RESOURCE GUIDE FOR PLANNING, DESIGNING AND IMPLEMENTING

GREEN INFRASTRUCTURE IN PARKS

NRPA National Recreation and Park Association

Because everyone deserves a great park

ACKNOWLEDGEMENTS

The Great Urban Parks Campaign: Green Infrastructure in Underserved Communities is a partnership between the National Recreation and Park Association (NRPA) and the American Planning Association (APA), with support from the Low Impact Development Center Inc. (LID Center). The purpose is to improve environmental and social outcomes in underserved communities through green infrastructure in urban, regional and municipal parks.

Additional resources on designing and implementing green stormwater management projects in urban parks to improve equity can be found by visiting NRPA's Great Urban Parks Campaign webpage. Available materials include briefing papers, webinars and case studies focused on the integration of green infrastructure stormwater management in parks in a manner that improves social equity, environmental quality and economic benefit.

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INTRODUCTION

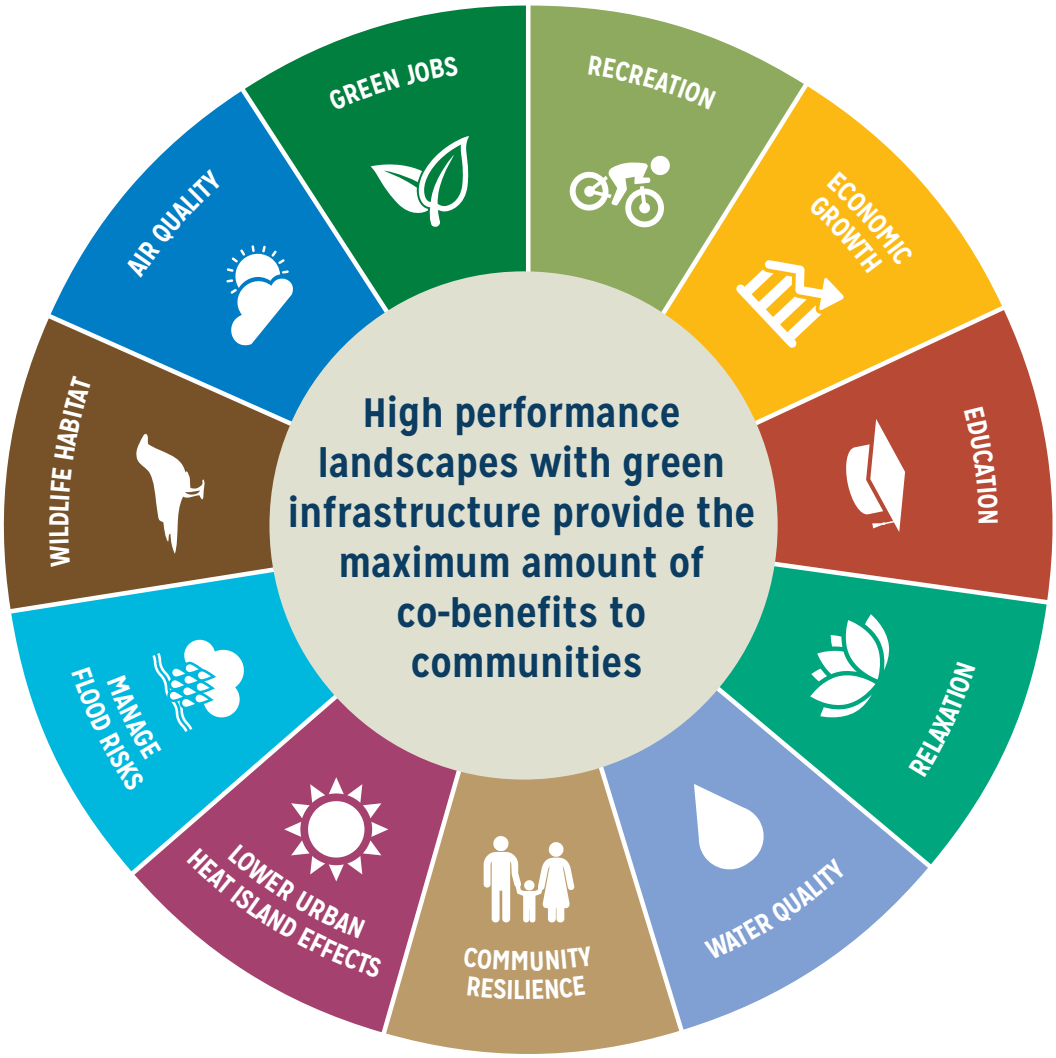
OVERVIEW

Parks have long played an integral role in community landscapes. As open green space becomes more scarce, public park agencies have new opportunity and reasons to work with other departments and agencies to utilize protected public green space in innovative ways. Designing new or existing parks to manage stormwater using green infrastructure principles is an ideal way to realize many of these benefits. Green stormwater infrastructure installations can be used to revitalize existing parks or enhance the design and functionality of new parks.

Parks provide ideal opportunities for green infrastructure as they are often already highly visible, multifunctional public spaces that typically include green elements. The use of green infrastructure has increased over the last decade as knowledge of its benefits has grown. Incorporating green infrastructure into parks can bring wide-reaching improvements to neighborhoods. Focusing green infrastructure-based park development and redevelopment efforts in underserved areas where the need is often the greatest will ensure the impact has social equity benefits as well as environmental and economic value.

Combining green stormwater infrastructure into park retrofits and new park development with a goal of increasing social equity can help ensure that open space is used to its full potential by providing multiple environmental and social benefits and helping cities grow or revitalize more equitably. Creating new high-performance public spaces by adding green infrastructure elements to existing and new parks is not without social and economic impacts. In some cases, such infrastructure can contribute to environmental gentrification. Care must be taken beginning in the initial conceptual design, through planning stages, that these investments do not lead to gentrification that negatively impacts existing communities.

This *Resource Guide for Planning, Designing and Implementing Green Infrastructure in Parks* builds on the success of park and green infrastructure initiatives throughout the United States. It provides basic principles, inspiration, and ideas that can help planners, designers, and decision-makers equitably integrate green stormwater infrastructure into parks and park systems across the country.



HOW TO USE THIS GUIDE

This resource guide provides a starting point for park and recreation professionals, planners, and designers interested in integrating green stormwater infrastructure concepts and practices into park design, construction, and maintenance. The purpose of this guide is to help professionals and communities design and maintain greener, cleaner, more resilient parks that maximize benefits to their communities.

Green Stormwater Infrastructure includes descriptions and resources related to common types of green stormwater infrastructure practices in parks. *Understanding the Context* explores different park environments, detailing the opportunities and challenges of implementing green stormwater infrastructure in a variety of park contexts. The final section – Best Practices – provides best practice models for the design, construction, and maintenance of green stormwater infrastructure in parks.

Before undertaking any green stormwater infrastructure project, park agencies must assess their capacity for financing, designing, building, and maintaining these projects, as well as conducting thorough outreach and engagement. If there are resource gaps within agencies, other government agencies or existing partners may be able to contribute. If not, external contractors may be needed.

GREEN STORMWATER **INFRASTRUCTURE**

Two definitions of green infrastructure commonly apply to park planning: green infrastructure, and green stormwater infrastructure.[1] *Green infrastructure* refers to an interconnected network of open space consisting of natural areas and other green features that protects ecosystem functions and contribute to clean air and water.[2] Regional planning approaches such as the conservation of large tracts of open land fall into this category. These play an important role in water resource management and the creation of healthy environments. *Green stormwater infrastructure* refers to using or mimicking natural processes to prevent, capture, and/or filter stormwater runoff.[3]

This guide focuses on the application of green stormwater infrastructure to park properties, as it provides a more specific design and management framework with more quantifiable water quality benefits.

Many cities have begun to integrate green stormwater infrastructure into their park systems. A 2014 survey by the Trust for Public Land (TPL) found that more than 5,000 acres of parkland in 48 major cities had been modified in some way to control stormwater. The projects were many and varied. The survey identified projects in 23 states ranging from 1 to 887 acres.[4] With community parks containing hundreds of thousands of acres across the country, there are a multitude of opportunities for integrating green infrastructure into park systems nationwide.

Jedidiah Gordon-Moran

A constructed wetland built in a community park in a formerly industrialized area of Chattanooga, TN collects and cleans runoff before it flows into the Tennessee River.

COMMON GREEN STORMWATER INFRASTRUCTURE PRACTICES FOR PARK SETTINGS

Common green stormwater infrastructure practices are defined below as adapted from the U.S. Environmental Protection Agency Green Infrastructure website.[5]

Montgomery County Department of Environmental Protection

BIORETENTION is a versatile stormwater treatment system that collects, filters, and infiltrates stormwater runoff from impervious surfaces during small storm events and allows it to infiltrate into subsurface soils and evapotranspirate, the movement of water from the land to the atmosphere by evaporation and by transpiration from plants. Bioretention areas are depressed, flat-bottomed cells of various shapes and configurations that include plants and an engineered soil mix and may include an underdrain. Their flexible design features, relatively small footprint, and ability to be adjusted to accommodate utilities and other conflicts allow them to easily fit into community landscapes. Common variants include rain gardens, micro-bioretention areas, stormwater planters, and tree box filters. Bioswales are another variant detailed below.

BIOSWALES are bioretention channels that collect runoff from small drainage areas. Bioswales differ from other bioretention practices in that they are designed to be conveyance treatment devices, not storage devices. Water does not pond and slowly infiltrate in bioswales. Instead, treatment and retention is provided as stormwater moves from one place to another. As linear features, they are particularly well suited to being placed along streets, sidewalks, and parking lots.

Steven Vance

CONSTRUCTED WETLANDS mimic the functions of natural wetlands to capture runoff, improve water quality, and provide wildlife habitat. Constructed wetlands filter stormwater by slowing down water flow and trapping sediments and pollutants. Plants unique to wetland habitats take up pollutants and foster the growth of microorganisms that remove pollutants from water. Wetlands can be a cost-effective, practical approach to treating polluted runoff. However, they can generally only be built on uplands and outside floodplains to avoid damaging natural aquatic ecosystems.[6]

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IMPERVIOUS SURFACE DISCONNECTIONS involve directing runoff from rooftops or other small impervious areas (such as a hard turf area, a small parking lot, or section of roadway) into a pervious area or another stormwater best management practice that infiltrates, filters, and/or captures the runoff. Disconnecting downspouts from the storm drain system is a simple, effective green infrastructure practice that is applicable to a wide variety of site conditions and development designs.


Arlington County, VA

GREEN ROOFS use soil and plants in place of traditional roof material to enable rainfall infiltration and the evapotranspiration of stored water. Green roofs can be cost-effective in dense urban areas where land values are high. There are two common types of green roofs: extensive and intensive. Extensive green roofs typically have a growing medium of 3 to 4 inches, are commonly planted with sedum (a hardy groundcover), require less irrigation, and have low maintenance requirements. Intensive green roofs have up to 12 inches of growing medium and can support shrubs and trees. The ability to maintain larger plant material also introduces a need for constant irrigation and a more regular maintenance schedule.[7] Green roofs are easily accommodated during building design. Retrofitting an existing roof requires structural evaluation and calculations.


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PERMEABLE PAVEMENTS infiltrate, treat, and/or store rainwater where it falls. Permeable pavements provide an alternative to conventional pavement systems and can be made of pervious concrete, porous asphalt, or permeable interlocking pavers. Permeable pavement can be used in a variety of settings and is good for walking, biking, parking areas, and low-trafficked roads without heavy truck use. Permeable pavements typically include an underdrain system that prevents the pavement from flooding when rainfall exceeds infiltration. This practice can be particularly cost-effective where land values are high or flooding or icing is a problem. Permeable pavements must be swept and vacuumed regularly to prevent the pores from clogging, which prevents infiltration.


Low Impact Development Center, Inc.

RAINWATER HARVESTING involves collecting or storing rainwater for later use, such as for irrigating lawns or gardens.[8] A typical rain barrel is sized to hold between 40-75 gallons of rainwater stored above grade; cisterns can hold up to 10,000 gallons or more of rainwater and can be stored above or below grade. Both systems can help reduce a building's overall potable water usage. To be most effective, their water should be used up between rain events to maximize water capture with each storm.


Roger Foley

STREAM RESTORATION involves restoring or "daylighting" streams and channels by removing artificial barriers (such as pipes, channelization, or steep grades) and returning them to natural conditions, creating wetlands, providing appropriate vegetation along banks, and restoring natural habitat of streams and non-tidal wetlands.[9]

Low Impact Development Center, Inc.

URBAN TREE CANOPY reduces and slows stormwater by intercepting precipitation in leaves and branches. Tree roots stabilize soil; trees also take in carbon dioxide and release oxygen. Many cities have set tree canopy goals to restore some of the benefits of trees that were lost when the areas were developed. Homeowners, businesses, and community groups can participate in planting and maintaining trees throughout the urban environment.

LAND CONSERVATION: The water quality and flooding impacts of stormwater can be addressed by protecting open spaces and sensitive natural areas within and adjacent to a city or town (including upstream watersheds) while providing recreational opportunities for residents. Open spaces provide natural stormwater filtration and convey water more slowly than concrete drainage systems. Natural areas that should be a focus of this effort include riparian areas, wetlands, and undeveloped hillsides.

Panama City Beach Park and Recreation

VEGETATION MANAGEMENT: Comprehensive landscape design practices like proper plant selection and arrangement; the use of plants for weed control and surface stabilization; and good construction practices can help minimize maintenance costs and improve water quality. For example, selecting native plants that are water-efficient minimizes irrigation; while pest-resistant plants and turf grasses minimize the use of pesticides.[10] Converting under-utilized turf areas to less maintenance-intensive forms of landscape can yield significant environmental and cost benefits while still providing attractive settings.

VEGETATED BUFFERS: Healthy, vegetated buffers adjacent to waterways improve water quality and overall stream health by filtering and slowing stormwater runoff. They also provide additional benefits, such as connecting natural areas, providing important wildlife habitat, and providing areas for passive recreation trails (where compatible).

Steve Droter/ Chesapeake Bay Program

PRE-PLANNING AND ASSESSMENT

Parks can play a central role in providing opportunities for green stormwater infrastructure. A park assessment and pre-planning process driven by a strong community engagement program is necessary to ensure that the final plan is responsive to the community's diverse needs.[11] As discussed in the APA Briefing Paper: Green Infrastructure and Park System Planning,[12] area-wide assessments conducted during the park system planning process can identify underserved areas in need of additional park and green space resources. Once sites are selected for improvements, a more in-depth analysis can reveal demographic trends and existing stakeholder groups that may be targeted for further outreach during design.

Initial park assessments and pre-planning help to identify resources that may be needed throughout outreach, design, construction, and maintenance. They help determine what projects are feasible given existing resources and where expanding capacity can help achieve stormwater management and social equity goals. The choice of the green stormwater infrastructure methods employed will depend on the:

- Park context or location where the practice will be installed;
- Existing site conditions such as hydrology, hydraulics, soils, and vegetation; and
- Available funding

PARK CONTEXT

There is a growing need for parks to accommodate a variety of activities, purposes, and user groups. Parks are increasingly being designed or redesigned to allow for flexible, multi-purpose program space. This resource guide identifies eight common park amenities where green stormwater infrastructure practices can be integrated to provide ecological, aesthetic, and programmatic enhancements. The list is not exhaustive but includes elements commonly found in parks that can inform decisions related to siting green stormwater infrastructure.

ACTIVE RECREATION AREAS – Generally, active recreational activities are those that require specific, dedicated infrastructure and space, such as sports fields, golf courses, and playgrounds. Active recreation is encouraged by providing activity-specific equipment that can be tailored to different themes and/or age groups.[13]

Active recreation areas often require significant financial investment and ongoing management and maintenance. They can be designed or retrofitted to serve stormwater management purposes, often without impeding recreational use. For example, a playing field can be designed to provide sub-surface stormwater treatment, while hard courts and sidewalks can be constructed with permeable pavement.[14] Bioretention facilities, plants, and trees can be installed around play areas to capture runoff. Playgrounds also provide opportunities to educate children about stormwater issues.[15]

PASSIVE RECREATION AREAS AND TRAILS – Passive recreation areas are generally minimally developed or undisturbed natural areas that allow for nonspecific uses requiring little dedicated infrastructure or space. They can provide for recreation such as walking/running, fishing, or canoeing.[16] Parkland forests serve as natural infiltration zones; bioretention practices such as rain gardens can be installed as part of a wildlife habitat or in tandem with a park's environmental education initiative.[17]

Park trails are designed for their intended users. Some are multi-use; others are meant only for a single use (such as bicyclists or horseback riders). Park trails provide opportunities for recreation and enjoyment. They can be the focal point of a park or greenway or connect parks to nearby communities[18]. They can also provide access to natural resources and connections throughout communities while preserving ecological functions that naturally manage stormwater, such as raised boardwalks through wetlands. Adding trees, native plants, and bioretention areas along trails can create demonstration projects that educate trail users about stormwater issues. Trails are also good candidates for permeable pavement or other pervious surfaces.[19, 20]

NATURAL AREAS – Also referred to as "Natural Resource Areas," natural areas are "lands set aside for preservation of significant natural resources, remnant landscapes, open space, and visual aesthetics/buffering".[21] Natural areas are designed for minimal recreational use, and vary in size depending on the existing resource. Natural areas in parks may include wetlands, water bodies, forests, geologic features, trails, or interpretive exhibits.[22] Many of these areas provide a "natural" form of green stormwater infrastructure in parks that can reduce/absorb runoff from developed areas. Stream and shorelines are potential candidates for restoration projects.

PARK ENTRANCES – Park entrances are commonly developed to draw attention and invite the public in. The use of an attractive green stormwater infrastructure practice at the entrance and/or the park perimeter provides multiple functions, such as creating an inviting entrance, providing a highly visible educational component, and treating polluted stormwater runoff not just from within the park but potentially from the surrounding roadway.

PARKING AREAS –Parking areas provide many opportunities for reducing stormwater runoff by integrating green stormwater infrastructure into their design. Replacing traditional asphalt with permeable paving materials can promote infiltration of stormwater runoff. Bioswales or bioretention cells can capture or slow runoff and can be installed in existing or expanded medians or parking lot edges. Planting trees and native vegetation around and within parking lots can help slow runoff while reducing the heat island effect, making the park environment more enjoyable for pedestrians.[23]

SITE CONSIDERATIONS

The small footprint of many green stormwater infrastructure practices enables them to be easily integrated into community parks. Well-designed green stormwater infrastructure practices blend seamlessly into the existing landscape. They can also be a visual reference point or a focal point for interpretation or education. Green stormwater infrastructure may be incorporated into the design of new parks or incorporated into retrofit or redevelopment projects. Including green stormwater infrastructure in a new park development or redevelopment project at the earliest planning stage can significantly reduce the total cost of planning and installation.

Retrofitting existing sites with green infrastructure through activities such as replacing impervious surfaces or the greening of previously grey infrastructure involves constructing a project in a park that is already developed and is not currently planned for redevelopment. This typically costs more. However, a retrofit may reduce water quality impacts, solve a localized flooding problem, or add a demonstration or education component. In these cases, the cost of the retrofit can be reduced by integrating it with another community, infrastructure, or capital improvement projects.[24, 25]

Various site conditions have an impact on determining the most appropriate green stormwater infrastructure practices available, or how a specific practice must be adapted to meet the physical constraints of the site. These include climate, soil conditions, space availability, and the location of sewer, stormwater, water, and other utilities. Site assessment checklists like those available from the Oregon State University Extension Service[26] or Rutgers University[27] can be helpful tools for assessing a site. They can also be used as starting points for tailoring a checklist specific to a park.

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Permeable pavers in the Brookside Gardens parking lot in Wheaton, MD

CONTEXT-SENSITIVE DESIGN – The size and shape of existing parkland or land slated for park redevelopment may affect the amount of land available for stormwater management. Identifying any areas that should be avoided is an important step in assessing the site's capacity for green stormwater infrastructure (see existing site features below). Allowing water to infiltrate into the soil can be challenging when space is limited. Integrating green stormwater infrastructure practices into existing landscape features, such as placing bioretention areas or bioswales alongside medians or parking areas, serves multiple purposes.[28]

EXISTING SITE FEATURES – Utilities, structures, mature trees, and other existing natural resources and rights-of-way can impact the amount of space available to integrate green stormwater infrastructure practices. This is particularly true with existing park or infill sites. Utilities that may be buried below-ground include sewer, water, electrical, gas, and fiber optic communication lines. It is important to locate these features early in the design process to identify and coordinate with the responsible agencies. Adjacent structures and buildings can also have an impact. Tall buildings in urban settings can block the sun or adversely impact wind, noise, and odors.[29] Depth to the water table, average annual rainfall and temperature, and the location of wetlands, flood-

Park Pride

A two-acre detention pond was created as the centerpiece of an urban park in Atlanta's historic Fourth Ward Park

plains, riparian areas, and topography are all common features to consider. Cultural and historic elements must be considered along with other existing site features.

SOILS – Existing soil types and textures can impact infiltration rates (i.e., the ability for stormwater to soak down into the soil). Clay soils and urban soils, for example, have low infiltration rates. Common characteristics of urban soils include high soil compaction, low organic matter content, and soil contamination.[30] The presence of existing pavement, bare spots, scouring, exposed/above ground roots, construction debris, and the quality of existing vegetation can all provide visual clues of soil conditions. These observations can be verified with professional laboratory and field tests. Such factors do not rule out green stormwater infrastructure, but they do need to be kept in mind during planning. Techniques such as soil remediation or amending the soil, de-compacting soils, and minimizing clogging of pores can improve performance and infiltration.[31] Your local Soil Conservation District (SCD) representative may be helpful in assessing soil characteristics.

VACANT LANDS AND BROWNFIELDS – Vacant sites and brownfields (land previously used for industrial or commercial purposes where the presence of contaminants is likely) provide viable options for park development projects. However, care should be taken to ensure that contaminants or waste materials in the soil are abated without increasing the risk of groundwater contamination. Visual examinations of the site should be coupled with a thorough examination of historic property and environmental records. An environmental investigation of the property is typically required prior to property transfers. This may include collecting and testing surface and subsurface soil samples and groundwater samples.[32] In some cases, brownfield remediation can provide motivation and funding for park development. In Atlanta, Georgia, Historic Fourth Ward Park was built on a former industrial area, and uses a high-capacity stormwater detention pond in addition to smaller green stormwater infrastructure practices to treat polluted runoff and reduce flooding. Park development included numerous play areas and trails connecting to other amenities around the city.[33]

ACCESS TO WATER FOR IRRIGATION – The need or potential need for occasional irrigation of green stormwater infrastructure plantings can be limiting factors for arid and semiarid regions. In addition, new plants in need of establishment may require supplemental irrigation. It is important to be aware of water access on the intended site and how to meet these needs upfront. Irrigation requirements can be reduced by using native, drought-tolerant plants, amending the soil, proper mulching, utilizing rainwater harvested on-site with rain barrels or cisterns, and proper maintenance.[34] Consult local and state regulations, if applicable, for restrictions on water harvesting related to issues such as water-quality, public health concerns, and existing water-rights laws.[35]

CLIMATIC CONDITIONS – Local climates affect the performance of green stormwater infrastructure installations. Tailoring designs to account for climatic extremes can help avoid negative impacts. For example, cold weather can impact the structural integrity of devices such as permeable pavement. However, with proper siting, material selection, and maintenance, porous asphalt can perform very well in cold climates.[36] Green infrastructure practices in arid climates require different types of vegetation than those in more temperate areas, and may be used to address different needs. Green infrastructure may be used to conserve water or to stabilize soil to prevent erosion and reduce drought susceptibility.[37] Green stormwater infrastructure can aid in groundwater recharge, which may provide an additional source of funding.

Hunter's Point South Waterfront Park in New York City incorporates the site's industrial remnants in the green infrastructure features, such as this rail garden.

RESILIENCE – Environmental resiliency, as defined by EPA, refers to "minimizing environmental risks associated with disasters, quickly returning critical environmental and ecological services to functionality after a disaster while applying this learning process to reduce vulnerabilities and risks to future incidents".[38] Susceptibility to extreme weather events, especially flooding or torrential rainfall, can significantly impact the design of green stormwater infrastructure. Parks in these areas must be constructed of sturdy materials while possibly accommodating flood water and/or contributing to flood mitigation. Parks can be a viable development option in flood-prone areas where buildings would suffer damage. They can be designed to be flexible and sturdy enough to accommodate large amounts of water. The Hunters Point South Waterfront Park in Queens, New York, exemplifies a resilient park that withstood a storm surge during Hurricane Sandy in 2012 while slowing the flow of damaging flood waters.[39] Natural areas that are conserved to provide flooding, water quality, and/or wildlife benefits can be used as parks and areas for passive recreation. Examples include Milwaukee, Wisconsin's Greenseams conservation program[40] or the India Basin Shoreline Park in San Francisco, California.[41]

EXISTING PARK USES – Existing parks may not be conducive to some types of green stormwater infrastructure devices. Compromises between the most effective stormwater treatment devices and community needs may affect design choices. These compromises may include reducing the footprint of installations, relocating them, or locating them underground to avoid conflicts with above-ground uses. For example, park users may object to sports fields being turned into gardens or ponds.[42] On the other hand, these "compromises" to accommodate park uses can be mutually beneficial. This was the case in Pittsburgh, Pennsylvania, where park planners addressed community feedback by redesigning the plans for McKinley Park[43] to modify the green stormwater infrastructure. This design change created even more opportunities for green stormwater infrastructure than was previously available and increased the stormwater capture potential. Athletic fields in Atlanta, Georgia and installation of a synthetic turf field over a large storage cistern in Alexandria, Virginia show the possibilities for green infrastructure in existing parks.

FUNDING CONSIDERATIONS

A 2017 National Recreation and Park Association (NRPA) member survey found that a lack of funding is the greatest barrier that keeps park agencies from implementing green infrastructure and sustainability projects.[44] Federal, state, and private grant programs can help seed pilot programs, but long-term funding relies on public-private partnerships and access to upfront capital. The issue of funding is particularly burdensome to distressed or underserved communities.

One method park agencies have used to fund green infrastructure projects is to leverage the co-benefits they provide. Many local governments are required to implement stormwater management in response to a National Pollutant Discharge Elimination System (NPDES)[45] municipal separate storm sewer system (MS4) permit. Other legal and regulatory mandates such as a combined sewer overflow (CSO)[46] consent decree or a total maximum daily load (TMDL)[47] allocation may also drive stormwater implementation. This can open up partnership opportunities between park agencies and water utilities or other locally regulated entities to implement green stormwater infrastructure practices[48, 49]. Two EPA resources that provide examples are Getting to Green: Paying for Green Infrastructure and Green Infrastructure in Parks: A Guide to Collaboration, Funding, and Community Engagement.[50, 51] The EPA also maintains a Water Finance Clearinghouse that provides information on available funding sources for stormwater and other water infrastructure projects as well as reports and information on available financing mechanisms and approaches.[52]

Park projects in underserved areas targeted for revitalization can spur community and economic revitalization, providing opportunities to coordinate with local departments of housing and economic development as well as the private sector. Green infrastructure enhancements within the public right-of-way surrounding parks and the incorporation of recreational benefits provide opportunities to coordinate and co-fund projects with local departments of transportation.[53]

Depending on a project's expense, securing the necessary funding will typically involve a scan of a variety of sources. Opportunities to leverage funding from and with other agencies will depend on its co-benefits. Co-benefits can include additional environmental benefits (such as pollinator gardens, wetland protection, and flood mitigation). They may also include active and traditional transportation projects, green schoolyard retrofits, and urban revitalization projects implemented in conjunction with Business Improvement Districts (BIDs) or other public/private partnerships. Additional information on funding considerations and options is provided in the APA Briefing Paper: Financing Green Infrastructure Projects.[54]

BEST PRACTICES

Parks are a critical component of green infrastructure networks as they provide ideal locations to incorporate green stormwater infrastructure practices that manage stormwater, improve equity, and maximize community benefits. The information presented here is a collection of green stormwater infrastructure best practices employed in parks and greenspaces across the United States. These practices are intended to help steer and promote the development and installation of green stormwater infrastructure projects within parks. These practices are best utilized in a system-wide approach.

- Involve a Multi-Disciplinary Team
- Listen to and Empower the Community
- Communicate the Benefits
- Design for Equity and Inclusivity
- Establish a Demonstration Project
- Support Public Health
- Plan for Connectivity and Accessibility
- "Biddable" and "Buildable" Designs
- Ensure Parks Staff and Contractors are Trained
- Create Career Pathways
- Keep the Public Informed and Involved
- Ensure Effective Operation and Maintenance
- Engage the Community
- Incorporate Projects into Environmental Programming

SITE DESIGN

The design phase should involve a multi-disciplinary team in a participatory process to identify community needs and develop a well-informed, community supported vision for the project. The multiple benefits green infrastructure can provide to the community can be highlighted and communicated to the community through continued and meaningful engagement and demonstration projects. These steps will lead to a detailed plan that can be actualized and that considers equitable access to the site, both which are critical to a successful project.

Dialogue sessions, public meetings, visioning sessions, and engaging the community in the design is an important element in improving beneficial environmental and social outcomes in underserved communities.[55, 56]

BEST PRACTICE:
INVOLVE A MULTI-DISCIPLINARY TEAM

DESCRIPTION: Successful development and implementation of green stormwater infrastructure practices in park settings requires carefully balancing and addressing multiple agency and community goals. Finding the right balance can be challenging. A strong project team should involve members knowledgeable in the design, construction, long-term maintenance, recreational, educational, and community engagement value of green stormwater infrastructure. This may include:

- A park planner to provide input on plans, designs, and materials appropriate for parks
- A landscape architect familiar with green stormwater infrastructure to give input on location, plantings, planning strategies, and other choices
- A water resource engineer with experience focused on the design, monitoring, and evaluation of green stormwater infrastructure to prepare or review engineered designs
- A construction specialist to provide feedback on construction constraints and challenges
- Facilities maintenance personnel knowledgeable about operations and maintenance
- Community and education outreach specialists to engage and gather input from community members
- Other municipal or county agency representatives with permitting authority (if a construction or development permit) or other specialties required for the project
- Community members to communicate their needs and desires

STRATEGIES:

- Ensure the project leader has experience with the design and construction of green stormwater infrastructure projects.
- If the project team's experience is limited, seek input and/or review from planning, design, construction, and maintenance professionals from other agencies, local universities, extension agencies, or other sources who can help troubleshoot problems.
- Establish clear roles and responsibilities for each team member; prepare a memorandum of understanding or some other partnership agreements between the park agency and other responsible parties to lay out how each will work together to build and maintain the green infrastructure project.[57]
- Identify the most pressing problem to be addressed – both from a stormwater perspective and from the perspective of other participants.
- Involve Friends of Park groups or community partner to help raise funds, identify stakeholders, or for other expertise they might bring to the project
- Authentically engage and collaborate with residents and community representatives to ensure that the project serves the interests of the whole community.

EXAMPLES:

- In 2016, the City of Austin, Texas, adopted the South Central Waterfront Vision Framework Plan to guide public and private development of an 118-acre area along Lady Bird Lake, just south of downtown. The City's Urban Design Division sought numerous outside resources and formed diverse partnerships to help

develop the plan. This district-scale plan received input from the American Institute of Architects' Sustainable Design Assessment Team, the Sustainable Places Project, made possible by the U.S. Department of Housing and Urban Development, and the Texas Urban Futures Lab, an initiative of the University of Texas School of Architecture. In a later stage, the City won technical assistance through the EPA's "Greening of America's Capitals" program. This allowed them to bring in landscape architecture and urban design firms to further assist with specific designs for parks, streetscapes, and other green infrastructure features. City government representatives contributed as part of a Technical Advisory Group. These included the Transportation Department, Water Utility, Capital Planning, Economic Development, Office of Sustainability, Parks and Recreation, Public Works, and Watershed Protection Department.[58]

- In 2009, Seattle Public Utilities, along with an extensive team of professionals and stakeholders, completed the Thornton Creek Water Quality Channel stream restoration project in a densely populated area of Seattle, providing much-needed public green space. This integrated team included numerous government departments, landscape architects, maintenance staff, ecologists and soil specialists, structural, civil, and electrical engineers, hydraulic modelers, artists, and organized citizen stakeholders. The restored stream provides numerous benefits, including pedestrian links than connect transit stops, wildlife habitat and accompanying educational signs, improved water quality, and a revitalized real estate market.[59]

Ann Froschauer/USFWS

A stream restoration project in Seattle, WA benefited from the oversight of a multi-disciplinary team.

RESOURCES:

- National Recreation and Park Association: Green Infrastructure in Parks: Small-Scale, Low-Cost Green Stormwater Management Projects for Parks and Public Lands (recorded webinar).
- Water Environment Federation: Multidisciplinary approach, community engagement for green infrastructure (and related book: Green Infrastructure Implementation.)[60]
- EPA: Green Infrastructure in Parks: A Guide to Collaboration, Community Engagement and Funding.

BEST PRACTICE:
LISTEN TO AND EMPOWER THE COMMUNITY

DESCRIPTION: It is important to engage community members such as residents, businesses, and community organizations early and often in the planning, design, and implementation process. Involving stakeholders at the beginning is the best way to secure support. Incorporate their ideas into the design, and tailor projects to meet their needs. This includes addressing equity through engagement of residents of underserved communities (see

Best Practice: Design for Equity and Inclusivity). Green stormwater infrastructure projects can transform the look and feel of a community. In downtown where space is particularly valuable, it is also important to ensure that selected practices are designed to meet multiple goals.

STRATEGIES:

- Engage the community through operational staff who interact with the community daily (via comment boxes, conversations).
- Identify an individual, individuals, or organization to lead efforts to organize stakeholders—a "local champion committed to improving a neighborhood, city, or region's quality of life and sustainability".[61]
- Set a regular meeting schedule to keep stakeholders informed of the progress.
- Utilize tools such as formalized policies and frameworks for engagement to guide outreach in an inclusive direction and keep the design adaptive.
- Use visuals and key messaging to frame the conversation.
- Provide data and explain project benefits and the perceived and real drawbacks in a way the community understands so that they can make informed decisions.
- Hold meetings at times and places that make it possible for all members of the community to participate.
- Form partnerships to maintain momentum for the plan during a long implementation period.
- Utilize various ways to engage stakeholders, including charrettes and town meetings, to ensure different viewpoints are incorporated and projects provide long-term benefits such as jobs and volunteer opportunities.
- Consider upfront how to address language barriers, communication issues, cultural barriers, or seemingly irreconcilable differences of opinion.
- Consider the possibility of gentrification and involve partners such as the local Housing Authority to take necessary measures to maintain the community.

Amigos de los Rios

Interpretive sign of native plants at Lashbrook Park in El Monte, CA

EXAMPLES:

- In 2005, the nonprofit organization Amigos de los Rios introduced an ambitious plan known as the Emerald Necklace Expanded Vision Plan to "link the San Gabriel and Santa Monica Mountains with the Pacific Ocean"[62] through a network of parks, trails, and restored waterways. When complete, it is expected to link more than 1,500 acres of parks and open spaces around Rio Hondo, San Gabriel, and the lower Los Angeles Rivers.[63] One big challenge has been the large number of municipalities and unincorporated areas of the county that make up the plan area – many of which are already competing for limited investmentdollars. Amigos de los Rios has served as a much-needed liaison between the local communities and public agencies. The organization has been successful bringing youth into the design process, organizing volunteers for regularly-scheduled stewardship and cleanup events,

providing educational opportunities, and implementing green infrastructure and park projects in underserved neighborhoods. These efforts have helped build and sustain the interest of community members, public agencies, and officials.[64] A total of 12 park projects have been completed to date.[65]

- The Municipal Art Society of New York (MAS) created an interactive map of underused publicly-owned or leased land in New York City.[66] This tool makes it easy for anyone to see where there is potential for land to be repurposed, and whether it is located within a floodplain, in an underserved area, or in a low-income community. Making this information publicly available in a user-friendly format can help small organizations and individual residents become more educated and engaged about land use issues in their own communities.

RESOURCES:

- American Planning Association: How Cities Use Parks for Community Engagement.
- Environmental Protection Agency: Enhancing Sustainable Communities with Green Infrastructure
- Environmental Protection Agency: Getting in Step: Engaging Stakeholders in your Watershed
- National Park Service: A Toolkit for Engaging Communities and Fostering Relationships

BEST PRACTICE:
UNDERSTAND AND COMMUNICATE THE BENEFITS

DESCRIPTION: Green stormwater infrastructure installations in parks can provide a multitude of benefits beyond those associated with improved water quality and an improved environment. These include social benefits such as increased proximity to nature and community empowerment[67] and health benefits such as better air quality, improved physical activity, and reduced stress levels.[68] These benefits can be particularly significant for underserved and economically disadvantaged communities with less access to green infrastructure.[69] In addition, while parks that do implement green infrastructure and other sustainability measures indicate that cost savings are a driver, only a small percent measure those cost savings.[70] Educating community leaders and members on green stormwater infrastructure benefits can lead to stronger advocates.

STRATEGIES:

- Seek outside expertise and take advantage of online tools like the USDA Forest Service's iTree Tools and the EPA's Green Infrastructure Modeling Toolkit to calculate the multiple benefits of applied practices (both which have helpful online tutorials).
- Explain the benefits and the perceived and real drawbacks of the intended program or project in a way that community understands so that informed decisions can be made.
- Monetize the benefits of green infrastructure when possible.
- Use visuals and key messaging to frame the conversation.

EXAMPLES:

- Toledo, Ohio sits in a low-lying area known as the Great Black Swamp near the southwestern portion of Lake Erie. The city is highly impervious and has long suffered from localized flooding issues. More frequent, intense rain events have led to an uptick in basement floodings, property damage, water quality issues, and strained budgets.[71] In 2014, the city engaged citizens in preparing the Greater Toledo: Going Beyond Green Regional Sustainability Plan.[72] The community worked with the Digital Coast Partnership,

led by the National Oceanic and Atmospheric Administration (NOAA), to study the benefits of implementing green stormwater infrastructure in Toledo's Silver Creek Watershed. They found that, over a 20-year timeframe, this would result in approximately $700,000 in benefits from avoided building damage alone, with many green stormwater infrastructure practices expected to provide benefits beyond that period[73, 74]. This study, along with a triple bottom line approach identified in the sustainability plan, and a committed community, was influential in building momentum for prioritizing and implementing green stormwater infrastructure projects. One of the first projects to be implemented was a series of green infrastructure projects within Cullen Park,[75] the westernmost access point to Lake Erie, using $300,000 in funding from the U.S. EPA Great Lakes Initiative grant program.

RESOURCES:

- American Rivers and Center for Neighborhood Technology: The Value of Green Infrastructure (See Appendix A for a list of existing tools for assessing green infrastructure's performance and value).
- Environmental Protection Agency: Benefits of Green Infrastructure
- Environmental Protection Agency: Green Infrastructure Cost-Benefit Resources.
- Stratus Consulting: A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds
- USDA Forest Service: iTree
- Ohio Kentucky Indiana Regional Council of Governments: Trees and Stormwater

BEST PRACTICE:

DESIGN FOR EQUITY AND INCLUSIVITY

DESCRIPTION: It is important to ensure parks contribute to social equity and to prioritize underserved communities during the selection process. Engage communities throughout the design process, so that communities can actively participate in the design process and provide meaningful feedback, not just initial ideas or general desires. Equity must also be addressed at a system-wide or city-/county-wide scale to ensure resources are allocated fairly and investment is targeted where need is greatest.

STRATEGIES:

- Develop and incorporate levels of service standards that encourage equitable access to parks when siting projects.[76]
- Ensure that community outreach efforts involve all stakeholders, making efforts to include groups that have historically been underrepresented and underserved. Create a participatory process as much as possible.
- Accommodate as many ages, abilities, activity levels, and amenities as possible given site constraints; plan for a diversity of uses and users, according to community needs.

- Use equitable employment practices. Make efforts to recruit and hire parks and recreation employees that reflect the demographics of the communities in which they work.
- Use equity tools such as those created by Madison, WI or the Government Alliance on Race and Equity to help incorporate equity considerations into the decision-making process.
- Keep the design adaptive and remain responsive to community feedback.

EXAMPLES:

- Space to Grow is a unique partnership between Openlands and the Healthy Schools Campaign in Chicago, Illinois that focuses on greening schoolyards in Chicago's neighborhoods. Space to Grow uses a focused, two-step process to identify schools and communities with the greatest need for active recreation outdoor spaces and that are vulnerable to severe neighborhood flooding caused by combined sewer overflows. In step one, school eligibility is determined based on three factors: whether the Chicago Public Schools district has prioritized its need for a playground as high; it has sufficient space for a playground (≥ 30,000 sq ft); and no other major construction projects are planned. In step two, schools are invited to submit proposals and are evaluated on their flooding risk; community vulnerability; likelihood for success; and proximity to other Spaces to Grow schools.[77] The partnership will have retrofitted twenty-two schoolyards by the end of 2017.[78]
- In 2007, Elm Playlot was a small, forgotten park within a poor inner-city neighborhood in Richmond, California's Iron Triangle. Toody Moole, entrepreneur and founder of the nonprofit Pogo Park set about to change this by recruiting, hiring, and training about a dozen Iron Triangle residents to go door-to-door to solicit ideas for how to redesign the park from their neighbors. Emphasis was placed on getting input from neighborhood children. Residents were encouraged to "make full-scale mock-ups of their ideas, experimenting until it feels right".[79] A local fabrication company, Scientific Art Studio, helped make the residents' unique playground creations. The same core team of residents who were hired to design the park are now paid to maintain the park and act as park stewards. The effort has become a model for transforming other parks in the Iron Triangle, and from 2013-2015, Pogo Park partnered with the Trust for Public Land to rebuild Harbor-8 Park in the Iron Triangle.[80]

RESOURCES:

- Environmental Protection Agency: EJSCREEN: Environmental Justice Screening and Mapping Tool
- City of Madison Racial Equity & Social Justice Tools (Fast-Track and Comprehensive)
- Government Alliance on Race and Equity: Racial Equity Toolkit: An Opportunity to Operationalize Equity.
- American Planning Association: Briefing Paper: Planning for Equity in Parks with Green Infrastructure

BEST PRACTICE:
ESTABLISH A DEMONSTRATION PROJECT

Park Pride

Rain garden demonstration project with interpretive signage at Lindsay Street Park in Atlanta

DESCRIPTION: Demonstrating the effectiveness of green infrastructure within a community park and documenting success helps to evaluate and showcase how investing in green spaces can be leveraged to improve multiple outcomes, particularly in underserved communities. Demonstration projects can help build momentum and gain stakeholder and community buy-in. It is also an effective way to gain interest and educate designers, engineers, and the community on methods that deviate from conventional approaches.

STRATEGIES:

- Hold a green infrastructure in parks design competition.
- Install a pilot project in a highly-visible community park that illustrates and measures the benefits of integrating green stormwater infrastructure into park settings.
- Involve multiple agencies and community members and partners in the pilot process.
- Build an outdoor classroom and provide educational materials to inform park visitors of the importance of green stormwater infrastructure practices.

EXAMPLES:

- The Coupeville Stormwater Park in Coupeville, Washington is a pilot project to test the capacity for subsurface wetlands to treat stormwater runoff before it is released into the Puget Sound. The pilot project was initiated in 2012 by the Green Futures Lab in partnership with Town of Coupeville, and SvR Design. Project funding was provided by the Russell Family Foundation, the Bullitt Foundation, WA Department of Ecology, and the WA Sea Grant.[81]

Leslie Batten, UW Green Futures Research and Design Lab

Coupeville Stormwater Park, designed to collect, clean, and recycle stormwater

- Green infrastructure design competitions are a good way to raise awareness of green design and planning approaches in parks and train local landscape architects, planners, and engineers in green infrastructure principles and design. For example, in 2016, the City of Kansas City, Missouri launched a design competition to solicit visions for a 7-mile long linear park in the Twin Creeks area of the Northland. Other examples of where design competitions are being or have been used to spur innovation include Blair County, Pennsylvania; Houston, Texas; and Washington, DC.

RESOURCES:

- Georgetown Climate Center: Green Infrastructure Toolkit – Models for Starting Pilots
- WEF: Hosting a Low Impact Development Design Competition

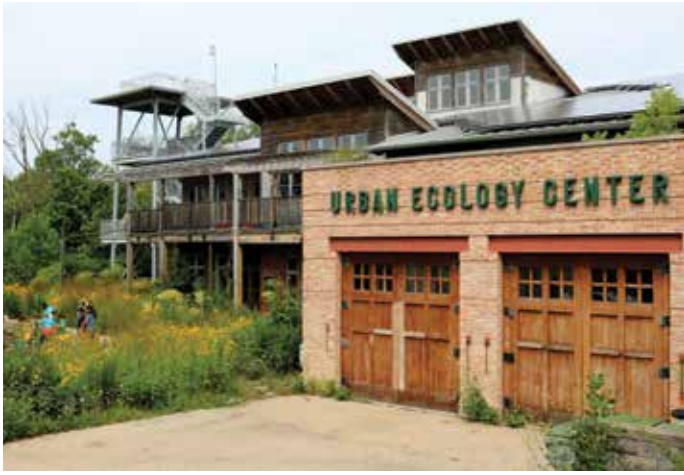
BEST PRACTICE:
SUPPORT PUBLIC HEALTH

DESCRIPTION: Parks can be important contributors to public health, as they can improve access to recreational opportunities, improve air quality, reduce polluted stormwater runoff, and even facilitate access to healthy food. Both park design and park programming are important in ensuring parks provide maximum public health benefits. Parks must be designed in ways that encourage active use, but their presence alone cannot guarantee that people will visit them – programming, outreach, and education are needed to draw people to parks and build healthy habits.

STRATEGIES:

- Use Health Impact Assessment (HIA) tools to evaluate potential health impacts of park projects.
- Balance the need for active recreation, passive recreation, and green stormwater infrastructure.
- Provide programming and facilities that encourage active physical recreation for all users.
- Create as much variety as possible in the types of recreational opportunities parks provide.
- Partner with organizations that can provide additional park programming and education.

Sarina Ryals



The Urban Ecology Center in Milwaukee, WI engages students and teachers in environmental education and outdoor recreation

EXAMPLES:

- Milwaukee's Department of Parks, Recreation and Culture partners with the private Urban Ecology Center to engage students and teachers in environmental education and outdoor recreation, providing numerous opportunities for healthy activities that some students might not otherwise be able to access. They have found that students become repeat visitors to parks and involve their families in park activities.[82]
- In 2011, Lancaster, Pennsylvania developed a strategy to install green infrastructure practices throughout the City to meet its stormwater management regulatory obligations under the Chesapeake Bay Total Maximum Daily Load. Brandon Park in Lancaster was selected as a demonstration area and received a $1.7 million renovation. A permeable basketball court was installed as part of the park's active recreation area, and porous rubber & infiltration was integrated into its playground areas. Bioretention areas, trees, and vegetative curb extensions were installed in the passive recreation areas and along the park's perimeter and entryway, and part of its parking lot was reconstructed with permeable pavement. New landscaping areas were installed to provide both aesthetics and stormwater benefits. The park now captures 3.61 million gallons of stormwater annually.[83, 84]

RESOURCES:

- American Planning Association: How Cities Use Parks to Improve Public Health
- Center for Disease Control and Prevention: Parks, Trails and Health Resources
- National Recreation and Park Association: Green Infrastructure and Social Equity (recorded webinar)
- National Association of County and City Health Officials
- National Park Service
- The Trust for Public Land

BEST PRACTICE:
PLAN FOR CONNECTIVITY AND ACCESSIBILITY

DESCRIPTION: Connectivity and accessibility make parks and trails user-friendly for all ages and levels of physical ability, encourage park use and ensure user safety. While connectivity can be a larger issue addressed in city- or county-wide plans, it ties into issues of accessibility and is important to address at the site scale. Specific park designs can determine connections to existing or potential future routes and how people travel within parks. Connecting smaller parks can also provide the same amenities as larger parks while requiring less land in one place.[85]

STRATEGIES:

- Follow Safe Routes to Parks guidelines and planning tools.
- Review existing and planned transportation routes in park vicinity.
- Develop an Alternative Transportation Plan that focuses on region-wide non-vehicular transportation.
- Gather public opinion related to park access and connectivity and incorporate community input into designs.
- Ensure that routes through planned park connect to existing/planned routes.
- Create inviting park entrances and wayfinding signage to encourage use.
- Follow applicable accessibility standards.

EXAMPLES:

- The City of St. Louis, Missouri's Park Department conducted a connectivity and mobility study to assess connections within and outside of Forest Park, an urban park spanning two square miles. This study helps address how this specific park can better meet the needs of St. Louis residents, while examining its relationship to the city's overall transportation system.[86]
- The City of Portland, Oregon emphasizes connectivity and accessibility in its trail design guidelines, laying out four main goals for trail design: safety, connectivity, context, and diversity. Its aim is to provide user-friendly trails and create a city-wide network, providing safe recreational opportunities for all users.[87]

RESOURCES:

- Forest Park Forever: Forest Park Connectivity and Mobility Study
- National Park Service and Centers for Disease Control and Prevention: Parks, Trails, and Health Workbook
- American Planning Association: Safe Routes to Parks Toolkit
- National Recreation and Parks Association: Safe Routes to Parks Report

BEST PRACTICE:
ENSURE DESIGNS ARE "BIDDABLE" AND "BUILDABLE"

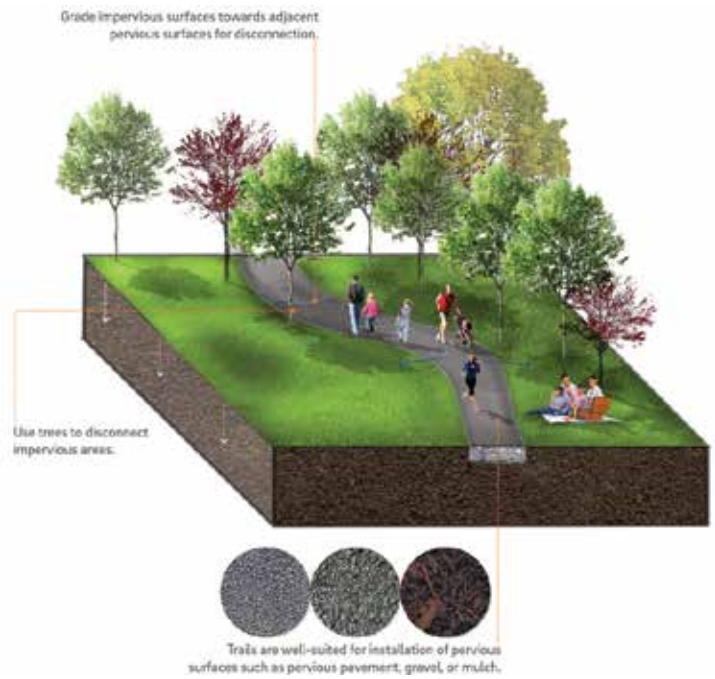
DESCRIPTION: Plans and specifications should be prepared in a way that allows a project to be constructed as detailed. Otherwise, projects are delayed, costs increase, local communities are impacted by prolonged construction disruptions, and public acceptance is compromised.[88]

STRATEGIES:

- Consider stormwater quality and flood control requirements early as initial site concepts are developed.[89]
- Establish detailed green infrastructure design standards for parks that are "tailored to the local physical and regulatory landscape".[90]
- Include inspection requirements, warranty clauses (when appropriate), and other quality assurance requirements in the contract to protect the park department's interest.[91]
- Have construction personnel conduct constructability reviews early into the design process to ensure projects are buildable and biddable.[92]
- Have maintenance personnel ensure that that facilities can be easily maintained.[93]
- Ensure that public health and safety concerns are addressed during the design process.[94]
- Establish a secure funding source.

EXAMPLES:

- The Philadelphia Water Department provides comprehensive planning and design standards for all green stormwater infrastructure projects. These manuals provide specific guidelines for planning, design, and post-design activities, ensuring that planners and designers create projects that align with Philadelphia Water's goals and can be easily constructed and permitted. They are tailored to local conditions and regulatory processes, and are available on a user-friendly, public website, ensuring their accessibility and transparency.[95]



Philadelphia Water Department

An illustration of a trail section with disconnected impervious cover from Philadelphia

- In 2013-2014, Seattle Public Utilities and the King County Wastewater Treatment Division jointly developed a siting and design manual for City and County-led capital projects in the public right-of-way. The purpose was to outline the process for assessing opportunities for green stormwater infrastructure and to engage the community during the siting and options phase. The manual also established field-tested planting palettes and planting and stormwater optimization guidance.[96]

RESOURCES:

- AASHTO: Constructability Review Best Practices Guide
- National Park Service: Quality Assurance Guideline
- NYC Environmental Protection: Guidelines for the Design and Construction of Stormwater Management Systems
- Water Environment Research Foundation: Green Infrastructure Design Considerations

SITE CONSTRUCTION

It's important to be accessible to the community and involve them throughout the construction phase in various ways. Providing opportunities to engage low-income and underrepresented populations and partnering with outside experts during construction can strengthen the overall impact of the project on the community and ensure that the project is high functioning and successful.

Cities are increasingly making public investments in green infrastructure projects. In fact, green infrastructure jobs are found in every part of the economy:

73% are in the private sector

27% are in the public sector

(from Exploring the Green Infrastructure Workforce JOBS FOR THE FUTURE)[97]

BEST PRACTICE:

ENSURE PARKS STAFF AND CONTRACTORS ARE TRAINED AND EXPERIENCED IN GREEN STORMWATER INFRASTRUCTURE INSTALLATION

DESCRIPTION: Not all parks staff, inspectors, and contractors are familiar with green stormwater infrastructure construction techniques. For parks staff and inspectors, many of these practices and the required construction processes may be unfamiliar. Training key parks staff on construction techniques will enable them to make better decisions when selecting contractors. Ensuring a qualified pool of contractors is also important for project success.

STRATEGIES:

- Establish a training program for targeted parks staff, inspectors, and/or contractor training programs to build broad knowledge and access; alternatively, take advantage of trainings offered by local or regional environmental agencies, universities, extension agencies, or watershed groups.
- Utilize a pre-qualification process and require mandatory pre-bid meetings to help identify experienced contractors; encourage contractors to provide certification/participate in a green infrastructure certification program, if one is available in the community.
- Maintain a list of firms that provide green infrastructure-related services.
- Ensure that staff and contractors have access to landscape manuals, construction manuals, and other manuals or handbooks that provide standards that should be followed.
- Require detailed construction staging and sequencing plans to understand and control how contractors will perform their work on the park site.[98]
- Check contractors' work early on to ensure that construction crews are following appropriate procedures.
- Provide recognition to park staff, inspectors, and consultants for achieving certifications or completing educational programs related to green stormwater infrastructure construction.

Philadelphia Water Department

Rain Garden Training Workshop for Contractors in Philadelphia

EXAMPLES:

- DC Water, the Water Environment Federation, and several partner organizations recently established an entry-level National Green Infrastructure Certification Program (NGICP) to verify that construction, inspection, and maintenance staff have the capacity to build, inspect, and maintain green stormwater infrastructure practice. The first round of NGICP certifications were awarded to 62 individuals in January 2017.[99]
- In Philadelphia, Pennsylvania, the Department of Parks and Recreation designs smaller green stormwater infrastructure projects in-house, but

outside consultants are brought in to design more complicated projects. In these cases, the Parks Department sometimes relies on expertise from the Philadelphia Water Department to review outside consultant recommendations with Park Staff.

RESOURCES:

- New Jersey Department of Environmental Protection Stormwater Training (available online)
- Seeing Green: Green Infrastructure Maintenance Training and Workforce Development Opportunities in Northeast Ohio
- Water Environment Foundation and DC Water: National Green Infrastructure Certification Program

Clean Water Partnership

Local workers install stormwater management device in Prince George's County, MD

BEST PRACTICE:

CREATE CAREER PATHWAYS FOR LOW-INCOME AND SOCIALLY EXCLUDED COMMUNITIES

Description: Large-scale park projects often rely on outside organizations to help coordinate and maintain the park. Involving nearby residents as employees or volunteers can create both short- and long-term job opportunities. Even when jobs are not directly made available to residents through park development, parks can provide educational opportunities to impart skills and knowledge, potentially contributing to long-term career and employment goals.

STRATEGIES:

- Set aside a certain minimum percent of the procurement and contracting opportunities for socially and economically disadvantaged small business owners.
- Closely monitor subcontract financial transactions and visit job sites to verify actual work is being performed by socially and economically disadvantaged small businesses.
- Provide education and training opportunities for disadvantaged groups.
- Encourage and facilitate the participation of socially excluded or disadvantaged groups in education, training, volunteering, and employment opportunities.

EXAMPLES:

- Philadelphia, Pennsylvania's Green City, Clean Waters program is supported by the Green Stormwater Infrastructure (GSI) Partners. GSI Partners is a group of local engineering, landscape architecture, maintenance, and material supply firms focused on growing the local stormwater management economy using green and innovative approaches.[100] Another employment-oriented program in Philadelphia is PowerCorpsPHL,

an AmeriCorps initiative that engages 100 young adults every year in environmental stewardship work with Philadelphia Water and Philadelphia Parks & Recreation.[101] The program was designed to support the City's "environmental stewardship initiatives, youth violence prevention and workforce development priorities".[102] PowerCorpsPHL provides various training opportunities such as green stormwater infrastructure and OSHA construction training. Participants gain work experience by serving with organizations across the city. Corps members have been involved in installing rain gardens, stormwater planters, and stormwater tree trenches, and in invasive species remediation. They also provide community outreach to residents.[103]

- Also in Philadelphia, the Philadelphia Horticulture Society's Community LandCare Program Reentry Initiative hires and trains ex-offenders to perform landscape maintenance services in their communities. This and the PHS Roots to Re-Entry provide models for maintenance programs directed towards maintaining vegetated green stormwater infrastructure practices.
- In Prince George's County, Maryland, a public-private partnership known as The Clean Water Partnership was formed to implement sustainable stormwater management solutions in the County. One of the major objectives of the Partnership is to employ local companies. The partnership terms require that small, local, minority- and women-owned businesses account for 30-40% of the total project scope. The partnership is building capacity through offering mentorship opportunities and by providing a course at the local community college to train contractors in the installation and maintenance of green stormwater management practices.[104]
- In Seattle, Washington, Seattle Public Utilities contracts with the Seattle Conservation Corps to maintain GSI capital improvement projects. Seattle Conservation Corps provides opportunities to "adults who are homeless or in transition to learn and work in a structured, salaried, and supportive program to develop transferrable job skills and accomplish mission-critical [work] for Seattle Parks and other agencies"[105].

Philadelphia Water Department

PowerCorpsPHL participants receive skills, training, and education in green stormwater infrastructure installation, operation, and maintenance

RESOURCES:

- American Rivers and Green for All: Staying Green and Growing Jobs: Green Infrastructure Operations and Maintenance as Career Pathway Stepping Stones.
- McEwen, Brendan, Tara Aubuchon, Harriette Crawford, Micah Davison, Karl Seidman: Green Infrastructure & Economic Development: Strategies to Foster Opportunity for Marginalized Communities.
- The Corps Network: Service and Conservation Corps: Development in Green Infrastructure.
- Jobs for the Future: Understanding the skills, credentials, and potential of the U.S. green infrastructure workforce.

BEST PRACTICE:
KEEP THE PUBLIC INFORMED AND INVOLVED DURING CONSTRUCTION

DESCRIPTION: Community engagement during construction is important to keep communities informed of the construction timeline, notify neighbors of any changes to construction, and acknowledge and address any concerns. Engaging community members in the design process and explaining the stages of construction ahead of time will help reduce concerns. Volunteers can be engaged throughout the construction process with tasks such as tree plantings, cleanups, or educational visits to the site. This can help interested community members gain an in-depth understanding of the project and appreciate its form and function.

Clean Water Partnership

Green stormwater infrastructure installation at a public school in Prince George's County, MD

STRATEGIES:

- Ensure a community liaison is available to community members and can answer questions related to the project's construction.
- Hold a pre-construction meeting with community residents, and hold regular meetings throughout the construction process.[106]
- Provide outreach materials that emphasize the community benefits, the project's needs, what to expect during construction, and the construction timeline. Notify community members of any schedule changes.
- Address concerns quickly, and provide regular progress updates.
- Select contractors with the ability to engage stakeholders.
- Provide temporary signage, listing all partner organizations, that notifies community members where the project is in the construction process (such as 'project coming soon', or 'almost complete: plantings coming soon').

EXAMPLES:

- The Clean Water Partnership in Prince George's County, Maryland has outreach staff assigned to different project types, including projects occurring on parkland, schools, municipally-owned properties, and private properties. Community outreach staff establish a regular meetings schedule with affected stakeholders to keep them informed. The Clean Water Partnership also provides informative and educational temporary signage at project sites so park users and others are aware of the project's progress.

RESOURCES:

- EPA: How to Ensure Effective Community Engagement at Construction Projects: Lessons Learned from Two CARE Communities in Connecticut
- International Finance Corporation: Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets

SITE MAINTENANCE & OPERATIONS

Proper long term maintenance is essential to ensuring green infrastructure benefits are realized. Planning for this stage of your project early on is critical. Maintenance is also an opportunity to keep residents engaged through volunteerism and to create job training and hand-on experiences for local youth and community organizations. Routine maintenance schedules for tasks such as trash removal, invasive species control, and replanting should be strictly adhered to as deferred maintenance can significantly increase the total project costs.

Community engagement during the maintenance phase "provides younger people with valuable opportunities to improve the communities in which they live, provides skills training and job experience, and results in citizens who are knowledgeable about the environment."

(EPA Green Infrastructure in Parks: A Guide to Collaboration, Funding, and Community Engagement - June 2017)[107]

BEST PRACTICE:

ENSURE EFFECTIVE OPERATION AND MAINTENANCE ACTIVITIES

DESCRIPTION: Installed green stormwater infrastructure devices require maintenance, just like conventional approaches do. Effective operation and maintenance procedures will ensure that installed devices function properly, that benefits are realized, and public safety is protected.

STRATEGIES:

- Involve maintenance personnel in the design process to ensure the facilities as designed can be easily maintained.
- Secure long-term maintenance budget to support capital improvements and maintenance needs for installed green stormwater infrastructure practices.
- Establish maintenance and inspection procedures and schedules; identify common triggers that require non-routine maintenance (e.g., excess sediment, erosion, dead or overgrown vegetation, or excess trash) to aid field inspectors.[108]
- Record and map the owner, type, and location of installed practices and include a log of maintenance activities; require the submittal of as-built plans for stormwater treatment systems.
- Establish a system for tracking activities, standard maintenance protocols, an operations and maintenance training program, and a database indicating where infrastructure is located.
- Monitor and evaluate over time. Engage university academia, researchers, extension agencies, and others in these efforts.
- Determine whether there is sufficient staff to cover inspections and maintenance needs; if necessary, evaluate whether to train staff or hire experienced contractors.[109]
- If needed, partner with other agencies or departments that have the equipment and skill sets to inspect and maintain green stormwater infrastructure practices; establish an Operations and Maintenance Memorandum of Understanding between agencies or departments for green stormwater infrastructure projects on park properties.
- Incorporate detailed maintenance information in green stormwater infrastructure manuals or as standalone guidebooks.

EXAMPLES:

- In Seattle, the Seattle Public Utilities and the King County Wastewater Treatment Division have established a joint program and have secured a long-term maintenance budget for green stormwater infrastructure in the public right-of-way.[110]
- The City of Shoreline, WA's Public Works Department and Department of Parks, Recreation, and Cultural Assets joined forces to restore the natural topography and add a constructed wetland to a previously barren 9-acre park. The two departments share maintenance responsibilities, with the park costing about $60,000 a year and the stormwater features about $11,000.[111]

RESOURCES:

- Philadelphia, PA: Green City, Clean Waters Green Infrastructure Maintenance Manual
- EPA: Operation and Maintenance Considerations for Green Infrastructure
- EPA: Elements of a Green Infrastructure Maintenance Business Plan
- Seattle, WA: Green Stormwater Operations and Maintenance Manual

BEST PRACTICE:

ENGAGE COMMUNITY IN INSPECTION, OPERATIONS, AND MAINTENANCE

DESCRIPTION: Engaging community members in maintenance and inspection activities can help relieve pressure on limited resources. Removing trash, leaf litter, and invasive species, and conducting regular inspections are simple, effective ways to involve volunteers. Volunteer programs such as the Stormwater Stewards program in the Puget Sound create opportunities to engage trained community members to take a proactive role in maintenance of green stormwater infrastructure practices. It is important to consider and address any liability concerns prior to allowing volunteer activities.[112]

STRATEGIES:

- Work with a local organization to establish a volunteer maintenance program that trains volunteers to take on inspection and maintenance responsibilities for specific green stormwater infrastructure devices.[113]
- Determine upfront how to handle liability concerns and emphasize proper training for those volunteer activities where needed.[114]
- Work with organizations that may be looking for service-learning opportunities such as schools, faith-based communities, or neighborhood groups to recruit volunteers.[115]

Forest Preserves of Cook County

Volunteer group in the forest preserves of Cook County

EXAMPLES:

- In Montgomery County, Maryland the Montgomery Parks department extends liability coverage to registered long-term volunteers that are supervised by staff. Volunteers participating in park cleanup and shorter-term events are not covered.[116]
- Cook County, Illinois boasts a strong volunteer program that helps maintain its Forest Preserves. Volunteers learn while they serve, acting as citizen scientists and helping with ecological restoration. Their website dedicated to volunteer resources provides guidelines, supply needs, and training materials to ensure volunteers are fully informed before their work.[117]
- New York City has an extensive volunteer program offering many levels of involvement. They offer both individual volunteer events and specific, ongoing programs such as the NYC Parks Stewardship program or Green Neighborhoods program, which recruit volunteers with specific interests and provide ongoing training and planned support. Their website is also a helpful, easy-to-use resource, making it easy to get involved.

RESOURCES:

- Pennsylvania Department of Conservation and Natural Resources: Creating Sustainable Community Parks and Landscapes (See Chapter 5: Education and Awareness).

BEST PRACTICE:

INCORPORATE GREEN INFRASTRUCTURE PROJECTS INTO ENVIRONMENTAL PROGRAMMING

DESCRIPTION: Local park agencies are leaders in promoting environmental education and awareness. Green stormwater infrastructure installations provide an opportunity for parks to develop and implement environmental signage and programming that raises understanding and provides meaningful outdoor classroom experiences.

Mark Simpson, Pittsburgh Parks Conservancy

The Frick Environmental Center in Pittsburgh, PA provides space for hands-on, experiential environmental education throughout their facility

STRATEGIES:

- Install interpretive signage, handouts, and educational displays that provide information on the infrastructure and the benefits it provides.
- Provide educational and informational materials via the park or park friends group websites; use smart phone and tablet technology to educate and connect with youth and others.
- Provide guided tours of green infrastructure installations on a recurring basis, or coordinate with other local agencies to include park installations as part of a self-guided tour.
- Establish a hands-on science lessons utilizing the park as an outdoor classroom; coordinate efforts with school agencies, or incorporate programming into volunteer days or other events.

EXAMPLES:

- The Frick Environmental Center in Pittsburgh, Pennsylvania provides "hands-on, experiential environmental education" for people of all ages. The Center was designed to meet LEED Platinum and Living Building Challenge standards. The building itself teaches visitors about the relationship between the built and natural environment. Innovative stormwater management features include a 5,000-gallon underground cistern that collects water from the parking lot's angled solar panel roof and stores it for non-potable uses.[118] The Center provides year-round programming to educate varying ages to promote Science, Technology, Engineering, and Math through hands-on learning.
- The Mississippi Watershed Management Organization (MWMO) in Minneapolis, Minnesota has a Stormwater Park and Learning Center that includes a series of green stormwater infrastructure installations that can absorb up to seven inches of rainfall daily without any runoff into the nearby river. Each installation includes educational interpretive signage. A 360° virtual tour of the park is provided online. The Center hosts various art and educational exhibits throughout the year intended to connect visitors with the Mississippi River.

RESOURCES:

- National Recreation and Park Association: Helpful Hints for Creating Great Park Signage.
- National Recreation and Parks Association: Creating Partnerships to Engage Youth in Conservation and Stewardship
- National Recreation and Parks Association: Connecting Youth with Nature: Environmental Awareness Through Leave No Trace (recorded webinar)

APPENDIX A

PROCESS TO COMPLETION CHECKLIST

PLANNING	☐ Select a park site for green infrastructure project based on community needs/ desires. Tour possible locations with community representatives	Create a participatory process to listen to and empower the community through regular meetings, tours and other community engagement events
	☐ Identify and organize partners and stakeholders; establish an interdisciplinary team	
	☐ Analyze existing information; evaluate GSI options	
	☐ Engage the community and develop a community vision for the project	
	☐ Prepare GSI planning concepts	
	☐ Present concept designs to community and secure community approval	
PRE-CONSTRUCTION/PERMITTING	☐ Secure funding for design and engineering phase	
	☐ Conduct site analysis for GSI features (includes site survey; soils information; location of sensitive environmental features)	
	☐ Present preliminary design to community and secure community approval	
	☐ Submit to regulatory agency for preliminary review (if necessary)	Continue community engagement efforts and seek out ways to involve the community in the project
	☐ Prepare detailed site design plans	
	☐ Secure construction funds	
	☐ Prepare plan for long-term maintenance	
	☐ Prepare and submit permit applications (if necessary)	
CONSTRUCTION	☐ Ensure Park staff and contractors are trained	
	☐ Begin construction of GSI features; use construction period to continue public awareness and public engagement	
	☐ Promote environmental education and awareness within the community	
EVALUATION	☐ Celebrate completion, inviting public to participate	
	☐ Perform regular maintenance on GSI features	
	☐ Monitor, evaluate, and document GSI performance and community benefits	
	☐ Communicate results	
	☐ Incorporate lessons-learned into future GSI project planning and delivery	

APPENDIX B: ADDITIONAL RESOURCES

GREEN INFRASTRUCTURE

- American Planning Association. 2017. Briefing Paper: Green Infrastructure and Park System Planning (2017). https://www.planning.org/media/document/9137981/
- American Planning Association. 2016. Great Urban Parks: Green Infrastructure in Underserved Communities. https://www.planning.org/media/document/9101585/
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FINANCE

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- Environmental Protection Agency. 2014. Getting to Green: Paying for Green Infrastructure. https://www.epa.gov/sites/production/files/2015-02/documents/gi_financing_options_12-2014_4.pdf
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- Environmental Planning Agency. No date. Water Finance Clearinghouse. https://ofmpub.epa.gov/apex/wfc/f?p=165:1:7651176678624::NO

INVOLVE A MULTI-DISCIPLINARY TEAM

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- Water Environment Federation. 2016. Multidisciplinary approach, community engagement for green infrastructure. http://stormwater.wef.org/2016/05/blog-multidisciplinary-approach-community-engagement-essential-green-infrastructure-implementation-success/
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LISTEN TO AND EMPOWER THE COMMUNITY

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- National Park Service. 2013. A Toolkit for Engaging Communities and Fostering Relationships. https://www.nps.gov/resources/upload/Task-9-Engaging-Communities-Toolkit.pdf

UNDERSTAND AND COMMUNICATE THE BENEFITS

- American Rivers and Center for Neighborhood Technology. 2011. The Value of Green Infrastructure. http://www.cnt.org/publications/the-value-of-green-infrastructure-a-guide-to-recognizing-its-economic-environmental-and
- Environmental Protection Agency. No date. Benefits of Green Infrastructure. https://www.epa.gov/green-infrastructure/benefits-green-infrastructure.
- Environmental Protection Agency. No date. Green Infrastructure Cost-Benefit Resources. https://www.epa.gov/green-infrastructure/green-infrastructure-cost-benefit-resources
- Environmental Protection Agency. No date. Green

Infrastructure Modeling Toolkit. https://www.epa.gov/water-research/green-infrastructure-modeling-toolkit
- Stratus Consulting. 2009. A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds. https://www.michigan.gov/documents/dnr/TBL.AssessmentGreenVsTraditionalStormwaterMgt_293337_7.pdf
- Ohio Kentucky Indiana Regional Council of Governments. No date. Trees and Stormwater. http://treesandstormwater.org/
- USDA United States Forest Service. No date. i-Tree. https://www.itreetools.org/index.php

DESIGN FOR EQUITY AND INCLUSIVITY

- American Planning Association. 2017 Briefing Paper: Planning for Equity in Parks with Green Infrastructure. https://www.planning.org/media/document/9137980/
- Environmental Protection Agency. No date. EJSCREEN: Environmental Justice Screening and Mapping Tool. https://www.epa.gov/ejscreen
- City of Madison, WI. Racial Equity & Social Justice Tools. No date. http://www.health.state.mn.us/divs/opi/healthequity/resources/madison-justice.html
- Local and Regional Government Alliance on Race and Equity. 2016. Racial Equity Toolkit: An Opportunity to Operationalize Equity. http://racialequityalliance.org/wp-content/uploads/2015/10/GARE-Racial_Equity_Toolkit.pdf
- Space to Grow Chicago. No date. http://www.spacetogrowchicago.org/

ESTABLISH A DEMONSTRATION PROJECT

- County of Blair, PA. No date. Green Infrastructure Design Competition. http://www.cleanblairwater.org/competition/
- DC Water. No date. Green Infrastructure Design Competition. https://www.dcwater.com/projects/green-infrastructure-design-challenge
- Georgetown Climate Center. No date. Green Infrastructure Toolkit – Models for Starting Pilots. http://www.georgetownclimate.org/adaptation/toolkits/green-infrastructure-toolkit/models-for-starting-pilots.html
- Land / Water Sustainability Forum. 2010. Houston LID Design Competition. http://www.houstonlwsforum.org/the-houston-experience.html
- Water Environment Foundation. 2013. Stormwater Report: Hosting a Low Impact Development Design Competition. http://stormwater.wef.org/2013/06/lid-design-competition/

SUPPORT PUBLIC HEALTH

- American Planning Association. No date. Briefing Paper: How Cities Use Parks to Improve Public Health. https://www.planning.org/cityparks/briefingpapers/physicalactivity.htm
- Center for Disease Control and Prevention: Parks, Trails and Health Resources. https://www.cdc.gov/healthyplaces/healthtopics/parks_resources.htm
- National Recreation and Park Association. 2016. Recorded Webinar: Green Infrastructure and Social Equity. https://learning.nrpa.org/products/green-infrastructure-and-social-equity#tab-product_tab_overview
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- National Park Service. 2015. Parks, Trails, and Health Workbook. https://www.nps.gov/public_health/hp/hphp/resources.htm
- The Trust for Public Land. 2011. From Fitness Zones to the Medical Mile: How Urban Park Systems Can Best Promote Health and Wellness. https://www.tpl.org/sites/default/files/cloud.tpl.org/pubs/ccpe-health-promoting-parks-rpt.pdf

PLAN FOR CONNECTIVITY AND ACCESSIBILITY

- Forest Park Forever. 2016. Forest Park Connectivity and Mobility Study. https://www.scribd.com/document/321530546/Forest-Park-Connectivity-and-Mobility-Study-2016
- National Park Service. 2015. Parks, Trails, and Health Workbook. https://www.nps.gov/public_health/hp/hphp/resources.htm
- American Planning Association and American Public Health Association. No date. Safe Routes to Parks

Toolkit. http://plan4health.us/tools-and-resources/toolkits/safe-routes-to-parks/
- National Recreation and Parks Association. No date. Safe Routes to Parks Report. http://www.nrpa.org/Safe-Routes-To-Parks/

ENSURE DESIGNS ARE "BIDDABLE" AND "BUILDABLE"

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- National Park Service. 2017. Quality Assurance (QA) Guideline and Review Checklist. https://www.nps.gov/dscw/qaguideline.htm
- New York City Environmental Protection. 2017. Guidelines for the Design and Construction of Stormwater Management Systems. http://www.nyc.gov/html/dep/pdf/green_infrastructure/stormwater_guidelines_2012_final.pdf
- Water Environment Research Foundation. 2007. Green Infrastructure Design Considerations. http://www.werf.org/liveablecommunities/pdf/design.pdf

ENSURE PARKS STAFF AND CONTRACTORS ARE TRAINED AND EXPERIENCED IN GREEN STORMWATER INFRASTRUCTURE INSTALLATION

- New Jersey Department of Environmental Protection. 2017. Stormwater Training. http://www.njstormwater.org/training.htm.
- LAND Studio. 2013. Seeing Green: Green Infrastructure Maintenance Training and Workforce Development Opportunities in Northeast Ohio. http://savetherain.us/wp-content/uploads/2011/10/GreenForAll_seeing_green_08-2013.pdf
- Water Environment Foundation and DC Water. No date. National Green Infrastructure Certification Program. http://ngicp.org/

CREATE CAREER PATHWAYS FOR LOW-INCOME AND SOCIALLY EXCLUDED COMMUNITIES

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- Jobs for the Future. No date. Understanding the skills, credentials, and potential of the U.S. green infrastructure workforce. http://www.jff.org/initiatives/natureworks

KEEP THE PUBLIC INFORMED AND INVOLVED DURING CONSTRUCTION

- Alliance for Innovation. Connected Communities: Local Governments as a Partner in Citizen Engagement and Community Building (White paper). http://transformgov.org/en/knowledge_network/documents/kn/document/301763/connected_communities_local_governments_as_a_partner_in_citizen_engagement_and_community_building
- Environmental Protection Agency. No date. How to Ensure Effective Community Engagement at Construction Projects: Lessons Learned from Two CARE Communities in Connecticut. https://www3.epa.gov/region1/superfund/sites/newbedford/70004588.pdf
- International Association for Public Participation. https://iap2usa.org/
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- National League of Cities. City Examples in Civic Engagement. http://www.nlc.org/search-0?q=city%20examples%20in%20civic%20engagement

ENSURE EFFECTIVE OPERATION AND MAINTENANCE ACTIVITIES

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- Environmental Protection Agency. 2015. Elements of a Green Infrastructure Maintenance Business Plan. https://www.epa.gov/sites/production/files/2015-10/documents/mmsd_tech_assistance.pdf
- Seattle Public Utilities. 2009. Green Stormwater Operations and Maintenance Manual. https://www.seattle.gov/util/cs/groups/public/@spu/@usm/documents/webcontent/spu02_020023.pdf

ENGAGE COMMUNITY IN INSPECTION, OPERATIONS, AND MAINTENANCE

- Pennsylvania Department of Conservation and Natural Resources. 2010. Creating Sustainable Community Parks and Landscapes, 2nd Edition (See Chapter 5: Education and Awareness). http://www.docs.dcnr.pa.gov/cs/groups/public/documents/document/d_000620.pdf

INCORPORATE GREEN INFRASTRUCTURE PROJECTS INTO ENVIRONMENTAL PROGRAMMING

- National Recreation and Park Association. 2015. Helpful Hints for Creating Great Park Signage. http://www.nrpa.org/parks-recreation-magazine/2015/october/helpful-hints-for-creating-great-park-signage/.
- National Recreation and Parks Association. 2011. Creating Partnerships to Engage Youth in Conservation and Stewardship. http://www.nrpa.org/uploadedFiles/nrpaorg/About_NRPA/Initiatives/Conservation-Engage-Youth-Stewardship.pdf
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