# Incremental Strategies for Better Stormwater Management

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**What is true of natural systems is equally applicable to** complex social systems such as cities. Small systems give rise to large systems with each component essential to stability over the entire natural landscape. Thus, city planners need to be mindful of small tweaks and changes that may improve the adaptive capacity of a city. Stormwater management can benefit immensely from small tweaks. Many planners and other local officials have in-depth knowledge of detention ponds, levees, and other large systems to guard against flooding, but knowledge about small, incremental modifications to stormwater management is no less important. Just as a small creek has an important role to play in promoting water quality, so too do small, stormwater retrofits in the day-to-day management of city rainwater.

## The Versatility of Pervious Pavement

Pavement can be the bane of good stormwater management. Hard, paved surfaces are typically associated with high surface water runoff loads, which tax city infrastructure and undermine water quality. However, there are a number of alternatives to the traditional concrete and asphalt surface that allow for further water retention on site. These types of paved surfaces, known as pervious pavement, are a valuable component of sustainable stormwater design. Pervious pavements are best suited to roads or surface lots where vehicular speed does not exceed 30 mph.[1] There are actually a number of different street types which can be retrofitted with pervious pavement. Consider, for example, the number of residential streets and car storage areas. Even a simple driveway can take up as much as 20 percent of surface area in residential development. Accordingly, switching to pervious surfaces in neighborhoods can make a big impact. For example, a small, residential development in the state of Washington uses pervious concrete for all its surfaces including driveways, sidewalks, and the main street.[2] Although pervious pavement may not be appropriate for all road drainage problems, within the right urban context, pervious surfaces in the right places may add up to being a powerful tool for stormwater management.

As another example, urban alleyways are used instead of suburban driveways to handle car storage needs. Much like driveways, most alleys typically use some type of impervious pavement. Many city administrations have started retrofitting their alleyways. In the city of Chicago, where the total distance covered by alleyways is 1,900 miles, local leaders instituted a green alley pilot program to improve local stormwater drainage and conserve energy.[3] Initially the program began with five alleys, but has since expanded. The city now converts 30 to 45 alleys to "green" each year. A typical alley in the program will generally take a few weeks to be completely retrofitted and may cost more than $100,000 if the alley needs to be completely reconstructed. In smaller communities, such as Dubuque, Iowa, green alleys have been implemented for as little $37,274.[4]

Although costs can vary widely, the true value of such a program lies in its scalability. A community can be ambitious or conservative in rolling out a green alleys program. Also, while many large cities maintain green alley programs, such as Portland, Oregon, and Saint Louis, there are a number of smaller cities, such as West Union, Iowa, that have chosen to institute similar green alley programs.[5]

## Showcasing Rainwater

In the case of stormwater, the dominant natural force at play is rain. For a natural asset to be managed, sometimes it needs to be shown off. The idea of using architectural ornament and design to display the movement of rainwater in the urban context is arguably one of the oldest techniques for managing rainwater.

There are many ways communities can showcase rain in creative ways, such as employing a rainwater trail. A rainwater trail may be the movement of runoff away from a place where it is not desired. This encompasses a number of basic water conveyance methods, including below ground pipes or above ground channels, swales, or ditches. Typically, rainwater trails are considered mundane, but a rainwater trail is a crucial component of resilient stormwater management as it can improve the water quality of city runoff. A rainwater trail improves water quality by: oxygenating the rainwater by making it move across a rough surface, detaining the rainwater through complex holding systems, and infiltrating the water in bioswales.[6]

A good example of a rainwater trail in action occurs at the Oregon Convention Center in Portland which collects, cleans, and retains stormwater from the convention center expansion's

5.5-acre roof.[7] Runoff is collected and drained into a large scupper located at ground level, which pours the rainwater into a large rain garden. The rain garden for the convention center has water basins and spillways to collect clean and retain the runoff. The end result is an attractive, but functional, rain garden.

A rainwater trail does not need to be large to filter and collect rainwater. At Howard Hall, on the Campus of Lewis and Clark College, also in Portland, a simple water trail carries rainwater from a building downspout to an adjacent bioretention system. The University of Virginia in Charlottesville employed another simple retrofit by installing a thin, incised channel within a larger, concrete conveyance structure. This small change allows continued water movement during low flow periods and accents the variable water volume associated with stormwater flows.

The core design concept for rainwater treatment systems is the same: in order to make rainwater a civic amenity and manage it better, a city should draw attention to its movement within the physical environment. People are generally attracted to the sound of running water.

### Integrate Green Infrastructure into Public Facilities

One simple step a city can pursue to improve its stormwater management is to undergo a careful evaluation of its public facilities to determine the suitability of green infrastructure techniques in city-owned properties. Even the smallest incorporated communities may have a park or other city-owned open space that could be enhanced by green infrastructure practices. In coastal Mississippi, the city of Pascagoula received a $20,000 matching grant from the National Fish and Wildlife Foundation to transform BB Jennings Park into a living laboratory for green infrastructure.[8] Over the course of five months, city employees and volunteers worked at BB Jennings Park by removing about 60 invasive popcorn trees and planting 200 native plants and trees to restore a stream bank within the park. Because the park is city property, local officials were able to accomplish significantly more for their budget by not acquiring additional land for the project.

City properties also can serve as valuable experimentation grounds to assess different stormwater techniques. Of course, cities must perform due diligence and research beforehand to see what properties are more conducive to green infrastructure. For example, replacing an impervious surface trail in the middle of a field with pervious paving sounds beneficial, but since the water will infiltrate into the ground just a few feet from where it falls this would not significantly improve drainage capacity.[9] Thus, when a city decides to integrate green infrastructure principles it should start with small and simple projects to see what works best.

Communities can save from 30% to 60% by integrating green projects with infrastructure improvements that are already planned. For example, Onondaga County, New York found some of the most cost effective green infrastructure projects were green schools, because the infrastructure changes were integrated into planned school renovation projects.

### Conclusion

In the realm of stormwater management, city planners must be willing to embrace policies and solutions that are more incremental and experimental by nature, constantly refining and modifying the existing fabric of city infrastructure. Not all of the solutions described above should be perceived as permanent solutions to the problems posed by excess rainwater and poor water quality. What they represent are strategies and tactics that can be applied on an ad-hoc basis to augment and enhance the larger systems associated with stormwater management. By allowing for incremental solutions and strategies to flourish in water retention and treatment, government leaders not only enhance a stormwater system's effectiveness, they enhance a city's adaptive capacity and its ability to respond to sudden, adverse change.

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### Endnotes

1. Kathryn Ellis, et al., *Low Impact Development in South Carolina: A Planning and Design Guide* (2014).
2. ConcreteNetwork.com, *Use of Pervious Concrete Eliminates Over $260,000 in Construction Costs* (2019).
3. Tracy Swartz RedEye, *Green Alleys: Chicago gets friendlier*, Chicago Tribune (Nov. 20, 2009).
4. City of Dubuque, *City of Dubuque/Bee Branch Watershed/Green Alley Program* (2019).
5. City of Dubuque, *Green Alley Construction* (2019).
6. Stuart Echols & Eliza Pennypacker, *Artful Rainwater Design: Creative Ways to Manage Stormwater*, (Island Press 2015).
7. Carol Mayer-Reed, *Rain Garden at the Oregon Convention Center*, American Society of Landscape Architects (2019).
8. WLOX, *Pascagoula park transformed into environmental living laboratory* (June 18, 2014).
9. Stormwater Report, *The Real Cost of Green Infrastructure* (Dec. 2, 2015).