Low Impact Development Center

EPA

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# Planting for Performance

Stormwater best management practices such as low impact development and nature-based stormwater practices are designed to manage urban runoff effectively and protect water quality by capturing and infiltrating rainwater at its source. These approaches, including green roofs and rain gardens, represent strategies for wet weather management that utilize natural systems or engineered processes emulating natural functions to infiltrate, evapotranspire, or recycle stormwater runoff. In addition to reducing polluted runoff, these practices offer numerous community benefits, such as cooling ambient temperatures, enhancing air quality, and expanding green spaces (EPA, 2023).

By restoring and simulating natural hydrological processes, these practices help counteract the adverse effects of increased impervious surfaces resulting from development, which can elevate polluted runoff and jeopardize the health of waterways and the well-being of communities reliant on clean water. The sustained effectiveness of low impact development and nature-based stormwater practices depends not only on proper installation but also on the long-term viability and maintenance of planting designs. Employing carefully selected planting palettes with maintenance needs in mind can lower ongoing costs and optimize performance. Furthermore, establishing structured operations and maintenance programs is essential for ensuring continued functionality and fostering public acceptance (American Rivers, 2019).

Building on these design principles, thoughtful plant selection is central to ensuring that stormwater systems remain both functional and visually appealing over time, increasing public awareness and acceptance.

## DESIGNING WITH MAINTENANCE IN MIND

Stormwater best management practices should be designed with maintenance in mind, especially when choosing plants. Plant choice is key for bioretention success, particularly in public areas. A thoughtful planting palette that takes community needs into account is necessary to ensure that residents view the installation as an amenity and not an eyesore. Selecting resilient vegetation that suits water, light, and site conditions ensures that plants will thrive, minimizing the need for frequent replanting. Utilizing native, noninvasive vegetation is recommended whenever feasible because native species are generally acclimated to local climatic conditions and require minimal maintenance. Additionally, their deep root systems enhance pollutant filtration and reduce reliance on fertilizers and pesticides (EPA, 2023).

A combination of groundcovers, trees, sedges, shrubs, ornamental grasses, and other herbaceous plants may also be beneficial in order to establish a microclimate that addresses environmental stressors such as drought, extreme temperatures, high winds, and sun exposure. This approach can also limit insect and disease infestations, suppress weed growth, and reduce maintenance requirements. Varying plant species in terms of size, color, and texture can enhance a site's appearance and provide ecological diversity. Trees and plants with deep roots contribute to carbon sequestration, as well as improved soil health, biodiversity, infiltration, and water retention.

Mix of shrubs and perennials with seasonal interest planted in a BMP

Ornamental grasses provide stabilization on the BMP side slopes

Public acceptance is vital for the success of low impact development and nature-based stormwater best management practices; therefore, it is crucial that planting palettes take into account the changing seasons. Thoughtful plant selections that include a mix of species can ensure visual interest across seasons. Some other considerations to enhance public acceptance include selecting plants that establish quickly, bloom long (if relevant), look good all year, and fit their space at maturity. It is also important to anticipate plant growth to avoid maintenance issues or conflicts with utilities and keep plant heights below 42–48 inches near intersections or follow local guidelines for visibility (American Rivers, 2019).

Maintenance plans should also anticipate impacts from future development, more intense rainfall, and prolonged dry periods. Selecting adaptable plant species and updating maintenance practices over time help ensure continued functionality under evolving conditions.

## MAINTENANCE PROGRAM CONSIDERATIONS

An important step in developing a maintenance program is deciding the entity or entities that will maintain the stormwater best management practice. This step includes specifying the role and responsibilities of each group and creating the contracts and agreements to document those roles and responsibilities. Each of the other components of maintenance, such as developing maintenance crews and determining how activities will be documented, is dependent on the entity performing the maintenance. In general, maintenance programs include one or a combination of the following:

Private property owner replanting a rain garden

- An in-house crew within the same agency responsible for the stormwater management program
- Another city department, including the city's parks department
- Contractors – either the general contractors that constructed the projects or landscape contractors
- Non-profits focused on developing education or green jobs programs; and/or
- City residents

Maintenance program entities should be selected based on the needs of the installations and the larger goals of the stormwater program as a whole. Because low impact development and nature-based stormwater practices have multiple benefits, some jurisdictions use their programs as a workforce development tool (EPA, 2013).

Prince George's County Department of the Environment in Maryland has developed two programs: the Emerging Landscapers Program and the Mentor Protégé Program. These programs focus on enhancing the capabilities of County-based small and County-based minority businesses through training and a formalized mentoring program between these small, local firms and larger firms. These two programs increase the ability of these small businesses over time to successfully compete for contracting opportunities at the prime level. These programs are coupled with ambitious procurement targets that require a certain percentage of protégé firms to be included in all County stormwater contract awards. To date, these programs have resulted in a County workforce utilization rate of 56%. For more information on these programs, please visit: https://thecleanwaterpartnership.com/.

Many jurisdictions partner with schools and community groups to increase awareness of stormwater quality issues while at the same time providing much needed green space. When utilizing these projects as an outreach tool, it is important to meet with stakeholders to determine their needs and concerns prior to design. This preliminary step is critical to ensure that once a practice is installed it will be maintained and valued as an amenity. Aesthetic and safety concerns that are often associated with the public perception that these practices are eyesores or safety hazards can be addressed during this initial stage, and plant selection and maintenance frequency can be tailored accordingly (American Rivers, 2019).

Maintenance planning should also consider safety and accessibility. Clear sight lines, secure access points, and prevention of standing water minimize risks for both the public and maintenance staff.

# COMPONENTS OF A MAINTENANCE PROGRAM

## OPERATIONS AND MAINTENANCE PLAN

An operations and maintenance plan helps ensure that low impact development and nature-based stormwater practices remain effective and manage stormwater efficiently. Key components include assigning maintenance roles, setting schedules, establishing inspection routines, documenting relevant easements or covenants, and identifying funding sources. The plan should also describe tasks like weeding, mulching, pruning, replanting, sediment and debris removal, and cleaning inlets and outlets (EPA, 2013).

Beyond routine maintenance, ongoing performance monitoring helps determine whether systems continue to meet design expectations. Tracking infiltration rates, vegetation survival, or pollutant removal over time allows managers to refine maintenance schedules and adapt designs based on field conditions. This adaptive approach ensures that installations remain effective under changing climate and site conditions.

Before: BMP with invasive growth and struggling plant species

After: BMP with invasive species removal and plant replacement

The absence of a structured maintenance plan implemented at appropriate intervals increases the risk that projects will not achieve their intended outcomes. Insufficient maintenance frequently leads to issues such as excessive sediment buildup, obstructed inlets and outlets, loss of vegetation, soil compaction, and inadequate stormwater infiltration. Poorly maintained projects can erode public trust in the effectiveness of these systems. Addressing these challenges requires not only robust design, construction, and continuous maintenance, but also proactive public education and outreach (Feehan, 2013).

## TRACKING SYSTEMS

Another critical component supporting effective operation and maintenance oversight is the establishment of a system to document and track maintenance activities. This system may range from printed checklists to computerized maintenance platforms capable of electronically logging maintenance tasks. The selection of an appropriate tracking system depends on factors such as who is responsible for maintenance, the number of installations being managed, and available funding. Regardless of the method chosen, formal documentation and tracking facilitate monitoring of activities, costs, and staff time, while identifying opportunities for enhancing preventative maintenance strategies. This approach helps to ensure that assets perform as intended. Tracking long-term maintenance costs and challenges also provides valuable feedback for future design improvements. Incorporating lessons learned from past installations helps refine plant selection, layout, and maintenance planning for greater efficiency (EPA, 2013).

## TRAINING

Education and training form essential elements of a successful operations and maintenance program. Providing targeted courses or workshops for municipal employees and contractors responsible for these systems delivers practical instruction on proper procedures and care. Some programs have found winter months to be a good time to implement targeted training when maintenance activities are often reduced. These programs help ensure consistency and effectiveness in carrying out required tasks.

On-site contractor training in Prince George's County, MD

Frequently, low impact development and nature-based stormwater practices are installed on private property and maintained by property owners or volunteers. To ensure proper maintenance and sustained functionality, it is important not only to implement a maintenance plan but also to conduct public education and outreach initiatives alongside training efforts. Strategies may include detailed brochures, instructional manuals, and one-on-one training sessions with residents and landowners on correct maintenance practices. Educating stakeholders about necessary maintenance can mitigate unintended damage, such as removal of native species or use of inappropriate chemicals within the watershed (American Rivers, 2019).

## PARTNERSHIPS

Partnerships often play a critical role in the implementation of operations and maintenance strategies. Many jurisdictions partner with public works, schools, and parks departments to maximize resources, increase available installation locations, and in some cases, procure plants. The Parks Department in Mongomery County, Maryland has developed a plant nursery that supplies trees, shrubs, and plants for many of the County's low impact development and nature-based installations. This nursery minimizes costs and ensures a consistent supply of locally grown plants.

Another example of partnering across agencies may be found in Philadelphia. The Philadelphia Water Department is tasked with managing stormwater for the City of Philadelphia. In 2011, the City launched a comprehensive 25-year initiative to reduce stormwater volumes entering combined sewers through the integration of nature-based stormwater practices as well as expanding stormwater treatment capacity with conventional infrastructure enhancements. To meet these objectives, the Philadelphia Water Department collaborates closely with entities such as the Philadelphia Parks Department and the Philadelphia Public Schools to install systems on parks and school properties, as well as within the public right-of-way. Such partnerships are instrumental in securing essential resources, including sufficient staffing, equipment, and funding necessary for sustaining both the environmental and aesthetic benefits of these projects. To date, the program has successfully installed over 2,800 practices at nearly 800 locations citywide. Additional information about the program can be found at https://water.phila.gov/green-city/.

Engaging community members in design and maintenance fosters stewardship and ensures that projects reflect neighborhood priorities. Partnering with local organizations and hiring local residents to maintain installations not only builds trust but also creates economic and educational opportunities.

### MAINTENANCE AND COMPLIANCE

When multiple stakeholders are involved, including contractors, private landowners or homeowners, and various municipal departments responsible for maintenance activities, it is beneficial for municipalities to establish a clear authority to ensure compliance. If a responsible party neglects its maintenance duties, risking project deterioration, a formal maintenance agreement can help establish accountability and ensure resolution. These agreements typically outline the scope of work, schedules, inspection protocols, permissions for site access, and consequences for non-performance. Best practices recommend recording such agreements with city and county recorder offices so that requirements remain tied to the property in perpetuity. This approach ensures continuity in maintenance responsibilities following property transfers and provides transparent documentation of obligations associated with the title (EPA, 2013).

Where maintenance agreements are absent, communities may utilize local ordinances to enforce compliance. Without a formal mechanism to assure compliance, municipal stormwater managers have limited recourse to mandate even basic maintenance necessary for the continued efficacy of stormwater initiatives. Consequently, investments in these capital improvements may be compromised if accountability measures, design and maintenance standards, and repercussions for non-compliance are not clearly established (Feehan, 2013).

### FINANCING

Finally, establishing a dedicated source of funding that provides a budget for maintenance, staff, equipment, and repair or replacement of low impact development components as needed supports the ongoing operation and maintenance of these projects. Many jurisdictions support long-term maintenance through stormwater utility fees, public-private partnerships, or dedicated maintenance funds established during project construction. Identifying sustainable funding mechanisms early helps avoid deferred maintenance and ensures ongoing performance (EPA, 2013).

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## IMAGE CREDIT