The challenge of improving aging infrastructure while enhancing water quality brings us to the next frontier in stormwater management and civil engineering design.

As many former industrial sites, institutions, or public and private facilities look to improve their sites for employees, visitors, and the surrounding communities, designers need to find new ways to incorporate stormwater design seamlessly into the planning of the site and public spaces.

For many years, stormwater design consisted of routing stormwater through pipes and getting it off the surface, or to grass basins with large footprints, unusable open spaces with no function other than to manage the largest storms. Today’s stormwater design is all about using a combination of green stormwater infrastructure and non-structural best management practices (BMPs) to manage runoff in lieu of more costly underground or structural solutions.

The green stormwater infrastructure toolbox may include rain gardens, vegetated and planted swales, planter beds, planted medians or bump-outs along streets, or tree boxes, all of which create a more aesthetically pleasing and welcoming environment for the public. The use of infiltration basins within rain gardens or as underground systems, and pervious pavers or pavements for parking lots, roads, and paths encourage groundwater recharge and reduce runoff to the downstream waterbodies. Green and blue roofs, which mitigate peak flows of stormwater from sites, are additional measures for managing stormwater.

Solving stormwater problems in municipalities across the country, and in particular older cities with combined stormwater and sanitary sewers, requires a new way of thinking.

Our approach to every project is to remember that each site is unique and brings its own constraints, challenges, and opportunities. This often requires a multi-pronged design approach, as well as creatively finding economical and aesthetically pleasing solutions.
GREEN CITY, CLEAN WATERS

Urban supports and regularly engages in projects that contribute to Green City, Clean Waters, Philadelphia’s 25-year plan to protect and enhance watersheds by managing stormwater with innovative green infrastructure. The Philadelphia Water Department (PWD) developed Green City, Clean Waters to provide a clear pathway to a sustainable future while strengthening the Utility, broadening its mission, and complying with environmental laws and regulations.

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RISING EXPECTATIONS
Nationwide, water utilities are confronting a new set of complex environmental, demographic, and financial challenges while also trying to meet customer expectations for a safe and affordable water supply, the collection and treatment of wastewater and stormwater, flood protection, and clean, attractive, fishable, swimmable rivers and streams. There are also new challenges posed by aging infrastructure and the impacts of climate change on human health and ecosystems.

During the past decade, PWD has created, tested, and implemented new strategies to promote the economic and social growth of the City and meet environmental, ecological, and business missions. As the City agency charged with ensuring compliance with the Federal Clean Water Act, PWD developed Green City, Clean Waters to protect and enhance waterways by using green infrastructure systems that assist or mimic natural processes.

HISTORICAL PERSPECTIVE
Philadelphia’s initial approach to the provision of sewers was similar to that of many other large cities in the United States in the mid-19th century. Street and surface drainage was diverted to pipe and culvert systems, which emptied into small surface streams. Many of these streams were themselves encapsulated and “culverted,” as land developed around them and roads were built over the culverts to facilitate development. Since the streams were already heavily polluted with household sewage, garbage, dead animals, and industrial discharge, the encapsulation was viewed as an improvement to health and sanitary conditions.

Continued development introduced more sanitary sewer connections to the street drainage pipes to further handle residential waste, expanding the combined sewer system. Much of this system remains in place and functional today, a significant part of Philadelphia’s network of more than 3,000 miles of drainage pipes. While efforts have been made throughout the years to separate sanitary and stormwater sewers, both through new construction and replacing older facilities, the combined system will need to continue to handle the City’s wastewater needs for the foreseeable future. Federal legislation in the form of the Clean Water Act of 1972 created a framework for the regulation and management of discharges and establishment of water quality standards for surface waters. The intent of this Act was to “restore chemical, physical, and biological integrity” of the nation’s surface waterways. The Combined Sewer Overflow (CSO) Control Policy of 1994 took this a step further and required communities to develop long-term CSO plans.

LONG-TERM CHALLENGES
In Philadelphia, as in many localities with combined systems, significant precipitation events that overtax the system can lead to sewer flow being diverted directly to streams without treatment, which is not desirable. Similarly, storm flow in combined systems must be handled at sewage treatment plants, even though it generally does not have the contaminants that must be removed and treated at considerable cost. Measures such as separating combined sewer systems and diverting storm runoff to natural drainage options, such as ground infiltration, pervious pavements, and green roofs for buildings, have been proposed to address these issues. The farmer will involve a long-term approach, particularly since sewer systems are designed with service lives of 100-150 years and agencies are hard-pressed to attack this separation in a significant way given the limited budgets for system replacement. The latter will present opportunities for partnerships as these measures can be implemented through various efforts, both public and private, and could potentially have benefits for facility owners that incorporate such measures into their developments and projects.

STORMWATER PERMITTING
A recurring challenge that PWD often points to in creating permit approval delays is incomplete plans and applications. PWD estimates that it reviews approximately 1,300 development applications annually and reports that up to 70% of these applications are incomplete causing unnecessary processing delays. It is important that engineers, architects, contractors, and other development professionals fully understand PWD’s regulations, policies, and guidelines and more importantly where to find the most updated versions of these documents. Urban’s stormwater permitting experts can guide you through this process.

GREENED ACRES
PWD envisions greening at least one-third of the existing impervious cover in Philadelphia’s Combined Sewer System drainage areas during the next two-and-a-half decades, transforming them into “Greened Acres” that will filter or store the first inch of rainwater runoff each time it rains. At the close of this 25-year implementation period, PWD will have invested approximately $2.4 billion to initiate the largest green stormwater infrastructure program ever envisioned in this country. Urban plans to support the Green City, Clean Waters initiative every step of the way, as we understand the challenges, expectations, and permitting needs of the local community and the vision for making all this possible.