshop	**West Coast workshop**
Priority #1	Research and develop recommendations to ***improve government incentives for GSI***. This includes evaluating the effectiveness of existing incentives across the United States, and developing a compendium of best practices.	Adopt or revise stormwater ***regulations that allow for creative, cost-effective design to meet volume-based performance standards.***
Priority #2	Develop and widely disseminate a ***diverse set of case studies***, based on actual projects and data, showing GSI benefits for property owners and tenants. Case studies should highlight both immediate and lifecycle benefits and costs.	Develop ***tools to capture all benefits and assess "total" (i.e., aggregate) value***, including how to quantify (where possible) and accurately characterize all values.
Priority #3	As a supplement to full case studies, develop ***peer testimonials*** to highlight specific aspects of GSI projects, including benefits of implementation.	Develop and widely disseminate a ***diverse set of case studies*** and stories, based on actual projects and data, showing GSI benefits for property owners and tenants. Case studies should highlight both immediate and lifecycle benefits and costs.
Priority #4	Develop guidelines or roadmaps for utilities and local governments outlining how to ***remove barriers to help facilitate GSI implementation***.	***Educate appraisers*** on the benefits of GSI, and learn to speak their language.

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Commercial office building at 1050 K Street, Washington, D.C.

NEXT STEPS

A wide variety of actors—from both the public and private sectors—will need to collaborate to accelerate GSI implementation in the commercial real estate sector. The workshop participants agreed that both the public and private sectors have good reasons to work together towards that goal.

Municipalities and utilities, which have responsibilities to reduce stormwater pollution from their sewer systems, will benefit from cost-effective approaches to compliance, while simultaneously improving neighborhood quality of life. State and federal agencies charged with protecting our rivers, lakes, bays, and beaches can accelerate the cleanup of polluted waterways. Commercial property owners, managers, and tenants can reap substantial economic benefits and life-cycle cost savings. The design and engineering community can foster innovation and grow a larger market for GSI-related services. Non-profit organizations, trade and professional associations, academic researchers, and philanthropic foundations that share some or all of these objectives can, likewise, advance their own missions by helping to catalyze change.

The following table lists key activities corresponding to the workshop recommendations described in this report. Further, it provides a targeted call to action, by identifying which types of entities are well-suited for leading roles and supporting roles to implement each action. See Table S-2 on page 7.

Table S-2. Next Steps for Public and Private Sector Actors

●● = Leading role O = Supporting role	Local governments and utilities	State and federal governments; and regional utilities and governmental bodies	Non-profits (local, regional, and national)	Trade and professional associations (local, regional, and national)	Private firms/ practitioners in the development and design communities	Appraisers	Academics	Foundations
Develop/refine effective government regulations and incentives								
Study existing local incentives to determine the most effective approaches	O	O	●●	●●			●●	
Develop "how to" guides for local governments and utilities on improving regulations, policies, incentives	O	●●	●●	O				
Adopt or revise regulations and site plan review processes	●●	●●	O	O	O			
Adopt or revise incentive programs	●●	●●	O	O	O			
Communicate with the development community to better understand local drivers that motivate or inhibit GSI	●●	●●	O	●●	●●			
Develop regionally-specifc manuals, guides, and other materials to assist private sector in designing, obtaining approval for, and maintaining GSI projects	●●	●●	O	●●	O			
Fill data gaps								
Develop standardized data collection methods/metrics	O		●●	●●	●●		●●	
Generate and share data from GSI projects	O				●●			
Collect, make publicly accessible, and analyze data from GSI projects	O	O	●●	●●			●●	
Communicate values of GI								
Develop detailed case studies & narrative testimonials	O		●●	●●	●●		●●	
Create venues for peer-to-peer learning	O		O	●●				
Present first-hand peer testimonials					●●			
Disseminate written materials and information to developers and designers (directly and through media)	●●	●●	●●	●●	●●		O	
Disseminate materials and information to "consumers" of commercial real estate	O	O	●●	●●	●●		O	
Facilitate use of data for project-specific decisionmaking								
Create "tools" for developers to easily calculate life-cycle ROI based on project-specific characteristics (including ranges of uncertainty in costs/benefits)			●●	●●	●●		●●	
Edcuate appraisal community on GSI benefits	O		O	O	O	●●	O	
Publish methods for incorporating GSI benefits into project valuation			O	O	O	●●	O	
Provide funding to support the above actions								
Provide grants to support efforts by local governments and NGOs	O	●●		O				●●

INTRODUCTION

Many cities—including Philadelphia, New York City, Seattle, and Milwaukee—have adopted ambitious green stormwater infrastructure (GSI) programs to address chronic urban water pollution problems and meet Clean Water Act obligations concerning combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), and polluted runoff from municipal separate storm sewer systems (MS4s).

While traditional gray infrastructure relies on physical infrastructure like pipes and pumps to move rainwater away from where it falls, green infrastructure relies on more natural approaches to infiltrate, evapotranspire, or capture and reuse rainwater on or near where it falls. GSI includes green roofs, rain gardens, bioswales, permeable pavement, trees, cisterns, and other mechanisms that mimic natural hydrologic functions or otherwise capture runoff on-site for productive use. These practices can also yield many important co-benefits to communities, such as beautifying neighborhoods, reducing flooding, cooling and cleansing the air, reducing asthma and heat-related illnesses, lowering heating and cooling energy costs, recharging groundwater aquifers, and creating "green-collar" jobs.

Cities are increasingly investing in GSI in the public right-of-way (i.e., roadways and sidewalks) and on other public property because they own and control these properties. However, to broaden GSI to fully protect and restore urban waterways in highly developed watersheds, these cities will also need private landowners to manage more of their own stormwater, since private property accounts for large amounts of the impervious area that generates urban runoff. Indeed, the cities with the most ambitious GSI plans all rely heavily on private property to meet their long-term targets.[1]

Many cities have imposed regulations that require property owners to retain a certain amount of stormwater onsite (i.e., to capture it with no discharge into public sewers) to reduce runoff from private property. Typically an application for approval of new construction or redevelopment triggers these rules. In addition, cities are seeking ways to promote GSI retrofits at existing private development, independent of any other construction or redevelopment activities. For example, some cities have implemented tax credits or grant programs for GSI retrofits, but, in their present form, these have typically not achieved broad uptake among commercial property owners. Some cities allow property owners to reduce their stormwater utility fees by installing GSI retrofits. However, at current levels of stormwater fees, such programs generally do not provide acceptable payback periods for most commercial property owners. Thus, GSI is usually only implemented on commercial property to the extent required to meet minimum regulatory requirements (for development or redevelopment). It is also implemented by building

owners and developers interested in "doing the right thing" or capturing the brand value of "green" development. To a lesser extent, local financial incentives in certain places also stimulate GSI implementation.

To help accelerate GSI implementation in the private sector, NRDC retained Stratus Consulting to explore the financial benefits commercial property owners can accrue by installing GSI. (Commercial property here primarily refers to office, retail, and multi-family residential buildings.) Results of the study were documented in *The Green Edge: How Commercial Property Investment in Green Infrastructure Creates Value*.[2] The report demonstrated that well designed green stormwater infrastructure can create significant benefits for property owners When one accounts for these benefits, the payback period for GSI investments can dramatically improve. In addition to reduced stormwater fees (which apply only in some cities), benefits include increased rental and occupancy rates, higher property values, increased retail sales, energy savings, reduced or eliminated grey infrastructure costs, tax credits, decreased water bills, reduced flood damage costs, reduced crime, and improved health and employee satisfaction.

Building on the *Green Edge* report, NRDC and Stratus Consulting collaborated in 2014 and 2015 to explore how commercial property owners and developers think about GSI; the economic benefits and challenges associated with implementation; and the information, data, or other strategies needed to increase adoption of GSI practices on commercial property. The project team implemented a series of surveys and facilitated two all-day workshops with commercial developers, property owners and managers, appraisers, GSI designers (e.g., engineers, landscape architects), municipal and utility representatives, trade associations, and others. In this report, we describe our general approach to organizing and implementing the roundtable discussions as well as the key findings and outcomes, including participants' recommendations for encouraging GSI adoption. We also present an outline of next steps towards implementing those recommendations, in which governmental, private sector, non-profit, academic, and philanthropic actors all have important roles to play.

THE BENEFITS OF GREEN STORMWATER INFRASTRUCTURE ON PRIVATE COMMERCIAL PROPERTY

GREEN ROOFTOPS

Apartment buildings with green roofs received a 16% rental premium, according to one study.

Green roofs typically last twice as long as conventional roofs, saving hundreds of thousand of dollars in roof repair/replacement costs.

The green roof on the Target Center Arena in Minneapolis has decreased annual energy costs by $300,000.

LANDSCAPING
WITH RAIN GARDENS AND BIOSWALES

Well-designed landscaping boosts average rental rates for office buildings by approximately 7 percent

ECO-LABELS

LEED, Sustainable Sites Initiative or other certifications can increase property values, rents, and occupancy rates in commercial office buildings.
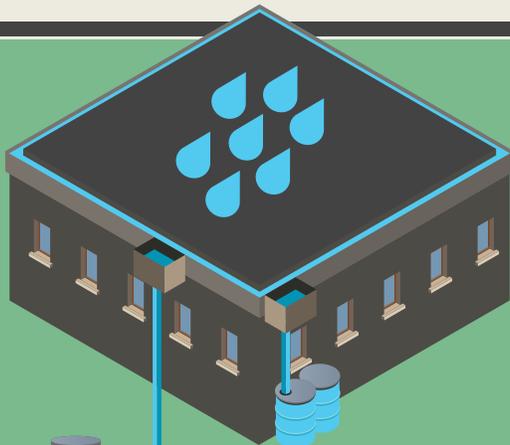
TREE COVER

Trees can reduce building energy demand for heating and cooling by providing shade in summer and blocking wind in winter. Multiple trees on a site can save hundreds of dollars in annual energy costs.

Retail customers are willing to pay 8% to 12% more for products in shopping centers with mature tree canopy.

RAIN BARRELS AND CISTERNS

Capturing rainwater for reuse can help save on water bills for landscape irrigation and other non-potable water uses.
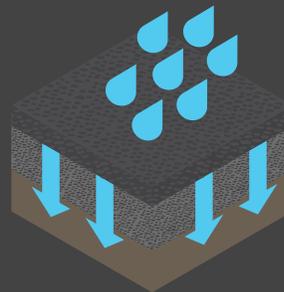
PERMEABLE PAVEMENT

Permeable asphalt, concrete, or paver blocks allow water to seep into gravel and soil below. These systems can have significantly lower maintenance costs than traditional pavement, resulting in lower overall life-cycle costs.

APPROACH

The project team held two workshops: one on November 11, 2014, in Philadelphia (East Coast workshop) and the second on February 25, 2015, in San Francisco (West Coast workshop). Before each workshop, we researched and recruited participants to create a diverse group of stakeholders in the commercial real estate space, including building owners, developers, GSI designers, and appraisers. We also invited representatives from academic institutions, nonprofit organizations, and municipal agencies with knowledge and experience with GSI implementation in the private sector. For both workshops, we attained a good mix of participants representing different backgrounds and perspectives.

The East Coast workshop was attended by 18 participants and 20 attended the West Coast workshop. The Philadelphia meeting drew primarily on participants from East Coast cities. The West Coast workshop had a wider geographic representation, including participants from Southern and Northern California, Portland, Seattle, Milwaukee, and Arkansas. Many participants worked in specific metropolitan areas and others worked throughout a broader region or represented firms or organizations with a regional or national reach. The Appendix provides a list of project participants for each workshop and a brief summary of participant characteristics.

Prior to each workshop, we developed an online survey for the participants and used the results to help structure discussions, developing a series of questions around five key topic areas:

- **GSI awareness, including among both developers and "consumers" of commercial real estate.** Is public perception driving demand? Who typically initiates GSI projects? How do designers increase awareness of GSI among clients?

- **Return on investment (ROI).** Do developers and building owners calculate ROI for GSI investments? What is included in this calculation? How well understood are initial costs and maintenance costs? Has it been easy to show a positive ROI?

- **Maintenance requirements.** Does uncertainty surrounding maintenance needs and costs prevent implementation? How are maintenance needs communicated? What data, information, or metrics are needed?

- **Information needs.** Will better information related to GSI benefits, ROI, costs, or maintenance requirements encourage private implementation? How would this information best be presented? What type of organizations or individuals would be the best sources for this information?

© Photo courtesy of Martina Frey

Buckman Heights Apartments, Portland, OR.

- **Other ways to promote GSI.** What role might public policy tools such as regulations, voluntary certifications, or financial or permitting incentives play in increasing implementation?

We structured the workshops to maximize participation and discussion. At the outset of each workshop, we went over our objectives, survey results, and the findings of the Green Edge report. We devoted the remainder of each workshop to participant discussions, loosely following the outline of the key topic areas. To conclude, we asked participants for their top recommendations to help facilitate the implementation GSI on private property.

Following the workshops, we consolidated a list of participant recommendations and distributed a follow-up survey that asked participants to rank their top four recommendations. We also posed additional questions related to the recommendations.

KEY FINDINGS AND DISCUSSION

This section describes key findings from the surveys and discussions, providing background on the priority recommendations that are presented in the next section of this report.

Awareness and interest in GSI is growing but education is needed

Responses to the initial workshop surveys indicated that many private property owners and developers are aware of GSI, and that interest in GSI is growing. Many indicated that awareness of GSI has been driven by codes and regulations for development and redevelopment projects. Voluntary standards—such as Leadership in Energy and Environmental Design (LEED), the American Society of Landscape Architects' Sustainable Sites Initiative (SITES)—have increased awareness to some extent, especially in cities like Philadelphia, Washington, and San Francisco.

Despite increasing awareness and interest, most participants also agreed that developers, contractors, property owners, designers, and planners often lack knowledge about GSI, and that the market is largely uninformed. In addition, interest and awareness can vary by project type. For example, several West Coast participants indicated a lower level of knowledge and interest among commercial and industrial property owners, while institutional buildings and redevelopment sites have a higher rate of implementation.

> *Organizations such as "NRDC can play a valuable role in elevating the awareness of GSI in the development community. Creating a buzz around GSI will help to encourage its use, particularly among developers who are always looking for ways to differentiate their product."*

Workshop discussions revealed the need to educate engineers, contractors, developers, and consumers (i.e., tenants and purchasers) on different aspects of GSI at the outset or "before the pen hits the paper." (This means at the very start of the project design phase or, for consumers, as part of the marketing and at the time of lease or sale.) This would help ensure that GSI elements are integrated into project designs and not "value engineered" out, and would help motivate both the supply and demand sides of the market. Participants also stressed the importance of working with an integrated team of engineers, landscape architects, contractors, and developers during the design process. There was much discussion, particularly at the West Coast workshop, on "changing the culture of design" in this way.

> *"It is easy to use the word 'integration' without understanding how it is a fundamentally different way of practicing design and construction…. Taking the time to analyze and explore multiple integrated bundles of parameters BEFORE the design begins is essential to realize stacked benefits and synergistic systems that are cost- and performance-effective."*

The idea of revising standards for professional certifications of developers, designers, and contractors to include GSI was also suggested as a way to increase awareness and education as well as to institute a collaborative team design process. Participants also stated that the need for education extends to local agency staff, who review site plans and write policies and codes. Their decisions—both explicitly and in more subtle ways—shape the developers' choices when seeking the path of least resistance to obtain project approvals.

Regulations are a primary driver for implementing GSI, but government incentives, "doing the right thing," and perceptions of consumer demand and financial benefits also contribute

In cities with strong regulations that require runoff volume reductions or specific GSI practices, those regulations seem to serve as the primary driver for implementing GSI. However, many responses to the initial survey indicated that property owners and developers also implement GSI "to do the right thing," take advantage of government and tax incentives, or increase property values. Figure 1 shows the importance of different drivers for implementing GSI based on responses to the initial survey.

As shown in Figure 1, East and West Coast respondents ranked the five categories of drivers in similar order, identifying regulations as the most important. With regard to other drivers, East Coast respondents indicated that property value benefits have been more important than tax and other government financial incentives, whereas West Coast respondents reported the opposite. This suggests that West Coast participants believe government financial incentives are more valuable, or more accessible, in their region. At the East Coast workshop, a few developers expressed frustration

Figure 1. Primary drivers of GSI implementation

Figure 1. Primary drivers of GSI implementation
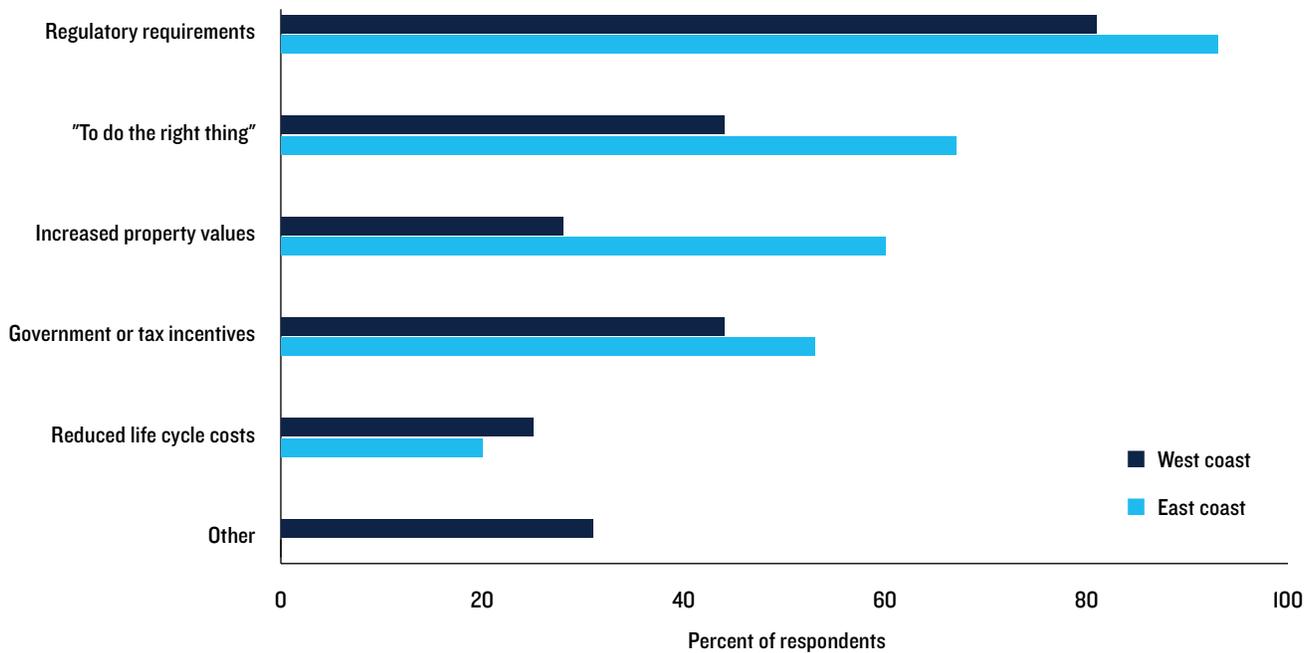
with the extensive requirements for grant funding or tax credits for GSI projects, some even stating that "it wasn't worth it." In addition, although East Coast participants indicated property value or increased occupancy benefits as a primary reason for implementation, discussions revealed that many developers and property owners remain skeptical about these benefits since it is hard to prove they exist or to distinguish between causation (e.g., adding GSI to a project causes increased property value) and correlation (e.g., higher-value properties happen to have more GSI).

Relatively few responses to the initial survey identified reducing lifecycle costs as a primary motivation. One reason may be that many developers are short-term owners, and not as interested in lifecycle costs. Another likely reason is developers' high degree of uncertainty with respect to lifecycle costs. Nonetheless, 20 to 25 percent of respondents did indicate that, even with available knowledge and data, reduced lifecycle costs have been a motivating factor.

Figure 1 also shows that, in addition to the five categories of drivers presented in the survey, West Coast respondents volunteered several other reasons for implementing GSI that the East Coast participants did not mention. These include increasing marketability, meeting LEED standards or other green building goals, and monitoring or demonstrating GSI benefits. West Coast discussions confirmed that marketability plays an important role. Specifically, several developers stressed the importance of creating demand for GSI by including it as part of an overall "sustainability package" that emphasizes employee productivity, retention, and well-being.

Some East Coast participants also raised related themes, although to a lesser extent. For example, at least one developer at the East Coast workshop stated that neither presence nor absence of upfront cost savings is a significant factor in her firm's decision to implement GSI. They simply implement GSI when it can serve as an amenity to differentiate a property in the marketplace.

Although not discussed at length during the workshops, primary drivers seem to differ across development types. For example, regulations usually only apply to new development or redevelopment projects, but do not require retrofits of existing buildings. Thus, government or financial incentives have been the most significant public policy tool to date for catalyzing retrofits of existing development. Workshop discussions confirmed that GSI is often perceived as more cost-effective for new development and redevelopment—compared to the existing building retrofit context—but costs can vary significantly by site.

Discussion revealed another potentially important distinction: the varying dynamics of particular segments of the commercial real estate market. For example, GSI perceptions and marketability may vary between cities and suburbs, regions with hotter real estate markets and those with lower rates of development and redevelopment, and high-end (e.g., "Class A") properties and others. Some participants suggested that more data to characterize different attitudes toward GSI among these market segments would be helpful to better understand the drivers of GSI implementation.

A green roof on the offices of YouTube in San Bruno, California.

Looking onto the green roof at the YouTube offices in San Bruno, California.

Voluntary standards such as LEED are also important drivers, but the impact in terms of stormwater management is uncertain

Most participants indicated that voluntary certifications (e.g., LEED, Sustainable SITES InitiativeTM) are very important factors for many building owners and developers when deciding whether to implement GSI. These programs help educate the market and build consumer awareness. They are now becoming brands in their own right and are impacting property values. However, there is some uncertainty and skepticism regarding the effectiveness of LEED, as it is currently structured, as a driver for GSI. There are various optional credits a project team can choose from and, if GSI related credits are relatively more expensive or more challenging, a project is likely to seek LEED certification using other credits. Some also pointed out that the high price of obtaining certification limits the appeal.

Where regulations apply, financial incentives or a positive ROI are usually needed to induce developers to go beyond regulatory requirements

Most participants indicated that, when regulations are the primary driver, individuals do not typically go above and beyond the requirements unless they can take advantage of other financial incentives, obtain LEED certification, or benefit from additional marketing or public relations opportunities. In the initial workshop survey, some respondents reported that it is easy to encourage or "convince" property owners and developers to implement GSI if a positive ROI can be demonstrated. It can be more difficult to convince architects and engineers who are inexperienced with GSI, as they are often risk-averse, hesitant, or just uncertain of how to implement these practices.

Some participants stated that they had to be able to show a positive ROI in order to justify GSI project elements to their management. However, discussions revealed that project developers do not typically account for total project benefits, such as increased property values, increased occupancy rates, energy savings, or avoided grey infrastructure costs. Instead, they tend to focus more on upfront capital and operations and maintenance costs. Thus, it can be difficult demonstrate that GSI has a higher ROI compared to more traditional project elements. This is exacerbated by the limited available information on GSI benefits and costs, particularly maintenance costs. In addition, some participants also mentioned that it was difficult to integrate full lifecycle costs and benefits across budget areas. For example, the benefits of a green roof can include reduced stormwater fees, avoided roof replacement costs, and energy savings. These items are often included in different parts of the budget, and are not typically combined to show the ROI for one element of an overall project. Moreover, as noted above, many developers are short-term owners, who tend to be less interested in lifecycle costs and benefits.

At least one participant, however, noted that developers in drought-prone regions are beginning to appreciate the long-term savings and climate resiliency benefits associated with rainwater harvesting, which provides both stormwater management and water conservation. In markets with rising water costs and uncertain future water availability, this participant noted that the ROI on rainwater harvesting is becoming increasingly attractive in some places.

A few participants indicated that in cities like Washington and San Francisco, building occupants are beginning to expect certain GSI elements and this is driving implementation. Some building owners or developers also go beyond regulations for GSI to meet corporate sustainability mandates. At the West Coast workshop, there was much discussion of the importance of creating demand for GSI (e.g., from building tenants and purchasers) in order to further incentivize implementation by developers.

Toronto's City Council adopted construction standards in May 2009 that require all new buildings and retrofits with more than 2,000 square meters (approximately 21,528 square feet) of floor area to include a green roof; since the bylaw went into effect, approximately 1 million square feet of additional green roofs have entered the planning phase.

Cost, uncertainty, lack of knowledge, and challenges of navigating local regulatory approval processes are primary barriers to implementation

In the initial survey, respondents identified a number of barriers to GSI implementation. Cost was cited most frequently. Cost-related barriers include initial capital and ongoing maintenance costs, uncertainty surrounding those costs, and opportunity costs associated with electing to build GSI instead of using the space for something viewed as more profitable. Participants also identified the shortage of clear information and hard data on benefits, including property values, rental premiums, avoided grey infrastructure costs, and uncertainty about how GSI contributes to marketability.

In addition to benefits and costs, there was much discussion at both workshops regarding barriers posed by local government regulations and standards. At the West Coast workshop, participants identified a perceived inflexibility of regulations as a primary barrier to cost-effectively implementing context-appropriate and successful GSI. Even when developers wish to use GSI, standard approaches that are most easily accepted by local regulators are not always the best solution due to site-specific or project-specific constraints. For example, some regions and cities have a standard list of GSI practices or designs that can be implemented at a given site, or particular formulas for "crediting" the functionality of GSI designs. Several designers indicated that, if they were allowed more flexibility in designing these management practices or allowed to use more modern calculation methods to quantify the stormwater capture capacity of GSI, they could more cost-effectively implement GSI, while still meeting stormwater management objectives.

At the East Coast workshop, much of the discussion focused on the difficulties of navigating the permit process or qualifying for incentives, like grant funding. In addition, East Coast participants acknowledged that inexperienced regulatory review staff and inconsistent (sometimes incorrect) application of standards can be an obstacle to smart, creative, site-specific solutions. Participants also stated that it can be difficult to find engineers and designers with knowledge and understanding of GSI, and that this can pose a significant barrier to implementing GSI solutions—although that is expected to change as demand for GSI grows.

Participants also discussed practical challenges concerning the assignment of responsibility for GSI maintenance. The operation and maintenance of GSI is often different from the maintenance of traditional project elements. Many developers are hesitant to incorporate GSI simply because they are unfamiliar with maintenance needs. In addition, project developers are often not long-term site owners, and would need to educate buyers on maintenance requirements. At the same time, cities often do not have the skills or budget to maintain GSI projects on private property or to enforce maintenance agreements. In some cities, there is also concern about spending public money to maintain GSI improvements on private property when property owners do not fulfill their maintenance responsibilities. Some recommended that private-public partnerships within this space should be explored.

Discussion revealed that in places where the local design community, construction firms, property managers, and local governments are unfamiliar with GSI practices, efforts to maximize GSI opportunities can run into significant practical challenges. The cost and effort needed to overcome such barriers can sometimes be (or be seen as) prohibitive, even in cases where successful GSI implementation could generate substantial long-term benefits.

Many property owners and developers have seen first-hand evidence that GSI can provide significant benefits, but some remain skeptical of the magnitude

In the initial survey, East Coast respondents reported a number of GSI benefits at the site level, including cost savings, energy reduction, property value increases, fast-track permit approval, increased marketing opportunities, community recognition, noise reduction, and increased use of outdoor space by building occupants. However, discussions revealed some skepticism regarding GSI benefits (and the ability to quantify these benefits) for the private sector. Specifically, many participants indicated that further studies should better account for the difference between correlation and causation. Projects with GSI features often include other sustainable design features and amenities—as well as other characteristics, like location—which may also help differentiate them in the market and contribute to benefits such as increased rents, retail sales, and property values. Participants also identified a need for hard data on

GSI benefits that have been demonstrated at actual projects and better information on the level of GSI implementation necessary at a given site to realize particular benefits.

The West Coast participants, like their East Coast counterparts, identified a number of site-level benefits. They focused on marketability, increased rents, increased occupancy rates, increased property values, and reduced capital and maintenance costs (including energy and water savings). West Coast participants also discussed the importance of health benefits associated with "biophilic" designs that reconnect people to nature, which translate into increased worker productivity and retention. On a broader scale, some participants mentioned benefits associated with water quality, ecosystem services, and groundwater supply augmentation. Although West Coast participants indicated that developers do not typically quantify the benefits of GSI, they cited a number of studies and real-world examples that have documented various GSI benefits. In West Coast discussions, participants also expounded on GSI benefits related to worker productivity and wellness, noting that GSI is part of a larger "health and wellness" package that is becoming very desirable to building owners and tenants.

The upfront capital costs of GSI are generally understood by savvy industry professionals, but there are some uncertainties and misconceptions

Many responses to the initial survey indicated that the capital costs of GSI are relatively well documented and understood by industry professionals. However, designers and developers inexperienced with GSI may have difficulty developing realistic cost estimates. They often rely on contractors who are also unfamiliar with GSI and, therefore, inflate their own cost estimates as well. Some participants stated that the construction costs of well-performing GSI solutions are underestimated in the literature, which can lead to false expectations. Further, cost uncertainty stems from regional and site-specific differences in regulatory environments, available GSI options, and other factors.

There is uncertainty surrounding operation and maintenance costs

Most respondents agreed that GSI maintenance costs are not as well understood as other costs, and standard maintenance costs can be difficult to apply to individual sites. In addition, building owners and developers still have a lot to learn about the requirements of functional versus amenity-driven maintenance (i.e., requirements associated with maintaining a site so that it retains both its aesthetic and stormwater management functions). One participant also noted that it is often hard to find building contract companies with knowledge and experience maintaining GSI. As facilities mature, developers and building owners will become more familiar with maintenance needs and associated costs. Although research is beginning to fill in the gaps regarding costs, participants indicated that there is still much more to do in terms of collecting data, developing actual case studies, and making the information easily accessible.

"There's an assumption that maintenance is expensive, rather than that it replaces something else that would otherwise need to be maintained. We have NO IDEA how long components last."

Data, case studies, and testimonials on the benefits, costs, and incentives for implementing GSI would be useful

Participants almost universally agreed that additional data and case studies on the costs and total benefits of GSI would help promote awareness and expand GSI implementation. Specifically, participants are interested in real-world examples and testimonials; more information on GSI maintenance costs; better tools to determine ROI; and hard data on how GSI can increase rents, occupancy rates, and property values. East Coast participants stressed that these testimonials should come from leading developers experienced with GSI projects so that developers can see leading examples from peers. Likewise, designers would learn best from other designers, and so on. West Coast participants agreed and added the need to communicate to developers about the broader watershed and resiliency benefits of GSI, and about the public sector's efforts in line with the private sector's, so the private sector understands that "we're all in this together."

"Testimonials and success stories in well-read publications will spread the word about green infrastructure and motivate owners and developers to be greener than their peers"

In addition, participants identified a lack of available data on which local incentive programs have actually been the most effective at inducing private GSI implementation that would not have occurred otherwise. For example, it would be useful to have more information on the necessary tax credit or subsidy level to induce behavioral changes, as opposed to merely benefitting those who would have implemented GSI projects even without the financial incentive.

Better communication between the public and private sector is necessary

Government standards and incentives can encourage implementation, but participants generally agreed that the public sector needs to better understand how regulations and incentives affect GSI costs and benefits for developers, and therefore drive or inhibit GSI implementation. For example, several East Coast respondents stated that private property owners would be more likely to implement GSI if local permitting agencies reduced permit wait times for projects that incorporated GSI. West Coast participants

Apartment complex at Headwaters at Tyron Creek, in Portland, Oregon.

disagreed with this, noting that it often takes so much time to determine whether a project qualifies for "fast track permitting" that any benefit is lost. A better understanding of private sector motivations would help government agencies identify "win-win" strategies. Some West Coast participants stated that additional federal and state government funding should be allocated to activities that help local governments identify and implement such strategies. At both workshops, participants indicated that opportunities for communication between public and private representatives (e.g., through formal networks or forums) would facilitate this process. Some also recommended developing layman's guides to GSI for non-technical real estate development professionals, to help educate senior decision-makers who must sign-off on project budgets. Such guides could be tailored to local circumstances, including links to relevant local codes and resources for more detailed information.

"It was a eureka moment for me that we've studied the impact of green infrastructure on property values, but that appraisal practices were not part of the mix. There's a lot to explore here!"

Hard data is needed to integrate the benefits of GSI into the appraisal process. A key issue explored as part of the initial workshop survey and in workshop discussions was whether GSI implementation can result in higher appraisal values when establishing financing, thereby enabling access to upfront capital and better project financing terms. Without higher appraisals, developers struggle to gain adequate upfront capital to cover any higher initial costs that may accompany GSI implementation. At the East Coast workshop, participants recognized the importance of educating appraisers on the value of GSI, in terms of increased rental premiums and occupancy rates, and decreased lifecycle costs (in some cases). However, most East Coast participants were not familiar with this appraisal issue. The West Coast workshop was attended by two appraisers, allowing us to discuss this issue in more depth. They flagged the need to educate appraisers on how GSI can increase property values using examples and data from real-world projects, stating that appraisers need information that will allow them to develop comparable estimates of value. They are comfortable with uncertainty, but need hard data from which to draw inferences. The appraisers discussed the importance of "speaking the same language" as the appraisal community, and publishing information and articles in widely read publications, such as the Appraisal Journal.

PRIORITY RECOMMENDATIONS

As described above, after each workshop we consolidated the full list of recommendations and developed a short online survey to further explore and identify top priorities. The following provides a summary of the top recommendations from each workshop. These reflect the consensus of the workshop participants, all of whom reviewed a draft of this report before publication.

EAST COAST WORKSHOP RECOMMENDATIONS

The recommendations of the East Coast participants, based on workshop discussions and responses to the follow-up survey, are described below. Figure 2 lists all of the recommendations in rank order. It shows the participants' average ranking for each recommendation: 4 reflects the highest priority and 1 reflects the lowest priority.[3] Further discussion of the top priorities, as well as other notable recommendations, follows.

East Coast participants identified ***researching and developing recommendations to improve government incentives for GSI*** as their top priority recommendation. Participants who selected this recommendation as a top priority noted that the public sector needs to better understand incentives that have catalyzed investments in GSI nationally and internationally. A lot of workshop discussion focused on direct monetary incentives (e.g., grants, tax incentives), as well as indirect incentives

(e.g., fast track permitting). Participants also encouraged exploring incentives in urban areas that target retrofits at existing developed sites, since redevelopment accounts for a relatively small percentage of the market. They also

> *"Any information on effective incentives—what works and what doesn't—would be helpful to cities and utilities. The public sector needs to know what motivates private development."*

discussed the importance of compiling a body of research and case studies on incentives, i.e., a compendium of best practices. One participant suggested building on existing U.S. Environmental Protection Agency (EPA) case studies; another suggested developing and maintaining a central, open access database.

Figure 2. Workshop participants' ranking of recommendations, East Coast
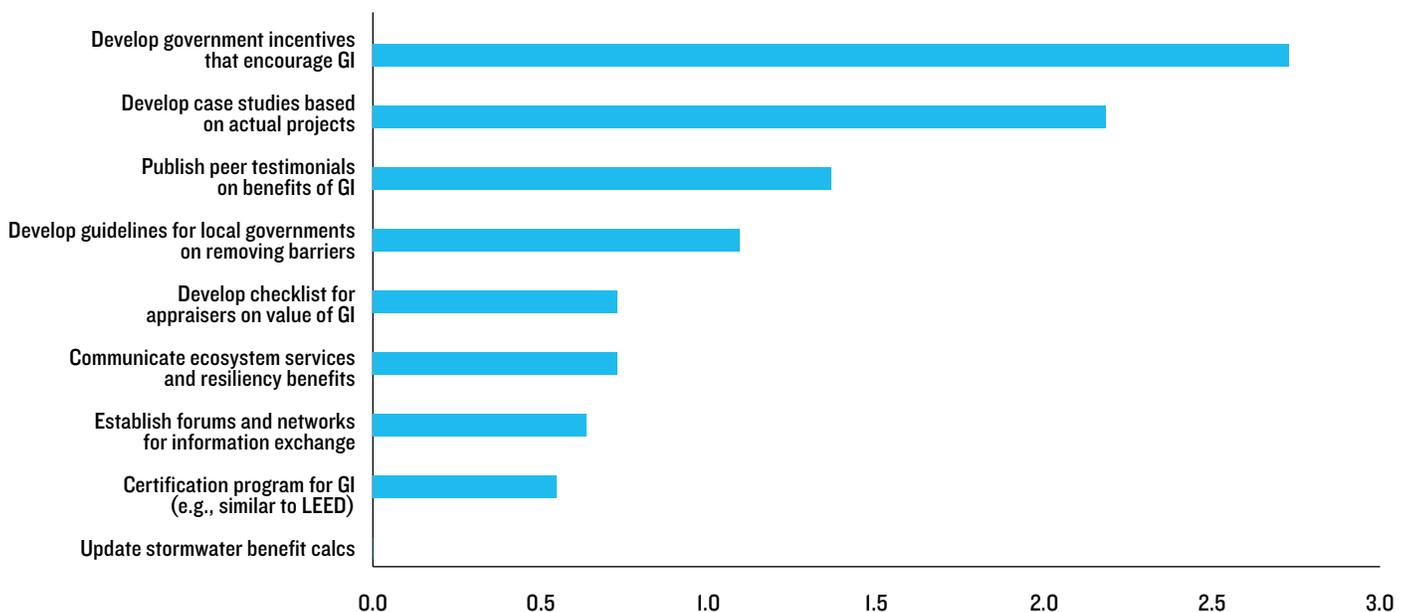
> *"Case studies that clearly map investments to benefits in ways that are tangible and 'real' are an excellent way to convince developers that benefits are not derived from a statistical teasing out of variables, but from adding real value to their property. Hypothetical examples can only go so far."*

Case studies and peer testimonials were also frequently discussed, as reflected in the second and third priority recommendations to **develop and widely disseminate a diverse set of case studies of GSI benefits based on actual projects and data and to develop peer testimonials to highlight specific aspects of GSI projects.** In relation to case studies, participants stressed the importance of monitored results and actual projects, as well as diverse representation by geography, types of GSI, and building and development types. Participants also indicated that case studies should explore the level of GSI needed to achieve benefits, identify the opportunity costs of GSI (e.g., if a developer installs GSI, how many parking spaces do they lose?), and distinguish between causation and correlation in relation to GSI benefits. In terms of specific benefits, participants seemed particularly interested in more information on how GSI can increase rents, occupancy rates, and property values. (These were the same benefits indicated in the *Green Edge* report as typically having the greatest dollar value for commercial property owners.)

In addition to case studies, participants identified the need for "peer testimonials" or stories from other developers to help communicate the benefits of GSI. Peer testimonials provide a trusted source of information and can help to inspire healthy competition to implement GSI. Peer testimonials are not as in-depth as case studies, and could be developed more as a way to market GSI benefits and encourage implementation. Participants agreed that case studies and peer testimonials should be provided in a non-advocacy format and should be published in widely read publications and newspapers targeted at a general audience as well as in the trade press. One participant stated that sometimes, from the perspective of senior decision-makers at real estate development firms, an opportunity to innovate or improve environmental sustainability "isn't big news until they see it in the headlines." When that happens, senior decision-makers will often ask, "Why aren't *we* doing this?"

Participants also said that creating formal venues for the exchange of GSI-related information (e.g., through existing trade associations or new, localized peer-to-peer networks) would help communicate these stories. Many emphasized that this would be an invaluable tool, because learning from colleagues' firsthand experiences is often the most powerful way to change deeply ingrained habits of "the way things are done." Integrating GSI into curricula for continuing professional education programs, especially for design and engineering professionals, was also mentioned as another venue for peer-to-peer learning.

The fourth priority recommendation from the East Coast workshop was to **develop guidelines or roadmaps for utilities and local governments on how they can best remove barriers to implementation.** This recommendation complements others addressing incentives by focusing on the need to eliminate local government barriers that can arise when a developer actually wants to implement GSI. This includes updating codes and policies written without GSI in mind, addressing challenges to approval of innovative designs under existing stormwater regulations, and developing clear and effective guidance for implementing different types of projects. These steps will also help developers take advantage of existing incentives, providing additional motivation to implement GSI.

Several other notable recommendations emerged from the East Coast workshop, which did not garner a top ranking but received support from a number of participants. One that received strong support was to develop a GSI checklist

> *"Remove barriers first. Without their removal, incentives won't work as well as they could. Possible questions to explore: What are other cities doing to facilitate green? What do their approval processes look like? Do other cities have better alignment of code and policy that makes it easier for developers to navigate? Do they have a triage/liaison type service that helps developers navigate the process? Do they offer more support/guidance when it comes to a hierarchy of green designs and tools to choose from? What do other cities do about maintenance?"*

for appraisers so that the increase in property values associated with GSI can be accounted for in the appraised value. Although this recommendation was discussed in more detail at the West Coast workshop, East Coast participants recognized the significant incentive this could provide to developers and property owners.

The importance of obtaining additional data on benefits and costs and communicating the value of GSI through case studies and peer testimonials was highlighted in the priority recommendations described above. However, East Coast participants also stressed the importance of establishing forums and networks to facilitate the exchange of information and data among cities and utilities, real estate representatives, trade groups, developers, and industry leaders. Although this recommendation was not ranked as a top priority in the follow-up survey, the development of such networks was discussed throughout the East Coast workshop.

Another recommendation focused on evaluating and communicating GSI's potential role in providing important ecosystem services and climate resiliency. This recommendation also goes back to the general theme of communicating the value of GSI to help encourage implementation.

Some participants also recommended developing or expanding upon a certification program, similar to LEED, but specifically for GSI. This might include further developing the American Society of Landscape Architects' Sustainable SITES Initiative program.

Finally, in relation to specific government actions, some designers also called attention to an important technical engineering issue: the need to update procedures and formulas for calculating GSI performance when measuring compliance with regulatory performance standards. Local codes often require site designers to use outdated methods, which were designed for other purposes, to calculate the amount of stormwater capture associated with GSI technologies. These can underestimate the true performance of GSI, so that even regulations intended to drive the use of GSI are less effective than they could be.

WEST COAST WORKSHOP RECOMMENDATIONS

The recommendations of the West Coast participants, based on workshop discussions and the follow-up survey, are described below. Figure 3 ranks all recommendations, using the same methodology as the East Coast recommendations shown in Figure 2. Further discussion of the top priorities, as well as other notable recommendations, follows.

The highest priority recommendation from the West Coast workshop was to *adopt or revise local stormwater regulations that allow for creative, cost-effective design*

to meet volume-based performance standards. This recommendation is in direct response to one of the key barriers described in Section 3: inflexible design standards associated with local and state stormwater regulations. Participants noted that local governments need to understand the common barriers to implementation, as well as the factors driving GSI adoption, in order to develop effective regulations. In the follow-up survey, one participant suggested that local governments develop specific design guidelines as an off-the-shelf approach to comply with regulations, while making allowances in the regulations themselves for designs that are more tailored to the needs of particular sites or projects but nonetheless meet objective performance standards. These guidelines could help designers unfamiliar with GSI avoid the assumption that there is no feasible or applicable green design solution. However, it was also noted that knowledgeable government regulators must still weigh in during the design review process because "off-the-shelf" approaches can be misused, particularly by inexperienced designers, if site-specific factors are not taken into account.

The second priority recommendation from West Coast participants was to *develop tools to capture all benefits and assess "total" (i.e., aggregate) value, including how to quantify (where possible) and accurately characterize all values.* This recommendation is in line with workshop

> *"There are benefits tools out there, but no standardization. It's like using a dictionary every time I want to show people the benefits of green infrastructure: I have to look it up, pick what definition or study is meaningful and what's not."*

Figure 3. Workshop participants' ranking of recommendations, West Coast
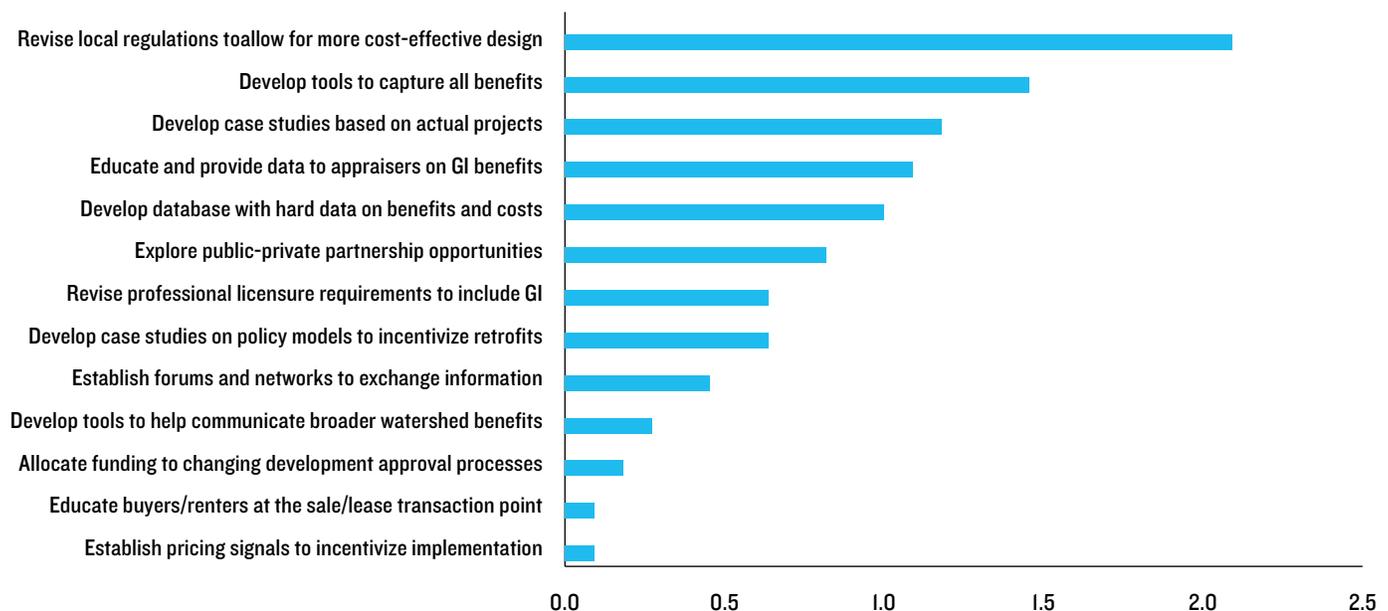
discussions related to the need for hard data on benefits and costs, ROI, and GSI value streams. The development of such a tool could also allow developers to understand the "intangible" benefits of GSI, such as its many community benefits, in real terms. One participant noted that having tools that capture and present the benefits of proposed projects is a key to fostering buy-in and adoption of GSI in private developments.

Along those lines, the West Coast's third priority recommendation was to **develop and widely disseminate a diverse set of case studies and stories based on actual projects and data.** This recommendation is closely related to the second recommendation and underscores the importance of hard data on benefits, costs, and total value. In addition to more information on benefits, West Coast participants also prioritized the need for case studies

"Lessons learned and shared allow and facilitate others' engagement and involvement; some from excitement, some from shame. Transparency to the good, the bad, and the ugly allows for confidence and trust-building!"

on operations and maintenance. Like their East Coast peers, participants stressed the importance of developing case studies and information for a range of GSI projects, development types, market segments, and geographic locations.

The fourth priority recommendation from West Coast participants was to **educate appraisers on the benefits of GSI.** As noted above, appraisals that account for the values of GSI make it possible to secure financing for upfront capital costs. This recommendation included "learning how to speak appraisers' language" to minimize fear and risks associated with GSI during the financial decision-making process. Again, the need for hard data on the benefits of GSI was highlighted. Participants generally recognized

"At the end of the day the Business Case makes or breaks most deals. Good credible data that the finance team can defend is critical to securing funding and building momentum."

the importance of educating the valuation community to encourage further implementation. In the follow-up survey, one West Coast participant noted "I can now see that having accurate infrastructure valuation information (property values, for example) to support GSI planning and more importantly, financing, is super important to advancing the use and implementation of GSI. Green features seem to foster a number of positive outcomes, yet the technical support for

outcomes seems to be lacking. Collaborating with appraisers and making sure the appropriate technical information is gathered, analyzed, and presented appears to be an important implementation step."

Several other notable recommendations emerged from the West Coast workshop, which did not garner a top ranking but received support from a number of participants. One such recommendation was to develop an information repository containing hard data on benefits and costs. Developers and designers could draw on this repository to inform project design and education efforts, justify projects to investors, and provide insight into the appraisal process. Public-private partnership opportunities for GSI implementation and maintenance also received attention in the follow-up survey. Although not discussed at length, participants identified the need to identify opportunities for public investment to leverage additional private investment, including developing joint business cases to identify the most cost-effective solutions.

Consistent with the top priority recommendation for developing and revising local stormwater regulations, another recommendation was to allocate a portion of state and federal funding to help small jurisdictions change their development approval processes to more reliably facilitate the routine use of high-quality GSI practices. (Regional wastewater utilities may be able to provide similar support to municipalities within their service areas.) Other recommendations related to government actions and incentives included developing case studies on policy

"I think a lot of opportunity is lost at point of sale. We have to make sure all kinds of other infrastructure is up to standard at point of sale (plumbing, electrical, etc.)... Why not add stormwater management to the mix?"

models for incentivizing retrofits of existing buildings; revising professional licensure requirements to include GSI; and establishing pricing signals to further incentivize implementation.

There were several additional recommendations for communicating the value of GSI. This included developing tools and information to help local governments communicate the broader, watershed benefits of regulations so that developers understand how implementing GSI at individual project sites fits in to the "bigger picture story" of water quality and ecosystem restoration. Another recommendation was to develop information that would help educate buyers and renters during sale and lease transactions and when renovations are being made to existing buildings. Like their East Coast counterparts, West Coast participants also suggested forums and networks to facilitate the exchange of information and promote GSI, both across and within disciplines.

CONCLUSIONS AND NEXT STEPS

The roundtable discussions and associated surveys provided significant insight into how property owners and developers currently think about GSI, and what can be done to further GSI adoption on private lands. Table 1 provides a summary of the top four recommendations from each workshop.

Table 1. Top four priority recommendations from the East and West Coast workshops		
	East Coast workshop	**West Coast workshop**
Priority #1	Research and develop recommendations to **improve government incentives for GSI**. This includes evaluating the effectiveness of existing incentives across the United States, and developing a compendium of best practices.	Adopt or revise stormwater **regulations that allow for creative, cost-effective design to meet volume-based performance standards.**
Priority #2	Develop and widely disseminate a **diverse set of case studies**, based on actual projects and data, showing GSI benefits for property owners and tenants. Case studies should highlight both immediate and lifecycle benefits and costs.	Develop **tools to capture all benefits and assess "total" (i.e., aggregate) value**, including how to quantify (where possible) and accurately characterize all values.
Priority #3	As a supplement to full case studies, develop **peer testimonials** to highlight specific aspects of GSI projects, including benefits of implementation.	Develop and widely disseminate a **diverse set of case studies** and stories, based on actual projects and data, showing GSI benefits for property owners and tenants. Case studies should highlight both immediate and lifecycle benefits and costs.
Priority #4	Develop guidelines or roadmaps for utilities and local governments outlining how to **remove barriers to help facilitate GSI implementation**.	**Educate appraisers** on the benefits of GSI, and learn to speak their language.

Overall, participant recommendations generally fall within three broad programs of action:

- **Developing and refining effective government regulations and incentives**. Two of the top priority recommendations from the East Coast workshop as well as the top priority recommendation from the West Coast workshop were directly related to this topic. Specifically, participants on the East Coast identified the need to research and develop recommendations to improve government incentives for GSI implementation. Those selecting this recommendation as a top priority noted that the public sector needs to better understand incentives and other drivers that have catalyzed GSI investments nationally and internationally. East Coast participants also recommended creating guidelines and best practices to help local governments remove barriers to implementation. On the West Coast, the top priority recommendation focused on developing or revising stormwater regulations to allow for creative, cost-effective design to meet volume-based performance standards. This recommendation was made, in part, in response to one of the key barriers identified during workshop discussions: inflexible design standards associated with some state and local stormwater regulations.

- **Filling information gaps and providing analytic tools concerning the benefits and costs of GSI.** Participants identified a shortage of hard data on the benefits and costs of GSI as a key barrier to implementation, and many of the top recommendations reflected the need to fill this information gap. For example, on the West Coast, the second top priority recommendation was to develop tools to assess and quantify the "total" (i.e., aggregate) value of GSI improvements. This includes benefits that are not always taken into account in ROI, like increased rents and occupancy rates, energy and water savings, reduced or avoided "grey" infrastructure costs, lifecycle costs (including operations, maintenance, and replacement), and personal and public health benefits that result from the vegetated elements of GSI (i.e., "biophilic" designs that reconnect people to nature). West Coast participants also prioritized the need to develop hard data on how GSI can increase property values to educate appraisers about its value. This would allow appraisers to develop comparable value estimates when establishing financing, thereby enabling better project financing terms that provide a market-based incentive for GSI implementation. At both workshops, participants agreed on the need to use hard data from a diverse set of actual projects—including

typical projects representing a range of market segments. These recommendations all require additional data—or improved accessibility of existing data—on the benefits and costs of GSI. East Coast participants also expressed a need to understand how GSI can help to increase resiliency and manage extreme rain events, which are expected to increase under climate change.

- ■ **Communicating the value of GSI through case studies, peer testimonials, and other networks.** At both workshops, the development of case studies to communicate the value of GSI was frequently discussed. Participants stressed the importance of basing case studies on monitored results and actual built projects, as well as diverse representation by geography, types of GSI, and building and development types. Participants also identified the compelling nature of "peer testimonials" or stories from other developers to help communicate the benefits of GSI. Peer testimonials provide a trusted source of information and can help both to enhance the comfort level of those less familiar with GSI and to inspire healthy competition for implementation. Participants agreed that case studies and peer testimonials should be provided in a non-advocacy format and should be published in widely circulated publications and newspapers, as well as in the trade press. Participants also generally agreed that creating formal venues for the exchange of GSI-related information (e.g., through existing trade associations) could help to communicate these stories and promote GSI.

NEXT STEPS

A wide variety of actors—from both the public and private sectors—will need to collaborate to accelerate GSI implementation in the commercial real estate sector. The workshop participants agreed that both the public and private sectors have good reasons to work together towards that goal.

Municipalities and utilities, which have responsibilities to reduce stormwater pollution from their sewer systems, will benefit from cost-effective approaches to compliance, while simultaneously improving neighborhood quality of life. State and federal agencies charged with protecting our rivers, lakes, bays, and beaches can accelerate the cleanup of polluted waterways. Commercial property owners, managers, and tenants can reap substantial economic benefits and life-cycle cost savings. The design and engineering community can foster innovation and grow a larger market for GSI-related services. Non-profit organizations, trade and professional associations, academic researchers, and philanthropic foundations that share some or all of these objectives can, likewise, advance their own missions by helping to catalyze change.

The following table lists key activities corresponding to the workshop recommendations described in this report. Further, it provides a targeted call to action, by identifying which types of entities are well-suited for leading roles and supporting roles to implement each action. See Table 2 on page 23.

Workshop participants left the workshops energized for action. NRDC will continue to engage with the participants and others to advance the recommendations presented here, which can transform GSI into the standard way of doing business throughout the commercial real estate market.

ENDNOTES

1   See NRDC's report *Rooftops to Rivers II: Green Strategies for Controlling Stormwater and Combined Sewer Overflows* (www.nrdc.org/rooftops) for profiles of more than a dozen cities' GSI programs, as of October 2013. As of this writing, four of the most ambitious long-term GSI plans are in Philadelphia, New York, Milwaukee, and Seattle. In each of these places, the plan relies on private property GSI to meet a substantial portion of overall GSI targets.

2   Clements, J., St. Juliana, A., and Davis, P., "The Green Edge: How Commercial Property Investment in Green Infrastructure Creates Value," NRDC, December 2013, www.nrdc.org/water/commercial-value-green-infrastructure.asp

3   In the participant follow-up survey, respondents were asked to rank their top four recommendations from the workshop from a consolidated list. In calculating the average rankings, recommendations that did not fall within a participant's top 4 priorities were assigned a score of 0.

Table 2. Next Steps for Public and Private Sector Actors

●● = Leading role O = Supporting role	Local governments and utilities	State and federal governments; and regional utilities and governmental bodies	Non-profits (local, regional, and national)	Trade and professional associations (local, regional, and national)	Private firms/practitioners in the development and design communities	Appraisers	Academics	Foundations
Develop/refine effective government regulations and incentives								
Study existing local incentives to determine the most effective approaches	O	O	●●	●●			●●	
Develop "how to" guides for local governments and utilities on improving regulations, policies, incentives	O	●●	●●	O				
Adopt or revise regulations and site plan review processes	●●	●●	O	O	O			
Adopt or revise incentive programs	●●	●●	O	O	O			
Communicate with the development community to better understand local drivers that motive or inhibit GSI	●●	●●	O	●●	●●			
Develop regionally-specifc manuals, guides, and other materials to assist private sector in designing, obtaining approval for, and maintaining GSI projects	●●	●●	O	●●	O			
Fill data gaps								
Develop standardized data collection methods/metrics	O		●●	●●	●●		●●	
Generate and share data from GSI projects	O				●●			
Collect, make publicly accessible, and analyze data from GSI projects	O	O	●●	●●			●●	
Communicate values of GI								
Develop detailed case studies & narrative testimonials	O		●●	●●	●●		●●	
Create venues for peer-to-peer learning	O		O	●●				
Present first-hand peer testimonials					●●			
Disseminate written materials and information to developers and designers (directly and through media)	●●	●●	●●	●●	●●		O	
Disseminate materials and information to "consumers" of commercial real estate	O	O	●●	●●	●●		O	
Facilitate use of data for project-specific decisionmaking								
Create "tools" for developers to easily calculate life-cycle ROI based on project-specific characteristics (including ranges of uncertainty in costs/benefits)			●●	●●	●●		●●	
Edcuate appraisal community on GSI benefits	O		O	O	O	●●	O	
Publish methods for incorporating GSI benefits into project valuation			O	O	O	●●	O	
Provide funding to support the above actions								
Provide grants to support efforts by local governments and NGOs	O	●●		O				●●

APPENDIX: WORKSHOP PARTICIPANTS

Table A1. East Coast Workshop Attendees		
Name	**Affiliation**	**Location**
Michele Adams	Meliora Design	Philadelphia, PA
Tom Ballestero	University of New Hampshire	Durham, NH
Liz Beardsley	U.S. Green Building Council	Washington, D.C.
Christopher Coes	Locus/SGA	Washington, D.C.
Luke Falk	Related Group	New York, NY
Chris Garvin	Terrapin	New York, NY
Eugenia Gregorio	The Tower Companies	Washington, D.C.
Ilana Judah	FXFowle	New York, NY
LuGay Lanier	Timmons Group	Richmond, VA
Jim Lutz	Liberty Property	Philadelphia, PA
Jim Maransky	E. Built	Philadelphia, PA
Brad Molotsky	Brandywine Property	Philadelphia, PA
Suki Paciorek	Vornado	New York, NY
Aditya Ranade	Lux Research	Boston, MA
Anna Shipp	Sustainable Business Network	Philadelphia, PA
Shandor Szalay	AKRF	Philadelphia, PA
Brian Van Wye	District of Columbia Department of the Environment	Washington, D.C.
Erin Williams	Philadelphia Water Department	Philadelphia, PA

Table A2. West Coast Workshop Attendees		
Name	**Affiliation**	**Location**
Randall Bell	Real Estate Damage Economics	Laguna Beach, CA
Josiah Cain	Sherwood Engineers	San Francisco, CA
Mark Edlen	Gerding Edlen	Portland, OR
Pam Emerson	City of Seattle, Green Infrastructure Advisor - Office of Sustainability & Environment and Seattle Public Utilities	Seattle, WA
Mark Grey	Bldg Industry Ass'n of So.CA	Irvine, CA
Adel Hagekhalil	City of Los Angeles, Bureau of Sanitation	Los Angeles, CA
Jason King	Herrera Environmental Consultants	Seattle, WAS
Ken Kortkamp	San Francisco Public Utilities Commission	San Francisco, CA
Amalia Leighton	SVR Design Company	Seattle, CA
Don Moseley	WalMart	Bentonville, AR
Sandy Wiggins	Consilience; a creator of LEED-ND	Washington, D.C.
Jeff Odefey	American Rivers	San Francisco, CA
Bill Reed	Regenesis Group	Boston, MA
Rowan Roderick-Jones	ARUP	San Francisco, CA
Tim Runde	Carneghi and Partners, Inc.	San Francisco,CA
Karen Sands	Milwaukee Metropolitan Sewerage District	Milwaukee, WI
Frank Teng	Jones Lang LaSalle, JLL	San Francisco, CA
Andy Wiegman	Mandel Group	Milwaukee, WI

CHARACTERISTICS OF EAST COAST WORKSHOP PARTICIPANTS

The participants in the East Coast workshop represent a variety of interests and have a great deal of experience with the current GSI market. The following discussion provides a summary of participant characteristics, based on individual responses to the participant survey.

Participants work with various types of clients in different capacities. Most participants work directly with clients to implement GSI, or are developers that integrate GSI solutions at new development and redevelopment sites. Some participants play more of an advisory, advocacy, or research role, or work on behalf of a government agency to facilitate GSI implementation. Figure 4 summarizes the different positions held by workshop participants.

Participants design, construct, and evaluate various GSI solutions. While a few participants focus on specific types of GSI such as green roofs, most work with all types of GSI, including permeable pavements, tree planting, bioretention systems, and green roofs. Some participants also apply or evaluate GSI on a broader scale for public stormwater infrastructure or ecosystem restoration purposes.

Most participants work on development, redevelopment, and retrofit projects at a variety of project sites, including multi-family buildings, office buildings, retail locations, schools and university campuses, hospitals, mixed use developments, parks, and public facilities.

Many participants have a regional geographic focus. Some participants work all over the United States and even internationally, but many work primarily in the mid-Atlantic and northeastern part of the country.

Most participants work for companies or groups that have fewer than 50 employees. Figure 5 presents workshop participants by size of company or organization.

Figure 4. Participants' involvement in GSI
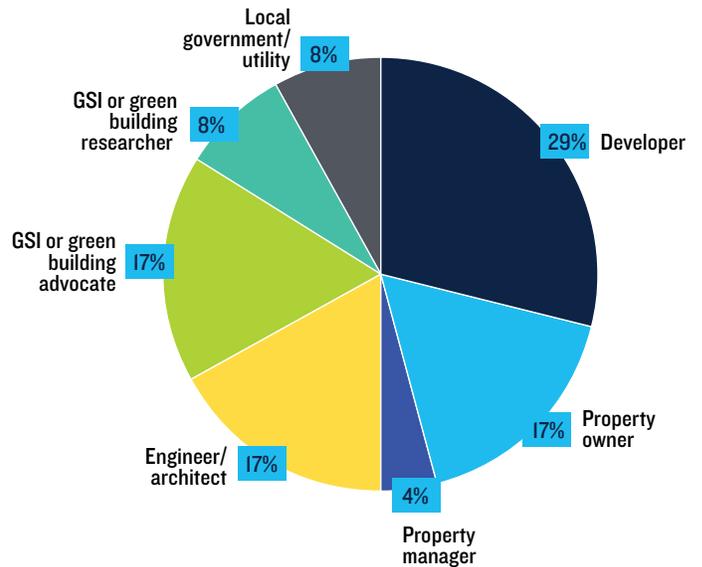
Figure 5. Number of employees in participants' organizations
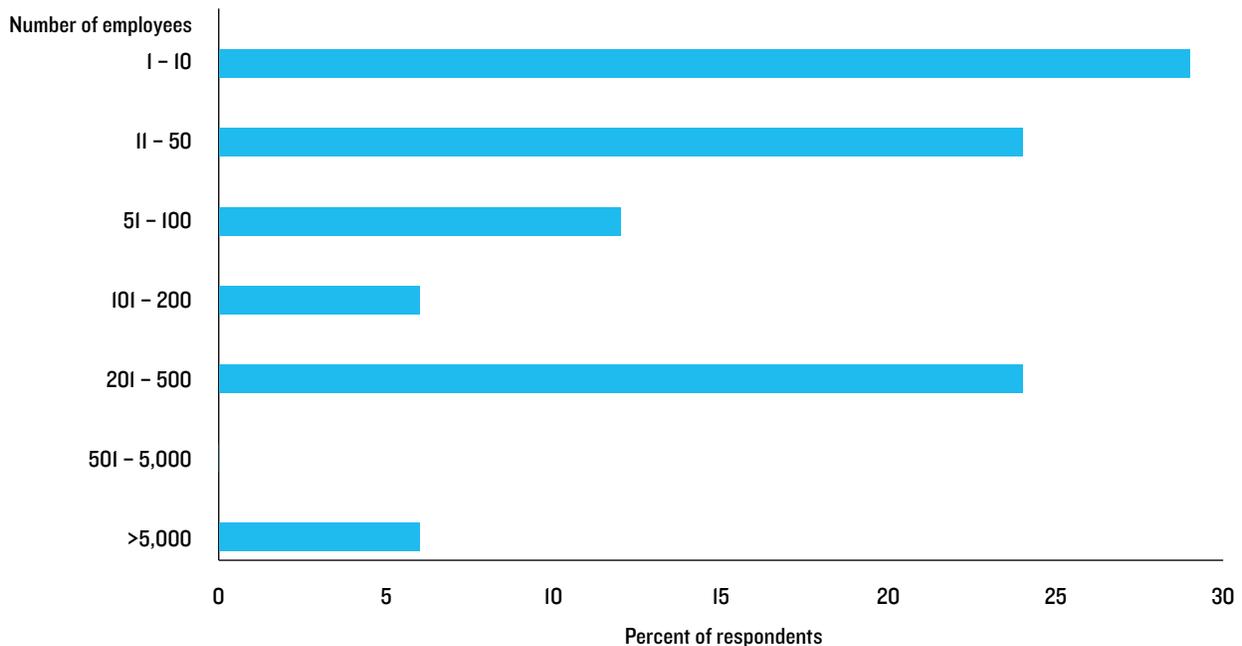
CHARACTERISTICS OF WEST COAST WORKSHOP PARTICIPANTS

The participants in the West Coast workshop represent a variety of interests and have a great deal of experience with the current GSI market. The following discussion provides a summary of participant characteristics, based on individual responses to the participant survey.

Participants work with various types of clients in different capacities. Most participants work directly with clients to design and/or implement GSI, or are developers and property owners that integrate GSI solutions at commercial, multi-family, industrial, or public properties. Some participants play more of an advisory, advocacy, or research role, or work on behalf of a government agency to facilitate GSI implementation, while several focus on financing or appraisal aspects of GSI. Figure 6 summarizes the different positions held by workshop participants.

Participants design, construct, and evaluate various GSI solutions. Most work with all types of GSI, including permeable pavements, tree planting, bioretention systems, and green roofs. Many are also interested or work with GSI on a broader scale for public stormwater infrastructure, or at the business improvement district level.

Most participants work on development, redevelopment, and retrofit projects at a variety of project sites, including office buildings (72%), multi-family buildings (61%), schools and university campuses (61%), mixed use developments (61%), public facilities (56%), retail locations (39%), and industrial sites (44%). A few participants indicated that they focus solely on new development for specific building types, including multi-family and office buildings.

Many participants have a regional geographic focus. Some participants work all over the United States and even internationally, but most work in the west (primarily California and the Pacific Northwest) and mid-western part of the country.

Participants work for companies and groups of all sizes. Figure 7 presents workshop participants by size of company or organization. About one-third of participants work for organizations that have between 11 and 50 employees. However, there is a strong representation from organizations of all sizes.

Figure 6. Participants' involvement in GSI
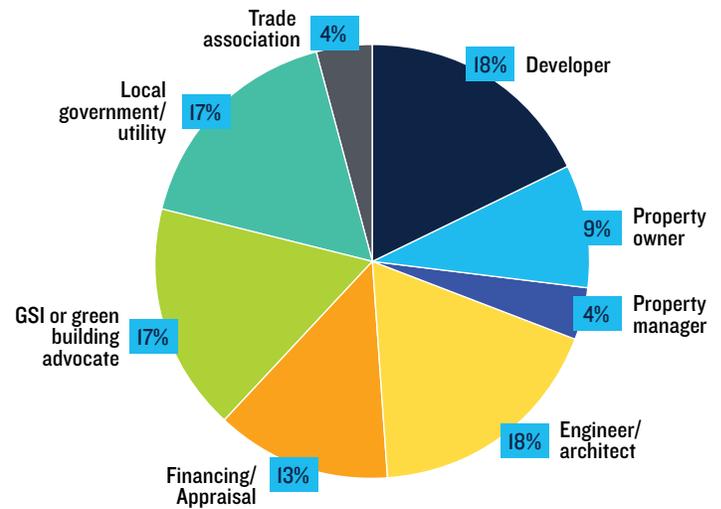
Figure 7. Number of employees in Participants' organizations