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Comment
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*1019 PHILADELPHIA STORMWATER COLLECTION: A GRASSROOTS APPROACH TO IMPROVING WATER QUALITY

INTRODUCTION

Since its founding by the Quakers and the Dutch, the City of Philadelphia has relied on nearby waterways for commerce, transportation, and drinking water. The Philadelphia Metropolitan Area encompasses five watersheds -- Darby-Cobbs, Delaware, Pennypack, Poquessing, Schuylkill, Tookany-Frankford, and Wissahickon.[1] The natural abundance of streams and rivers allowed Philadelphia to develop into an industrial hub during the 19th century. This industrialization lead to rapid urbanization, which in turn lead to frequent public health epidemics where water-borne illnesses, most commonly Typhoid Fever, killed large numbers of Philadelphia residents.[2]

In the late 19th century, the City's planners and engineers installed a sewer system to carry off human and factory refuse.[3] This sewer system utilized the myriad of natural streams and rivers meandering through Philadelphia and the surrounding area. The new system took advantage of gravity and allowed the water to carry away the wastewater through the City to the Schuylkill and Delaware Rivers.[4] Pipes for the new sewer system were lain in creek beds throughout the city and then covered with dirt to make level ground. The sewer installation drastically changed Philadelphia's topography and hydrology. Prior to installation, Philadelphia had 283 linear miles of creeks and streams; after installation, only 118 linear miles remained.[5] The maps in figure 1 illustrate the before and after:

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***1020 Figure 1**

Before and after map published by the Philadelphia Water Department illustrates the intentional changes to the natural topography of Philadelphia after the completion of the sewer system. www.phillywatersheds.org

Today, Philadelphia continues to struggle with urbanization's degrading effects on surrounding waterways.[6] After the nineteenth century sewer installation, the new, flat topography allowed for more roads and buildings, which covered more of the Schuylkill and Delaware watersheds with impervious surfaces.[7] Impervious surfaces are detrimental to the overall health of a watershed because they cause more stormwater runoff.[8]

The United States Environmental Protection Agency (US EPA) reports that urban stormwater is one of the largest sources of pollution for lakes and rivers.[9] When precipitation falls on pervious surfaces such as grass or other vegetation-covered areas, it filters through the soil and other materials, where pollutants are removed by leaching onto materials in the ground, before the water finally collects in an aquifer.[10] In contrast, when precipitation hits an impervious surface such as a road, parking lot,

sidewalk, or building, it cannot be absorbed. As a result, the runoff collects various pollutants off the surface (e.g. road grime),which then flows into the nearest storm drain or combined sewer system.[11]

*1021 I. A LOOK AT STORMWATER

The precipitation runoff from impervious surfaces is called stormwater.[12] Philadelphia currently uses two mechanisms for stormwater collection: a combined sewer system and storm drains.[13] In parts of the City with storm drains, stormwater collects on the street, flows from the street into the storm drain, and then directly into the Schuylkill or Delaware Rivers without being treated.[14] In a combined sewer system, stormwater flows from the impervious surface into the sewer system where it combines with untreated wastewater, which often contains raw sewage. The stormwater-wastewater combination then flows to a plant where it is treated to meet EPA standards before being returned to the Delaware or Schuylkill Rivers.[15] However, during heavy precipitation events, these systems can overflow.[16] To prevent the overflow of wastewater back through a storm drain onto the street, the EPA allows Philadelphia to send water in a combined sewer system to a combined sewer outfall (CSO) where the stormwater-wastewater mix flows directly into waterways.[17] A CSO is a location where the contents of the combined-sewer system (a stormwater-wastewater mix) are discharged, generally via pipe, into an open waterway.[18]

There are 164 CSO's along the Schuylkill and Delaware rivers and the Cobbs, Tookany-Frankford, and lower Pennypack creeks.[19] CSO's prevent flooding, but they also decrease the waterways' water quality by releasing untreated stormwater and wastewater directly into them.[20] CSOs along the Delaware and Schuylkill Rivers, and their tributary streams, present a significant problem because they essentially allow a mix of stormwater and wastewater to be dumped into the Delaware and Schuylkill Rivers, which are a major source of Philadelphia's drinking water.[21] Expanding the current infrastructure to have wider pipes that can carry a larger volume of water, and thus need to "overflow" less often is prohibitively expensive, and does not directly address the issue of polluted waterways. ***1022** Green stormwater infrastructure is a better alternative because it is cheaper, and also generates less pollution causing stormwater.

II. CURRENT LEGAL FRAMEWORK

A scheme of federal and state legislation supports Philadelphia's improvement of its urban waterways. The Clean Water Act (CWA) created a regulatory framework under which municipalities, industries, and other entities are required to establish and maintain water pollution control programs.[22] It also established water quality standards for surface waters including rivers and streams.[23] The CWA aims to control water pollution and improve water quality by regulating direct pollution discharges into surface water.[24] This direct discharge is called "point source" pollution, and the CWA established a permit program -- the National Pollutant Discharge Elimination System (NPDES) to regulate these discharges.[25]

The NPDES program regulates CSOs nationally through a permit program. In the short term, this permit program requires municipalities to install fairly basic technology that reduces the immediate impact of CSOs.[26] Looking to the long term, cities with combined sewer systems are required to develop long-term CSO control plans that outline a range of options for how the city will improve their water to comply with CWA standards.[27] The CWA also requires states to develop a list of waters that do not meet standards because they are too polluted.[28] The CWA further requires states to establish a Total Maximum Daily Load (TMDL) threshold for these waterways.[29] A TMDL is the maximum amount of pollutants that a particular water body can contain and still meet the CWA's clean water goals.[30]

***1023** In addition to regulating point source pollution from CSOs, the NPDES permit system also aims to prevent pollution of waterways from stormwater directly discharged into surface water.[31] The NPDES Municipal Separate Storm Sewer Systems Stormwater Regulations provision of the CWA requires municipalities with storm drains that discharge untreated stormwater directly into waterways to acquire an NPDES permit and develop a stormwater management plan (SWMP).[32] The SWMP must include a water management control as well as measurable goals.[33] Additionally, Pennsylvania has its own stormwater management statute as well.[34] Stormwater Management Planning PA Act 167 requires each county in Pennsylvania to develop and implement a stormwater management plan for every watershed within each of Pennsylvania's counties.[35] Finally, the federal Safe Drinking Water Act of 1974 created water quality standards to ensure that the American public has continued access to safe and clean drinking water.[36]

III. CURRENT REFORM EFFORTS

Operating within this regulatory framework, the Philadelphia Water Department is improving water quality in the Delaware and Schuylkill rivers with the Green Cities, Clean Waters program.[37] This project aims to remove CSO streams from Pennsylvania's list of impaired waters because most of these streams contribute to sources of Philadelphia's drinking water.[38] Philadelphia undertook a large-scale research and planning campaign to determine river trends, the current state of aquatic life in the watersheds, current land-use activities, and how these factors affect overall watershed health.[39] The City dedicated over $1.6 billion from water and sewer revenues to fund a 25-year green infrastructure plan.[40]This green infrastructure project aims at improving water quality by reducing stormwater runoff ***1024** through reducing impervious surface cover in Philadelphia.[41] Reducing impervious surface cover in a highly developed urban area like Philadelphia is no easy feat.

The project currently has eight land-based programs designed to tackle these challenges.[42] First, the Green Streets project uses green stormwater catchments like stormwater tree trenches, curb bump-outs, and pervious pavement.[43] Second, the Green Parking project aims at retrofitting existing parking lots with rain gardens, infiltration beds, pervious pavement, and vegetated strips to reduce impervious surface cover.[44] Third, the Green Parks project drains stormwater from impervious surfaces close to parks to the greenspaces in local parks.[45] Fourth, the Green Alleys, Driveways, and Walkways project diverts rooftop runoff to green infrastructure (generally a rain garden or bump-out) at the end of the alley.[46] Fifth, the Green Industry, Business, Commerce, and Institutions project utilizes the City's water management regulations to incentivize private entities to switch to green stormwater infrastructure.[47] Sixth, the Green Homes Project provides incentives to homeowners to install green stormwater infrastructure.[48] Finally, the Green Schools Program aims at educating students and families on the benefits of green infrastructure, and also at implementing green stormwater infrastructure such as rain gardens on school grounds.[49]

All of the green stormwater infrastructure improvements capture stormwater before it flows into a storm drain. The pervious surfaces allow stormwater to percolate through the ground where it is naturally filtered into an aquifer. Once in the aquifer, the water will flow back to a river or creek and enter it cleaner than if it had flowed in from a storm drain or CSO.[50] The goal of the Green stormwater infrastructure portion of the Green Cities, Clean Waters Program is to reduce the amount of pollution-causing stormwater-wastewater mix that flows from a combined-sewer into a natural waterway. This program does so by using green stormwater infrastructure to reduce the volume of stormwater in the combined sewer ***1025** system, thus reducing the total volume of stormwater-wastewater mix the system must handle in a precipitation event.

In 2009, the water department began a four-year phase in for a stormwater utility fee. The City charges people and entities fees based on the amount of stormwater they generate rather than the total amount of water they use.[51] Non-residential properties are charged based on the ratio of impervious surface area to the gross property area.[52] Properties with high amounts of impervious surface areas will be charged more, while greener stormwater management techniques (such as pervious pavement, green roofs, rain gardens) will be credited.[53] This payment scheme creates an incentive for property owners to reduce the amount of stormwater they generate. Philadelphia's Water Department is working diligently to ensure that residents of the city have continued access to clean drinking water and also that the two rivers which have been so essential to the City's development remain healthy for years to come through reducing stormwater pollution.

With these proposed reforms, the Green Cities, Clean Waters program will bring about major changes to the look and structure of Philadelphia's built environment and natural landscape. CSOs are a problem for many older cities along the Eastern Seaboard, and there has been much debate as to the best way to update old sewer systems. There are currently two prevailing methods for updating old and inadequate infrastructure. First is Low Impact Development (LID), which uses green stormwater infrastructure to reduce the amount of stormwater that flows into the combined sewer system thereby reducing the need for CSOs to prevent stormwater-wastewater backup onto the streets during intense precipitation events. Second, is updating the combined sewer system to accommodate a larger volume of stormwater and wastewater. LID is often the better option for municipalities because it brings additional benefits besides reducing CSOs. LID features such as green roofs and reduction in overall impervious cover reduces surface temperatures and can potentially reduce heat-related fatalities. LID is comprised mostly of retrofitting existing structures and therefore, it does not require much by way of zoning permits. Additionally, LID does not require much time for construction and will not require road and building closures the way that retrofitting existing sewer systems would. Finally, LID is more cost effective than expanding the sewer system.

*1026 CONCLUSION

The City of Philadelphia has made a huge stride in the right direction with the Green City, Clean Waters program. However, it will have to continually monitor each of the newly-implemented green stormwater infrastructure projects in order form an accurate picture of which projects are the most successful. Data on project successes and failures can help the City decide which endeavors are the most economical use of limited funds in the future. Furthermore, the City must continue to closely monitor amounts of impervious surface in new development in order to ensure that stormwater volume is reduced throughout the City. In fact, writing restrictions on impervious surface cover into the building and zoning codes could be a solution that ensures that new construction meets green stormwater standards and does not need to be retrofitted in the future.

Footnotes

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[16] *Id.*

[17] Combined Sewer Oveflow (CSO) Control Policy, 59 Fed. Reg. 75 (April 19, 1994).

[18] *Id.*

[19] Phila. Water Dep't., Combined Sewer System.

[20] *Id.*

[21] *Id.*

[22] Federal Water Pollution Control Act Amendments § 402, National Pollutant Discharge Elimination System, 33 U.S.C.A. § 1342 (2008).

[23] *Id.*

[24] Federal Water Pollution Control Act Amendments § 1251 Congressional Declaration of Goals and Policy, 33 U.S.C.A. § 1251 (1972).

[25] 33 U.S.C.A. § 1342.

[26] *Id.*

[27] *Id.*

[28] *Id.*

[29] *Id.*

[30] Federal Water Pollution Control Act Amendments § 1313, Water Quality Stanadards and Implementation Plans, 33 U.S.C.A § 1313(d), (2000).

[31] 33 U.S.C.A. § 1342.

[32] *Id.*

[33] *Id.*

[34] Stormwater Management Act, 32 P.S. § 680.3 (1978).

[35] 32 P.S. § 680.5 (1978).

[36] Safe Drinking Water Act, 42 U.S.C. 300(f), (1974).

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[43] *Id.*

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