City Beautiful H_2O

COMMUNITY GREENING PLAN

A GREEN STORMWATER INFRASTRUCTURE PLAN FOR HARRISBURG

JANUARY 2017

CAPITAL REGION™ WATER

This plan is partially funded by the Pennsylvania Department of Conservation and Natural Resources, Bureau of Recreation and Conservation and the Environmental Stewardship Fund.

CAPITAL REGION WATER

WRT

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Soil, Water & the Environment

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DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

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Credit: Flickr // Jason Eppink

A LETTER FROM OUR CEO

CAPITAL REGION | WATER

Just over a century ago, the City of Harrisburg was suffering from terrible health conditions including unsanitary drinking water and raw sewage along the banks of the river. These conditions, and the health crises they caused, prompted Harrisburg area civic leaders to rally the community to improve the City through what is known as the City Beautiful movement.

We are still benefitting from the century-old movement. We can walk along our riverfront steps, visit our great parks, including Reservoir Park and the "Emerald Necklace" now called the Capital Area Greenbelt - beautiful landscapes, there to blend our water and sewer infrastructure into the natural environment - and appreciate the efforts of these civic leaders.

The City of Harrisburg, our community, has reached another turning point. Over the next thirty years, we will be investing millions of dollars to address combined sewer overflows (periodic discharge of raw sewage) to further protect the health of our local waterways. Like the civic leaders of the City Beautiful Movement a century ago, we too must use this challenge as an opportunity to radically improve our City for current and future generations over the next century.

Community greening, or green stormwater infrastructure, gives us this opportunity. Green stormwater infrastructure has the power to transform our neighborhoods in Harrisburg while reducing combined sewer overflows - but only if driven by the neighborhood community itself.

What follows is the result of over a year of on-the-ground, frequent, and persistent community involvement and planning, but it is also just the start. The Community Greening Plan: A Green Stormwater Infrastructure Plan for Harrisburg is our community's vision for greening Harrisburg.

We look forward to continue working with you to turn this vision into reality.

From raindrop to river,

Shannon Gority

Shannon Gority, PE
CEO, Capital Region Water

Credit: Capital Region Water

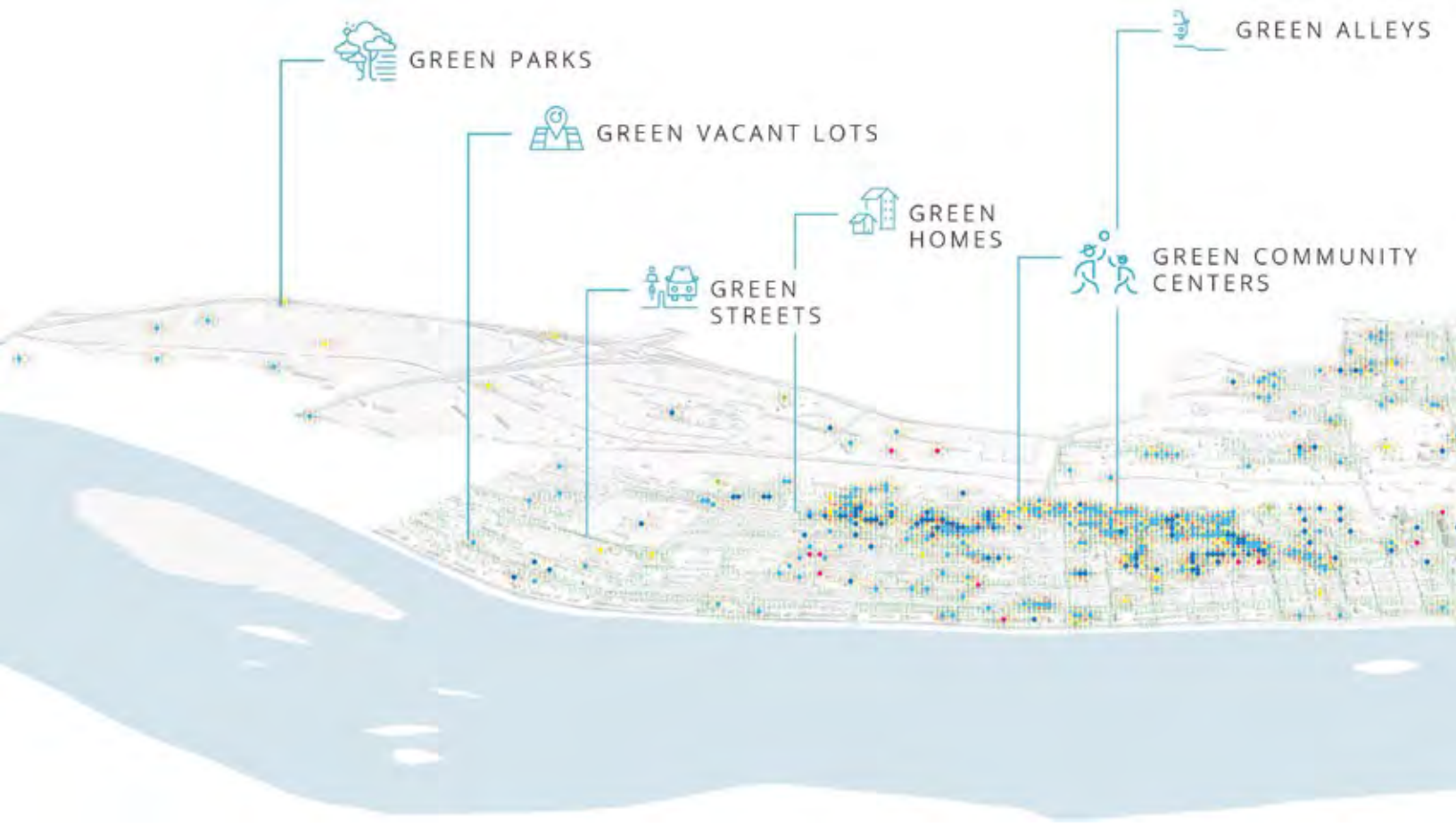
EXECUTIVE SUMMARY

THE CITY AS A NETWORK OF GREEN STORMWATER INFRASTRUCTURE

The 1902 City Beautiful plan envisioned the "City as a Park." The Community Greening Plan takes this one step further by extending nature and bringing green stormwater strategies into streets, businesses, schools, public spaces, and more.

A GREEN VISION FOR HARRISBURG

Imagine streets lined with trees and planters. Intersections that are narrower and easier to cross. Homes and businesses that can save money in the long term on utility costs. Schools that lead by example and provide hands-on learning about the environment. Parks with water features and gardens filled with native, or adaptive plants that foster community. A clean Paxton Creek and a Susquehanna River that gleams from the riverfront steps. Now, imagine that this vision of greening, driven by the community, could be achieved while also satisfying regulations that require managing stormwater and reducing flooding.



As the operator of Harrisburg's drinking water, wastewater and stormwater systems with a mandate to reduce combined sewer overflows, Capital Region Water is in a unique position to positively impact the environmental health of the region and its water. Capital Region Water's commitment to protect and support the long-term health of our community and environment has ripple effects that extend beyond the provision of clean, safe water to our residents and businesses.

This Community Greening Plan, Capital Region Water's Green Stormwater Infrastructure Plan, focuses on identifying areas of opportunity for green stormwater infrastructure and assessing the feasibility of implementation in Harrisburg. While the main purpose of green stormwater infrastructure is to manage stormwater, the transformative nature cannot be ignored. Not only are the region's waterways poised to benefit from a green stormwater infrastructure master plan, but so are residents, businesses, and visitors of Harrisburg. Green stormwater infrastructure has the ability to enhance placemaking, stimulate economic development, and lead to the development of more memorable and enjoyable public space.

< A NETWORK OF OPPORTUNITIES

This diagram depicts green stormwater infrastructure opportunities and community greening potential throughout Harrisburg. Each small project starts to add up and create a network of green stormwater infrastructure that manages stormwater, improves the health of our waterways, and enhances and beautifies our surroundings.

Credit: Flickr // Axel Drainville

Harrisburg, like cities across the country, is facing the challenge of upgrading and maintaining water and sewer infrastructure that was built decades ago. About 75 percent of these sewer pipes are part of the city's combined sewer system. In a combined system, stormwater and sewage are conveyed in the same pipe. During dry weather, sewage is transported to a sewage treatment facility. However, when stormwater enters the system, the system may reach capacity causing a mixture of sewage and stormwater to overflow and discharge into the Susquehanna River or Paxton Creek.

As the cost of maintenance continues to increase, utilities and cities need to stretch fewer dollars further. Green stormwater infrastructure represents an exciting opportunity to leverage public dollars needed for infrastructure investment to effect positive change in Harrisburg.

< PROTECTING THE HEALTH OF OUR WATERWAYS

Managing stormwater and reducing combined sewer overflows will help protect our waterways from dangerous pollution.

"Green stormwater infrastructure has the power to transform our neighborhoods in Harrisburg, but only if driven by the neighborhood community itself. This plan is based on several exciting conversations with city residents, businesses and local organizations, and is the start of many more. Be a part of the transformation. It's time to get involved." – Shannon Gority, CEO Capital Region Water

Given that the issues surrounding green stormwater infrastructure are all connected, they require big picture thinking and partnerships. The City and community's participation in the planning process to create this Community Greening Plan — from residents, to partner organizations, to experts in design and infrastructure — was essential and will continue to be vital to its implementation. For example, during community meetings, participants stressed the importance of improving streets, parks, vacant lots, schools, trees, and the river through community greening solutions. The opportunities to improve these public and open spaces are detailed and prioritized throughout the plan. There are numerous ways in which the projects will benefit the public, including improving water quality, attracting economic investments, reviving public space in distressed neighborhoods, providing new opportunities for recreation, and encouraging

redevelopment. Taken together, these greening projects will begin to improve the overall sustainability of Harrisburg — often described through the lens of the triple bottom line – the city's environment, economy, and equity.

The Community Greening Plan is Capital Region Water's commitment to partner with the community to focus on green stormwater infrastructure as a strategy to improve the health of Harrisburg's waterways and provide additional benefits to city residents.

WHAT'S IN THE PLAN: THE COMMUNITY GREENING PLAN AT A GLANCE

The Problem:
Describes the issues surrounding stormwater and the city's combined sewer system that is unable handle the volume of stormwater that enters the system during wet weather events.

The Solutions:
Includes information on the many ways that green stormwater infrastructure works to absorb and treat stormwater runoff and provides details on the different types of interventions – from stormwater bumpouts to pervious paving to stormwater basins.

The Opportunities:
Describes the network of potential green stormwater infrastructure projects that exist in Harrisburg.

What's Next:
Identifies locations for effective early action projects that can be implemented and make an immediate impact and contains information on how the green stormwater infrastructure program can be funded and implemented through a combination of projects, public-private partnerships, incentives, and other means. The community's input throughout the process, and its support for implementation, is essential to creating a successful stormwater management program.

Credit: Flickr // Harvey Barrison

< ENHANCING THE PUBLIC REALM.

Green stormwater infrastructure has the potential to not only manage stormwater, but also improve public spaces and make a more enjoyable public realm.

PLANNING CONTEXT

Capital Region Water has entered into a partial consent decree with the United States Department of Justice to address water quality issues related to discharges from the combined sewer and municipal separate storm sewer systems that it manages.

Capital Region Water understands the potential for green stormwater infrastructure to reduce the impact of stormwater from wet weather events and provide additional environmental, economic, and social benefits. In recognition of the importance of addressing stormwater and its effects, Capital Region Water applied for a grant from the Pennsylvania Department of Conservation and Natural Resources to help fund a green stormwater infrastructure planning effort.

In 2013, Capital Region Water entered into a Shared Services Agreement with the City of Harrisburg that established a Green stormwater infrastructure Escrow Fund. Capital Region Water pledged $3.5 million to the City for green stormwater infrastructure projects consistent with a green stormwater infrastructure plan that would reduce stormwater and its negative impacts. This Community Greening Plan identifies opportunities for green stormwater infrastructure and will serve as a foundation for implementing green stormwater infrastructure or GSI strategies. The planning process took into account a variety of concurrent planning processes and existing plans for the City of Harrisburg. The following pages provide a brief synopsis of these planning processes and plans.

WHAT DOES CAPITAL REGION WATER DO?

Capital Region Water provides eight million gallons of water to over 60,000 residents of the City of Harrisburg and portions of surrounding municipalities every day. They also maintain 134 miles of sewer pipes within the City boundaries and treat wastewater from surrounding communities at the Advanced Wastewater Treatment Facility.

Credit: Flickr // Gigi Griffis_gigigriffis-com

MANDATES / CONSENT DECREE

As with other water utilities serving older, industrialized cities, Capital Region Water has entered into a partial consent decree with the United States Department of Justice to address water quality issues related to discharges from the combined sewer and municipal separate storm sewer systems that it manages. The partial consent decree requires Capital Region Water to develop a plan to reduce runoff pollution entering the Susquehanna River and Paxton Creek, employ operation and controls for the system, and implement early action projects to ensure that the city complies with the federal Clean Water Act and the PA Clean Streams Law. Capital Region Water has already completed some of the items required by the partial consent decree including updating the Combined Sewer System Operations and Maintenance Manual (Nine Minimum Controls) and implementing some of the early action projects.

MS4 PERMIT

Capital Region Water is currently obtaining an MS4 Permit, administered by the Pennsylvania Department of Environmental Protection. The MS4 permit covers the

portion of Harrisburg's separate storm sewer system, which discharges stormwater into local bodies of water, including Paxton Creek, Spring Creek, and the Susquehanna River. Permittees are required to incorporate six minimum control measures into stormwater management programs to reduce the negative effects of stormwater, including pollution.

LONG-TERM CONTROL PLAN

Capital Region Water is currently updating its Long Term Control Plan for Combined Sewer Overflows (CSOs). The Long Term Control Plan, which will be completed by April 1st 2018, is composed of three main parts: characterization of the current system, development and evaluation of alternative control measures, and selection of preferred controls and implementation strategy. A hydrologic model of the city is being created and will be employed to characterize existing conditions and evaluate the effectiveness of wet weather control measures. Throughout the Community Greening Plan process, Capital Region Water has worked to ensure that green stormwater infrastructure opportunities are integrated into the Long Term Control Plan as a component of the overall wet weather planning effort.

PAXTON CREEK TMDL PLAN

Capital Region Water, Lower Paxton Township, and Susquehanna Township are currently working on a Paxton Creek Total Maximum Daily Load (TMDL) Strategy to improve the health of Paxton Creek by reducing sediment from combined sewer overflows, stormwater discharges, and stream bank erosion. The plan covers 20 miles of Paxton Creek, about 40 percent of the creek, which are considered by the Pennsylvania Department of Environmental Protection (DEP) to be impaired by sediment. The United States Environmental Protection Agency (EPA) requires entities discharging stormwater or combined sewer overflows to the creek to reduce sediment by 35 percent. The plan is broken into two phases: a TMDL Strategy and a TMDL Design Details Plan. The TMDL Strategy outlines the type and extent of projects, operations, and/or polices to meet the requirements of the TMDL. The TMDL Design Details Plan will provide site-specific information and an implementation schedule for the proposed strategies. The TMDL Strategy, completed in December 2015, recommends:

- Restoration of the streambank or riparian area along 11 miles of the creek
- Installation of new or retrofitted stormwater management controls for 10 percent of the drainage area within the creek's watershed
- Control of Capital Region Water's combined sewer overflows to reduce sediment load and improve the health of the creek
- Enhanced riparian preservation practices, construction site erosion and sediment control, post-construction stormwater control for development projects, and maintenance of MS4s
- Collaboration among Capital Region Water, Lower Paxton Township, and Susquehanna Township, and other entities that discharge to the creek, funding partners, and stakeholders to support the development and implementation of the plan


Credit: WRT

BEHBG COMPREHENSIVE PLAN

The City of Harrisburg is currently completing the final phase of an update to its comprehensive plan. The BeHBG team and partners worked with communities throughout the city to create a vision for Harrisburg's future and determine how it should evolve, develop, and grow over the next twenty years. The final plan will be a blueprint to guide future investment in community and economic development, housing, transportation, parks and open space, the environment, and historic and cultural resources. Among the many ideas generated through the BeHBG process were ones directly tied to the implementation of green stormwater infrastructure, including creating a riverfront destination, beautifying the city, using green stormwater infrastructure to reduce flooding and increase energy efficiency, improving sidewalks and streets, and enhancing Paxton Creek.

CITY BEAUTIFUL / CITY BEAUTIFUL 2.0

The City Beautiful Movement was founded on the idea that beauty could create social change. In the late nineteenth and early twentieth centuries, the population of American cities was expanding at a rapid rate. However, crowding, poverty, and blight were rampant. Daniel Burnham, an architect from Chicago, sought to remedy urban ills by creating a humane city with grand boulevards, groupings of open spaces, and great buildings and monuments. The Plan of Chicago and the 1893 World's Fair, both designed by Burnham, served as the basis for most City Beautiful designs with neoclassical architecture, large parks, axial boulevards, monuments, and formal spaces.

In the early twentieth century Harrisburg was characterized as a manufacturing town with polluted waterways and overflowing sewers. However, the city's access to a large portion of the Susquehanna River's shoreline and natural scenic topography presented untapped opportunities. A City Beautiful plan that detailed a comprehensive system of parks, new stormwater and water infrastructure, and flood controls was created for the city by landscape architect Warren Manning. The concept focused on three large parks: the Riverfront Park along the Susquehanna, Reservoir Park on the eastern edge of the city, and Wildwood Park at the northern edge of the city. These parks were connected by boulevards planted with street trees in an effort to extend the natural beauty of the parks into neighborhoods. The plan was authorized by a bond vote in February of 1902 after local activists like Myra Lloyd

Credit: Capital Region Water

< HARRISBURG'S FUTURE IS BRIGHT

The BeHBG vision for the city, City Beautiful 2.0, and City Beautiful H_20 are looking forward to a future where residents, the city, and other partners work together to achieve a forward-looking vision for the future.

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IMPROVING LOCAL WATERWAYS

The City Beautiful H_20 campaign, launched by Capital Region Water, is working to bring community leaders, stakeholders, and residents together to develop strategies and programs that will improve the health of local waterways including the Susquehanna.

Dock and Horace McFarland advocated for the initiative. The movement flourished in Harrisburg and shaped much of the historic infrastructure and parks in the city.

The City Beautiful 2.0 movement is working to engage residents and the city to reignite interest and support for the "City as a Park." This movement is rooted in ideals brought forth by the original City Beautiful Movement from the early 1900s. The CB 2.0 strategic plan presents a physical plan and framework for updating the city's infrastructure and public spaces. This plan, adopted by the organization in 2016, calls for a city that is beautiful, green, sustainable, designed and built for the human scape, and accessible to all. The main principles of the plan mirror that of Manning's original plan. They include:

- Maintaining a comprehensive system of parks, public spaces, and tree-lined streets so that every resident is within walking distance of a park space
- Designing with nature by managing the city's topography in an environmentally responsible manner
- Integrating public art into parks and public spaces
- Establishing an organization, preferably a non-profit conservancy, that is responsible for maintaining and managing the "City as a Park"

Credit: WRT

< SCENIC BEAUTY

The original City Beautiful plan for Harrisburg noted the untapped potential of the city's scenic bluffs, topography, and proximity to the river.

CITY BEAUTIFUL H_20

Capital Region Water announced the creation of the City Beautiful H_20 campaign in the spring of 2015. The campaign focuses on improving the health of Harrisburg's local waterways by reducing combined sewer overflows and reducing pollutants from stormwater. A major component of the campaign is community engagement and education. Capital Region Water has hosted numerous events, including festivals, stakeholder sessions, and community meetings to engage residents. Other activities have included art contests to help spread the word about water issues facing the city.

Similar to the original City Beautiful Movement, City Beautiful H_20 is working to bring leaders and the community together to develop a plan that will improve the health of local waterways. The Community Greening Plan was born out of this movement and an effort to focus on green stormwater infrastructure as a strategy to improve the health of waterways and provide additional benefits to city residents. Capital Region Water developed a Community Ambassador program to gain insight from active members of the community. The group, which is made up of residents who are champions of stormwater management in their communities, meets monthly to discuss issues and provide feedback on planning efforts.

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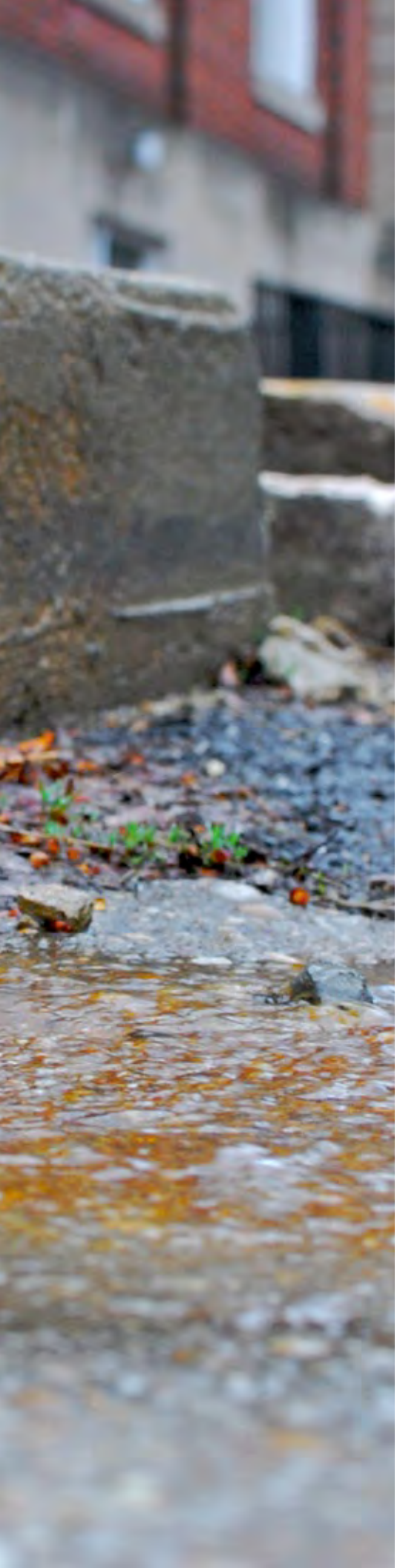
THE PROBLEM

Credit: Flickr // Chesapeake Bay Program



WHAT IS THE PROBLEM?

What is the problem? The simple answer is stormwater. Harrisburg, like cities across the country, is facing the challenge of upgrading and maintaining water and sewer infrastructure that was built decades ago. The city's infrastructure, a complex network of pipes, sewers, pumps, and waterways, is simply unable to handle the volume of water that enters the system during wet weather events. This means that when there is a moderate to severe wet weather event — rainfall or ice melt — the city experiences pockets of flooding caused by sewer backups. It can also lead to sewer backups in basements of homes and combined sewer overflows that carry pollution into waterways and threaten the health of the city's ecosystem. The effects of flooding, sewer backups, and combined sewer overflows are costly to clean up. These negative effects will only multiply as wet weather events become more severe and more frequent.

Capital Region Water, as part of a Federal Consent Decree with the United States Department of Justice, is required to address water quality issues related to discharges from the combined sewer and municipal separate storm sewer systems that it manages.

IN AN URBAN ENVIRONMENT, STORMWATER RUNS OFF OF IMPERVIOUS SURFACES

Instead of being absorbed back into the ground, stormwater runs off of impervious surfaces or puddles on sidewalks and roads.

STORMWATER

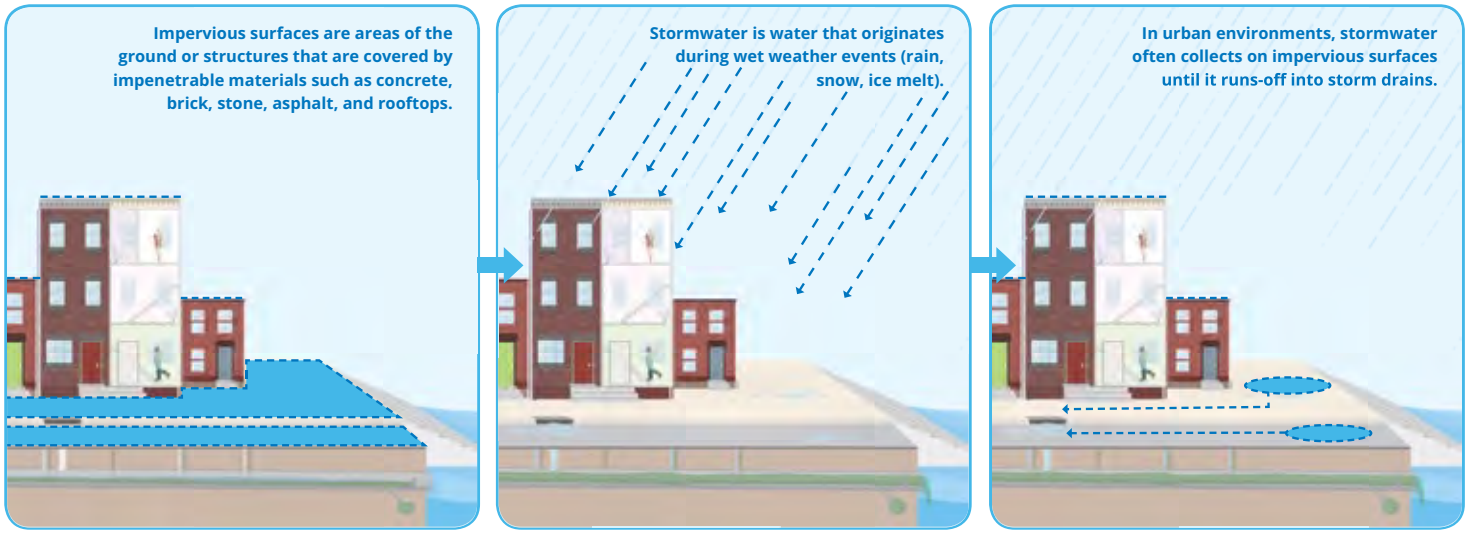
WHAT IS STORMWATER?

Stormwater is water from rain, snow, or ice melt that does not get absorbed into the ground. In a natural environment, most rain, snow, or ice melt falls on *pervious* surfaces like grass and filters into the ground, recharging ground water and keeping water tables more consistent. In an urban environment like a city, water from precipitation falls on *impervious* surfaces like roofs and porches that do not allow water to soak into the ground. Why is this important? Instead of being absorbed into the ground, stormwater puddles and/or collects on impervious surfaces and runs off into storm drains. While it is traveling to the nearest storm drain or pervious surface, stormwater can pick up pollutants and even debris.

WHAT IS A COMBINED SEWER SYSTEM?

Most people give little thought to where that rain goes when it falls. When the largely invisible stormwater infrastructure, composed of pipes, stormwater drains, and pumps, has sufficient capacity and works, it is easy to overlook. About 75 percent of Harrisburg's stormwater infrastructure is comprised of combined sewer, which was built over a century ago. In a combined sewer system, a single pipe carries sewage and stormwater. In dry conditions, the system functions as expected, carrying sewage to a separate treatment facility. However, during heavy rain or snow storms, the amount of water can exceed the capacity of the combined system, causing the mixture of sewage and stormwater to overflow into rivers and streams.

In the remaining parts of the city, there is a separate sewer system. In that system, one sewer pipe collects stormwater and discharges it directly to a waterway, without being treated, while another pipe collects sewage to be treated.



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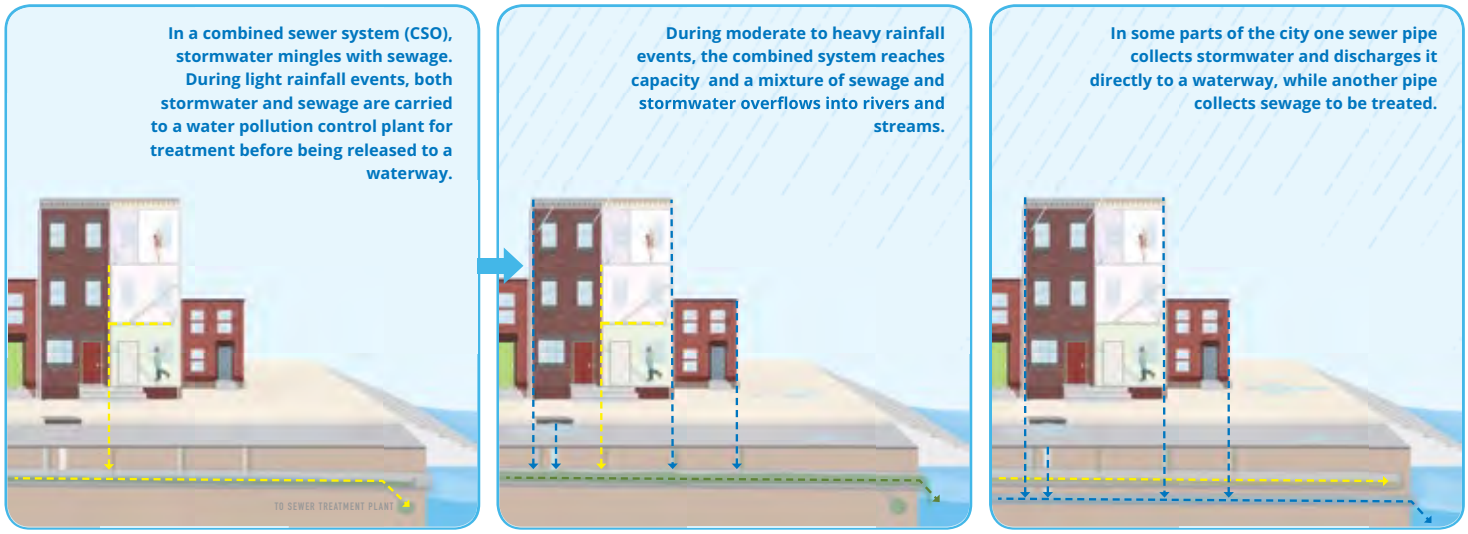
STORMWATER IS WATER THAT ORIGINATES DURING WET WEATHER EVENTS (RAIN, SNOW, ICE MELT)



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DURING MODERATE TO HEAVY RAINFALL, STORMWATER MINGLES WITH SEWAGE AND OVERFLOWS

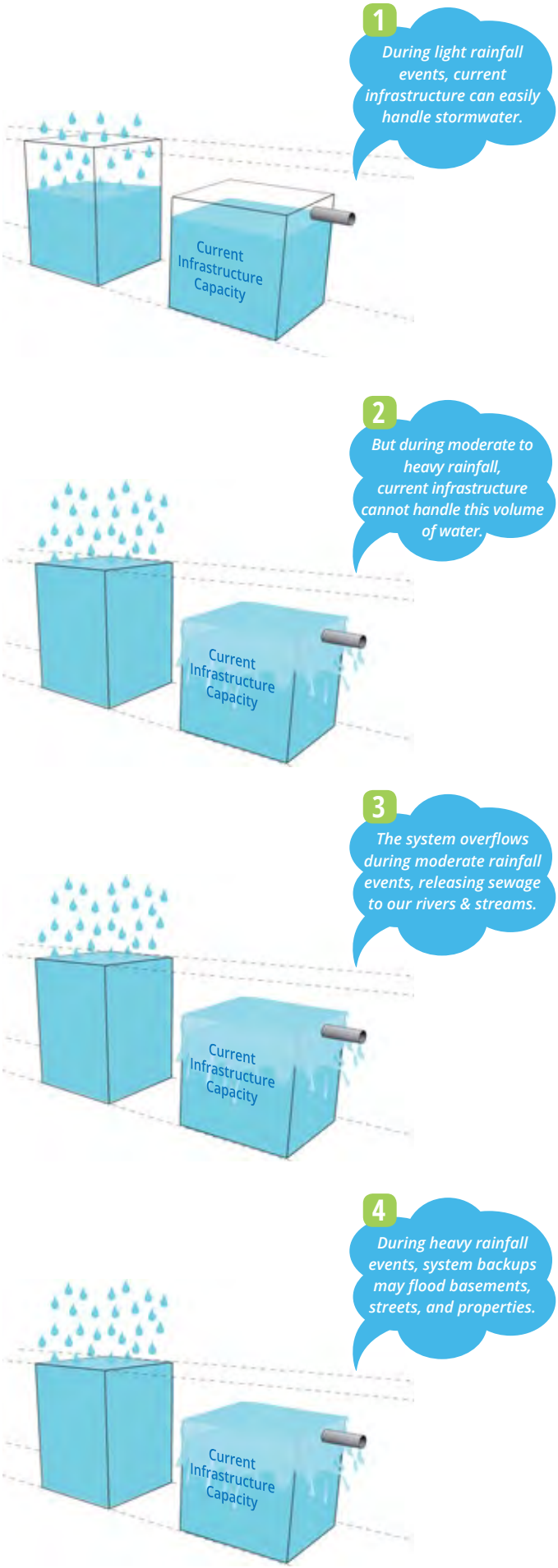
WHY IS IT A PROBLEM?

When stormwater lands on an impervious surface it travels until it can find a surface that will absorb it. However, in built-up environments like cities, pervious surfaces are often not plentiful enough to absorb much of the stormwater before it reaches a storm drain or collects in a depressed area. Combined sewer overflows, or CSOs, occur when the system reaches capacity, causing combined stormwater and sewage to overflow into waterways. When unmanaged, stormwater can cause many issues in urban environments.

It causes water pollution. When stormwater runs off of impervious surfaces it collects pollutants. This could be oil slicks from vehicles, chemicals from nearby buildings, or any number of other pollutants. These pollutants and debris are then transferred to waterways jeopardizing the health of drinking and recreational water. Pollutants from runoff, including oil, pesticides, and bacteria, can contaminate drinking water, pose a danger to public health, and damage aquatic life. Stormwater combined with raw sewage only increases the amount of pollution and damage.

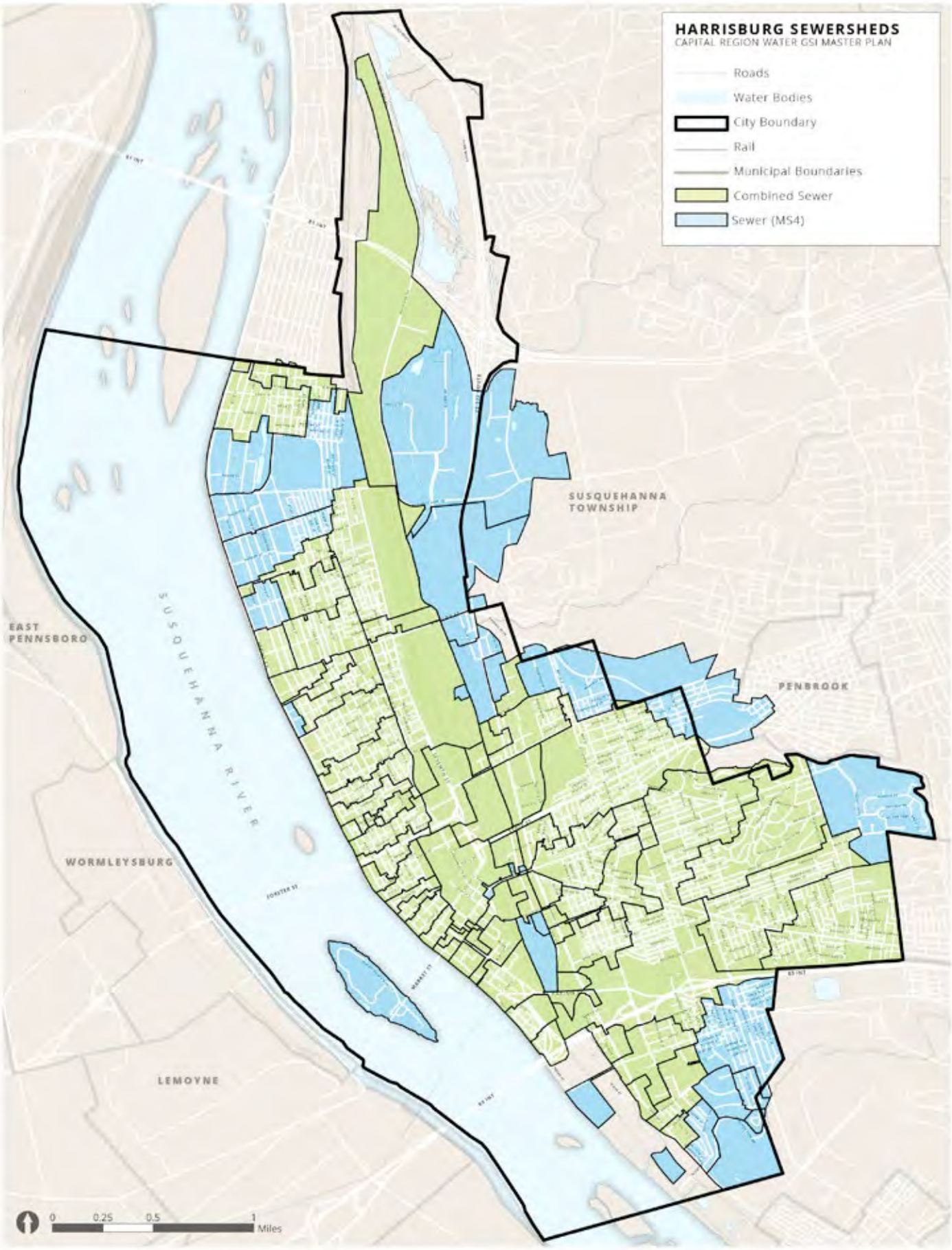
It causes sewer backups and flooding. During moderate to heavy wet weather events, stormwater does not just tax local stormwater infrastructure, it also causes localized flooding. If storm drains are clogged or the amount of rain or snow is too great, not all of the water enters the sewer system. Some of it overflows into streets causing hazardous travel conditions and flooding. This flooding can damage homes and businesses. In addition, even moderate amounts of stormwater and aging infrastructure can lead to sewer backups and basement flooding.

It erodes streams and damages nearby infrastructure. CSOs dumping large amounts of polluted stormwater into waterways, including rivers and creeks, can result in erosion and damage from sediment deposits. This can be especially dangerous in tight urban environments where critical infrastructure and buildings are often located near waterways.



< WHAT STORMWATER DOES TO OUR SYSTEM

Our current stormwater infrastructure is built to handle rainfall events from over a century ago. During moderate to heavy rainfall, the system reaches capacity causing sewage and stormwater to mingle and overflow into waterways. System backups can also cause basement flooding, street flooding, and property damage.


HARRISBURG SEWERSHEDS
CAPITAL REGION WATER GSI MASTER PLAN
Roads
Water Bodies
City Boundary
Rail
Municipal Boundaries
Combined Sewer
Sewer (MS4)
SUSQUEHANNA TOWNSHIP
EAST PENNSBORO
SUSQUEHANNA RIVER
PENBROOK
WORMLEYSBURG
LEMOYNE
0
0.25
0.5
1
Miles

SEWERSHEDS

Sewersheds are catchment areas that drain to a common outlet or point before being conveyed elsewhere. Similar to natural watersheds, sewersheds are determined by natural features such as topography. However, they are also affected by the placement of curbs, pipes, storm drains, inlets, and outfalls.

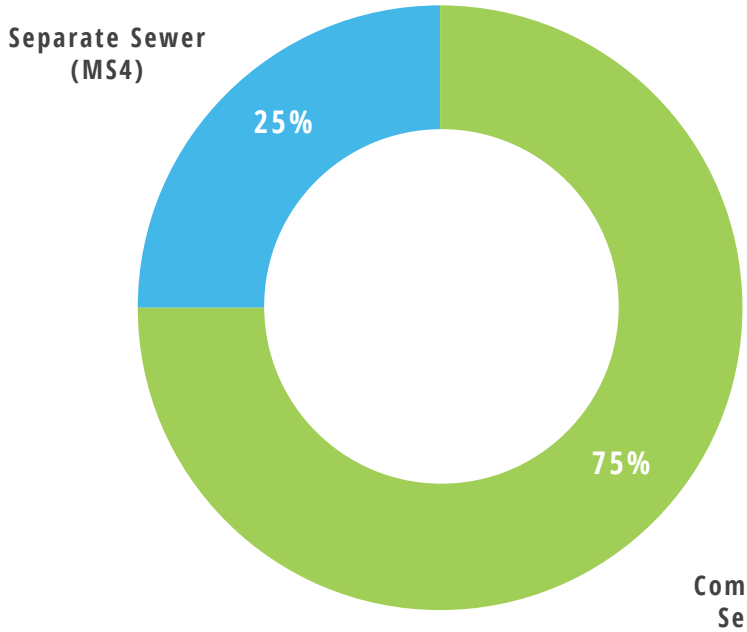
The majority, 75 percent, of sewersheds in the city drain to combined sewers. Most of the separate sewers and sewersheds are located in South Harrisburg, City Island, Riverside, and portions of Uptown.

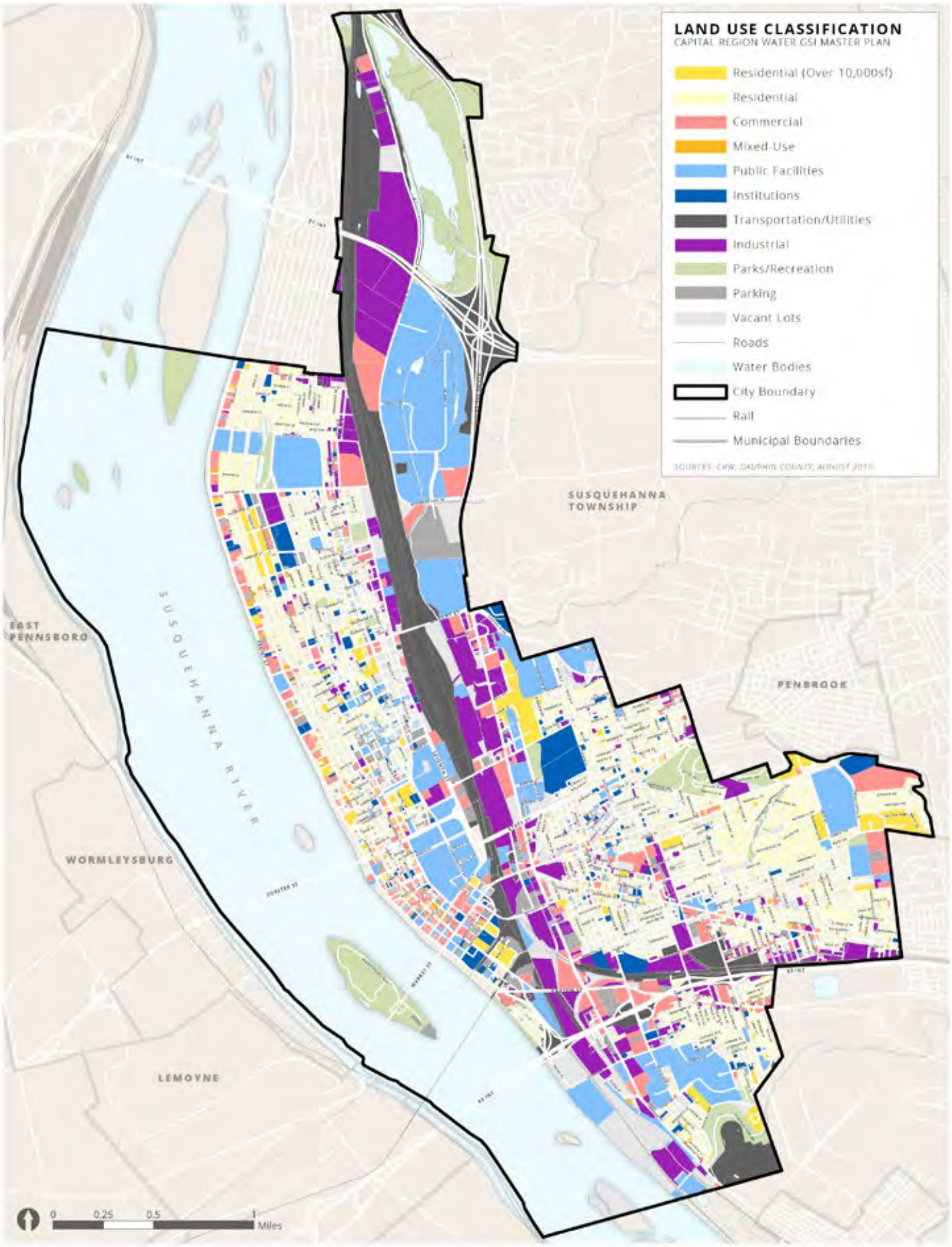
< WHAT DOES THIS ALL MEAN? KEY TAKEAWAYS:

About 75% of the city is served by a combined sewer system.

89

catchment areas



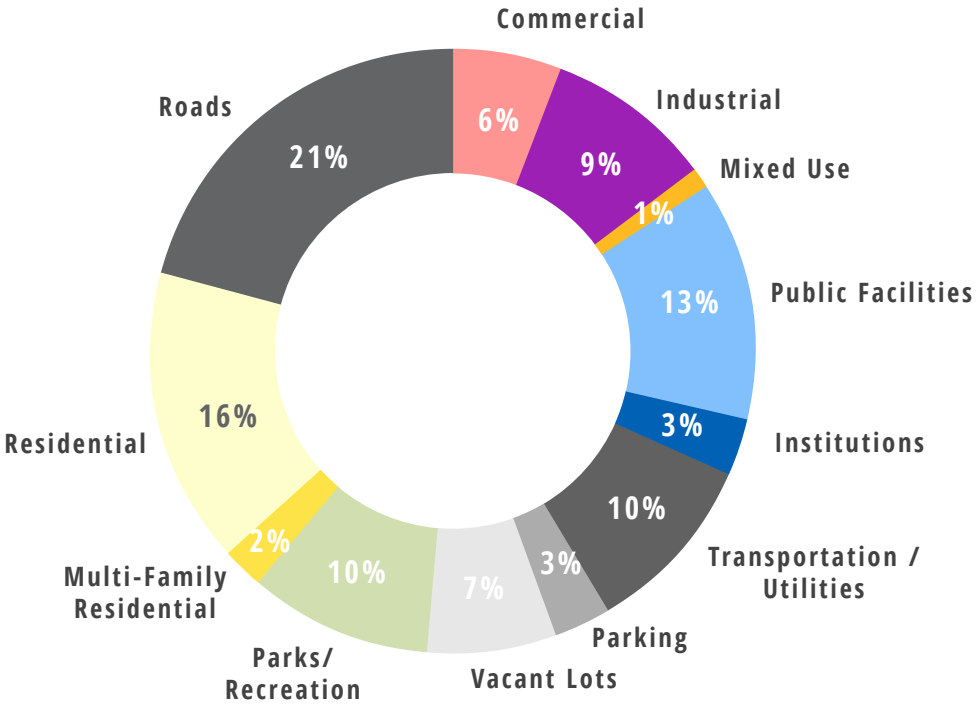

LAND USE CLASSIFICATION
CAPITAL REGION WATER GSI MASTER PLAN
Residential (Over 10,000sf)
Residential
Commercial
Mixed-Use
Public Facilities
Institutions
Transportation/Utilities
Industrial
Parks/Recreation
Parking
Vacant Lots
Roads
Water Bodies
City Boundary
Rail
Municipal Boundaries
SUSQUEHANNA TOWNSHIP
EAST PENNSBORO
PENBROOK
WORMLEYSBURG
LEMOYNE
SUSQUEHANNA RIVER
0
0.25
0.5
1
Miles

LAND USE

In order to understand how stormwater affects Harrisburg, it is first important to understand the built and natural environment. Land use analysis provides a basis for analyzing the physical characteristics of the city and how stormwater may affect certain areas. Harrisburg can be broken into twelve categories of land use that share general similarities in use and ownership. These categories include roads, commercial uses, industrial uses, mixed uses, public facilities, institutions, transportation / utilities, parking, vacant lots, parks/recreation, multi-family residential uses, and residential uses. The land use map at left depicts the land use of all property in the city.

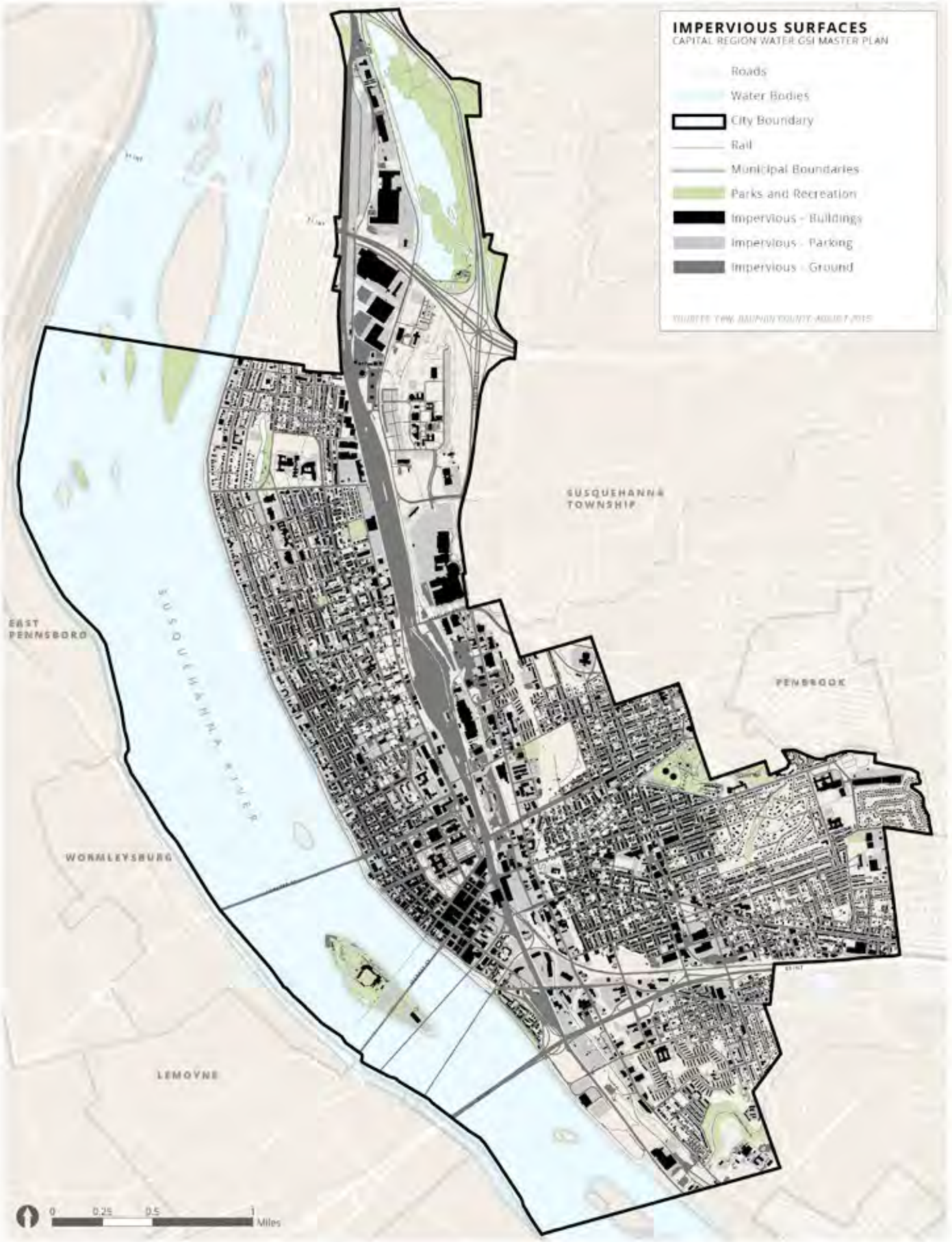
< WHAT DOES THIS ALL MEAN? KEY TAKEAWAYS:

Roads represent the largest land use (21%). Wildwood Lake Park is the largest park in the city, totaling 46% of all parks / recreation land area. Residential land use parcels have 10,911 individual owners, the highest number of owners in any land use category.



5,297.81

total acres


IMPERVIOUS SURFACES
CAPITAL REGION WATER GSI MASTER PLAN
Roads
Water Bodies
City Boundary
Rail
Municipal Boundaries
Parks and Recreation
Impervious - Buildings
Impervious - Parking
Impervious - Ground
SUSQUEHANNA TOWNSHIP
EAST PENNSBORO
SUSQUEHANNA RIVER
PENBROOK
WORMLEYSBURG
LEMOYNE
0
0.25
0.5
1
Miles

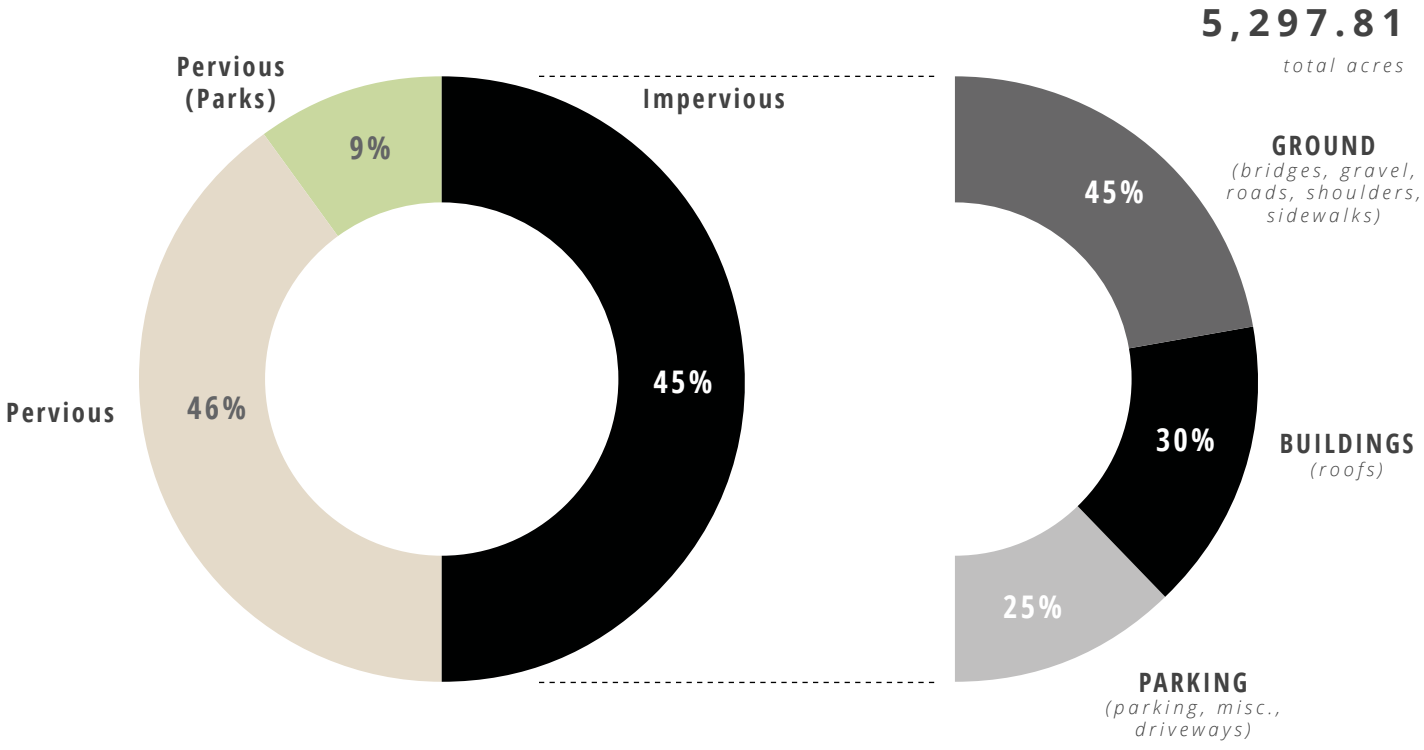
IMPERVIOUS SURFACES

Harrisburg is 45% impervious. This is broken into three categories: ground-level (45%), buildings (30%), and parking (25%). Ground-level surfaces include bridges, gravel, roads, shoulders, and sidewalks. Impervious building surfaces include roofs of residential, commercial, industrial, and institutional properties. Impervious parking surfaces include parking, driveways, and miscellaneous surfaces. The impervious surfaces map shows the allocation of pervious and impervious surfaces throughout the city. Concentrations of impervious surfaces are notable near key transportation corridors, including rail lines and highways and downtown. The high percentage of ground-level surfaces suggests that water running off of streets, sidewalks, and shoulders likely causes a good portion of stormwater runoff and localized street and property flooding in neighborhoods throughout the city.

< 45% OF LAND IN HARRISBURG IS IMPERVIOUS

Parking in commercial areas covers the area of more than 750 football fields (25% of impervious area). Parks and Recreation parcels have the highest percentage of pervious surfaces.

Parking (19%), roads (0%), and commercial (20%) parcels have the lowest percentage of pervious surfaces. Roads represent the largest land use and have the highest percentage of impervious surfaces (100%)



WHERE IS THE WATER COMING FROM?

IMPERVIOUS SURFACES BY LAND USE

Understanding where concentrations of impervious surfaces are located can help determine where investment in green or grey infrastructure should be targeted. For example, roads, parking, commercial, mixed use, industrial, and transportation and utilities land uses all average over 60 percent impervious. These land uses make up 29 percent of Harrisburg's total land area. Based on this analysis, these land uses would be prioritized in a program to reduce stormwater. However, each of these land uses has a specific set of opportunities and potential issues related to stormwater.

Parking represents only three percent, or 134.9 acres of the city's land area, but is 81 percent impervious. The top three landowners in this category own about 37 percent of all parking land area. However, with the exception of a few large municipal and state parking lots, a majority of parking lots are privately owned.

Commercial land uses represent six percent, or 298.5 acres of the city's land area, but are 80 percent impervious. The top three landowners in this category own about 15 percent of all commercial land on three single parcels. While this land use has potential for contributing to the management of stormwater, all of the parcels are privately owned, which would require partnerships with individual owners.

Mixed use represents only one percent, or 31 acres of the city's land area, but is 79 percent impervious. An overwhelming majority of the mixed use impervious surfaces, 74 percent, are building roofs. Unlike some other categories, mixed use properties have 336 different owners, making coordination with owners more difficult compared to other uses.

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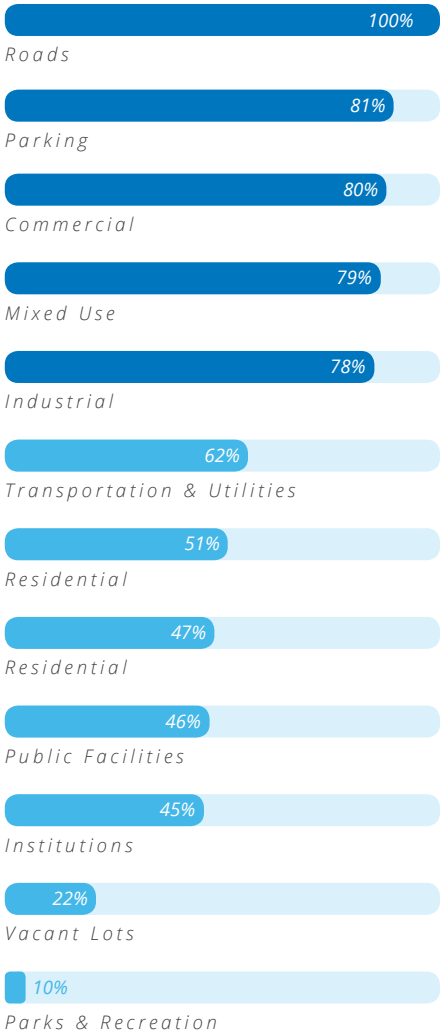
LAND USES WITH THE HIGHEST PERCENTAGE OF IMPERVIOUS SURFACES



WHERE ARE THE ISSUES?

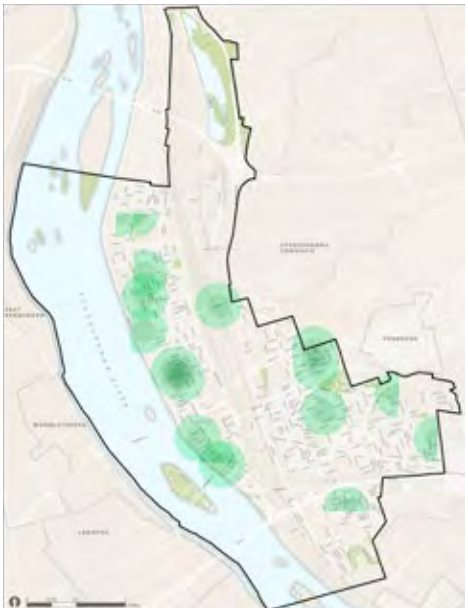
SEWER BACKUPS, FLOATABLES / POLLUTION IN THE RIVER, AND FLOODING INCIDENTS

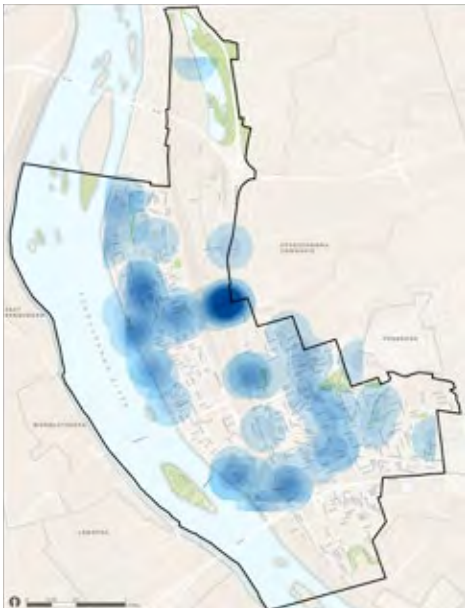
The series of maps below depict areas where participants identified sewer backups, floatables / pollution in the river, and flooding incidents throughout the city.

COMMUNITY-IDENTIFIED PROBLEM AREAS

While analysis maps provide a basis for determining where issues related to stormwater may occur, residents have firsthand knowledge of problem areas in their neighborhoods. At the first round of public meetings in January 2016, participants were asked where they have seen issues in their neighborhood and throughout the city. The maps below illustrate where residents identified flooding, sewer backups, and pollution in the river.

Sewer backups were identified in Downtown, Midtown, and in Allison Hill. Concentrations of sewer backups were noted near Brown Street between Long Street and Linn Street in Allison Hill and at 3rd Street between Clinton Street and Reily Street in Midtown. Other pockets of sewer backups were noted in Uptown between Winconisco Street and Maclay Street.





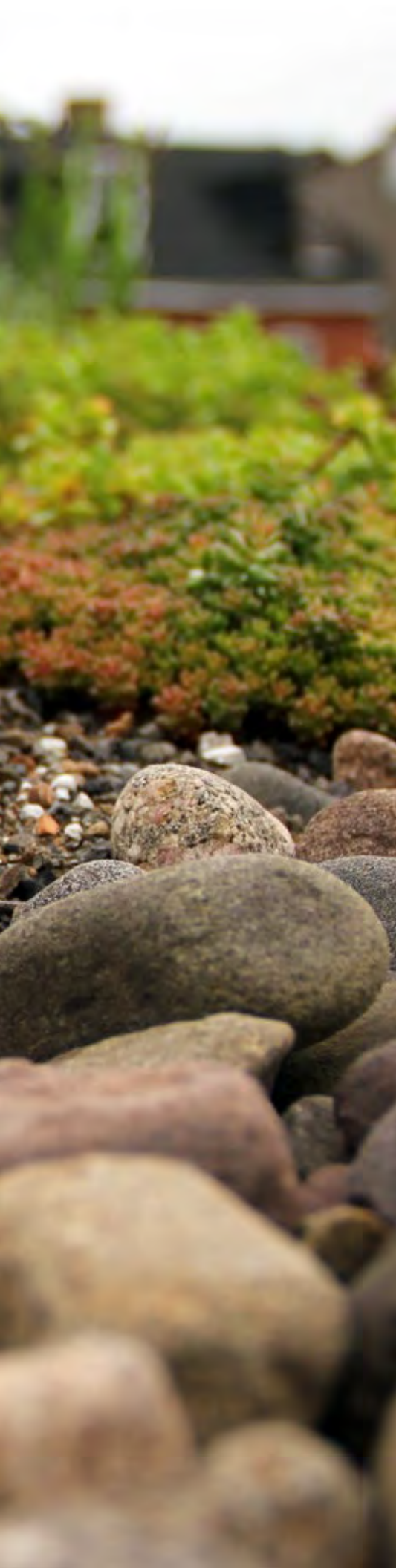
< FLOODING IN HARRISBURG

This photo depicts flooding at the intersection of Schuylkill Street and Front Street.

Floatables and pollution were identified for the entire length of the Susquehanna River and portions of Paxton Creek. Residents noted seeing concentrations of floatables and pollution north of Market Street to Division Street. The reporting of floatables and pollution in this area coincides with most of the combined sewer overflows located along the Susquehanna River.

Residents identified flooding as a more widespread issue with pockets of flooding along Front Street in Riverview, Uptown, and Midtown and additional pockets of flooding throughout Allison Hill. The intersection of Cameron Street and Maclay Street was noted as a frequent location of flooding that impedes vehicular traffic. Other flooding hotspots include areas near Paxton Creek along Cameron from Maclay Street south to Paxton Street. Additional areas included streets in the Bellevue neighborhood and areas around 11th Street from Verbeke south past Derry Street.

Credit: Flickr // Chesapeake Bay Program



PURPOSE OF THE PLAN

This Community Greening Plan identifies areas of opportunity for green stormwater infrastructure and assesses the feasibility of implementation in Harrisburg. While the main purpose of green stormwater infrastructure is to manage stormwater, its transformative nature cannot be ignored. Not only are the region's waterways poised to benefit from a green stormwater infrastructure master plan, but so are residents, businesses, and visitors of Harrisburg. Green stormwater infrastructure has the ability to enhance placemaking, stimulate economic development, and lead to the development of a more memorable and enjoyable public realm.

Green stormwater infrastructure may not solve all of the stormwater issues Harrisburg is facing. However, through a combination of green stormwater infrastructure and traditional infrastructure, the city can see a reduction in the amount of stormwater entering the system, an improvement in water quality, as well as additional benefits that affect the overall social, environmental, and economic health of residents.

GREY VS. GREEN

Stormwater is a problem in Harrisburg. It damages property, pollutes waterways, causes stream erosion, and threatens critical infrastructure. With the understanding that stormwater is an issue that the city must face in the coming years, what are the potential solutions? Grey infrastructure or green stormwater infrastructure, why not a mixture of both?

While grey infrastructure is often referred to as traditional infrastructure, green stormwater infrastructure is perhaps the oldest method of stormwater management. Wetlands, forests, meadows, and valleys are nature's form of infrastructure. Before the development of cities, these areas provided natural filtration of stormwater, reducing pollution and supporting local ecosystems.

^

GREEN STORMWATER INFRASTRUCTURE USES NATURE AS A MODEL

Vegetation and natural systems do a good job of filtering stormwater. Forests, wetlands, and meadows act as green stormwater infrastructure systems, managing stormwater and supporting local wildlife. Green stormwater infrastructure mimics natural systems to filter stormwater, keeping it out of sewers and providing additional benefits to the built and natural environment.

Credit: Capital Region Water

GREY INFRASTRUCTURE

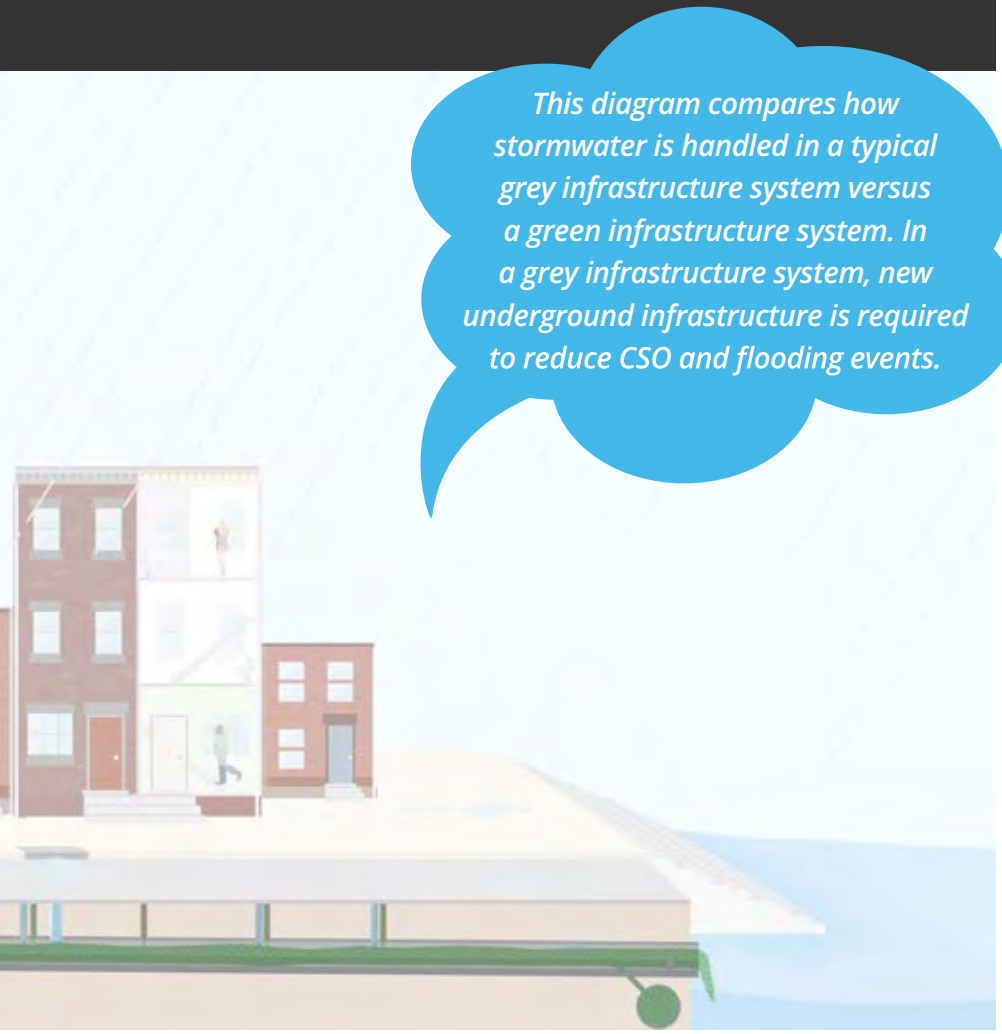
^

HARRISBURG HAS A COMBINED SEWER SYSTEM (CSS)

This means that sewage and stormwater mix together in the same pipe. During dry conditions, sewage is sent to a separate treatment facility. But when there is moderate to heavy rainfall, the system reaches capacity and overflows into our waterways.

Grey infrastructure is often what people think about when they hear the term "stormwater infrastructure." It is a centralized system of inlets, drains, treatment facilities, and underground pipes. This method of managing stormwater and wastewater has been around for more than a century. However, cities like Harrisburg, with a system that is over one hundred years old are faced with determining how to upgrade and maintain this aging infrastructure. Increases in the amount of impervious surfaces and built areas, higher volumes of stormwater from storms, and degrading pipes and inlets has put a strain on Harrisburg's system. While maintenance and replacement of certain parts of the system is necessary, updating these systems to meet current needs comes at a high cost.

Capital Region Water maintains Harrisburg's grey infrastructure system, which consists of wastewater, stormwater, and drinking water infrastructure. The system includes 134 miles of sewer pipes within the city boundaries. About 75 percent of these sewer pipes are part of the city's combined sewer system. In a combined system stormwater and sewage are conveyed in the same pipe. During dry weather, sewage is transported to a sewage treatment facility. However, when stormwater enters the system, the system may reach capacity causing a mixture of sewage



This diagram compares how stormwater is handled in a typical grey infrastructure system versus a green infrastructure system. In a grey infrastructure system, new underground infrastructure is required to reduce CSO and flooding events.

< HOW DOES A TYPICAL GREY INFRASTRUCTURE SYSTEM WORK?

and stormwater to overflow and discharge into the Susquehanna River or Paxton Creek. There are more than sixty combined sewer outfalls along the Susquehanna River and Paxton Creek. In the other portion of the city, a separate sewer system conveys sewage and stormwater in separate pipes. Sewage is sent to a wastewater treatment plant, while untreated stormwater is discharged to the Susquehanna River or Paxton Creek.

To completely avoid combined sewer overflows through grey infrastructure alone would require designing and building a system that was so large it could manage even the heaviest rainfall. Anything less would only reduce, not eliminate, the number of overflows. This would be prohibitively expensive. Furthermore, because grey infrastructure is largely underground, expanding sewers 'buries' the infrastructure investment where people cannot see it.

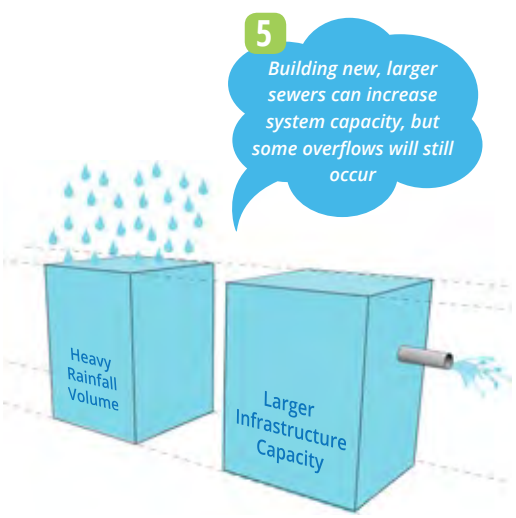
GREEN STORMWATER INFRASTRUCTURE CAN PROVIDE MULTIPLE BENEFITS

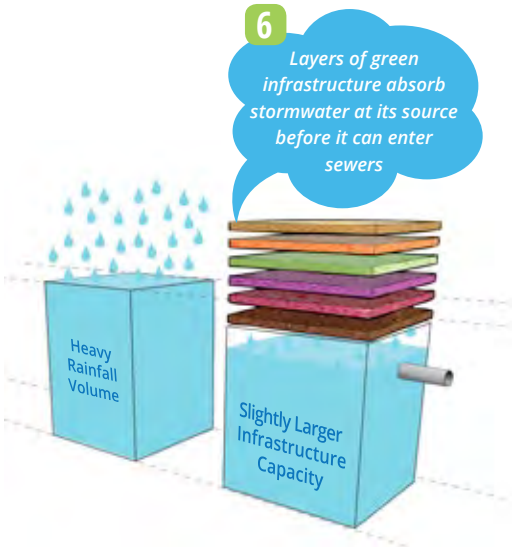
Unlike grey infrastructure, green stormwater infrastructure is visible from the surface. This means that you can see infrastructure working in your community.

Green stormwater infrastructure is a decentralized system of surface and subsurface management that captures stormwater from impervious surfaces before it enters sewers. These systems use natural filtration from native, or adaptive plant species and storage media to reduce runoff and provide stormwater storage. Green stormwater infrastructure stores stormwater allowing it to infiltrate into the soil, be reduced through evapotranspiration from plants, be released slowly to the sewer, and/or pass through processes that remove pollutants. Employing green stormwater infrastructure can reduce the volume of stormwater, reduce peak rates, and protect waterways from pollution created by untreated stormwater and combined sewer overflows. Certain types of green stormwater infrastructure can be scaled up to help control flooding during larger storms. And because green stormwater infrastructure is on the surface, it is visible and provides an opportunity to enhance and beautify neighborhoods and gives residents a chance to connect with and learn from the environment.

There are many different types of green stormwater infrastructure (GSI). Many provide additional greening and beautification benefits to a community. Some common types, illustrated in the diagram below, include rain gardens, flow-through planters, green roofs, stormwater bumpouts, pervious paving, rain barrels/cisterns, and stormwater tree trenches. Many of these strategies use native, or adaptive, water-tolerant plants or trees to capture stormwater from a nearby runoff source.

GREEN INFRASTRUCTURE (COMMUNITY GREENING)





Some GSI strategies like flow-through planters, green roofs, and rain barrels are well-suited for dense residential areas in cities. Other strategies, including stormwater bumpouts and planters, can be used to retrofit streets to manage stormwater within the street right-of-way.

< HOW DOES THE SYSTEM WORK WHEN GREEN STORMWATER INFRASTRUCTURE IS ADDED?

A green infrastructure system uses natural filtration to reduce runoff. Reducing runoff reduces flooding and protects our waterways from pollution caused by CSO overflows.

OUR GOALS

The purpose of this plan is simple – use investments in infrastructure to reduce stormwater and its negative effects while beautifying communities, enhancing the public realm, cleaning up our waterways, and revitalizing neighborhoods. The four goals of the plan will help Capital Region Water and its partners achieve this vision for Harrisburg.

Increase the benefits provided by public investment. Green stormwater infrastructure represents an exciting opportunity to leverage public dollars needed for infrastructure investment to effect positive change in Harrisburg. GSI projects have the potential to go beyond benefiting the environment by providing additional social and economic benefits. ***Reduce the volume of stormwater entering the sewer system.*** Green stormwater infrastructure can absorb a portion of the stormwater generated before it even enters the sewer system, which may lead to fewer combined sewer overflows, less flooding, and healthier waterways. ***Foster a network of partners for Capital Region Water to work with to reach goals.*** No organization can tackle the issue of stormwater alone. Implementation of green stormwater infrastructure will require partnerships between Capital Region Water and local agencies, community groups, businesses, and residents. ***Enhance and revitalize Harrisburg through private/public investment in public gathering spaces.*** Green stormwater infrastructure investments and investments in public space, including parks, plazas, and streets, often go hand in hand.

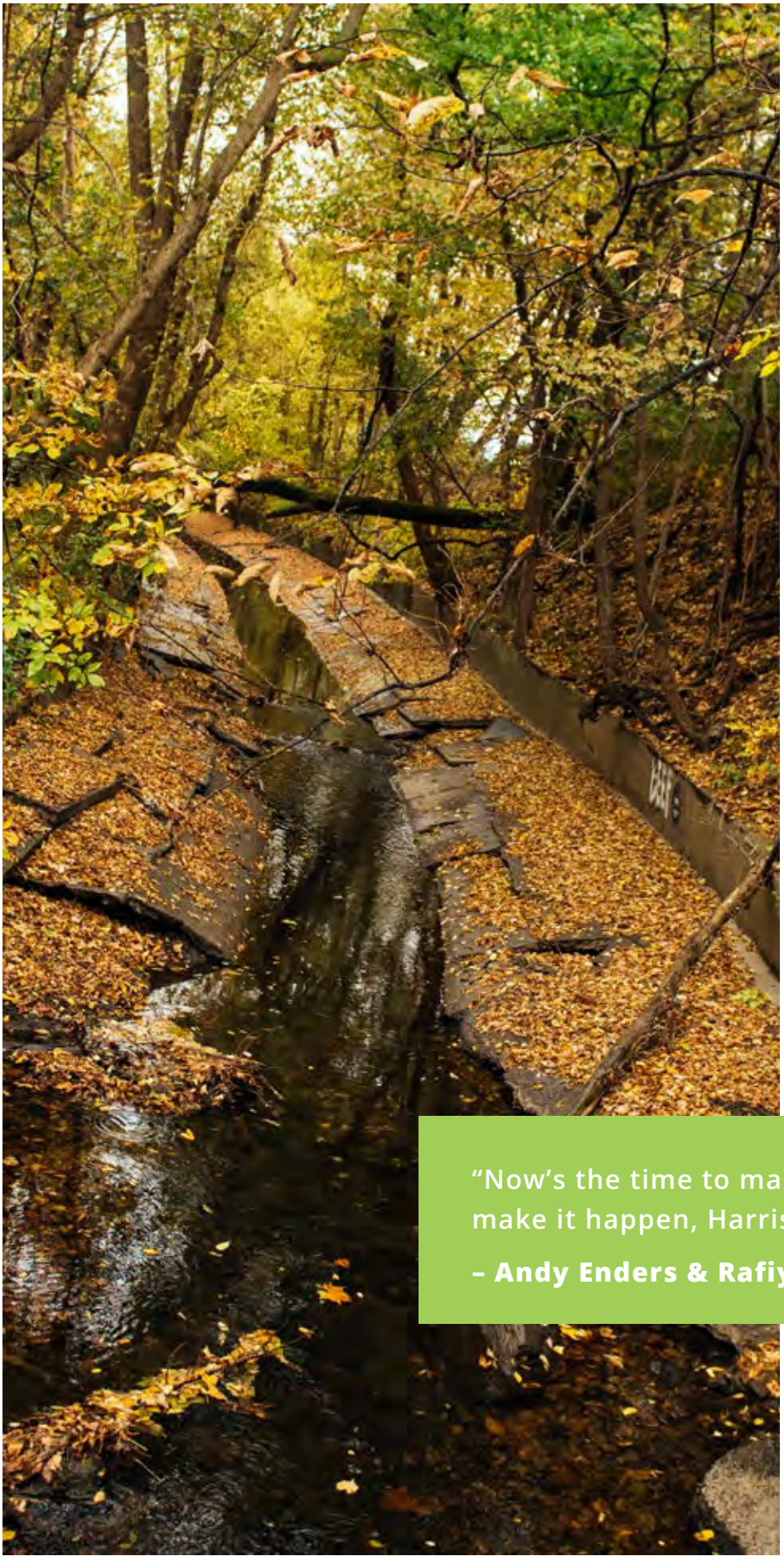
Reduce street flooding, sewer backups, and combined sewer overflows while beautifying our surroundings and cleaning up our water.

Increase the benefits provided by public investment.

Reduce the volume of stormwater entering the sewer system.

Foster a network of partners for Capital Region Water to work with to reach goals.

Enhance and revitalize Harrisburg through private/public investment in public gathering spaces.



< IMPROVING THE HEALTH OF OUR WATERWAYS

Green stormwater infrastructure improves the health of waterways by reducing the number of combined sewer overflows and naturally filtering out pollutants from stormwater runoff.

"Now's the time to make your voice heard. Let's make it happen, Harrisburg!"

– Andy Enders & Rafiyqa Muhammad

02

THE SOLUTIONS

Credit: Capital Region Water

A COMMUNITY APPROACH

Given that the issues surrounding green stormwater infrastructure are all connected, they require big picture thinking and partnerships. The City and community participation in the planning process that created this Community Greening Plan — from residents, to partner organizations, to experts in design and infrastructure — was essential and will continue to be vital to its implementation. For example, during community meetings, participants stressed the importance of improving streets, parks, vacant lots, schools, trees, and the river through community greening solutions. The opportunities to improve these public and open spaces are detailed and prioritized throughout the plan. There are numerous ways in which the projects will benefit the public, including improving water quality, attracting economic investments, reviving public space in distressed neighborhoods, providing new opportunities for recreation, and encouraging redevelopment. Taken together, these greening projects will begin to improve the overall sustainability of Harrisburg — often described through the lens of the triple bottom line – the city's environment, economy, and equity.

Capital Region Water will continue working with the community to find opportunities to beautify and revitalize neighborhoods throughout Harrisburg.

A COMMUNITY-DRIVEN PLAN

A community-driven plan means more than just making contact or engaging with community residents. It is about making sure individuals and groups in the community are represented, have meaningful opportunities to have their voices heard, and see those opinions reflected in the final plan. In order for this to be successful, a community engagement process must expand opportunities for dialogue, empower residents, and foster ownership of the recommendations included in the plan.

The Community Greening Plan was developed through a process that encouraged the entire community to contribute ideas. These ideas are included and reflected in the program and project recommendations. Over the course of this 18-month process, Capital Region Water engaged with over a thousand residents and held more than thirty engagement events with the community. Public meetings, Community Greening Parties, small workshops, focus group meetings, community events, and online surveys provided many opportunities for residents to engage in a dialogue about stormwater, its effects, and the potential solutions. Social media, fliers, website updates, person-to-person interactions, media placements, and emails provided supplementary outreach.

The community's participation in this planning process was essential. The plan represents Capital Region Water's commitment to implementing a green stormwater infrastructure program in partnership with Harrisburg's communities to address common concerns. Flooding, pollution, sewer backups and other stormwater-related issues affect neighborhoods throughout the city. Capital Region Water plans to work with and engage communities in an effort to ensure that all residents benefit from the Community Greening Plan.

>
RESIDENTS ATTEND THE COMMUNITY GREENING PARTY @ THE CAMP CURTIN YMCA

Capital Region Water held one of its Community Greening Parties at the Camp Curtin YMCA's National Night Out. Residents enjoyed a night of food and fun while providing input on community greening concepts for Harrisburg.

Credit: Capital Region Water

> COMMUNITY AMBASSADORS TOUR GSI PROJECTS IN LANCASTER, PA

Capital Region Water traveled with the Community Ambassadors to Lancaster in January of 2016 to tour green stormwater infrastructure projects with the city's Stormwater Manager, Ruth Hocker. The tour gave the group an opportunity to see pervious paving, stormwater bumpouts, green parking strategies, and more.

In June of 2016, the Community Ambassadors toured additional green stormwater infrastructure sites, including the 'Big Green Block' with representatives from Philadelphia Water in Philadelphia.

Credit: Capital Region Water

Meet your Community Ambassadors

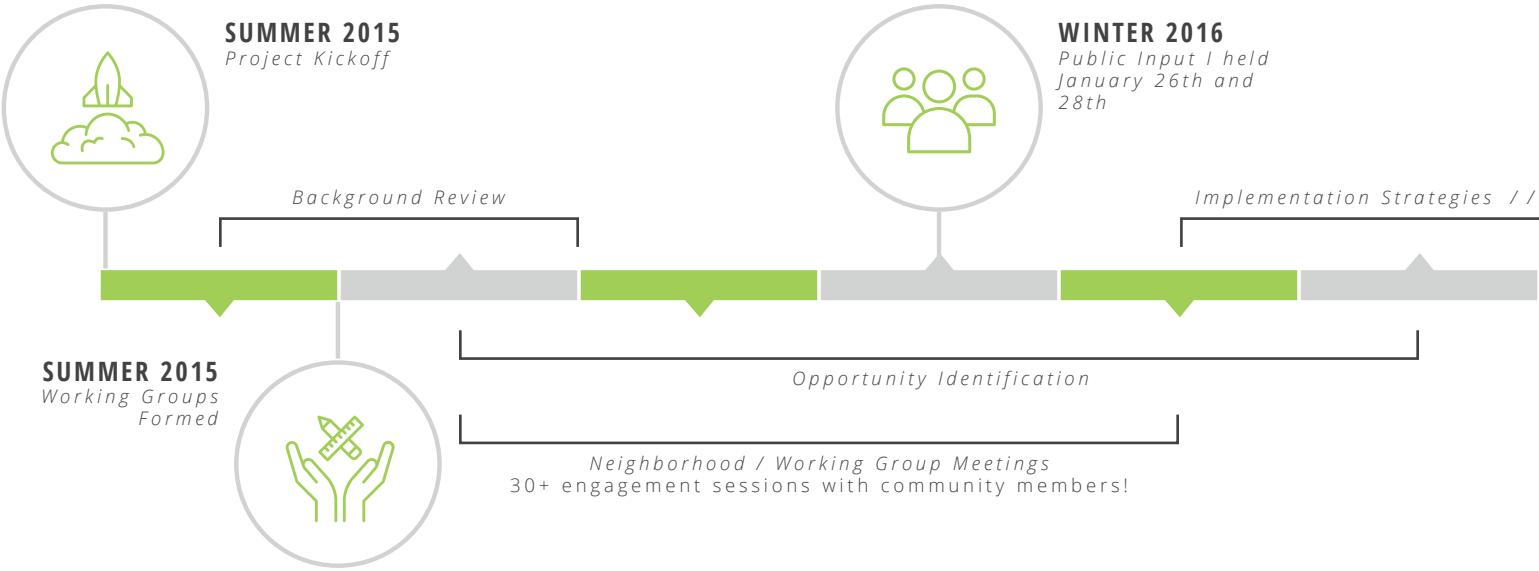
Engaging every community in Harrisburg was one of the most important components of the plan. Capital Region Water created the Community Ambassador program to empower interested residents with knowledge about stormwater issues and encourage them to reach out to their neighbors to share this information and get feedback through face-to-face interactions. They act as advocates for their neighborhood, provide information about upcoming events, and help educate their community about green stormwater infrastructure and community greening measures. Capital Region Water will continue to work with the ambassadors to build capacity and advocate for their neighborhoods and their city.

- **Bill Allis**
- **Bishop Roberta Thomas**
- **Brian Humphrey**
- **Evelyn Hunt**
- **Cheryl Capozzoli**
- **David Botero**
- **Garvey Presley**
- **Gloria Vasquez Merrick**
- **Jamien Harvey**
- **Loretta Darbee-Dare**
- **Pam Goodwin**
- **Rafiqya Muhammad**
- **Rhonda Mays**
- **Scott Schepler**
- **Tara Leo Auchey**
- **Terry Lawson**
- **Jean Cutler**
- **Gary Huggens**
- **Claude Phipps**

THE PROCESS

The 18-month planning process engaged residents, stakeholders, and field experts to create a Community Greening Plan for Harrisburg. Capital Region Water engaged WRT, a planning and design firm in Philadelphia, as a consultant to complete the plan. Stakeholder engagement was facilitated through the creation of two workgroups. Starting in the Summer of 2015, Capital Region Water, the consultant team, and other partners met with the Community Greening Plan working groups: a Community Ambassador Workgroup and a GSI Partners Workgroup. The working groups provided input on public engagement strategies, prioritization criteria, and implementation and program recommendations.

The Community Ambassador workgroup is made up of representatives from neighborhoods across Harrisburg. More information about this group is found on the previous page.



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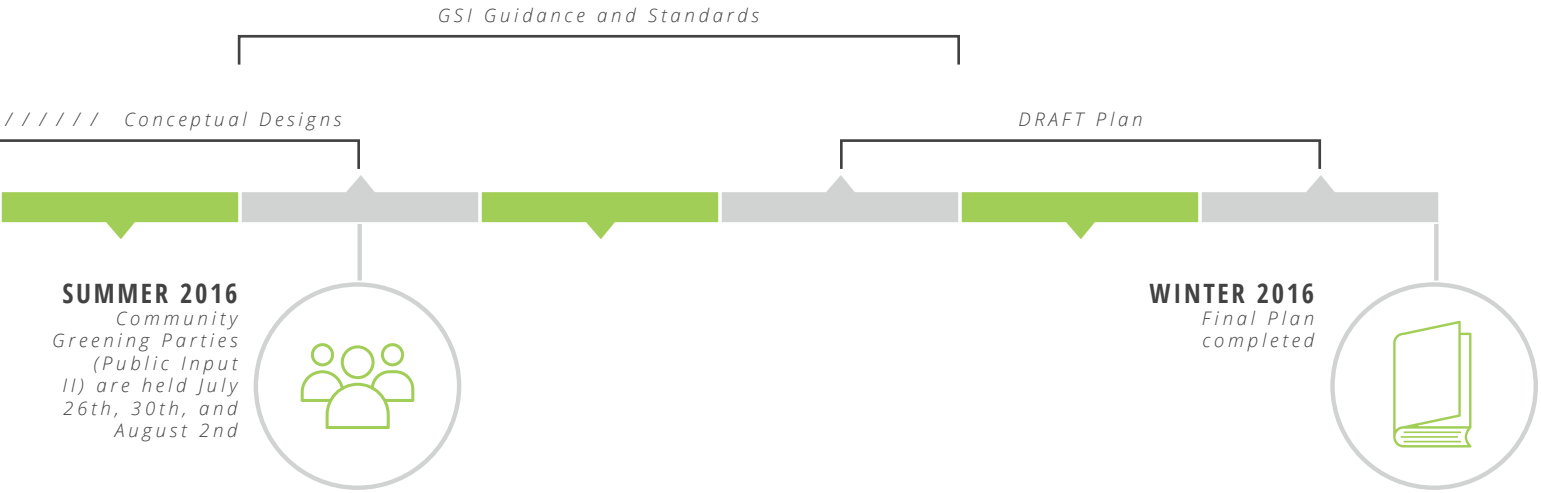
30+ COMMUNITY ENGAGEMENT EVENTS INCLUDING PUBLIC MEETINGS AND COMMUNITY GREENING PARTIES

Residents from South Harrisburg provide input on where green stormwater infrastructure strategies should be prioritized across the city.



Credit: Capital Region Water

The GSI Partners Workgroup includes a number of partners who can help Capital Region Water implement green stormwater infrastructure in communities. These partners include the City of Harrisburg, the Downtown Improvement District, U.S. Green Building Council, Harrisburg Housing Authority, Harrisburg Redevelopment Authority, CAT, EAC, and Harrisburg Young Professionals (HYP).

Community engagement was an essential component of the process. Two large public engagement events, one in the winter of 2016 and one in the summer of 2016, were held as well as more than thirty other small engagement opportunities throughout the process. The process engaged over 1,000 residents from all areas of the city.

Credit: Capital Region Water

< SOUTH ALLISON HILL RESIDENTS GIVE THEIR INPUT ON COMMUNITY GREENING CONCEPTS.

Residents stopped by Community Greening Party stations and provided input on where they would like to see green schools, green parks, and more in their neighborhoods.

"We all share this earth together. So we have to look at the environment, how we're going to work to heal it together." – Rafiyqa Muhammad

The first public event included two meetings. The first was held in Uptown at the Camp Curtin YMCA, and the second was held in North Allison Hill at the Lincoln School. The meetings focused on educating Harrisburg residents about stormwater and potential solutions to alleviate flooding and environmental issues. Residents learned about stormwater runoff and impervious surfaces with demonstration projects provided by the Penn State Extension. After learning about stormwater and runoff, residents looked at potential green stormwater infrastructure strategies and provided input on how to prioritize program funding – whether investment should be focused in building GSI in public space, providing grants or incentives to community groups to build GSI, providing grants or incentives to homeowners to build GSI, or build larger sewers. Residents also provided input on how the community should pay for investments in stormwater infrastructure. Based on models used in other cities, options included fees integrated in sewer fees, flat fees per parcel, fees based on the size of the parcel, and fees based on the amount of stormwater generated. An impact station provided residents with information

Credit: Capital Region Water

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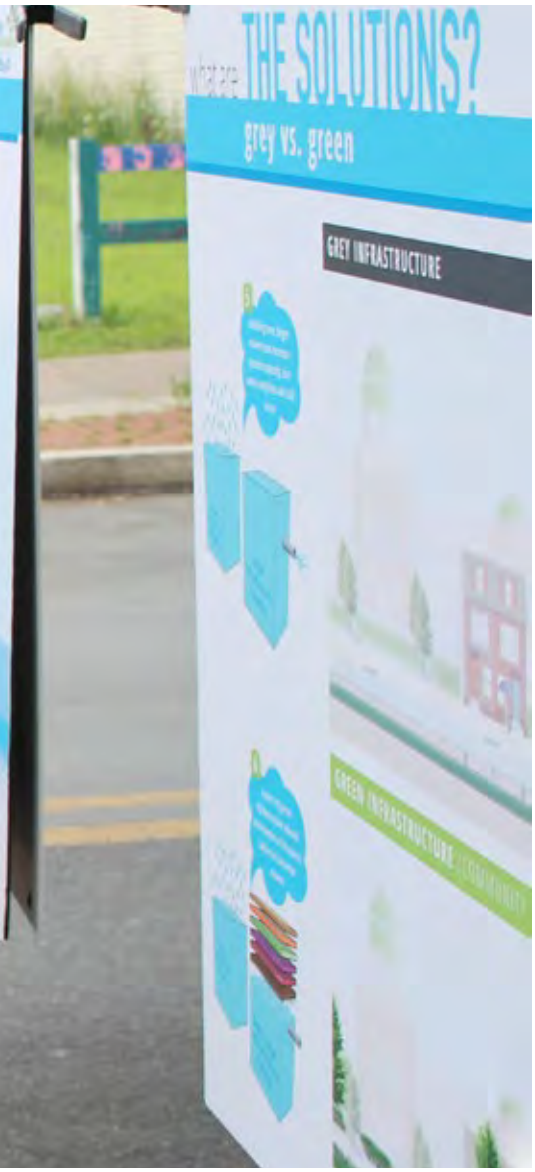
ENGAGING ALL HARRISBURG RESIDENTS

One of our team members walks a Spanish-speaking family from South Allison Hill through potential green stormwater infrastructure solutions.

about potential employment opportunities that may result from a green stormwater management program in Harrisburg. The results from this initial set of public meetings provided Capital Region Water with guidance on where to focus program dollars, how to pay for green stormwater infrastructure, how residents would like to be involved in the program, and what areas need investment or community greening. The majority of people felt that investment should be focused on greening streets, parks, vacant lots, and schools.

Capital Region Water continued to engage with residents between public meetings by hosting small focus groups, attending community events, holding Community Ambassador Workgroup meetings, and hosting community clean-ups.



Who did we reach?

Over a thousand Harrisburg residents from every neighborhood in the city were engaged in the planning process. We held 30+ engagement events including:

- **Meeting with Senator Teplitz**
- **Meeting with Representative Kim**
- **Public Event #1**
- **Public Event #2**
- **Presentation to County Commissioners**
- **Camp Curtin Neighborhood Group Meeting**
- **Pecha Kucha Presentation**
- **Meeting with Interfaith Leaders**
- **Harrisburg IMC Presentation**
- **Harrisburg School District Meeting**
- **Sierra Club Presentation**
- **Wesley Union AME Zion Meeting**
- **Capitol Area Neighbors Meeting**
- **Harrisburg Young Professionals Meeting**
- **Bellevue Park Association Meeting**
- **Neighborhood Action Group Meeting**
- **South Allison Hill Homeowners Association Meeting**
- **Heinz Menack Senior Center Event**
- **Meeting with Melrose Gardens Representative**
- **Harrisburg Home Tour**
- **Neighborhood Center Meeting**
- **South Harrisburg Public Event**
- **Spanish Event with the Latino Hispanic American Community Center**
- **Camp Curtin Community Neighbors United Meeting**
- **Green stormwater infrastructure Tour to Philadelphia**
- **Riverside United Neighbors**
- **Summit Terrace Neighborhood Meeting**
- **Allison Hill Community Greening Party**
- **South Harrisburg Community Greening Party**
- **Uptown Community Greening Party**
- **Midtown Greening Party**

THE COMMUNITY GREENING PARTIES ENGAGED 200+ RESIDENTS

Residents from all over the city participated in the Community Greening Parties online and in-person.

The second public event, a series of the Community Greening Parties, asked residents to provide input on community greening concepts. The Community Greening Parties were held in Allison Hill, South Harrisburg, and Uptown. Community partners, including the Camp Curtin YMCA, Fountain Gate Church and Ministries, local musicians and DJs, and food vendors helped Capital Region Water provide entertainment and food for residents while they learned more about community greening concepts and stormwater management opportunities.

In an effort to reach as many communities and groups in Harrisburg as possible, meetings were held in different neighborhoods. The Community Greening Parties engaged close to two hundred residents. The South Harrisburg party was held at Cloverly Heights Park while the Uptown party was held at the Camp Curtin YMCA during National Night Out. The Allison Hill party was held in conjunction with the Fountain Gate Church and Ministries' 14th Annual Community Day at the neighborhood's community garden.In an effort to ensure all residents had an opportunity to participate, translation services and Spanish versions of meeting materials were made available to Spanish-speaking residents.

Credit: Capital Region Water

We asked residents at the first community meeting to identify areas where they wanted to prioritize investment in community greening. The categories of the community greening concepts — green alleys, green streets, green schools, green neighborhoods, green public spaces, green businesses, green community centers, green vacant lots and green parks — were selected based on this input. A member of the project team walked residents through the concepts showing potential community greening transformations. Residents then used dots and post-it notes to make suggestions for where community greening strategies would benefit other schools, parks, or neighborhoods in the city.

Other engagement activities, including a Midtown Community Greening Ice Cream Social and the Raindrop to River Conservation Carnival, were held in the summer of 2016 to gain additional input. Online surveys for both public events were posted on Capital Region Water's website to allow for additional engagement with community members who were unable to attend the events.

<

RESIDENTS ARE EXCITED TO SEE INVESTMENT IN THEIR COMMUNITIES

Green stormwater infrastructure investment provides a great opportunity for many communities in Harrisburg who have seen a long period of disinvestment. Investments in GSI may spur the local economy and create new, safe places for the community to gather.

HOW WE PLAN TO CONTINUE ENGAGING THE COMMUNITY

Capital Region Water is committed to Harrisburg and will continue to engage communities well beyond the completion of this plan. Now that Harrisburg communities are better informed about the issues surrounding stormwater and the potential solutions, the work of implementing these solutions begins. Capital Region Water will continue to work at the neighborhood level with local partners to educate residents, find opportunities for green stormwater infrastructure, help communities achieve their goals, and improve quality of life for residents.

SUPPORTING HARRISBURG COMMUNITIES

Capital Region Water is here to support communities and look for opportunities where community or neighborhood goals match the goals of the Community Greening Plan.

Credit: Capital Region Water

< 2-MINUTE TUESDAY CLEAN-UPS

Activities like the 2-Minute Tuesday Clean-up, a monthly event, help reduce litter that is unsightly and a source of runoff pollution. Engaging residents in a short 30 minute session to help clean up the city's streets and protect the health of the Susquehanna River supports community education and empowers residents to take ownership of their communities and their environment.

WORKING AT THE NEIGHBORHOOD LEVEL

Capital Region Water plans to work at the neighborhood level with local partners. The Community Greening Plan suggests locations where GSI might be most effective and includes a toolkit of GSI strategies. The next step is translating this information from the macro level of the city to the micro level of individual neighborhoods and blocks throughout Harrisburg. Capital Region Water plans to engage with local partners, letting these partners drive the process toward implementation. The process will focus on educating the community and finding opportunities where neighborhood goals match stormwater goals.

A PARTNERSHIP BETWEEN CAPITAL REGION WATER AND THE COMMUNITY

This plan is a commitment to our continuing partnership with the community. Capital Region Water will continue to reach out and find opportunities to collaborate and partner with local organizations throughout Harrisburg.

The Community Greening Plan started the process of educating the greater Harrisburg community about stormwater issues facing communities throughout the city. Capital Region Water plans to continue hosting educational sessions and providing educational materials to grow awareness of stormwater issues and provide city residents, businesses, and students with opportunities to do their part to protect the health and quality of Harrisburg's water.

Where there is synergy between neighborhood goals and stormwater goals, Capital Region Water plans to partner with local organizations, including community groups, neighborhood organizations, and local businesses to plan and implement green stormwater infrastructure projects.

Credit: Capital Region Water

Credit: Capital Region Water

< COMMUNITY CLEAN-UPS & OUTREACH

Capital Region Water will continue to engage the community to plan for green stormwater infrastructure and protect their watersheds.

In partnering with local organizations and groups, Capital Region Water is actively working to build capacity in neighborhoods and create advocates for green stormwater infrastructure by developing programs to empower more stewards of Harrisburg's waterways and infrastructure. The aspiration is that these projects will begin to transform neighborhoods, creating safe, community spaces and bringing a sense of pride to neighborhoods that may have been neglected in the past.


RAIN GARDEN
FLOW-THROUGH PLANTER
GREEN R
STORMWATER BUMPOUT
PERVIOUS PAVING
RAIN BARREL

GREEN SOLUTIONS

Green stormwater infrastructure (GSI) presents an exciting opportunity to reduce stormwater runoff and leverage infrastructure investment to transform and revitalize communities. There are many types of GSI tools that can be employed at a variety of scales, from a single house to an entire city block or neighborhood. All GSI provides a mix of environmental, social, and economic benefits, though the specific benefits vary by tool.

This section provides details about a number of green stormwater infrastructure solutions, including green stormwater planters, bioswales, stormwater wetlands, cisterns, stormwater basins, and stormwater tree trenches. Each "fact sheet" provides a description of the GSI tool, general scale guidelines, application, maintenance and cost requirements, limitations, and benefits. The final portion of this section provides a description of the possible triple bottom line benefits of green stormwater infrastructure to the environmental, social, and economic health of communities.

TYPES OF GSI

HOW DO PLANTS FILTER STORMWATER? *EVAPOTRANSPIRATION*

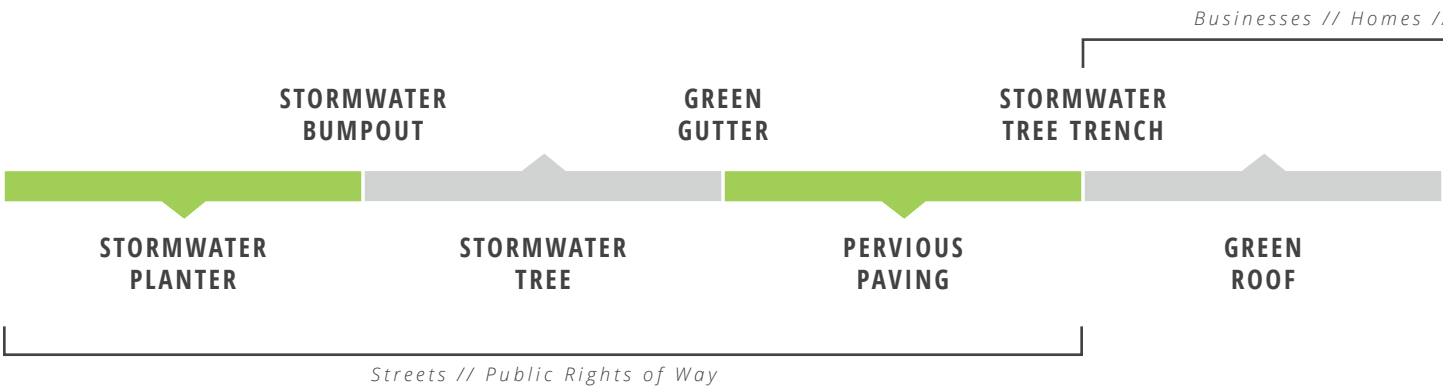
Evapotranspiration is the process by which water absorbed by a plant and soil is released into the air.

Green stormwater infrastructure works across land uses, scales, or contexts. At a small scale, rain barrels or flow-through planters can be attached to downspouts on homes to manage runoff from roofs. At the neighborhood or block scale, rain gardens or stormwater planters can manage stormwater from a block or a street. At the regional or city-wide scale, stormwater wetlands or restored forests or floodplains can restore critical natural landscapes and reduce runoff.

The graphic below provides a general guide for the scale and application of various types of GSI. For example, stormwater wetlands, stormwater basins, and bioswales are called out as large-scale strategies because they typically require a moderate amount of space to be successful. These are only general guidelines. Individual sizing should be based on site analysis and research.

GREEN STORMWATER INFRASTRUCTURE

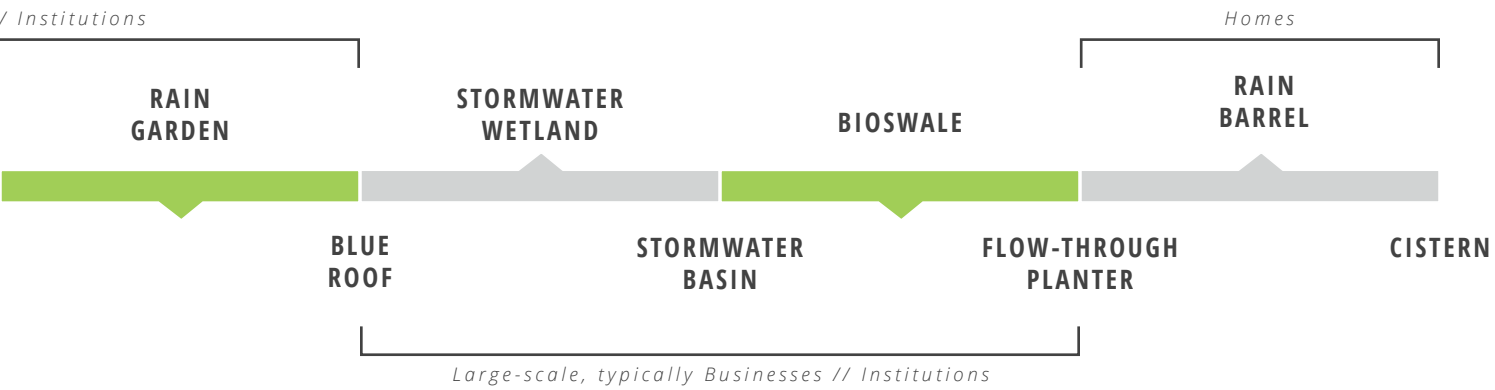
GSI comes in a variety of shapes, sizes, and applications. The Green stormwater infrastructure Fact Sheets provide additional information about each type (*see Appendix A*).




Credit: Flickr // Brad Davis AICP

< STORMWATER PLANTERS & STORMWATER TREES

Stormwater planters and stormwater trees line a sidewalk, filtering and reducing runoff while creating a buffer between pedestrians and vehicular traffic.



STORMWATER PLANTER

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

A stormwater planter is an area with soil and plants surrounded by a curb, typically located at the edge of a sidewalk where it meets a street. The soil and plants are lower than street level to capture stormwater from roads and sidewalks. Once the water enters the planter, some of it is absorbed into the top layer of soil and plants and released through evapotranspiration. The remaining water filters down into a bed filled with gravel or stone and is allowed to slowly infiltrate into the ground. Any excess water that exceeds the capacity of the planter is slowly released to an existing sewer. Stormwater planters can vary in size and materials depending on the application.

Stormwater planters reduce and filter runoff and enhance the public realm. The flexible nature of the planter makes it appropriate in a variety of environments, including high-density urban settings, along streets, sidewalks, and parking lots. They are often used along streets as part of green streets strategies. When employed along streets, the planter can also improve pedestrian safety by creating a buffer between vehicular traffic and pedestrians.

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation compared to other types of GSI, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Credit: Flickr // Center for Neighborhood Technology

This type of GSI has the potential to store a significant amount of stormwater in a relatively small footprint, but typically needs extended subsurface storage. Planters can be standardized for street application, making it a popular choice for cities looking to maximize GSI investment. Initial maintenance requirements may be time-consuming until vegetation is established. Afterwards, maintenance is relatively low. Consideration should be given to carefully selecting native, or adaptive, water-tolerant plants and testing infiltration rates to ensure that the planter functions properly. Regular maintenance after vegetation is established includes removing debris, cleaning inlets and overflows, weeding, and replacing plants as needed.

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STORMWATER PLANTERS CAN BE USED TO BUFFER PARKING

In this example, a stormwater planter provides a buffer or screening for a parking lot.

STORMWATER BUMPOUT

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

A stormwater bumpout is an area with soil and plants that extends out from the existing curb into the street, with a new curb at the street edge. It can be put at the corner of a block, in the middle of a block, or along the entire length of a block. The soil and plants are lower than street level to capture stormwater from roads and sidewalks. Once the water enters the bumpout from the street, some of it is absorbed into the top layer of soil and plants and released through evapotranspiration. The remaining water filters down into a bed filled with gravel or stone and is allowed to slowly soak into the ground. Any excess water is slowly released to an existing sewer.

Stormwater bumpouts work well in urban environments where space may be limited for larger GSI. The width of the bumpout is equal to a lane of on-street parking and, depending on the application, only marginally reduces parking. However, bumpouts may not be appropriate in certain locations based on existing street width and parking demand. This type of GSI is often used as a part of green streets strategies. Aside from providing visual interest and enhancing the streetscape, stormwater bumpouts calm traffic and improve pedestrian safety by reducing the distance needed to cross the street and creating a barrier between cars and pedestrians.

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Credit: Flickr // Center for Neighborhood Technology

Similar to the stormwater planter, this type of GSI has the potential to store a significant amount of stormwater in a relatively small footprint, typically with extended subsurface storage. It can be standardized for street application. Initial maintenance can be time-consuming until vegetation is established. Afterwards, maintenance is relatively low. Consideration should be given to carefully selecting native, or adaptive, water-tolerant plants. Infiltration rates should also be tested to ensure that the planter bumpout functions properly. Regular maintenance after vegetation is established includes removing debris, cleaning inlets and overflows, weeding, and replacing plants as needed.

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STORMWATER BUMPOUTS CAN CALM TRAFFIC

Stormwater bumpouts act as a barrier between pedestrians and vehicular traffic, but they also calm traffic by acting as a visual obstacle causing drivers to naturally slow down.

STORMWATER TREE

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

A stormwater tree is a street tree planted within soil that is lower than street level to capture stormwater from roads and sidewalks. The tree absorbs stormwater through its roots. Some stormwater tree pits have metal grates above them, while others have curb openings that direct stormwater to the trees.

Stormwater trees are flexible in application and design and are well suited to tight, urban environments where size constraints may limit GSI options. All that is required is the amount of space needed to plant a tree. Unlike many other forms of GSI, they do not have additional underground storage and do not require infiltration testing. Stormwater trees are limited in the amount of stormwater they can manage.

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Credit: Flickr // Chris Hamby

Stormwater trees increase tree canopy and increase air quality while enhancing streetscape. However, unlike a typical street tree, stormwater trees need to be able to handle larger volumes of water entering through tree pits. Therefore careful selection of native, or adaptive, water-tolerant trees is necessary to ensure tree health. Maintenance requirements include trimming limbs, removing debris, and occasional evaluation to ensure that the trees remain healthy.

^

STORMWATER TREES CAN WORK AS A SYSTEM OR ALONE

In this example, a single stormwater tree manages a portion of runoff from the street right-of-way. A single curb cut conveys water from the street into the bed of the planter.

STORMWATER TREE TRENCH

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

A stormwater tree trench is an underground storage system that connects multiple street trees, typically located at the edge of a sidewalk where it meets a street or at the edge of the street where it meets a sidewalk. The trees absorb some of the stormwater through their roots, while excess water drains down into an underground storage area made of stone, plastic crates, or other materials. Any water that exceeds the capacity of the underground storage area is slowly released to an existing sewer.

Stormwater tree trenches reduce and filter runoff, enhance the public realm, and increase tree canopy, which can reduce heat island effect and improve air quality. Similar to stormwater trees, stormwater tree trenches are appropriate in a variety of environments, including high-density urban settings, along streets, sidewalks, parking lots, and public plazas. This form of GSI can be used as an alternative to surface vegetated systems when hardscape is necessary, but stormwater management and greening are priorities. Stormwater tree trenches that are located along streets improve pedestrian safety by creating a buffer between vehicular traffic and pedestrians.

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Credit: Flickr // DeepRoot

The size of stormwater tree trenches is flexible. Depending on its size, this type of system has the potential to manage a large volume of stormwater with a relatively small surface footprint. Given the large underground component of this system, maintenance is more extensive than what is required for a stormwater tree. Maintenance requirements include removing debris, cleaning inlets and overflow, trimming tree limbs, and occasional surveys to ensure that the trees remain healthy.

^

STORMWATER TREE TRENCHES PROVIDE SHADE

In this example, a system of connected trees creates a shaded allée.

PERVIOUS PAVING

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

Pervious, or porous/permeable, paving is a special type of paving that allows stormwater to pass through it instead of running off of it. Pervious paving can include pervious interlocking concrete, pavers, and porous asphalt, and other types of manufactured pavers made of concrete or plastic. Pervious paving can be used in many places where traditional paving is used, particularly areas that do not have a lot of traffic, such as walkways and parking areas. Parking lots, parking lanes, driveways and other low-speed, low-traffic areas are the most appropriate applications. An underground storage system usually sits below the pavement to store stormwater.

Pervious paving reduces runoff by managing stormwater that falls directly on the surface of the paving and reducing the overall amount of impervious surfaces in a given area. This form of GSI can be widely applied throughout urban and non-urban environments because it manages stormwater without reducing hardscape areas. While pervious paving is a surface GSI system, it is not vegetated, but can be combined with a vegetated system like a stormwater planter, to increase stormwater and community greening benefits.

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Credit: Flickr // Jarrett M

While pervious paving is quite flexible, it may not be suitable for all locations where traditional pavement is used. Pervious paving may not be ideal for highly traveled roadways or steep sloped areas. Heavy use may loosen aggregate, which can erode the surface of the pavement and cause the overall system to not function as designed. Periodic maintenance is required to ensure that clogging of the pervious paving from sand and aggregate that fill spaces between pavers and joints, is prevented. Surfaces are usually cleaned with a large vacuum machine to avoid clogging issues. The proposed area should undergo infiltration testing before installation and should occasionally be tested throughout its life to guarantee that the system is draining properly.

^

PERVIOUS PAVING WORKS WELL IN PARKING AREAS

In this example, pervious paving is used for a parallel parking lane because it is not as heavily traveled as a roadway.

GREEN GUTTER

Green gutters are continuous, narrow areas with soil and plants along the edge of a street where it meets the sidewalk, with a new curb at the street edge. The soil and plants are lower than street level to capture stormwater from roads and sidewalks. The size and materials of green gutters can vary depending on application.

Green gutters reduce and filter runoff from the street and sidewalk. Unlike stormwater planters and bumpouts, green gutters are narrow and are located at the same elevation as the street. This system can be employed in urban areas where minimal space is available for GSI. They are often used along streets as part of green streets strategies. Similar to stormwater planters, green gutters provide a vegetated buffer between pedestrians and vehicular traffic, but they do not encroach on the sidewalk. Green gutters work best in areas where street parking and loading is not allowed. If used on a street that allows street parking, adequate protection must be used to prevent cars from driving into the green gutter. Provisions must also be made to allow people to access the sidewalk from a parked car.

Stormwater is managed in a green gutter through evapotranspiration and infiltration, if feasible. They can be designed with a flush curb so that street runoff can enter via sheet flow. Alternatively, a raised curb can be added that allows runoff to flow into the green gutter at curb openings along its length.

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Credit: Flickr // Jarrett M

While the maintenance requirements of the system are relatively low, the system has the capability to manage a moderate amount of stormwater. Initial maintenance can be time-consuming until vegetation is established. Consideration should be given to selecting native, or adaptive, water-tolerant plants and testing infiltration rates to ensure that the green gutter functions properly. Regular maintenance after vegetation is established includes removing debris, cleaning inlets and overflows, and replacing plants as needed.

Green gutters are typically not recommended for steeply sloped streets or areas where there may be potential conflicts with on-street parking or loading. The existing street right-of-way also needs to be wide enough to accommodate a green gutter system.

^
GREEN GUTTERS ARE LEVEL WITH THE ROADWAY

Green gutters curbs are at the same elevation, or level with the roadway. This allows the gutter to collect stormwater runoff directly from the surface of the road.

GREEN ROOF

A green roof (or vegetated roof) is a flat or mildly sloped roof that is either partially or fully covered by a system of plants. The plants grow in a lightweight engineered soil. Green roofs vary in size and depth depending on the weight that the existing roof can handle. Green roofs can be applied to almost any existing flat roof as long as the structure can handle the additional loading requirements. Not all existing structures can handle the load needed for a green roof system.

Green roofs primarily function to capture roof runoff, but they can also provide aesthetic value, reduce energy costs for heating and cooling, reduce the heat island effect, and improve air quality. The aesthetic value of green roofs is maximized when the roof itself is visible or accessible. In some cases, the green roof covers a portion of the roof, opening up space for public gathering and open space.

While green roofs may improve aesthetics, they are limited to only managing rooftop runoff and can be quite costly depending on size and engineering requirements. Depending on the thickness of the storage system, stormwater management may be limited. However, they provide volume removal of stormwater runoff that is stored through evapotranspiration. They also delay and reduce the rate of runoff from a roof.

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Higher maintenance is required until roof vegetation is established. Regular maintenance includes clearing debris, working to avoid plant loss, and checking for damage from environmental conditions. Ensuring that installed plants, growth medium, and other drainage materials are tailored to the specific environment (climate, building surroundings, etc.) can reduce maintenance requirements.

Application of green roofs is typically limited to flat and mildly sloped roofs. Green roofs are most cost-effective when installed during new construction or when a roof needs to be replaced and tend to be more expensive compared to ground-level stormwater management.

^
VISIBLE GREEN ROOF

In this example, the green roof, while not an active open space, is visible from adjacent houses and buildings, which increases the aesthetic value of the GSI.

BLUE ROOF

A blue roof is a flat roof that provides temporary storage and slow release of roof runoff. Detention of stormwater can be provided in open storage at the roof's surface, in storage media, in modular storage units or trays, or below decking or other roof cover. Blue roofs vary in size and can be used alongside green roofs. Blue roofs can be applied to almost any existing flat roof as long as the structure can handle the additional loading requirements. Not all existing structures can handle the load needed for a blue roof system. Application of blue roofs is typically limited to flat and mildly sloped roofs.

Blue roofs can provide aesthetic value and reduce energy costs for heating and cooling. Depending on the design, blue roofs can offer opportunities to reuse captured stormwater. Blue roofs can also be paired with green roofs, roof decks, or plazas.

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Similar to green roofs, blue roofs can only manage rooftop runoff and can be quite costly depending on the size and engineering requirements and offer limited ancillary benefits compared to vegetated systems. They are typically more cost-effective and best-suited for sites where a large percentage of the area is roof area. Blue roofs are not vegetated, therefore maintenance is minimal and consists of clearing debris and checking for damage from environmental conditions.

^
GREEN ROOF / BLUE ROOF

In this example, a green roof and blue roof hybrid provides visual interest and management of roof runoff.

RAIN GARDEN

A rain garden is a depressed area with soil and plants. The soil and plants are lower than surrounding areas to capture stormwater. The stormwater collects in the rain garden, creating a small, shallow pond until the water drains down through the soil. Some rain gardens have an underground storage system beneath them to hold more stormwater. Size and materials for rain gardens can vary.

Rain gardens are one of the most common systems employed to manage stormwater. They enhance the aesthetics of a place, reduce and filter runoff, can manage a large volume of stormwater, and can be connected to other types of GSI. They are flexible and can be designed to suit almost any environment and site. Construction can vary from simple gardens to more extensive systems with underground storage. Simple rain gardens without additional storage can be installed by homeowners or community groups, while rain gardens with additional storage and infiltration may require licensed contractors and engineers. This type of GSI can be installed at schools, parks, homes, vacant lots, and many other places throughout the urban environment.

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Credit: Flickr // PWD

Depending on the size of the system, rain gardens have the potential to manage a significant amount of stormwater. It is relatively inexpensive to install rain gardens, but initial maintenance can be time-consuming until vegetation is established. Consideration should be given to carefully selecting native, or adaptive, water-tolerant plants. Infiltration rates should be tested to ensure that the planter functions at designed levels. Regular maintenance after vegetation is established includes removing debris, cleaning inlets and overflows, and replacing plants as needed.

^

RAIN GARDENS CAN BE COMMUNITY ASSETS

Residential rain gardens, especially rain gardens built or supported by a local community, can become a community asset and amenity.

STORMWATER WETLAND

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

A stormwater wetland is an engineered marsh system that includes both open water areas and shallower, vegetated marsh areas. Stormwater wetlands typically include a small pool that filters some pollutants out of the stormwater and then a larger area with marshland vegetation that treats and filters the water similar to a natural wetland. Stormwater wetlands can serve as habitat for wildlife.

Stormwater wetlands not only manage stormwater runoff, but also provide flood control, enhance the natural environment, and create habitat for local wildlife. While they have the capability to manage a large amount of stormwater, stormwater wetlands are less flexible in application and require a large amount of physical space. They are most suitable in large parks and open spaces.

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Credit: Flickr // PWD

While the initial construction of a stormwater wetland can be costly, the long-term maintenance of the system is relatively minimal after vegetation is established. The success of the system requires careful selection of native, or adaptive, water-tolerant plants that will create a wetland suitable for wildlife. Regular maintenance includes removing debris, cleaning inlets and overflows, and replacing plants as needed.

^

STORMWATER WETLAND AS A PARK

In this example, the Stormwater Wetland at Saylor Grove in Philadelphia, Pennsylvania, the wetland was constructed within a park and is a natural amenity for the surrounding neighborhood.

STORMWATER BASIN

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

A stormwater basin (detention/retention pond) is a sunken, sometimes grassy or planted area that is designed to collect and store stormwater. Stormwater basins vary in size and can either slow the stormwater until it is treated elsewhere, or allow it to drain into the soil, or a combination of both.

Stormwater basins come in a variety of sizes and designs. Some are simply grassy depressions, while others have vegetation that helps to further filter stormwater and improve aesthetics. This type of GSI is quite flexible. They can be designed to manage different volumes of stormwater and suit a variety of environmental situations.

Overall cost depends on the size and design of the stormwater basin, but maintenance is relatively minimal. Initial maintenance can be time-consuming until vegetation, if applicable, is established. After vegetation is established maintenance consists of clearing debris, cleaning inlets and overflows, and replacing plants as needed.

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Credit: Flickr // Aaron Volkening

^
VEGETATED OR GRASSY

In this example, the stormwater basin when dry is a grassy depression. During wet weather events, the depression fills with stormwater before being slowly released.

BIOSWALE

A bioswale is a shallow linear depression designed to slow the flow of stormwater and allow it to drain into the soil. Bioswales can be used as an alternative to traditional piped ditches or as a way to slow stormwater before it gets to other GSI.

Bioswales reduce and filter runoff and can replace traditional ditches or gutter systems. This type of GSI can be used for infiltration or to convey stormwater from a runoff source to another GSI system where it is stored or allowed to infiltrate. They can be employed in a variety of environments, including residential properties, street medians, parks, and schools, but require enough space to move and treat stormwater. Bioswales work especially well in sloped areas where natural or constructed contours help move water from an impervious surface to a final treatment area.

Costs vary depending on the size and design of the bioswale. Bioswales can be lined with vegetation or stone, or a combination of both. Initial maintenance can be time-consuming until vegetation, if used, is established. Consideration should be given to carefully selecting native, or adaptive, water-tolerant plants. Regular maintenance includes clearing debris, cleaning inlets and overflows, and replacing plants as needed.

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Credit: Flickr // Montgomery County Planning

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BIOSWALE LANDSCAPING

Bioswales provide a natural, aesthetically pleasing way to convey water from one runoff source to another type of GSI.

FLOW-THROUGH PLANTER

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

A flow-through planter is a box with soil and plants that sits on the ground, typically located next to a building. The stormwater from the building's roof is directed to the stormwater planter through a downspout. Stormwater filters through the soil in the box.

Flow-through planters are commonly used in residential applications, but can also be scaled up to meet the stormwater treatment needs of larger commercial buildings, public facilities, and institutional uses. They reduce runoff from rooftops and enhance the surrounding landscape. The flexible nature of the design makes flow-through planters well-suited for urban environments, including rowhouses and dense commercial corridors. Unlike other types of GSI that rely on infiltration to release stormwater, flow-through planters do not require ground-level infiltration and instead filter stormwater through plants and soil and slowly release it back to the sewer.

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Credit: PWD

Depending on the size of the planters and the materials used, flow-through planters are a relatively inexpensive way to manage stormwater. However, the amount of stormwater a flow-through planter can manage is limited to runoff from the adjacent structure's roof. Maintenance of the planter itself is minimal once vegetation is established. As with many other types of GSI, careful consideration should be given to selecting native, or adaptive, water-tolerant plantings.

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DIY FLOW-THROUGH PLANTERS

Flow-through planters can be purchased prefabricated or constructed at home. Simple DIY planters can be constructed with some wood, an overflow structure, stone, soil, and native, or adaptive vegetation.

RAIN BARREL

Rain barrels are enclosed, typically plastic or metal structures that sit on the ground, often located next to a building. Stormwater from a building's roof is directed to the rain barrel through a downspout. Stormwater is stored in the rain barrel until it is needed for another use. The collected water is used for things that do not require drinking water, like watering plants or washing cars.

Rain barrels, similar to flow-through planters, are often used in residential applications. They reduce runoff by collecting water from an adjacent roof. However, unlike many other types of GSI, rain barrels do not use vegetation to filter stormwater. Instead, water is stored and used for irrigation and other non-potable water needs. This allows homeowners to conserve water and save money by reducing the amount of water needed for irrigation. However, this also requires a use for the stored water.

Demand for stored water can be seasonal and weather dependent, which can lead to insufficient available storage during rain events. For maximum stormwater benefit, rain barrels should be completely emptied before each rain event.

SOCIAL BENEFITS

- ● ENGAGE THE COMMUNITY
- ○ IMPROVE PUBLIC HEALTH
- ○ REDUCE HEAT
- ○ ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- ● IMPROVE WATER QUALITY
- ○ RESTORE ECOSYSTEMS
- ○ IMPROVE AIR QUALITY
- ○ SAVE ENERGY

ECONOMIC BENEFITS

- ○ SPUR PRIVATE INVESTMENT
- ○ CREATE JOBS
- ○ REVITALIZE NEIGHBORHOODS

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)

Most rain barrels are prefabricated which reduces the overall cost and maintenance requirements. However, due to their small size, the potential stormwater benefit is limited. Aside from ensuring roof leaders are clear of debris and regularly using the stored water, maintenance of the system is minimal. Rain barrels should be completely enclosed or have appropriate screens to control mosquitoes and should be completely emptied when temperatures fall below freezing.

^

SAVE WATER, USE A RAIN BARREL

Rain barrels provide an alternative to traditional irrigation. Rain water collected in the barrel can be used to water plants or wash a car.

CISTERN

Cisterns are large, enclosed structures that can sit on the ground or be buried below ground. Stormwater is directed to cisterns through downspouts or pipes. Stormwater is stored in the cistern until it is needed for another use. The collected water is used for things that do not require drinking water, like watering plants or washing cars.

Cisterns vary in size and application. The location is flexible, and the system can be a stand-alone practice or integrated into a larger stormwater detention system. Cisterns reduce runoff by collecting water from an adjacent roof. Similar to rain barrels, cisterns do not use vegetation to filter stormwater. Instead, water is stored and used for irrigation, cooling water, or other non-potable water needs. This allows homeowners or business owners to conserve water and save money by reducing the amount of water needed for irrigation and other uses.

Demand for stored water can be seasonal and weather dependent, such as re-use for irrigation. It can also be dependent on the periodic or cyclical nature of activity at the site. This irregular demand for stored water can lead to insufficient available storage during rain events. If a cistern's primary function is stormwater benefit, cisterns must be able to release stored water back to the drainage system

SOCIAL BENEFITS

- ENGAGE THE COMMUNITY
- IMPROVE PUBLIC HEALTH
- REDUCE HEAT
- ENHANCE RECREATION

ENVIRONMENTAL BENEFITS

- IMPROVE WATER QUALITY
- RESTORE ECOSYSTEMS
- IMPROVE AIR QUALITY
- SAVE ENERGY

ECONOMIC BENEFITS

- SPUR PRIVATE INVESTMENT
- CREATE JOBS
- REVITALIZE NEIGHBORHOODS

AT A GLANCE

An overview of the amount of maintenance required, the potential cost of installation, and the capacity of the system.

MAINTENANCE
(ease of cleaning/using the GSI)

COST
(typical cost of designing and building GSI)

SIZE/VOLUME
(typical size required/ volume managed by GSI)


Credit: PWD

at a controlled rate to ensure that there is available storage for subsequent storm events. Depending on the stormwater objectives or goals of a site, cisterns may need to be used in conjunction with another practice.

Cost and volume of managed stormwater depend on the size and application of the cistern. Underground cisterns require additional cost for excavation and soil testing. While above ground cisterns require minimal site preparation. Cistern systems may need to include appropriate pre-treatment of stormwater depending on the end use. Depending on the location of the cistern and the use, cisterns can rely on gravity or pumps to distribute the runoff. All piping from cisterns must clearly indicate that the water is non-potable. Additional plumbing requirements add cost to the design of a cistern.

^

UNDERGROUND WATER STORAGE

In this example, a cistern is placed underground with a pipe that allows the homeowner or business owner to reuse the water for non-potable water needs.

GSI BY LAND USE

This chart provides guidance for selecting the type of GSI that works best for each type of land use. This information coupled with the individual details of each type of GSI, including cost, maintenance, and size constraints, and potential limitations and benefits, is intended to provide a basis for selecting a GSI type.

TYPES OF GREEN STORMWATER INFRASTRUCTURE	LAND USE TYPOLOGIES											
	ROADS	COMMERCIAL	INDUSTRIAL	MIXED USE	PUBLIC FACILITIES	INSTITUTIONS	TRANSPORTATION/ UTILITIES	PARKING	VACANT LOTS	PARKS/RECREATION	MULTI-FAMILY RESIDENTIAL	RESIDENTIAL
STORMWATER PLANTER	●						●	●				
STORMWATER BUMPOUT	●						●	●				
STORMWATER TREE	●	●		●	●	●		●		●	●	●
STORMWATER TREE TRENCH	●						●	●				
PERVIOUS PAVING	●	●		●	●	●	●	●	●	●	●	●
GREEN GUTTER	●						●	●				
GREEN ROOF		●	●	●	●	●				●	●	●
BLUE ROOF		●	●	●	●	●				●	●	●
RAIN GARDEN		●	●	●	●	●	●	●	●	●	●	●
STORMWATER WETLAND		●	●	●	●	●			●	●		
STORMWATER BASIN		●	●	●	●	●	●			●		
BIOSWALE		●	●	●	●	●	●	●	●	●	●	●
FLOW-THROUGH PLANTER		●	●	●	●	●	●			●	●	●
RAIN BARREL		●	●	●	●	●					●	●
CISTERN		●	●	●	●	●				●	●	●

^

GREEN STORMWATER INFRASTRUCTURE CAN PROVIDE NUMEROUS SOCIAL BENEFITS

Green stormwater infrastructure projects can enhance recreation. For example, implementing green school strategies may result in additional green spaces for school children.

WHAT ARE THE BENEFITS?

The primary benefit of green stormwater infrastructure is the management of stormwater. However, GSI has the potential to provide additional social, environmental, and economic benefits that leverage stormwater investments. These triple bottom line benefits are not provided by traditional grey infrastructure.

SOCIAL

Engage the Community. Green stormwater infrastructure and community greening investment can bring people together and connect them to the environment. Communities can get involved with planning for their neighborhood, building a rain garden, planting a tree, or enjoying a new community garden or playground. According to a study conducted by the University of Illinois, residents who had

< THE TRIPLE BOTTOM LINE

Triple bottom line benefits represent additional environmental, social, and economic benefits that may be accrued by implementing green stormwater infrastructure.

trees and green space near their homes reported knowing more people in their immediate community, having stronger feelings of unity, and were more willing to help their fellow neighbors than residents in housing developments without trees and green space.

Improve public health. Greening communities improves air quality and enhances recreational opportunities, which improve public health. Studies have shown that just being in contact with nature causes a four percent decrease in stress levels and a two percent increase in satisfaction. Research studies, including a study by Penn State University's Department of Emergency Medicine, found that blood pressure, heart rate, and stress levels decrease after spending time in a greened space. Benefits may include reduced asthma rates, less stress and anxiety, lower rates of childhood and adult obesity, and even reduced mortality rates.

Reduce heat. Planting additional trees, installing green or blue roofs, and increasing the amount of pervious surfaces in urban areas can reduce the heat island effect caused by a concentration of paved areas. Reducing the heat island effect not only provides for a more comfortable urban environment, but may also reduce the number of heat-related deaths in the summer.

Credit: Capital Region Water

ENVIRONMENTAL

Improve water quality. Green stormwater infrastructure reduces the amount of stormwater runoff and filters it before it enters the sewer system or waterways. This lowers the potential for damaging flooding and combined sewer overflows which can pollute waterways.

Restore ecosystems. Restoring streams, controlling erosion, and improving the health of waterways restores ecosystems and encourages biodiversity. Green stormwater infrastructure can also create new wildlife habitats.

Improve air quality. Planting additional trees and greening communities improves air quality by filtering out pollutants.

Save energy. Planting trees and installing green roofs can reduce energy bills by shading structures and providing additional insulation.

ECONOMIC

Spur private investment. Greening communities by building parks, investing in infrastructure, and planting trees can spur private investment from developers and improve property values.

Create jobs. Workers are needed to plan, design, build, and maintain green stormwater infrastructure.

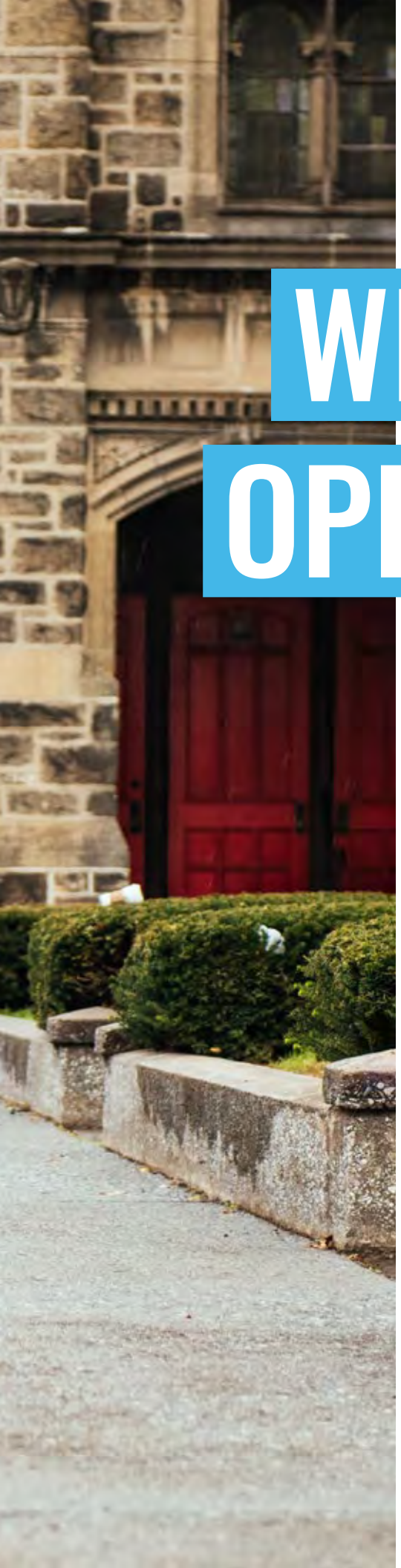
Revitalize neighborhoods. Community greening can have a transformative effect on neighborhoods by increasing the number of amenities, including parks and streetscapes, building resident capacity, and reutilizing vacant lots. These investments can improve neighborhood property values.

Credit: Flickr // DC Greens

03

THE OPPORTUNITIES


NO
PARKING
STREET
CLEANING
WEDNESDAY



WHERE ARE THE OPPORTUNITIES?

Where are there opportunities for green stormwater infrastructure in Harrisburg? In short, there are opportunities all across the city. However, it may be easier to implement green stormwater infrastructure in certain locations than in others. As previously discussed, land use, impervious surfaces, and problem areas play a part in determining how easy it is to construct green strmwater infrastructure. Also contributing to ease of construction are land ownership and control, the location of existing trees, parks, utilities, and other spatial and non-spatial characteristics. These factors are separated into two categories — physical and non-physical factors.

Together, these factors, when applied to the city, provide a snapshot of the most promising green stormwater infrastructure opportunities. This snapshot represents a starting point for Capital Region Water to identify locations for pilot green stormwater infrastructure projects. Capital Region Water will use the opportunity map as a starting point to layer other criteria, including community and partner support, to determine the best locations for green stormwater infrastructure.

OPPORTUNITY ANALYSIS

The green stormwater infrastructure opportunity analysis was done for all streets and parcels in Harrisburg. For streets, drainage areas were delineated based on elevation, street flow, and the location of existing sewer inlets. Blocks are often divided into two drainage areas because streets are “crowned” (higher) in the center and may be divided into multiple drainage areas if there is a high point in the middle of a block. Parcels, based on property lines, were considered their own drainage areas.

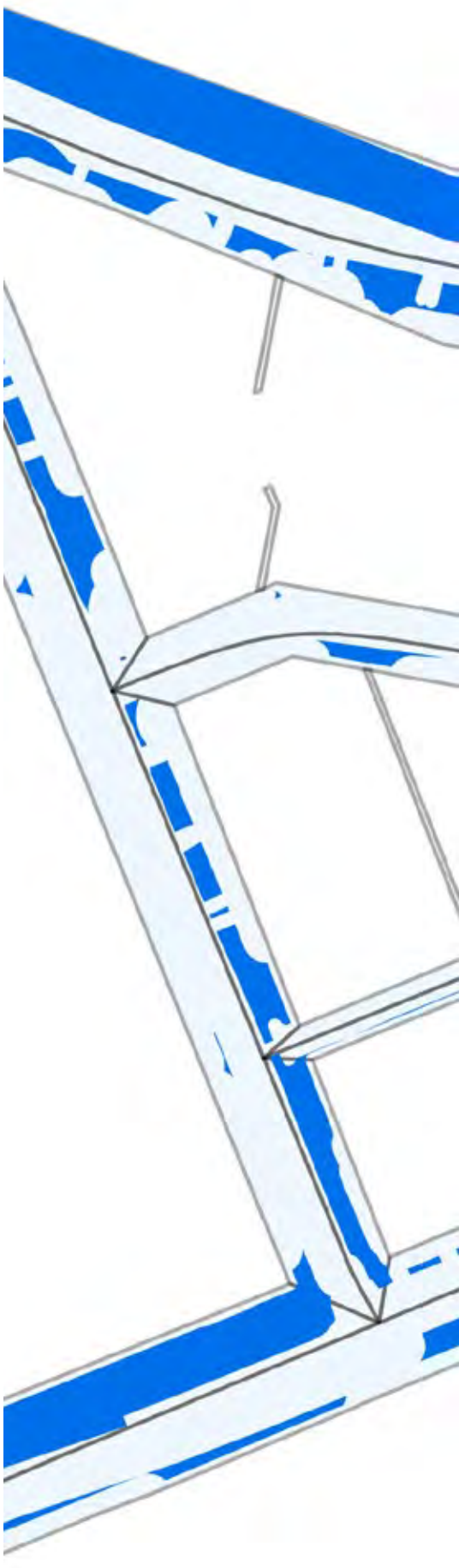
PHYSICAL FACTORS

Physical factors are used to assess where there is space to install green stormwater infrastructure. This is based on the dimensions of the parcels or street drainage areas and the locations of existing infrastructure.

NON-PHYSICAL FACTORS

Non-physical factors are used to take into account ownership and the potential for partnerships. This can include partnerships with community groups, partnerships with local agencies, and coordination with existing projects.

Different sets of physical and non-physical factors are used for streets and parcels to address site-specific and contextual differences.



STREET OPPORTUNITIES

Ease of Implementation

+1 Ensure cost effectiveness
Street drainage areas meet minimum size requirements (5,000 SF).

+1 Avoid spatial conflicts
Prevent conflicts with existing street trees, utilities, curbs, and buildings.

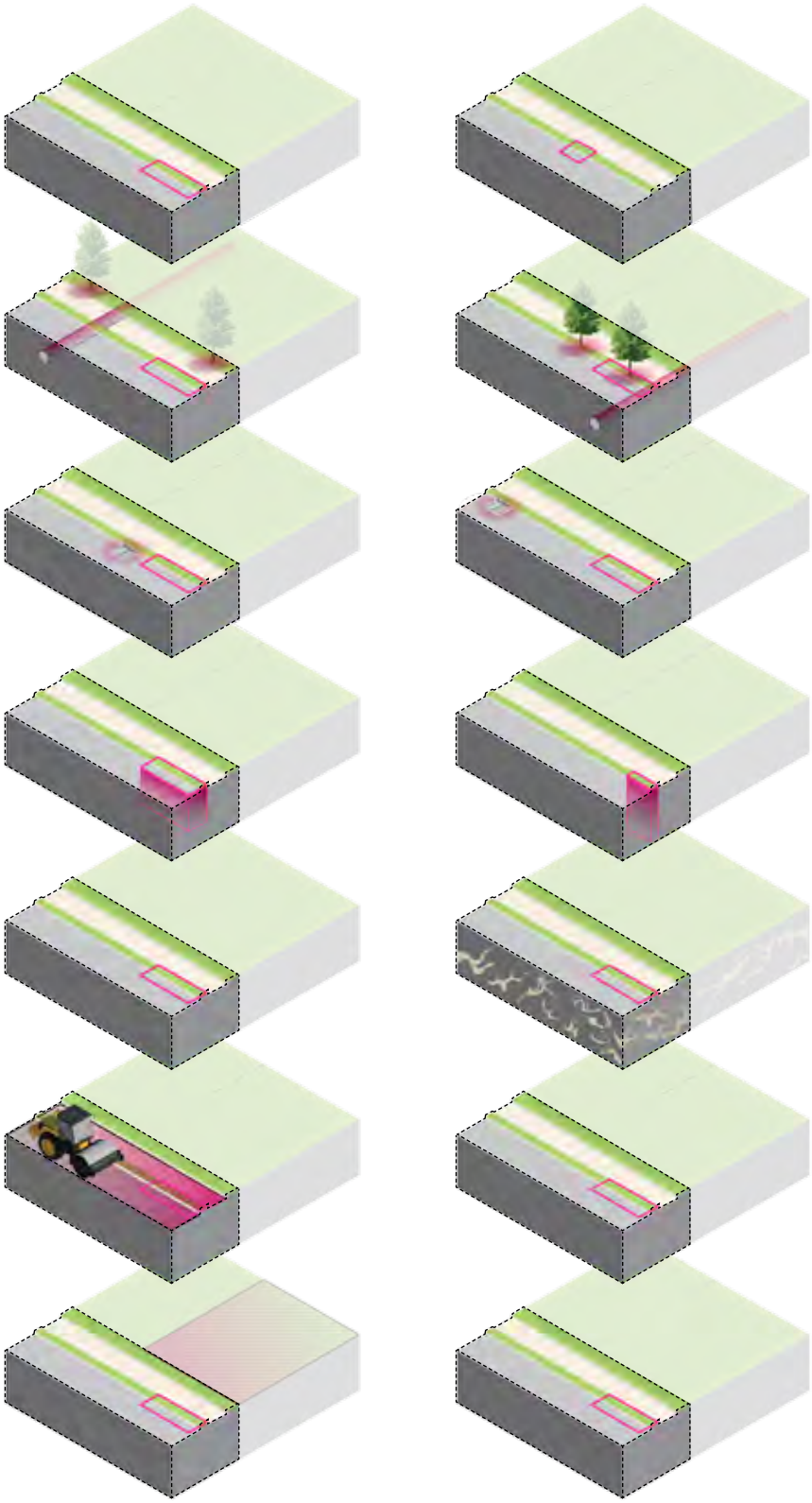
+1 Manage overflow
Drainage areas should be within a certain distance of an existing inlet.

+1 Provide area for infiltration
Maintain a 10:1 loading ratio to provide space to manage stormwater.

+1 Avoid problem areas
Karst geology provides a layer of challenges due to instability.

+1 Planned or potential projects
Proximity to transportation projects and redevelopment areas.

+1 Proximity to parcel opps
Priority areas where grouping GSI projects may be possible.

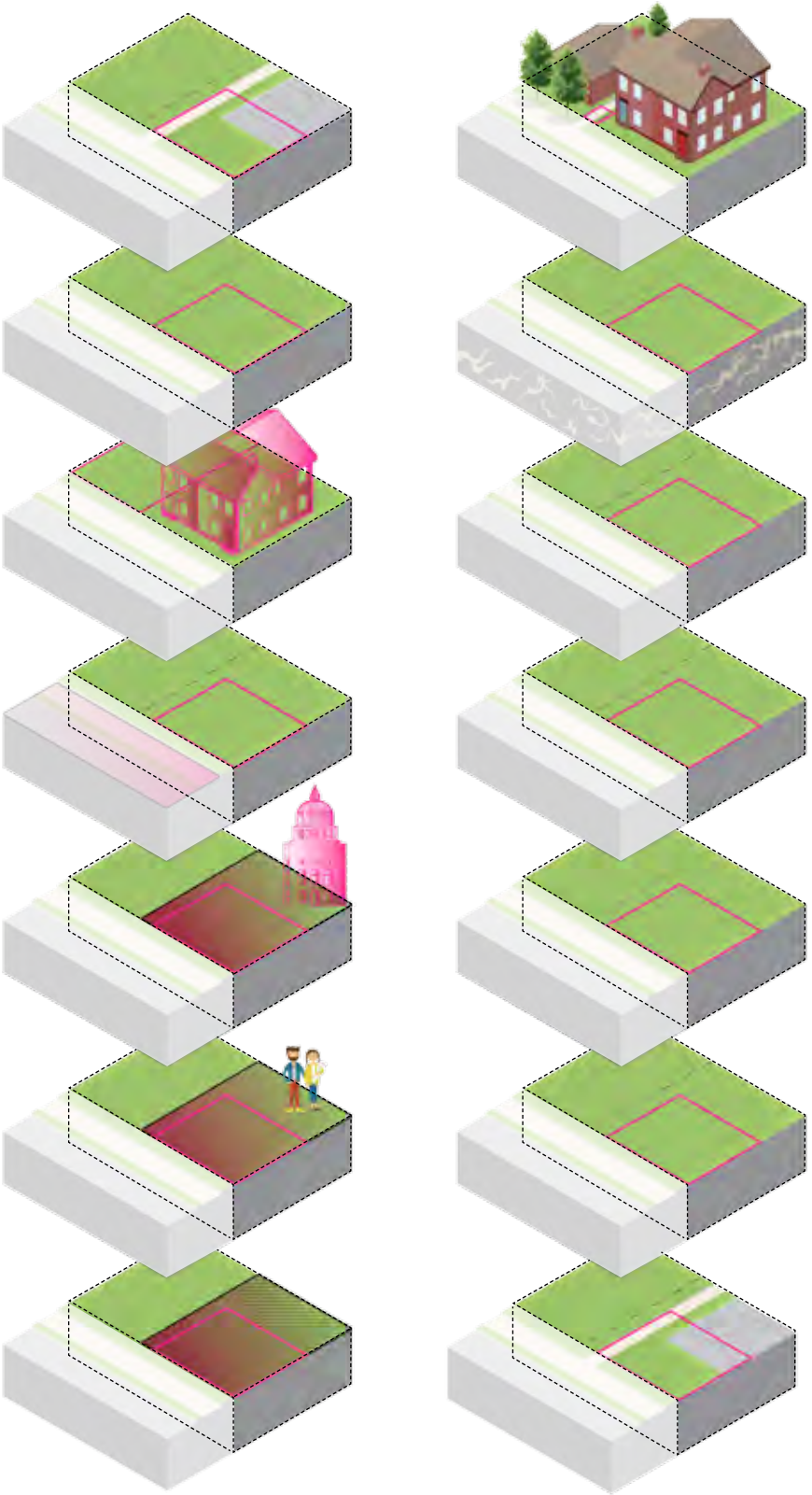


PARCEL OPPORTUNITIES

Ease of Implementation

✓ MEETS CRITERIA

✗ DOES NOT MEET CRITERIA



Ensure cost effectiveness

Minimum size of 500 SF. Includes a portion of sidewalk, parking, & pervious area.

Avoid problem areas

Karst geology provides a layer of challenges due to instability.

Planned or potential projects

Proximity to transportation projects and redevelopment areas.

Proximity to street opps

Priority areas where grouping GSI projects may be possible.

Public ownership

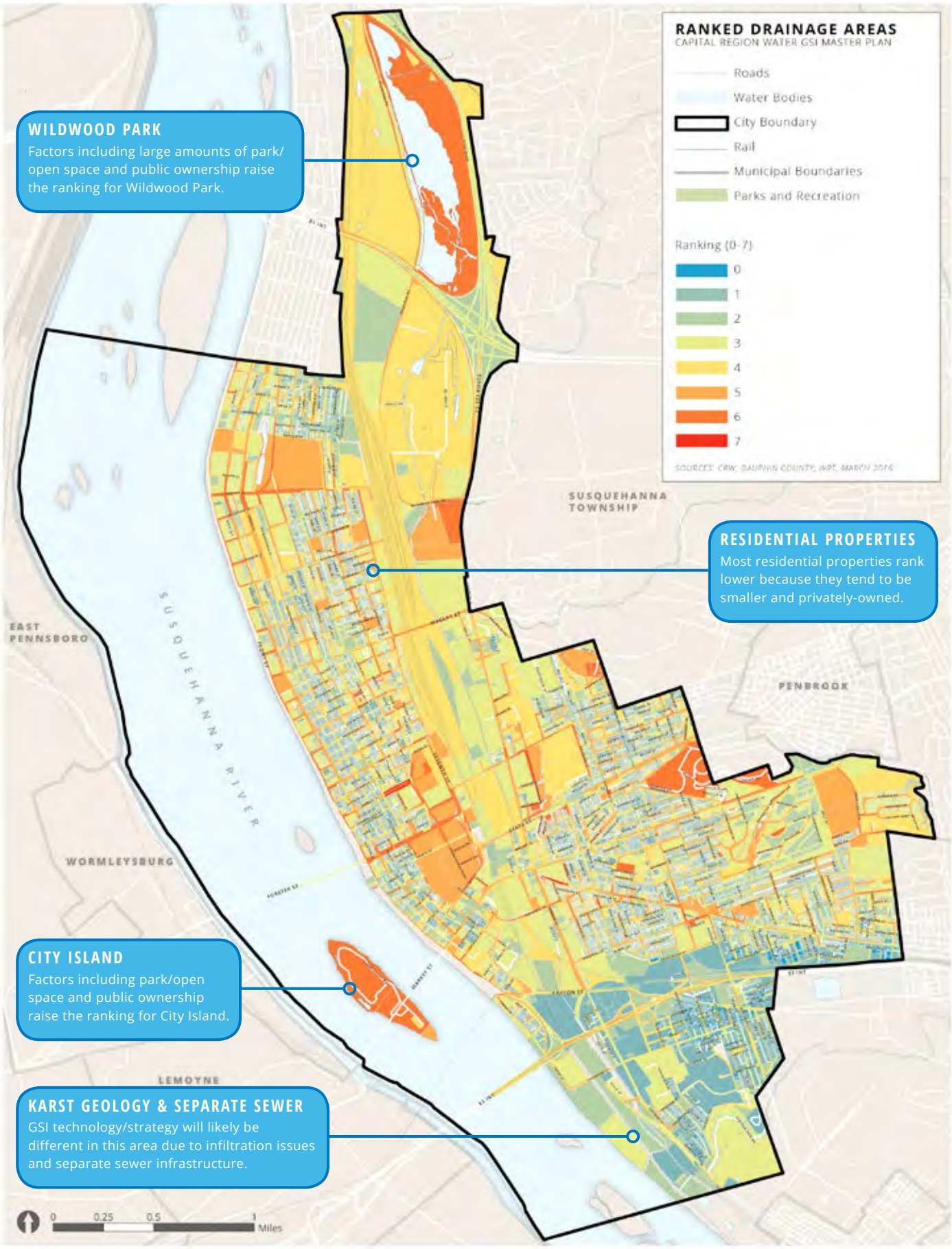
Publicly owned parcels have greater potential for GSI.

Strategic land ownership

Landowners with the most property by land use.

Productive land use

Prioritizes the reuse of vacant lots as a potential partnership opportunity.

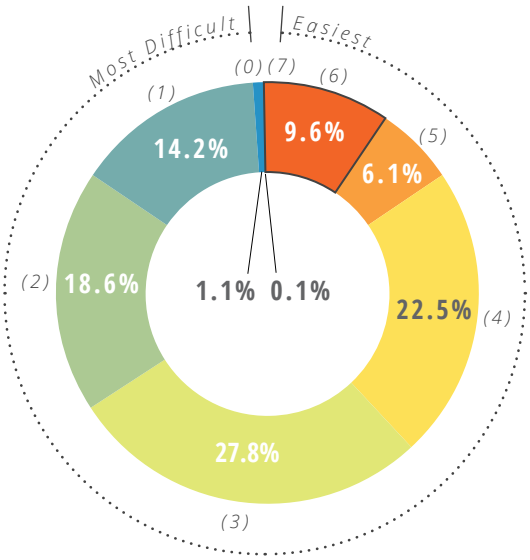


More detailed maps for each of the 7 districts/ neighborhoods are located in Appendix C.

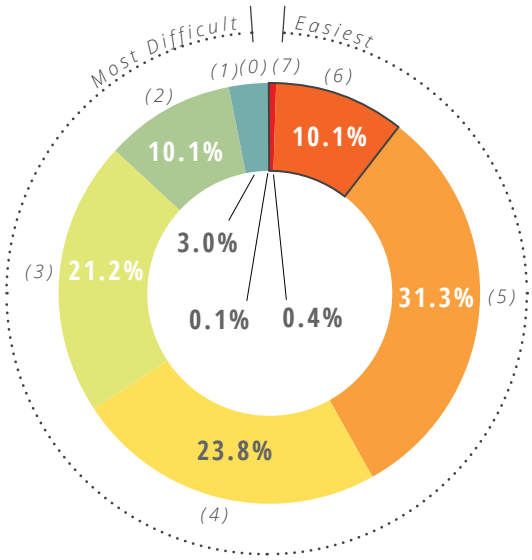
PARCEL & STREET OPPORTUNITIES

The pie charts below depict the breakdown of parcel and street opportunities by potential ease of implementation based on physical and non-physical factors. Using a scale from 0-7, 7 represents the easiest opportunities and 0 represents the more difficult opportunities.

PARCEL OPPORTUNITIES
EASE OF IMPLEMENTATION (% OF AREA)



STREET OPPORTUNITIES
EASE OF IMPLEMENTATION (% OF AREA)



WHAT ARE THE OPPORTUNITIES?

Out of 26,000+ parcel and street drainage areas, about 20 percent are considered among the easiest sites for implementing GSI.

20,150
parcel drainage areas

400 ac
of area potentially managed by easiest sites (6-7)

6,523
street drainage areas

680 ac
of area potentially managed by easiest streets (6-7)

Credit: Flickr // Center for Neighborhood Technology

COMMUNITY GREENING CONCEPTS

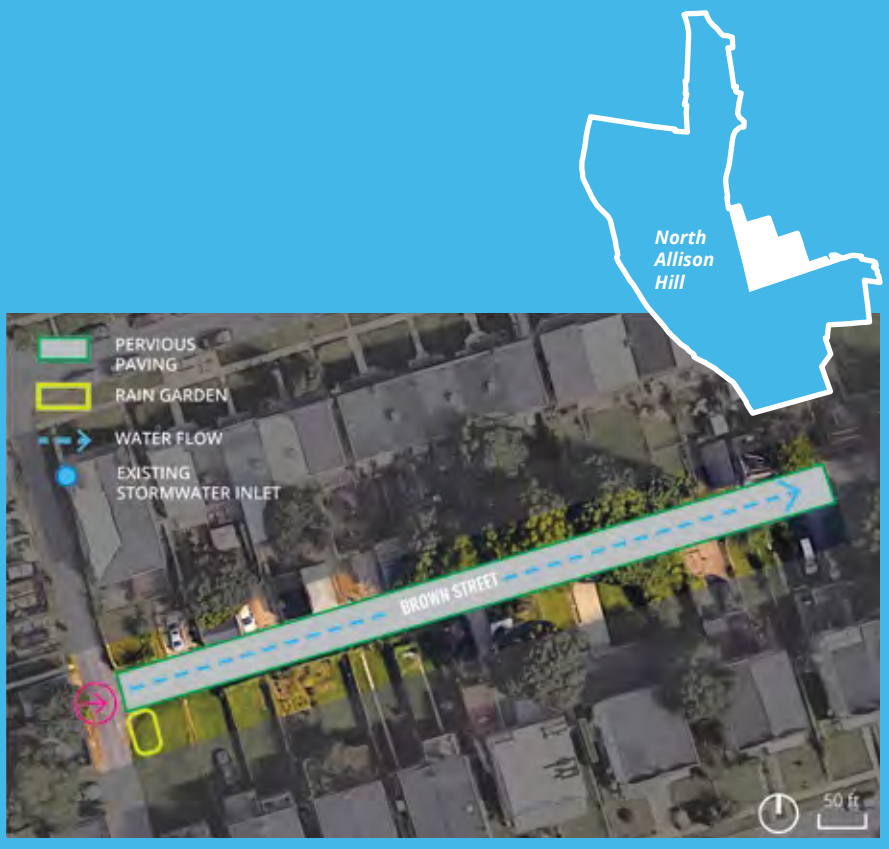
What might green stormwater infrastructure look like in Harrisburg? Using input from public meetings, where residents indicated where they wanted to see community greening investment in streets, parks, vacant lots, and schools, ten community greening concept categories were created. The ten categories — green alleys, green neighborhoods, green public spaces, green parks, green vacant lots, green community centers, green streets, green businesses, green schools, and green homes — represent many of the opportunities for community greening in Harrisburg.

The following sections illustrate these green stormwater strategies and how they may transform the neighborhoods, streets, and public spaces in Harrisburg.

Credit: WRT

Green Alleys

These often underutilized spaces are seen as a blight or nuisance in neighborhoods throughout the city. However, residential alleys, like the one depicted here, and commercial alleys can be transformed into inviting, usable public spaces with community greening and green stormwater infrastructure strategies.



^
A GREEN FENCE PROVIDES PRIVACY AND SCREENING

A green fence not only provides curb appeal and some stormwater management. It also provides an additional layer of privacy and can be used to screen trash cans and recycling bins.

THE CONCEPT

The community greening concept for alleys, illustrated here on Brown Street, combines a series of green stormwater infrastructure projects on private and publicly owned property to create an attractive, safe, and welcoming environment for residents. The alley still provides for vehicular passage, but community greening and stormwater management techniques enhance the space for pedestrians and bicyclists too.

The green alley concept above includes pervious pavement, a rain garden, a flow-through planter, and a green fence. Pervious paving manages stormwater from the alley itself. The rain garden manages runoff from one adjacent street and house. A flow-through planter manages runoff from another house.

Pervious paving works well in alleyways that are not subject to heavy traffic. Water seeps through the pervious pavers and into a subsurface storage system before evaporating or infiltrating into the ground. The rain garden, to the right of the alley, manages runoff from the roofs of adjacent houses. Aside from stormwater

<

RAIN GARDENS PROVIDE AN EDUCATIONAL TOOL

Rain gardens are great educational tools for teaching residents, including parents and children, about how green stormwater infrastructure works.

management benefits, the rain garden improves the aesthetics of the alley and provides a visible example of how green stormwater infrastructure works.

The green fence, located on the opposite corner, provides some stormwater capture with the use of troughs that capture rainfall. This technique can be used to screen trash cans and provide additional privacy for backyards.

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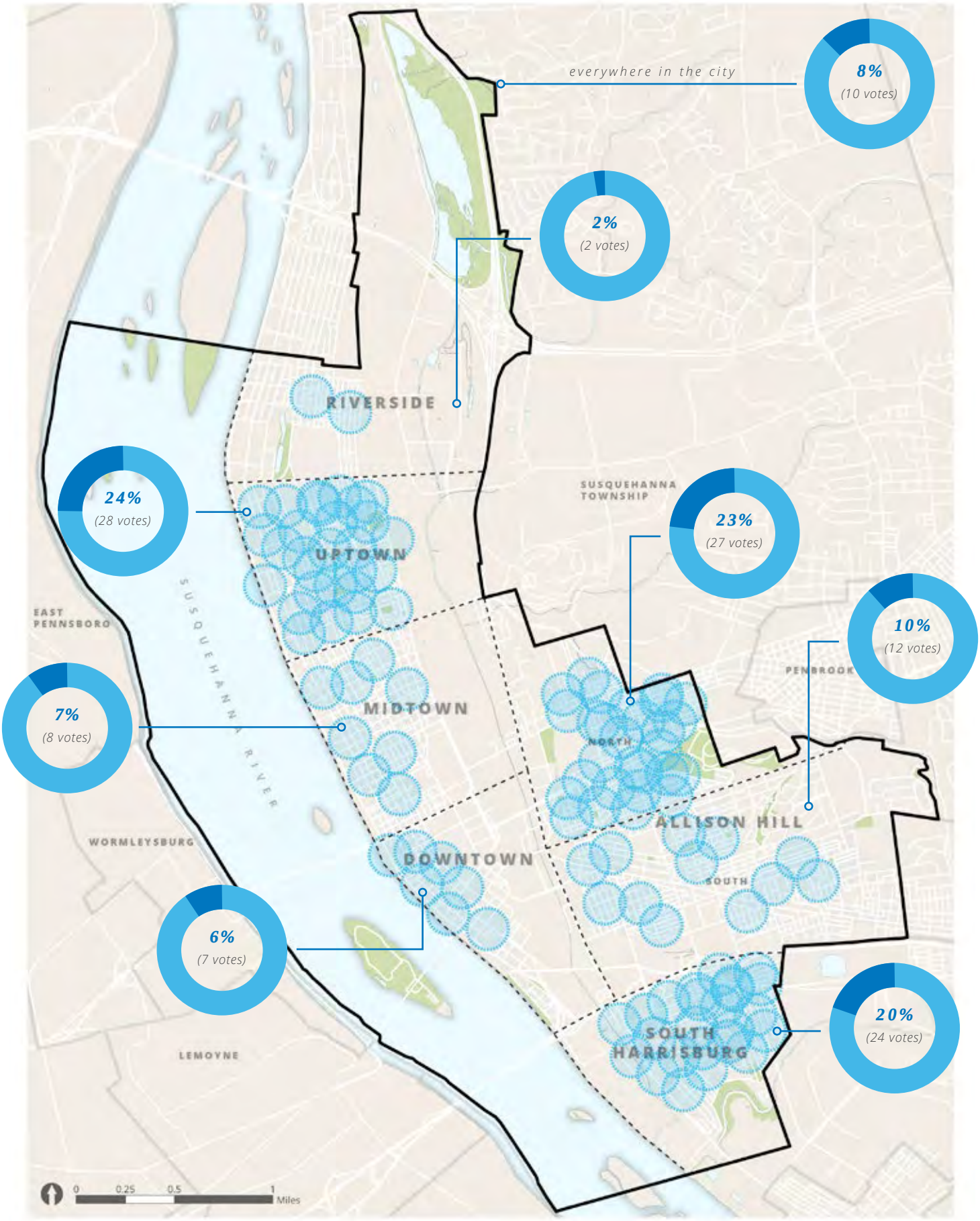
BEFORE IMAGE


everywhere in the city
8%
(10 votes)
2%
(2 votes)
RIVERSIDE
24%
(28 votes)
SUSQUEHANNA TOWNSHIP
23%
(27 votes)
UPTOWN
10%
(12 votes)
EAST PENNSBORO
PENBROOK
7%
(8 votes)
MIDTOWN
NORTH
SUSQUEHANNA RIVER
ALLISON HILL
WORMLEYSBURG
DOWNTOWN
SOUTH
6%
(7 votes)
20%
(24 votes)
SOUTH HARRISBURG
LEMOYNE
0
0.25
0.5
1
Miles

GREEN ALLEY OPPORTUNITIES

Residents attending the Community Greening Parties saw opportunities for green alley projects throughout the city. 67 percent of all participants felt that Uptown, North Allison Hill, and South Harrisburg were good candidates for green alley projects. Susquehanna Street, alleys off of Front Street in Uptown, Jefferson Street, and Green Street were all highlighted as specific opportunities for green alley projects. Sanford Street, the alley adjacent to Yellow Bird Cafe in midtown, was identified as a potential commercial green alley pilot project.

POTENTIAL PARTNERSHIPS

Potential partners for green alleys include:

- homeowners
- community organizations
- neighborhood associations
- business owners
- City of Harrisburg
- Department of Public Works

< UPTOWN, NORTH ALLISON HILL, AND SOUTH HARRISBURG WERE THE TOP 3 REQUESTED LOCATIONS FOR GREEN ALLEYS

67 percent of participants at the second round of public meetings wanted green alleys in the Uptown, North Allison Hill, and South Harrisburg neighborhoods.

Credit: WRT

Green Neighborhoods

Neighborhoods, including streets, homes, and small businesses are the building blocks of cities. Community greening and green stormwater infrastructure have the potential to revitalize neighborhoods and improve public health. Simple actions like planting street trees, installing flow-through planters, or creating rain gardens can dramatically transform the look of a neighborhood or block.

STORMWATER BUMPOUTS CALM TRAFFIC AND IMPROVE PEDESTRIAN SAFETY.

Stormwater bumpouts reduce the distance needed to cross the street and calm traffic, improving pedestrian safety.

THE CONCEPT

The green neighborhood concept, illustrated on the 2200 block of 4th Street, between Emerald Street and Woodbine Street, utilizes a series of green stormwater infrastructure strategies in the street right-of-way and on private properties. This block, located in Midtown, lacks consistent streetscaping and has few street trees. Strategies for the street right-of-way include stormwater tree trenches, stormwater bumpouts, and depaving. Strategies for private properties include rain gardens, flow-through planters, and rain barrels.

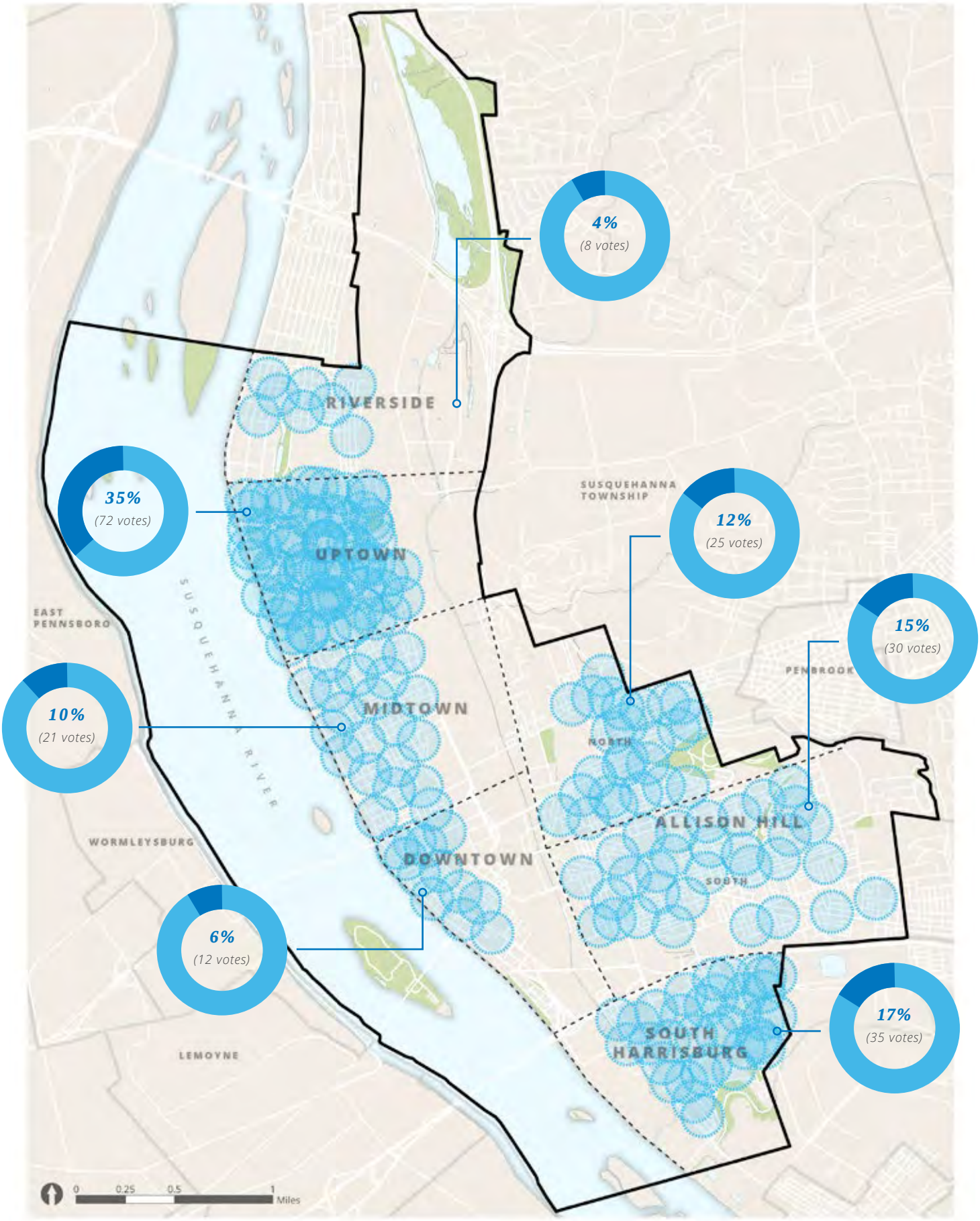
In this illustration, stormwater tree trenches line both sides of 4th Street. These trenches not only manage stormwater runoff from the street with an underground system of stone storage, but also increase tree canopy, which provides shade, reduces the heat island effect, and improves air quality. Stormwater bumpouts located midblock and at both corners manage stormwater from the street right-of-way, beautify the street, and improve pedestrian safety by reducing the distance required to cross the street. Finally, depaving of a portion of the western sidewalk reduces the amount of impervious surface, improves curb appeal, and creates

a more welcoming pedestrian environment. A small rain garden, flow-through planter, and rain barrel manage stormwater runoff from roofs on the eastern side of the street.

^
BEFORE IMAGE

<
STREET TREES PROVIDE SHADE AND IMPROVE AIR QUALITY

Street trees, stormwater tree trenches, stormwater bumpouts, and depaving reduce impervious surfaces, filter and manage stormwater runoff, and beautify the block.


4%
(8 votes)
RIVERSIDE
35%
(72 votes)
SUSQUEHANNA TOWNSHIP
12%
(25 votes)
UPTOWN
EAST PENNSBORO
15%
(30 votes)
PENBROOK
10%
(21 votes)
MIDTOWN
SUSQUEHANNA RIVER
NORTH
ALLISON HILL
WORMLEYSBURG
DOWNTOWN
SOUTH
6%
(12 votes)
17%
(35 votes)
SOUTH HARRISBURG
LEMOYNE
0
0.25
0.5
1
Miles

GREEN NEIGHBORHOOD OPPORTUNITIES

Residents attending the Community Greening Parties identified other neighborhoods in the city that are opportunities for green neighborhoods. While 50 percent of participants identified the Uptown and South Allison Hill neighborhoods, all of the neighborhoods were identified as opportunities to be green neighborhoods.

POTENTIAL PARTNERSHIPS

Potential partners for green neighborhoods include:

- homeowners
- community organizations
- neighborhood associations
- business owners
- City of Harrisburg
- Department of Public Works
- Capital Area Transit (CAT)

< UPTOWN AND SOUTH ALLISON HILL WERE THE TOP 2 REQUESTED LOCATIONS FOR GREEN NEIGHBORHOODS

50 percent of participants at the second round of public meetings wanted green strategies to be employed in the Uptown and South Allison Hill neighborhoods.

Credit: WRT

Green Public Spaces

Public spaces like plazas and markets should be memorable. They are the gathering spaces and landmarks that help shape an impression of a city for visitors and residents alike. Harrisburg has a great tradition rooted in the City Beautiful Movement that envisions the "City as a Park." However, many of the city's public spaces do not embody this ideal. By employing community greening and green stormwater management techniques, these public spaces can be transformed into more sustainable, thriving places for people to enjoy.

^
SIMPLE IMPROVEMENTS MAKE A BIG DIFFERENCE

Planting trees and depaving portions of the plaza transforms the space into a vibrant, colorful public space.

THE CONCEPT

The green public spaces concept is illustrated here at Broad Street Market, one of the oldest continuously operating farmers markets in the country and one of the most beloved public spaces in Harrisburg. The community greening concept focuses on managing stormwater through underground infiltration/ storage, stormwater planters, tree trenches, and depaving. A majority of the green stormwater infrastructure is focused on the central plaza between the two market buildings since stormwater from adjacent streets naturally flows toward that portion of the site. Since the plaza is used for outdoor markets and gathering, the surface footprint of GSI is minimal to maximize circulation, seating, vendor spaces, and gathering areas.

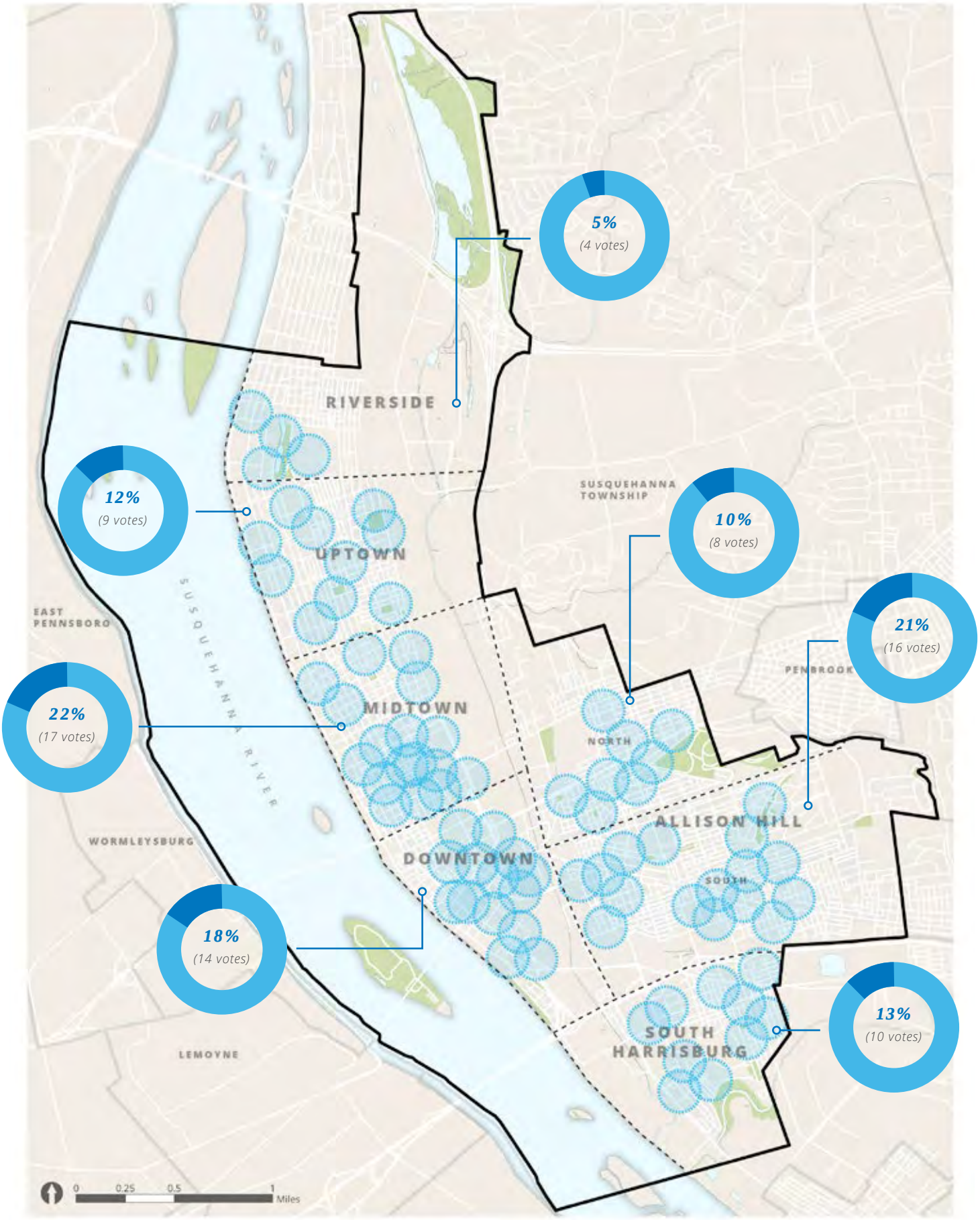
In this concept, the central plaza contains a stormwater tree trench. The tree pits, planted with native, or adaptive vegetation are connected to a larger underground infiltration/storage area that collects and stores stormwater. The trees provide shade for the plaza, reduce the heat island effect, and improve air quality while managing runoff from the plaza. Additional runoff may be piped

< ACTIVE, VIBRANT PUBLIC SPACES

Shade trees and vegetation reduce impervious surfaces and provide a more comfortable environment for gathering.

into the underground infiltration/ storage area from adjacent streets. Stormwater planters are located at the edges of the plaza and provide additional management for runoff from impervious surfaces. The planters are populated with native, or adaptive, water-tolerant vegetation improving the aesthetics of the plaza and reducing stormwater volume through evapotranspiration. Depaving a portion of the gravel area adjacent to the street reduces impervious surfaces, provides a space for additional plantings and street trees, and creates a buffer between pedestrians and vehicular traffic.

^ BEFORE IMAGE


5%
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RIVERSIDE
12%
(9 votes)
SUSQUEHANNA TOWNSHIP
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UPTOWN
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(16 votes)
EAST PENNSBORO
PENBROOK
22%
(17 votes)
MIDTOWN
NORTH
SUSQUEHANNA RIVER
ALLISON HILL
WORMLEYSBURG
DOWNTOWN
SOUTH
18%
(14 votes)
13%
(10 votes)
SOUTH HARRISBURG
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GREEN PUBLIC SPACE OPPORTUNITIES

Residents attending the Community Greening Parties identified other areas of the city that might benefit from green public spaces. 22 percent recommended spaces in Midtown, 21 percent recommended spaces in South Allison Hill, and 18 percent recommended spaces in Downtown. Specific public spaces that were identified as opportunities include Italian Lake, the State Capitol Complex, and Market Square.

POTENTIAL PARTNERSHIPS

Potential partners for green public spaces include:

- community organizations
- neighborhood associations
- business owners
- City of Harrisburg
- Broad Street Market Corporation
- Downtown Improvement District
- Harrisburg Redevelopment Authority
- Harrisburg Young Professionals
- Capital Area Transit (CAT)
- the Commonwealth
- Department of General Services (DGS)
- U.S. Green Building Council

< MIDTOWN, SOUTH ALLISON HILL, AND DOWNTOWN WERE THE TOP 3 REQUESTED LOCATIONS FOR GREEN PUBLIC SPACES

Over 60 percent of participants at the second round of public meetings wanted green strategies to be employed at public spaces in Midtown, South Allison Hill, and Downtown.

Credit: WRT

Green Parks

Parks provide great opportunities for green stormwater infrastructure. They are publicly owned, often have the space needed for GSI, and are highly visible sites. Parks range in scale from small neighborhood parks and playgrounds, like 4th and Dauphin, to large city-wide parks, like Reservoir Park. GSI can be replicated and tailored to fit a variety of environments and scales.

PERVIOUS BASKETBALL COURT

A new pervious basketball court not only provides a new surface for playing, but also manages stormwater that falls on the court and has additional underground storage to manage overflow from the rain garden, street planters, and swale.

THE CONCEPT

The green parks concept is illustrated here at 4th and Dauphin Park, a small, neighborhood park located in Midtown across from the Pennsylvania National Fire Museum. The green parks concept focuses on managing stormwater runoff from impervious surfaces within the park and on the adjacent street drainage areas. This park, along with four other parks in the city, received funding for improvements from the state Department of Community and Economic Development and the state Department of Conservation and Natural Resources (DCNR). The proposed GSI strategies include a bioswale that connects two rain gardens at either end of the park, pervious paving, and a porous basketball court with subsurface storage.

In this illustration, a rain garden behind the play equipment captures runoff from the street right-of-way and the small parking lot. Overflow from the rain garden would then travel down a bioswale that follows the curve of a pedestrian path. The rain garden, in the foreground, collects stormwater from the street right-of-way as well as overflow from the connected bioswale. Pervious paving along the sidewalk replaces existing asphalt, reducing the amount of impervious surface. New street

trees planted in the sidewalk/plaza provide shade for the basketball court and seating area. The porous basketball court manages surface runoff and the subsurface storage contains storage space for overflow from the rain gardens and swale.

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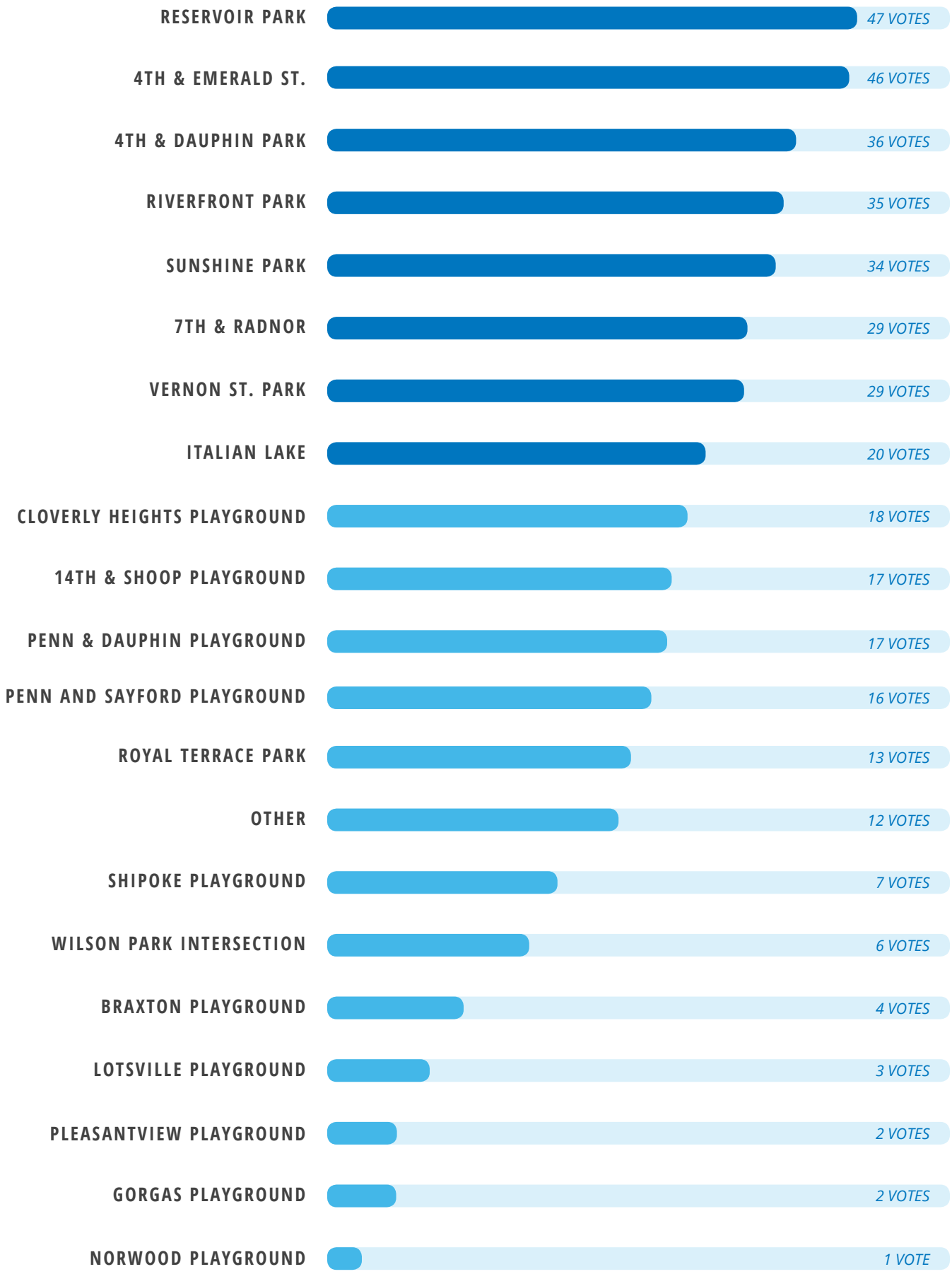
BEFORE IMAGE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SUNSHINE PARK
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7TH & RADNOR
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VERNON ST. PARK
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ITALIAN LAKE
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CLOVERLY HEIGHTS PLAYGROUND
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14TH & SHOOP PLAYGROUND
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PENN & DAUPHIN PLAYGROUND
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PENN AND SAYFORD PLAYGROUND
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ROYAL TERRACE PARK
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SHIPOKE PLAYGROUND
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BRAXTON PLAYGROUND
4 VOTES
LOTSVILLE PLAYGROUND
3 VOTES
PLEASANTVIEW PLAYGROUND
2 VOTES
GORGAS PLAYGROUND
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NORWOOD PLAYGROUND
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GREEN PARK OPPORTUNITIES

Residents attending the Community Greening Parties identified other parks in the city that might benefit from community greening strategies. Reservoir Park, 4th and Emerald Street Park, 4th and Dauphin Park, and Riverfront Park received the most votes. Reservoir Park and Riverfront Park are large scale parks from the original 1902 City Beautiful Plan while 4th and Emerald Street Park and 4th and Dauphin Park are smaller, neighborhood-scale parks. Green stormwater strategies, including rain gardens, swales, pervious paving, and tree trenches shown in the concept for 4th and Dauphin could be applied to both larger scale city parks and smaller scale neighborhood parks.

< RESERVOIR PARK, 4TH & EMERALD STREET PARK, AND 4TH AND DAUPHIN PARK WERE THE TOP 3 REQUESTED LOCATIONS FOR GREEN PARKS

33 percent of participants at the second round of public meetings wanted green strategies to be employed in Reservoir Park, 4th and Emerald Street Park, and 4th and Dauphin Park.

POTENTIAL PARTNERSHIPS

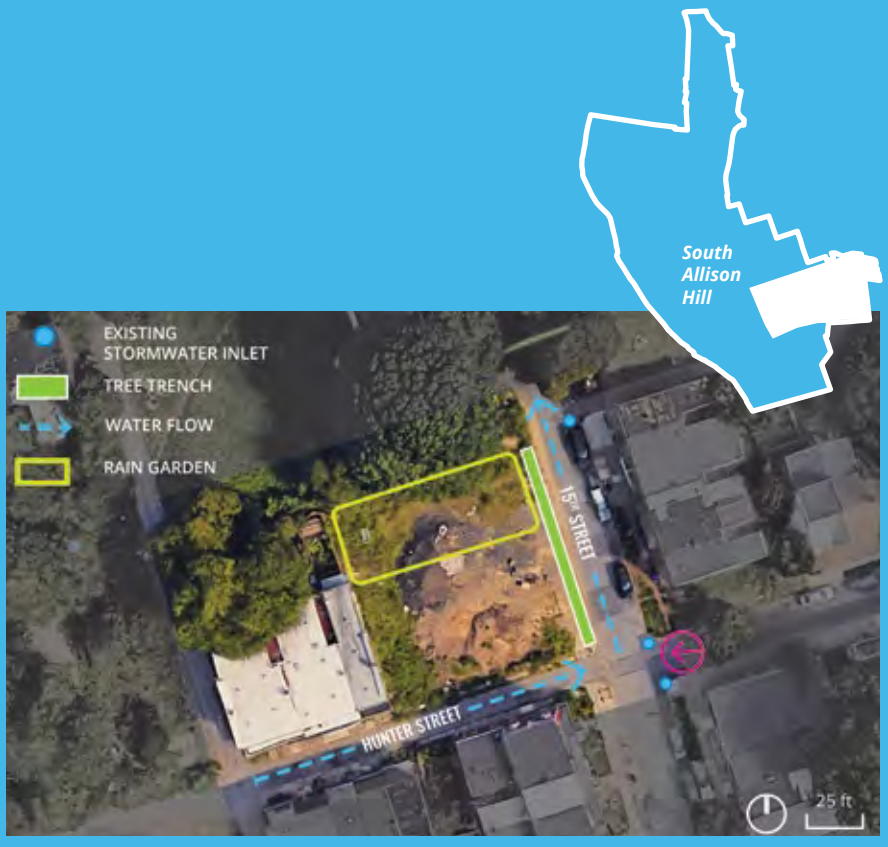
Potential partners for green parks spaces include:

- community organizations
- neighborhood associations
- City of Harrisburg
- Harrisburg Redevelopment Authority
- Harrisburg Young Professionals
- Capital Area Transit (CAT)
- U.S. Green Building Council
- PA Department of Conservation and Natural Resources
- PA Department of Community and Economic Development
- City Beautiful 2.0

Credit: WRT

Green Vacant Lots

Vacant lots, especially publicly owned vacant lots, can be put to productive use through redevelopment or community greening. Seven percent of all land in Harrisburg is vacant. Not all of these lots are suitable for redevelopment. Depending on the context, these lots can be used for stormwater management or as open space, community gardens, community gathering spaces, or playgrounds with elements of green stormwater infrastructure.



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COMMUNITY GARDENS + GSI

Community gardens and GSI are a perfect match for reutilizing vacant lots. They are both community-centered uses that engage and require buy-in from surrounding residents.

THE CONCEPT

The community greening concept for green vacant lots, illustrated at the corner of 15th Street and Hunter Street, employs a combination of green stormwater strategies and vacant lot reuse strategies to revitalize a blighting influence in the community. The illustration shows a large community garden and plaza with a rain garden and tree trench to manage stormwater from the adjacent street and sidewalk. This concept transforms an empty space into a productive and safe community-centered use.

The community garden provides a gathering space for residents, while the plaza anchors the corner frontage along 15th Street and Hunter Street. The rain garden, located behind the community garden, reduces and filters runoff from adjacent streets while beautifying the lot. A tree trench with stormwater planters, running parallel to the street, manages street runoff. The trees and natural vegetation provide shade, reduce the heat island effect, enhance the environment, and improve pedestrian safety by providing a buffer between pedestrians and vehicular traffic.

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EDUCATIONAL SIGNAGE

Educational signage explains how rain gardens function. They are great educational tools and help improve the visibility of green stormwater infrastructure projects.

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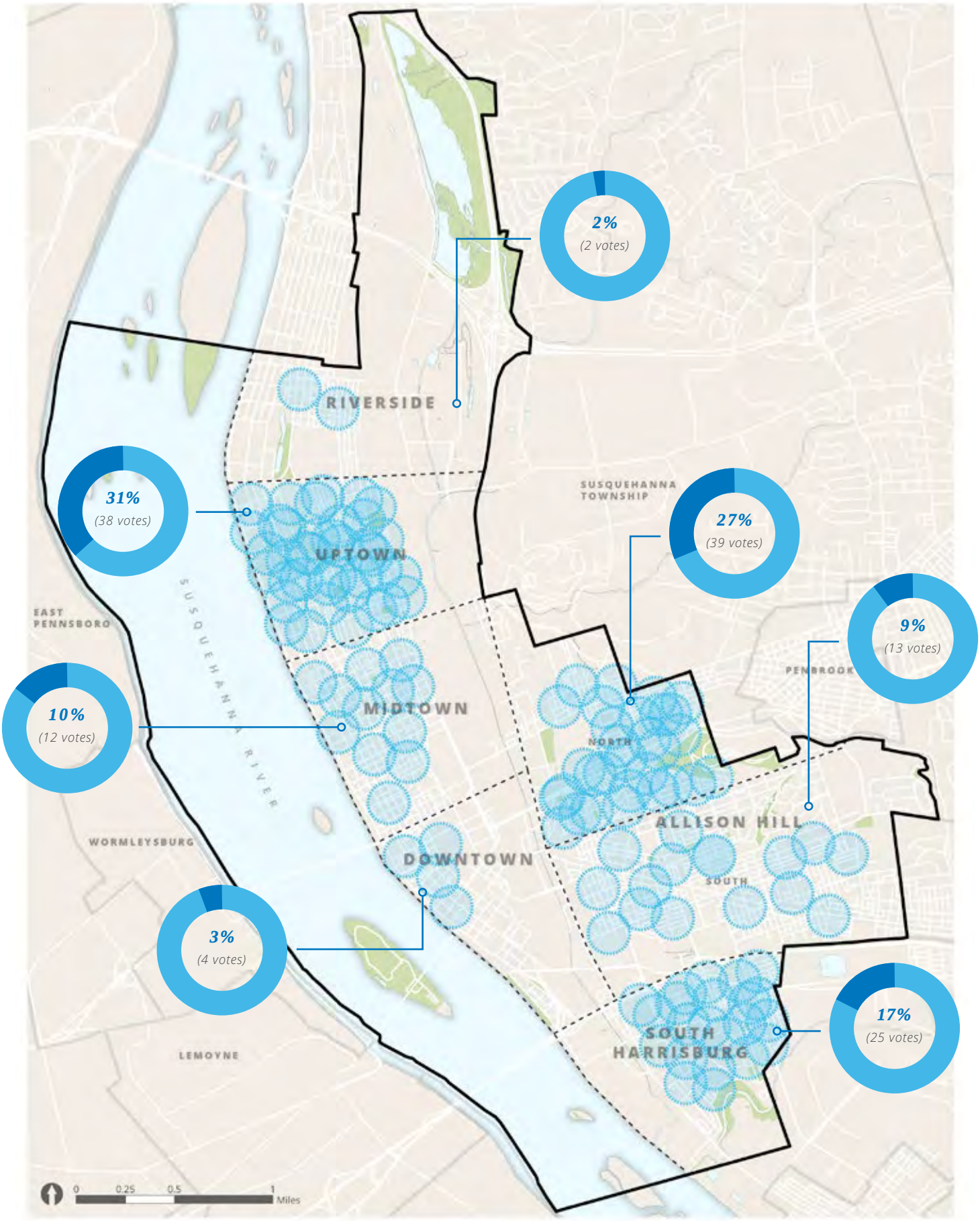
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GREEN VACANT LOT OPPORTUNITIES

Residents attending the Community Greening Parties identified other areas in the city with vacant lots that might benefit from community greening strategies. Uptown received 31 percent of the votes, with North Allison Hill receiving 27 percent of the votes. Some key vacant lots that were recommended as potential projects included those adjacent to the Broad Street Market and a series of vacant lots on 13th Street near the intersections of Hanover Street, Magnolia Street, and Vernon Street.

< UPTOWN AND NORTH ALLISON HILL WERE THE TOP 2 REQUESTED LOCATIONS FOR GREEN VACANT LOTS

More than 50 percent of participants at the second round of public meetings wanted green strategies to be employed on vacant lots in the Uptown and North Allison Hill neighborhoods.

POTENTIAL PARTNERSHIPS

Potential partners for green vacant lots include:

- community organizations
- neighborhood associations
- City of Harrisburg
- Harrisburg Redevelopment Authority
- Harrisburg Young Professionals
- PA Department of Conservation and Natural Resources
- Department of Public Works

"By taking abandoned lots and transforming them, it can bring a sense of pride back to the neighborhood" – Westburn Majors

Credit: WRT

Green Community Centers

Community centers are places where communities gather for social, recreational, or educational activities. This can include recreation centers like YMCAs, neighborhood meeting spaces, or churches. These spaces provide an opportunity to use GSI as an educational or demonstration tool and garner community support.

TREES PROVIDE SHADE FOR THE STREET, SIDEWALK, AND PLAYING FIELD

New street trees along Jefferson Street provide much needed shade for the street, sidewalk, and YMCA playing field.

THE CONCEPT

The concept for green community centers, illustrated at the Camp Curtin YMCA, manages stormwater and beautifies the site without impeding the functionality of the community center. Depaving, a linear rain garden with underground storage, a tree trench, and a green wall manage stormwater in a visible way.

In this illustration, the asphalt area under the picnic area is removed and planted with trees and grass to reduce impervious surfaces, increase shade, and provide a more pleasant space for gathering. The linear rain garden that runs along the edge of the parking lot manages stormwater runoff from the parking lot without encroaching on the playing field. The garden provides an attractive buffer of native, or adaptive planting between the parking lot and the playing field. New street trees provide shade for the street, sidewalk, and the adjacent playing field. A large subsurface storage area under the rain garden and play field provides storage space for additional stormwater runoff from adjacent streets. Finally, the green stormwater wall on the eastern facade of the building manages runoff from its roof. This feature not only manages stormwater, but also improves the aesthetics of the building and site.

"We are big on the environment at the YMCA because the environment is what you see when you go outside. It grows the hope inside of you."

– Jamien Harvey

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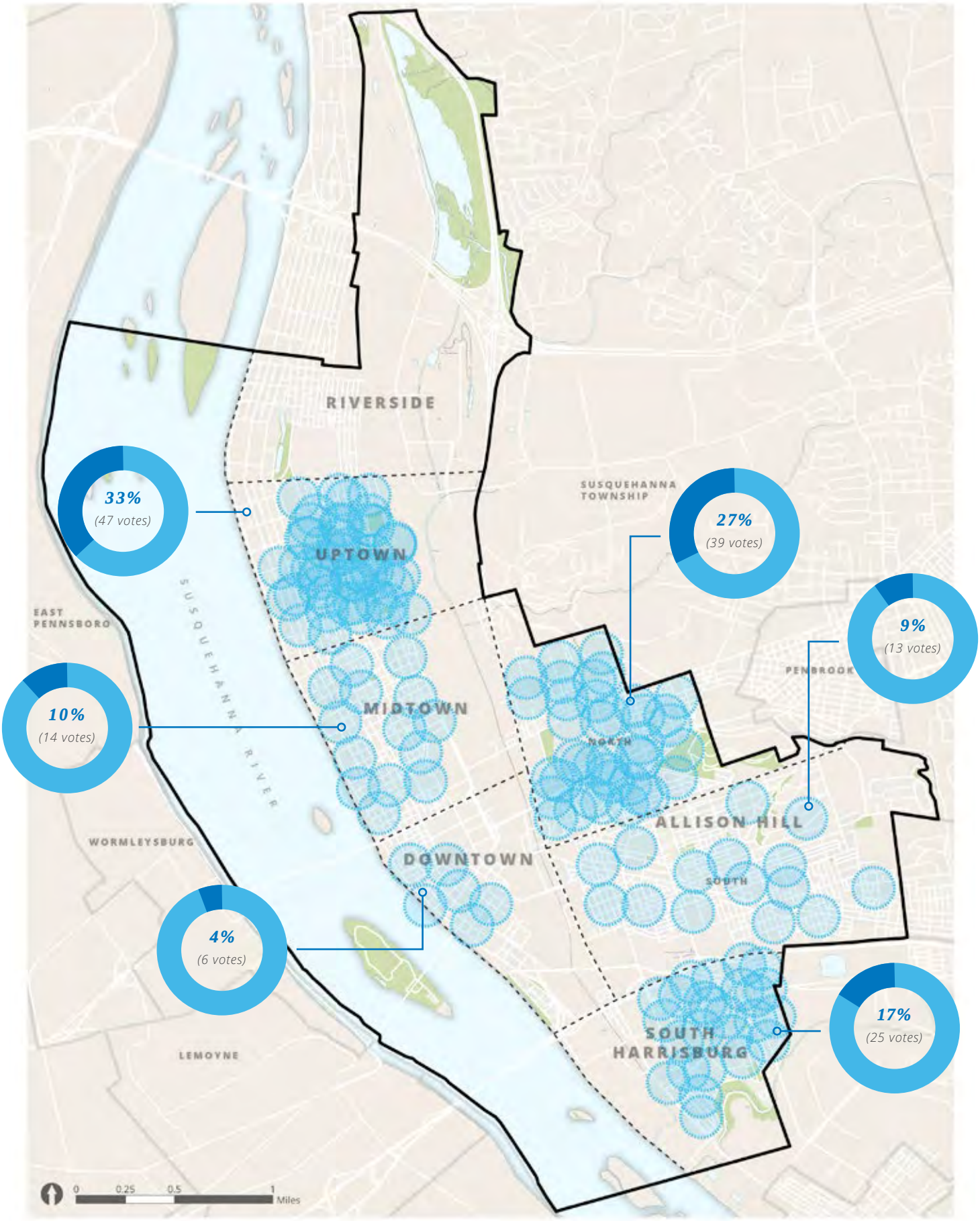
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GREEN COMMUNITY CENTER OPPORTUNITIES

Residents attending the Community Greening Parties identified other areas in the city with community centers that might benefit from community greening. Uptown received 33 percent of the votes, with North Allison Hill receiving 27 percent of the votes. South Harrisburg received 17 percent of the votes. Recommendations for potential green community center projects included the Boys and Girls Club, Mission Youth Center, Downtown YMCA, and the Neighborhood Center.

POTENTIAL PARTNERSHIPS

Potential partners for green community centers include:

- community organizations
- neighborhood associations
- City of Harrisburg
- Harrisburg Redevelopment Authority
- churches
- community centers
- Camp Curtin YMCA
- Boys and Girls Club

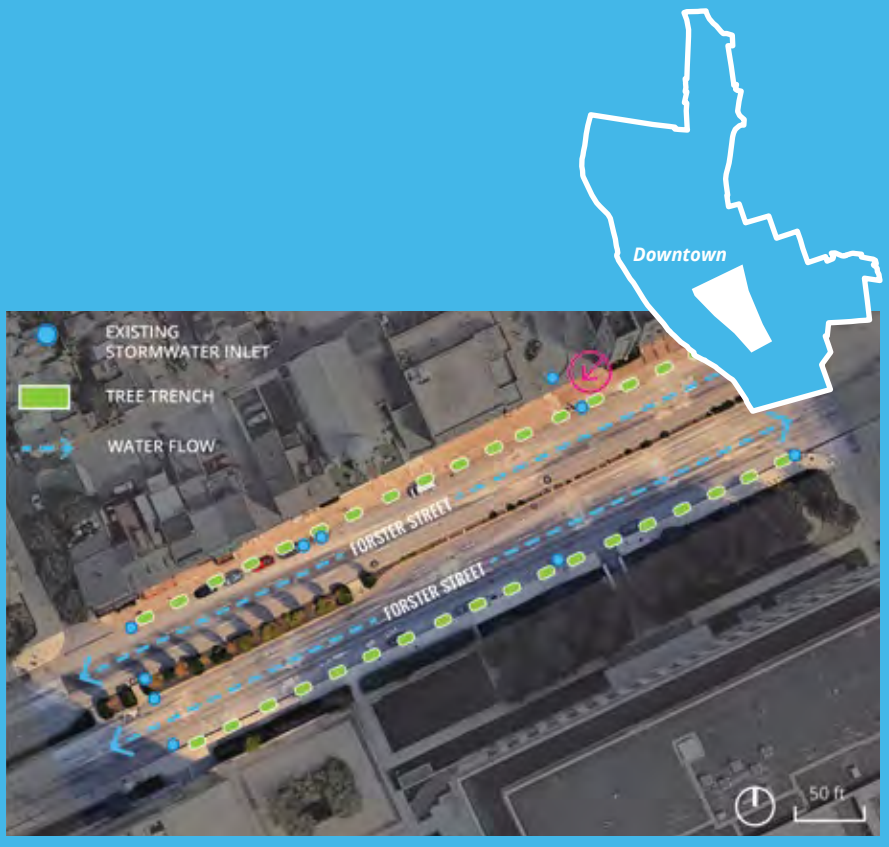
< UPTOWN AND NORTH ALLISON HILL WERE THE TOP 2 REQUESTED LOCATIONS FOR GREEN COMMUNITY CENTERS

60 percent of participants at the second round of public meetings wanted green strategies to be employed in the Uptown and North Allison Hill neighborhoods.

Credit: WRT

Green Streets

Streets are mostly impervious and make up a significant portion of the city's area, are visible, publicly owned, and can beautify and enhance the pedestrian environment and public realm.



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MEDIAN GREENING IMPROVES THE STREETSCAPE

Replanting the median with native, or adaptive vegetation adds to the streetscape transformation.

THE CONCEPT

The community greening concept for green streets, illustrated here along a segment of Forster Street between 6th Street and Capital Street, does not alter the functioning of the street itself. Tree planters line both sides of the street to manage runoff from the street and sidewalk, while a planted median improves the overall streetscape.

The tree planters provide space for street trees and native, or adaptive plantings without removing parallel parking spaces or significantly reducing the width of the sidewalk. The small planters take a small amount of space from the parking lane and the sidewalk, allowing both to function as normal. New street trees in each planter provide much needed shade, reduce the heat island effect, and improve air quality. The native plantings in each planter help to filter and absorb stormwater before it reaches a subsurface storage system. The center median, while not performing a stormwater function, works with the tree planters to enhance the overall streetscape and improve the pedestrian environment.

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AN ACTIVE, ENJOYABLE PUBLIC REALM

Stormwater tree planters provide shade and greenery, which contributes to a more active and enjoyable public realm.

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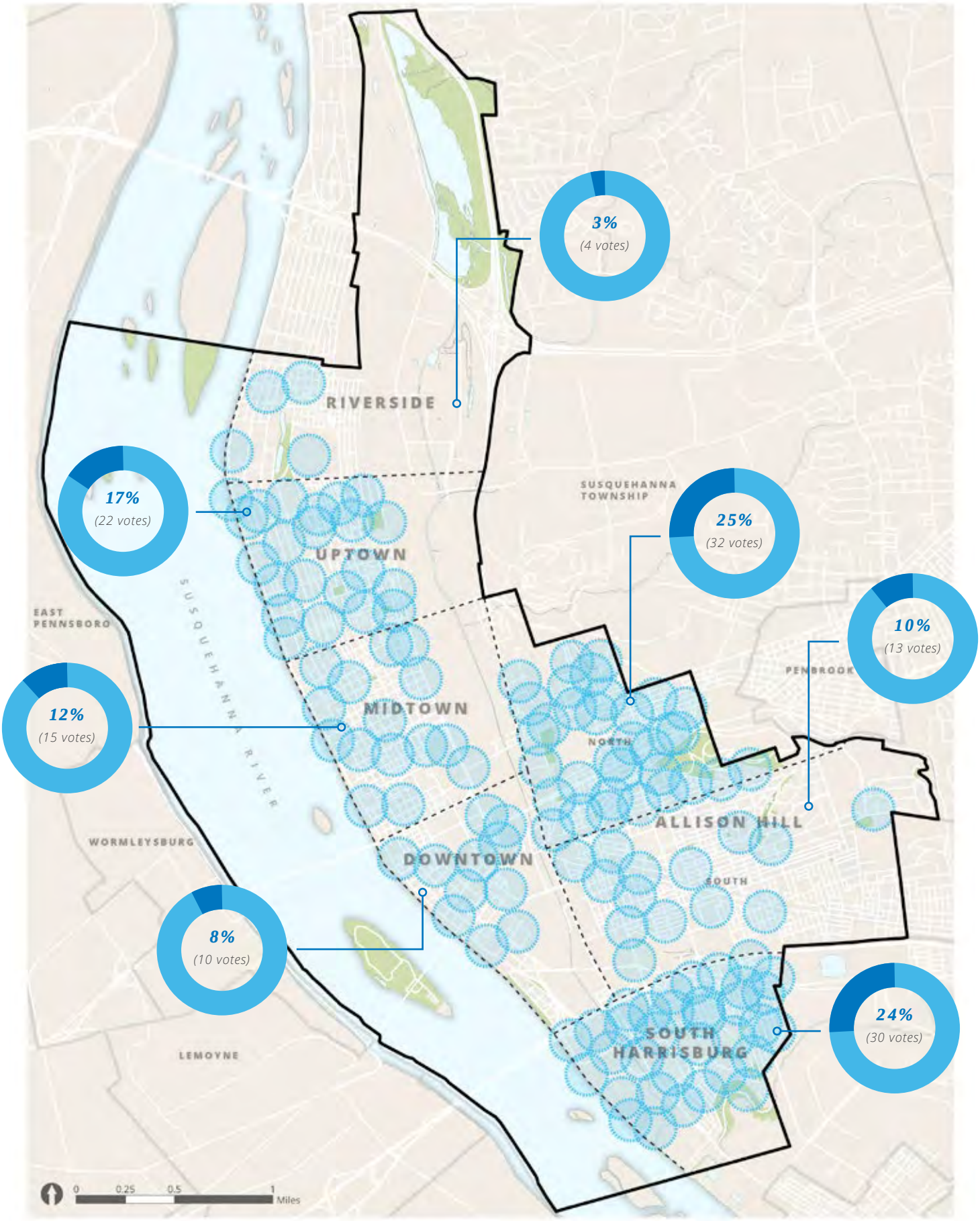
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GREEN STREET OPPORTUNITIES

Residents attending the Community Greening Parties identified other areas with streets that might benefit from community greening strategies. South Harrisburg and North Allison Hill each received about a quarter of the votes. Recommendations for potential green streets included many of the city's main thoroughfares — 3rd Street, 6th Street, Forster Street, 7th Street, and Derry Street as well as a few smaller, neighborhood streets.

POTENTIAL PARTNERSHIPS

Potential partners for green streets include:

- community organizations
- neighborhood associations
- City of Harrisburg
- Harrisburg Redevelopment Authority
- Harrisburg Young Professionals
- PennDOT
- Department of Public Works

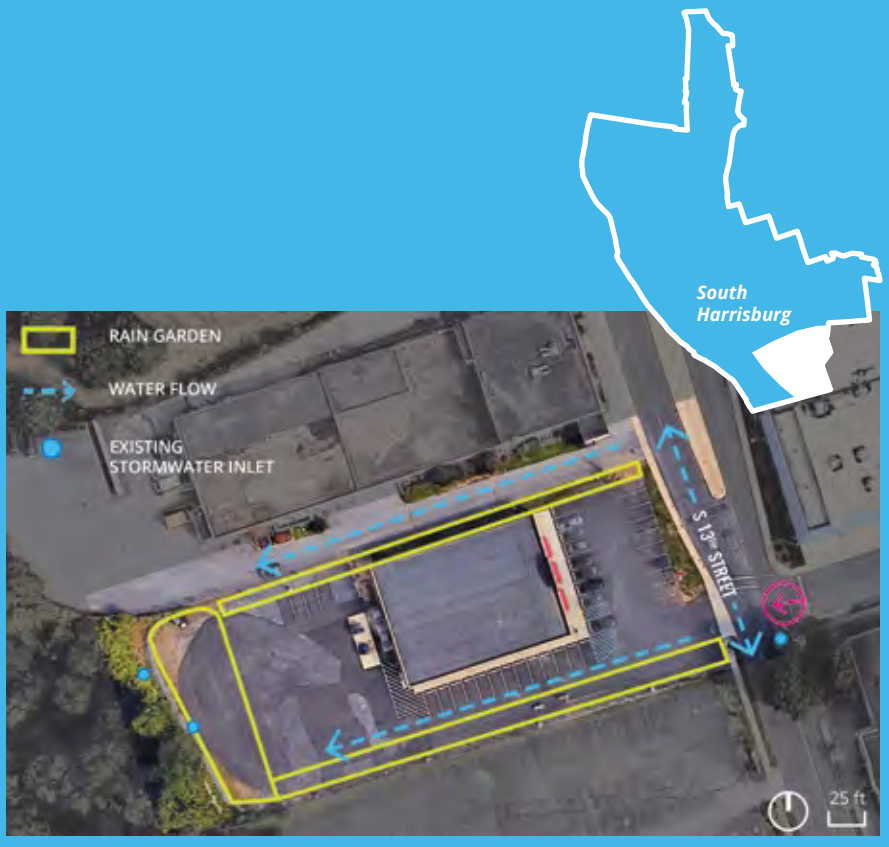
< NORTH ALLISON HILL AND SOUTH HARRISBURG WERE THE TOP 2 REQUESTED LOCATIONS FOR GREEN STREETS

Almost 50 percent of participants at the second round of public meetings wanted green streets strategies to be employed in North Allison Hill and South Harrisburg.

Credit: WRT

Green Businesses

Business sites represent significant potential given that they are, on average, 80 percent impervious. Green stormwater infrastructure projects on commercial properties – specifically greening parking lots, can manage stormwater in a visible way without affecting business operations in any significant way.



UNDERUTILIZED IMPERVIOUS SURFACES

In this concept, underutilized impervious parking surfaces are depaved and utilized for green stormwater management.

THE CONCEPT

The green business concept, illustrated at the Family Dollar on S. 13th Street, showcases green stormwater infrastructure retrofits and community greening techniques that businesses across the city can use. Techniques include rain gardens, depaving, and installation of street trees and native, or adaptive landscaping.

In this concept, underutilized paved areas are turned into rain gardens that manage stormwater runoff from the parking lot and adjacent street rights-of-way. These rain gardens not only manage stormwater, but also enhance the curb appeal of the business's property. Depaving portions of the parking lot and planting trees reduces the amount of impervious surfaces and provides much needed shade. New street trees and native, or adaptive plantings along the street provide shade, reduces the heat island effect, and improve air quality while enhancing the streetscape.

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BEFORE IMAGE

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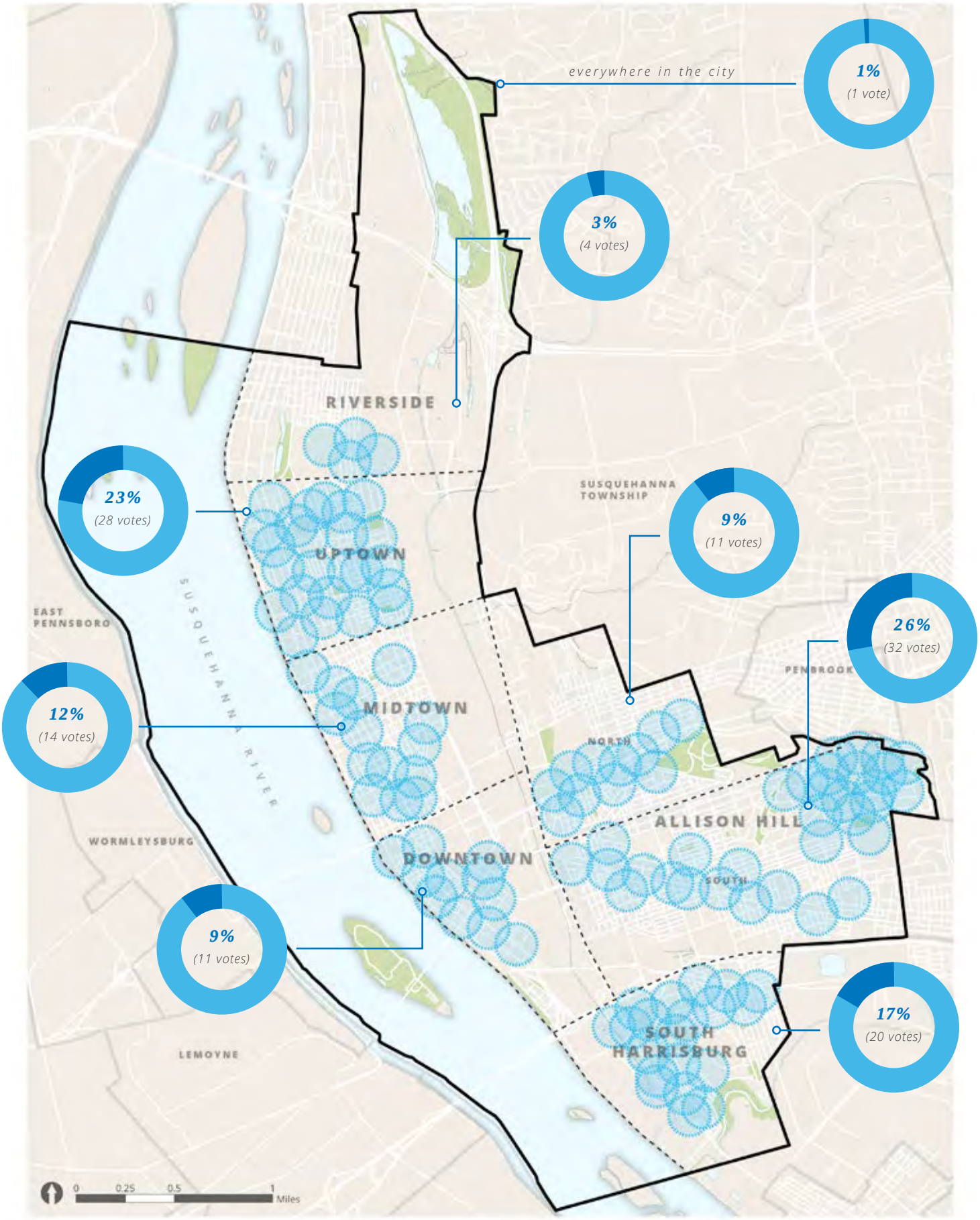
ENHANCING CURB APPEAL

Simple community greening strategies like planting ornamental trees and native, or adaptive vegetation can increase the curb appeal of a business without a great deal of investment.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GREEN BUSINESS OPPORTUNITIES

Residents attending the Community Greening Parties identified other areas with businesses that might benefit from community greening strategies. South Allison Hill received 26 percent of the votes and Uptown received 23 percent of the votes. This correlates with opportunities identified through the land use and stormwater potential analyses, including Kline Plaza, located in South Allison Hill, and Uptown Plaza, located in Uptown. Both of these businesses are large-scale, big box shopping centers surrounded by vast amounts of parking. Strategies similar to those employed in the community greening concept for green businesses could be used to reduce the amount of impervious surfaces, provide stormwater management, and improve the overall aesthetics of the shopping centers.

< SOUTH ALLISON HILL AND UPTOWN WERE THE TOP 2 REQUESTED LOCATIONS FOR GREEN BUSINESSES

Almost 50 percent of participants at the second round of public meetings wanted green strategies to be employed at businesses in South Allison Hill and Uptown.

POTENTIAL PARTNERSHIPS

Potential partners for green businesses include:

- community organizations
- neighborhood associations
- businesses
- City of Harrisburg
- Harrisburg Redevelopment Authority
- Harrisburg Chamber of Commerce

Credit: WRT

Green Schools

Schools are prime locations for demonstrating green stormwater infrastructure strategies. When green stormwater infrastructure projects are planned at schools there is an opportunity to create a curriculum that overlaps and teaches students about the importance of clean water, the threat of stormwater and pollution, and how green stormwater infrastructure can manage runoff and provide additional benefits to communities. Students can be involved in constructing or planting all or part of the green stormwater infrastructure project.

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STORMWATER PLANTERS IMPROVE STREETSCAPE

Stormwater planters, populated with native, or adaptive, water-tolerant plants improve the streetscape and provide a buffer between students and vehicular traffic.

The community greening concept for schools is illustrated here at the Rowland School, located at 19th and Derry in South Allison Hill. The concept demonstrates how green stormwater infrastructure and community greening techniques provide green amenities and improve the overall aesthetics of the campus. GSI strategies include stormwater planters, rain gardens, stormwater tree trenches, green roofs, depaving, and a green wall.

Stormwater planters line the street. These planters manage street runoff and provide space for native, or adaptive planting and street trees. Rain gardens are located at the corner of 19th and Derry and 18th and Swatara. Rain gardens at intersections manage additional street runoff. A stormwater tree trench along the existing sidewalk behind the school manages runoff from a portion of the street and provides space for new street trees. Green roofs are used on the flat roofs and are visible from the ground. Excess paving is removed where it does not impede pedestrian traffic. Finally, a green stormwater wall, manages a portion of the roof runoff.

<

A STORMWATER GREEN WALL

The stormwater green wall includes a series of small troughs that treat stormwater by allowing water to infiltrate through each trough until it reaches a planter at the base of the system.

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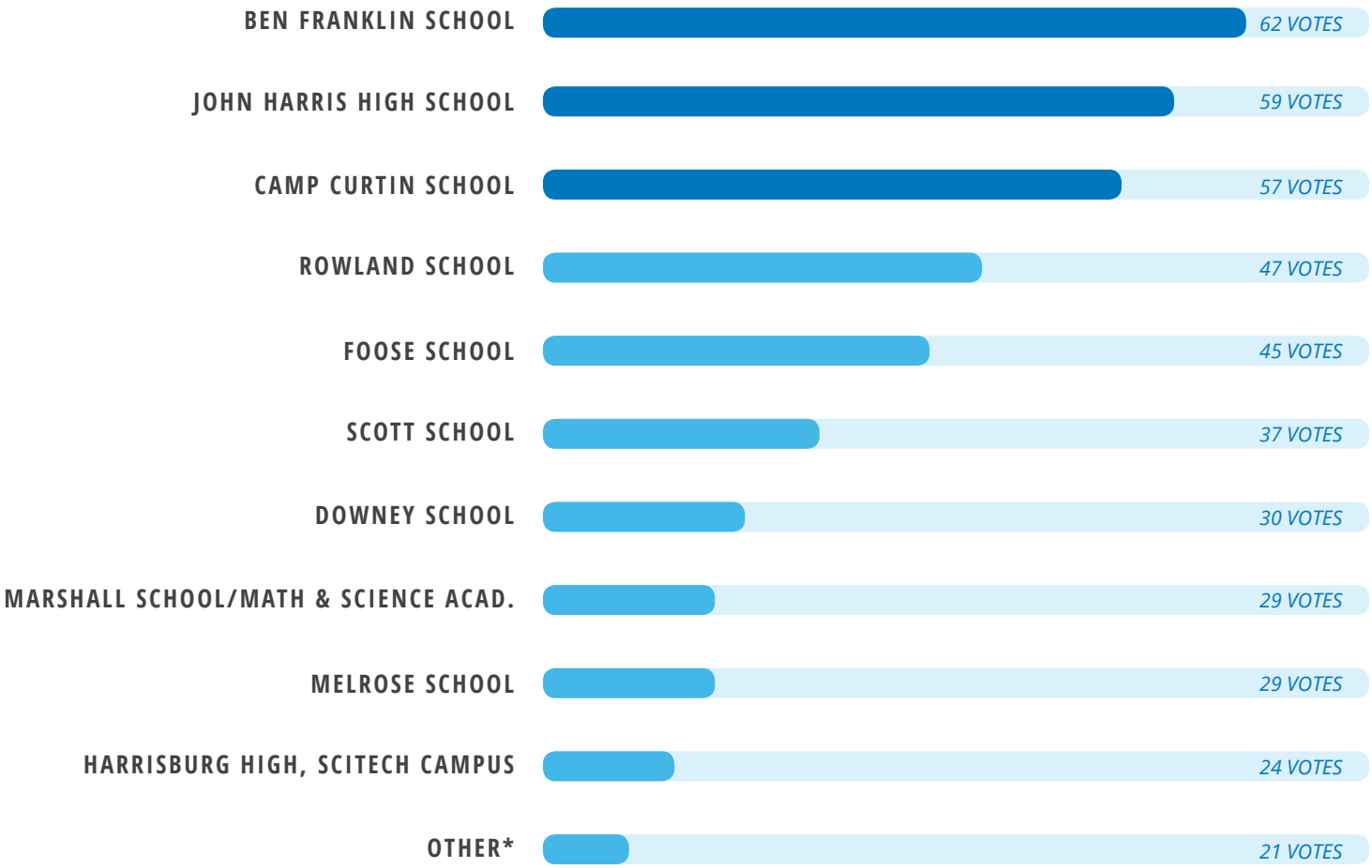

**Other included Premier Art & Sciences and unspecified private institutions.*

ADDITIONAL OPPORTUNITIES

Residents attending the Community Greening Parties identified other schools that might benefit from community greening strategies. Residents voiced support for green stormwater infrastructure at all schools in the city, but Ben Franklin School, John Harris High School, and Camp Curtin School received the most votes. Regardless of what green stormwater infrastructure type is employed, all of the schools listed could benefit from educational programs paired with infrastructure investments that focus on creating a new generation of stewards of the city's waterways and environment.

< BEN FRANKLIN SCHOOL, JOHN HARRIS HIGH, AND CAMP CURTIN SCHOOL WERE THE TOP 3 REQUESTED LOCATIONS FOR GREEN SCHOOLS

40 percent of participants at the second round of public meetings wanted green strategies to be employed at Ben Franklin School, John Harris High, and Camp Curtin School.

POTENTIAL PARTNERSHIPS

Potential partners for green schools include:

- City of Harrisburg
- Harrisburg Redevelopment Authority
- Harrisburg School District
- PennDOT
- Department of Public Works
- parents/Parent Teacher Associations (PTA)
- students
- teachers
- Pennsylvania State Education Association
- Penn State Extension
- Harrisburg Area Community College (HACC)

Credit: Flickr // Melbourne Water

Green Homes

Green stormwater infrastructure strategies can be applied even at a single home. Every green stormwater infrastructure project, no matter how small, adds up and accrues benefits. There are many types of GSI that individual homeowners can install and use on their own properties to manage stormwater and reduce runoff.

^
SMALL RAIN GARDENS CAN MANAGE RUNOFF FROM ROOFS OR IMPERVIOUS SURFACES

Rain Harvesting/Collecting — A portion of a city's water usage goes toward residential irrigation and other outdoor uses. This includes watering plants and even washing cars. Homeowners can reduce their water usage by installing rain barrels or cisterns to collect rain water from downspouts or roof leaders. This form of GSI not only manages some stormwater runoff, but also reduces the overall burden on the city's water infrastructure.

Native, or Adaptive Vegetation — Planting native, or adaptive, natural vegetation such as wildflowers or grasses, reduces the need for irrigation since native plants are already accustomed to the climate of central Pennsylvania. Native, or adaptive vegetation also requires less fertilizer and pesticides, which contribute to water pollution.

<

A RAIN BARREL MANAGES RUNOFF FROM A ROOF

Stormwater runoff from the roof of a garage or house is directed a rain barrel and then reused for irrigation or other use.

Blue and Green Roofs – Blue and green roofs can be applied to flat or mildly-sloped residential buildings to manage stormwater that falls upon the roof. However, not all existing structures are able to handle the structural load required by a blue or green roof.

Trees — Trees are a type of green stormwater infrastructure. Trees, similar to other forms of GSI, intercept rainwater with their leaves and absorb stormwater through their roots.

Flow-through Planters — Flow-through planters can be purchased prefabricated or constructed on-site with overflow and underdrains. Planters are typically located next to a building. Stormwater from the building's roof is directed to a planter through a downspout and filtered through the soil in the planter box.

Rain Gardens — Rain gardens can be built in a back, front, or side yard to reduce stormwater from a runoff source like a roof, patio, or driveway. Rain gardens use natural vegetation, soil, and stone storage to filter stormwater runoff.

Pervious Paving — Almost any residential ground-level impervious surface, including driveways, patios, and paths, can be replaced with pervious paving. Pervious paving can reduce stormwater runoff by allowing water to seep through the material instead of run off of it.

04

WHAT'S NEXT

Credit: WRT

THE SITES

Working with community groups in Harrisburg, Capital Region Water selected three pilot project areas for green stormwater infrastructure. Within these study areas, Capital Region Water and its consultant team identified opportunities to implement GSI and maximize stormwater management in cost effective and innovative ways. The opportunities demonstrate a wide range of GSI tools from simple, low-cost grading alternatives to signature design projects. Practices that provide management solutions in surface, vegetated systems were prioritized, but the majority of the systems also include a subsurface infiltration and/or detention component to maximize stormwater management.

The conceptual layout and sizing of the systems was based on providing storage for 1.4" of runoff from impervious areas, limiting the loading ratio of the system to 10:1 to improve the infiltration performance, and connecting to existing sewer-connected inlets or the combined sewer when possible.

4TH & DAUPHIN PARK

4th and Dauphin Park is located in Midtown across from the Pennsylvania National Fire Museum. The site includes the block surrounding the park, bounded by 4th Street, Kelker Street, Fulton Street, and Muench Street. The park is slated for improvements as part of an effort by the City, funded by grants from the state Department of Community and Economic Development and DCNR, to renovate five parks. GSI strategies integrated into the proposed park improvement plan, with some modifications, served as the basis for the conceptual GSI design.

Proposed GSI strategies include a bioswale downslope of the proposed playground, a porous basketball court with subsurface storage, and a rain garden adjacent to the basketball court. Systems located within the right-of-way include stormwater planters on the east side of 4th Street at Dauphin Street and a bioswale on the north side of Kelker Street at the intersection with 4th Street. The proposed project would manage 0.82 acres of impervious area.

FOURTH STREET PLANTERS:

Two stormwater planters are proposed along 4th Street to intercept stormwater runoff from the right-of-way and a portion of the park before it reaches the existing inlet at the intersection with Dauphin Street. Stormwater will be diverted from 4th Street into the planters using trench drains to maximize capture. The planting media in the planters will filter runoff and provide temporary storage while the plantings will provide volume removal through evapotranspiration. An overflow in the downslope planter will carry any excess runoff to the stone storage bed beneath the porous basketball court for infiltration and/or slow release. Plugged underdrains connected to the basketball court's subsurface bed will allow the planters to be drained if the soils prove to be unsuitable for infiltration.

TYPES OF GSI

BIOSWALE

RAIN GARDEN

STORMWATER PLANTER

GROUPING PARK IMPROVEMENTS & GSI.

Coupling park improvements with GSI creates efficiencies and maximizes triple bottom line benefits and overall value from investments.

LEGEND

A — Groups of Drainage Areas (impervious areas) managed by a GSI system

B — Green Stormwater Infrastructure (GSI) system (i.e., tree trenches, planters, etc.)

Credit: WRT

^
4TH AND DAUPHIN PARK FROM 4TH STREET

The park is slated for improvements including a new basketball court, and play equipment.

POROUS BASKETBALL COURT

The existing basketball court will be replaced with a new court surfaced with porous asphalt. The court will have a subsurface stone bed that is sized to manage runoff from the court, the rooftops of the three houses immediately north of the park, and overflow from the 4th Street planters. The subsurface stone storage bed will connect an outlet control structure that will overflow to the combined sewer and allow the storage bed to be underdrained if infiltration is not feasible.

RAIN GARDEN

The site plan prepared for the City proposes a rain garden and pavilion adjacent to the basketball court. The proposed GSI plan captures runoff from the play surface of the proposed swings, the path along the southern edge of the park, and the parking lot on the public housing property to the southeast of the park and diverts it into the rain garden. Runoff from the play surface of the swings will be directed through sheet flow while a trench drain across the path will divert runoff from the path to the rain garden. Runoff from the parking lot will be diverted

through a vegetated swale or pipe. A vegetated swale would require additional grading and excavation. An inlet within the rain garden will convey overflow to the porous basketball court's stone bed for additional storage. Site constraints limit rain garden storage, and it cannot provide storage for the full 1.4" of runoff from its contributing impervious areas. However, the porous basketball court has been designed to provide additional storage to offset this volume.

STORMWATER SWALE

The park renovation plan proposes a loop pathway around the playground and a rain garden upslope of the playground. In order to minimize runoff and increase stormwater capture, the rain garden was shifted to the downslope side of the playground and extended to function as a bioswale. The path was altered to reduce proposed impervious surfaces and provide opportunities for additional runoff capture. A trench drain directs runoff from the Fulton Street into the bioswale, where it flows adjacent to the path until reaching a ponding area downstream of the bioswale. The bioswale will ultimately manage runoff from Fulton Street, the small ADA parking area for the park, the path, and the playground. A domed riser (overflow control structure) at the bottom of the bioswale ties into the existing stormwater drainage infrastructure of the park and will provide a safe path for overflow from the bioswale.

BIOSWALE

A bioswale will be located on the north side of Kelker Street at the intersection with 4th Street to capture right-of-way runoff. Although there is an existing grass strip, it is too narrow to provide space for stormwater management. Instead, the proposed design shifts the sidewalk to create adequate space for a surface GSI system. Street runoff is diverted into the bioswale via a curb opening. Storage will be provided at the surface, in the planting media, and in a subsurface stone bed. A tree trench with only subsurface storage could be an alternate scheme that would not require shifting the sidewalk.

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THE PROJECT WILL MANAGE 35,657 SF OF IMPERVIOUS SURFACES AND IS ESTIMATED TO COST A TOTAL OF $269,500.

THIS IS EQUAL TO MANAGING 31,551 GALLONS OF STORMWATER.

BIG GREEN BLOCK

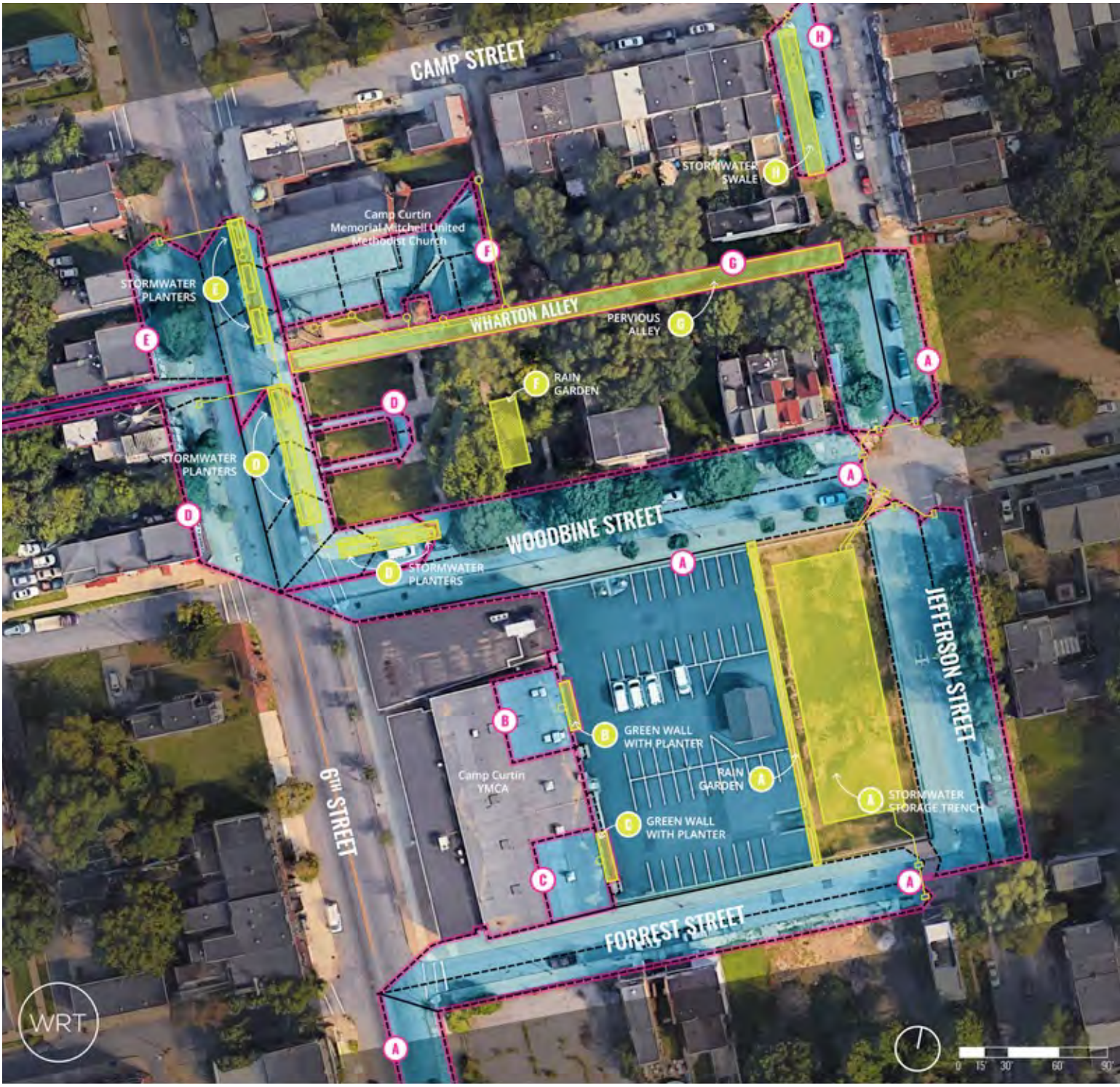
The Big Green Block site includes the area bounded by 6th Street, Camp Street, Jefferson Street, and Forrest Street. This project area became a focus not only for the stormwater opportunities, but also because of the potential for partnership with the Camp Curtin neighborhood and YMCA.

GSI opportunities for this area range from subsurface systems focused on maximizing runoff capture to signature design projects that provide neighborhood greening and highly visible demonstrations of stormwater management. The individual GSI opportunities manage runoff from the YMCA, the roof of the Camp Curtin Memorial Mitchell United Methodist Church, and the streets that create the boundary of the analysis area.

YMCA RAIN GARDEN AND STORAGE/ INFILTRATION TRENCH

A rain garden and storage/infiltration trench along the edge of the YMCA parking lot and beneath the playing field along Jefferson street will manage runoff from the parking lot, as well as runoff from Woodbine, Jefferson, Forrest, and 6th Streets. The narrow, linear rain garden manages surface runoff while minimizing encroachment into the playing field. The rain garden will overflow to a subsurface storage/ infiltration trench beneath the field that will provide additional storage for parking lot runoff as well as runoff from adjacent streets. New inlets installed upslope of existing sewer-connected inlets connect directly to the trench and divert right-of-way runoff. Diversion of runoff from the sides of Woodbine, Jefferson, and Forrest Streets opposite the YMCA property and from Jefferson Street between Woodbine Street and Wharton Alley will require additional evaluation of existing infrastructure to determine if managing those drainage areas is feasible.

TYPES OF GSI



GSI PROJECTS INCLUDE SUBSURFACE AND SURFACE SYSTEMS

A large storage infiltration area under the YMCA playfield, suburface storage under the planters along 6th Street, and the pervious paving on Wharton Alley have large subsurface storage components.

LEGEND

Groups of Drainage Areas (impervious areas) managed by a GSI system

Green Stormwater Infrastructure (GSI) system (i.e., tree trenches, planters, etc.)

Credit: WRT

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CAMP CURTIN MEMORIAL MITCHELL UNITED METHODIST CHURCH & ADJACENT ALLEYWAY

The alleyway, which is proposed to be resurfaced with pervious paving, is located between an historic church and park.

YMCA GREEN WALL WITH FLOW-THROUGH PLANTERS

Two existing roof leaders on the eastern face of the YMCA building will be diverted to green stormwater walls that will overflow to flow-through planter boxes. Each green stormwater wall consists of parallel troughs mounted to the side of the YMCA building that provide both surface and soil storage for runoff coming from the roof. The overflow and under drain from each trough flow to the trough below, and the bottommost trough overflows to a larger flow-through planter box that provides additional surface, soil, and stone storage. The sizing and layout of the troughs is subject to additional structure considerations and analysis. The stormwater planter will be lined and have both an overflow and under drain to safely convey stormwater away from the building. The stormwater benefits provided by this system of troughs and planters include volume reduction through evapotranspiration and increased time of concentration to reduce peak rate.

CHURCH STORMWATER PLANTERS AND STORAGE/INFILTRATION TRENCH

Stormwater planters along 6th Street and Woodbine Street will collect stormwater runoff from the Woodbine and 6th Street rights-of-way as well as a portion of the runoff from the Governor Curtin memorial at the northeast corner of the intersection. A stone storage/infiltration trench that connects the planters underground will provide additional storage and infiltration area. Runoff from the west side of 6th Street as well as both sides of Wharton Alley west of 6th Street that flow onto 6th Street will be captured via inlets and piped directly to the storage/ infiltration trench.

< THE PROJECT WILL MANAGE 2,910 – 134,050 SF OF IMPERVIOUS SURFACES AND IS ESTIMATED TO COST $54,000 – $1.15 MILLION.

THIS IS EQUAL TO MANAGING 106,500 GALLONS OF STORMWATER.

WHARTON ALLEY POROUS PAVEMENT

Wharton alley from 6th Street to Jefferson Street will be repaved with porous asphalt. However, given the proximity of the alley to the adjacent historic church, the depth of excavation in the alley will be limited. Porous asphalt will be installed over a stone bed, a portion of which will need to be lined due to proximity to existing buildings. A storage trench of this depth over the length of the alley provides enough static storage for about 1.24 inches of runoff from the alley and the portions of the church roof that could be diverted to the storage bed. Additional evaluation will be needed to confirm that the proposed excavation depth for the porous asphalt and pipe trenching is advisable adjacent to the church and that the proposed asphalt and subbase are sufficient given the typical traffic in the alley. The stone bed will need to be stepped along the length of the alley to provide a level bottom for infiltration. It may be possible to increase the depth of some of the steps to provide additional storage where there are no existing structures limiting the depth of excavation.

JEFFERSON STREET BIOSWALE

There is currently no sidewalk on the west side of Jefferson Street south of Camp Street. A new sidewalk will be constructed along with a bioswale that manages runoff from Jefferson Street and the new sidewalk. A flush curb or multiple curb openings will allow runoff from Jefferson Street to flow into the bioswale. Bollards or another deterrent may be required to prevent cars from parking in or driving on the bioswale if a flush curb is used.

SUMMIT TERRACE

The Summit Terrace Neighborhood was evaluated to highlight opportunities to implement GSI on vacant lots and corridors identified by the community. Based on that evaluation, proposed GSI in the neighborhood is focused on Walnut Street from Jonestown Street to 13th Street and Bailey Street from 12th Street to 13th Street. Although Summit Street from Bailey Street to Royal Terrace Park was also identified as a priority, it was not considered a favorable corridor for GSI implementation due to space constraints and utility conflicts.

The systems along Walnut Street are primarily within the right-of-way and demonstrate a range of surface and subsurface practices that provide streetscape enhancement and maximize capture. GSI in this area includes a stormwater plaza with planters, bumpouts, a tree trench, and stormwater trees. The systems along Bailey Street are less intensive systems that manage runoff at the surface in vacant lots while providing pocket gardens and park spaces along the corridor. In addition to four rain gardens that capture street runoff, a tree trench with subsurface storage is proposed adjacent to one of the rain gardens to manage runoff from a larger drainage area. Additional street trees are proposed along both corridors wherever feasible to absorb some stormwater and reduce urban heat island effect, improve air quality, and enhance the streetscape.

WALNUT STREET STORMWATER PLAZA WITH PLANTERS AT LINDEN STREET

A stormwater plaza at the southeast corner of Walnut Street and Linden Street will provide an attractive gathering space adjacent to the neighborhood's community garden. The plaza area, which is currently used as parking, will be surfaced with permeable concrete pavers and will include three planters and a subsurface storage area. The two planters on Walnut Street will intercept runoff from the south side of Walnut Street from Linden to 13th Street. The planter on Linden Street will intercept runoff from the east side of Linden Street from Shrub Street to Walnut Street. The planters will provide surface and soil storage for stormwater and will be constructed over a larger stone infiltration/storage trench that will provide additional storage.

TYPES OF GSI

A SERIES OF RAIN GARDENS CREATES SMALL NEIGHBORHOOD GATHERING SPACES

Rain gardens on vacant lots on Bailey Street create small neighborhood gathering spaces.

LEGEND

Groups of Drainage Areas (impervious areas) managed by a GSI system

Green Stormwater Infrastructure (GSI) system (i.e., tree trenches, planters, etc.)

Credit: WRT

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SUMMIT TERRACE COMMUNITY LOT

Vacant lots along Bailey Street, including the Summit Terrace Community Lot, will be used to manage stormwater from the street right-of-way. Cleaning up these lots and creating rain gardens will provide the community with additional gathering and recreational space.

WALNUT STREET BUMPOUTS

Two stormwater bumpouts along the south side of Walnut Street between Balm and Linden will capture and provide surface, soil and stone storage for runoff from the south side of Walnut Street from Linden Street to Balm Street. A stone storage/ infiltration trench in the sidewalk will provide additional storage. Runoff from the north side of Walnut Street will be diverted directly into the trench via a new inlet on the north side of the street.

WALNUT STREET TREE TRENCH

A stormwater tree trench on the south side of Walnut Street will provide subsurface storage for runoff from both sides of Walnut Street that will be diverted to the storage/infiltration trench via new inlets on either side of the street. The trench provides storage and infiltration or slow release of runoff. Street trees within the trench provide volume removal through evapotranspiration.

WALNUT STREET STORMWATER TREES

Eight stormwater trees are proposed along the north and south sides of Walnut Street between 12th Street and N. Summit Street. The trees will manage the contributing drainage areas by diverting street runoff through curb openings and providing subsurface storage in the tree pits. Although stormwater trees do not achieve the target storage that most of the other systems provide, they are an alternative that provides some stormwater storage, runoff reduction through interception and evapotranspiration, and streetscape enhancement where utility and other constraints preclude implementation of larger systems.

BAILEY STREET RAIN GARDENS

A rain garden on the south side of Bailey Street in a vacant lot between 12th Street and N Summit Street will manage stormwater from the south side of the street through a curb opening directly into the rain garden. A second rain garden will be located south of Bailey Street in the community-owned space where N Summit Street ends at Bailey Street. A trench drain will divert runoff from the south side of the street across the sidewalk and into the rain garden. A third rain garden will be located on the south side of Bailey Street in a vacant lot where Balm Street ends. Runoff from the south side of Bailey Street will be diverted into the rain garden via a trench drain. Due to some topography and space constraints, additional investigation will need to be completed to determine whether a rain garden of this shape is feasible. The fourth rain garden will be located at the southwest corner of the intersection of Bailey Street and 13th Street. A trench drain will divert runoff from the south side of Bailey Street across the sidewalk and into the rain garden. A tree trench adjacent to the rain garden and stone beneath the rain garden will provide additional storage for runoff. A new inlet will be installed on the north west corner of the intersection of Bailey Street and 13th Street to capture runoff from the high point of Shrub Street between 13th and Linden Streets flowing towards Linden Street, Linden Street between Shrub Street and Bailey Street, and the north side of Bailey Street between Linden Street and 13th Street. The new inlet will connect directly to a subsurface tree trench. One tree is added in the tree trench system and a new sidewalk is proposed for the area as the existing sidewalk is in disrepair. Additionally, four street trees are proposed along the north and south side of Bailey Street.

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THE PROJECT WILL MANAGE 3,630 – 61,170 SF OF IMPERVIOUS SURFACES AND IS ESTIMATED TO COST A TOTAL OF $10,300 – $441,100.

THIS IS EQUAL TO MANAGING 53,942 GALLONS OF STORMWATER.


WARNING
COMBINED SEWER OVERFLOW
AVOID CONTACT WITH DISCHARGE
CAPITAL REGION
WATER
PLEASE REPORT ANY DISCHARGE TO
CAPITAL REGION WATER
888-510-0606 (OPTION 4)
This is a temporary sign. Learn more: CapitalRegionWater.com/cbh20

Credit: WRT

SIGNAGE PLAN

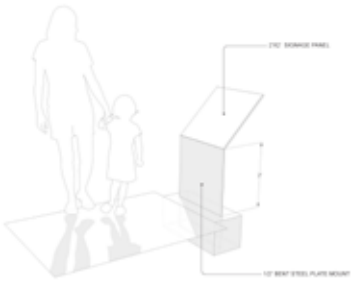
Capital Region Water's Nine Minimum Control Plan, approved by the EPA, requires implementation of nine minimum controls to reduce the negative effects of combined sewer overflows.

As part of this plan, Capital Region Water is required to raise public awareness about the effects of combined sewer overflows and bolster public support for control measures. Signage and notifications are a key component and help ensure that the public is informed about the location of outfalls, combined sewer overflow events, and the potential health and environmental threats associated with combined sewer overflows. The EPA Guidance Compliance Checklist requires utilities like Capital Region Water to install and maintain signs at every combined sewer outfall and at pubic access points to advise the public to avoid recreational use of affected water after a wet weather event.

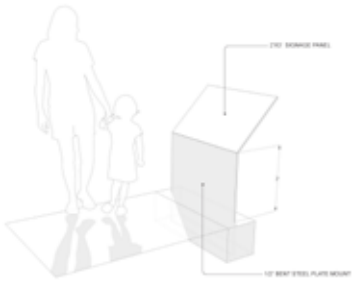
Capital Region Water is going beyond the base requirements in the plan and is creating a Signage Plan. The Signage Plan will not only cover warning signs at all 59 outfalls along the Susquehanna River and Paxton Creek, but will also include additional large educational signs at key public access points and locations. These educational signs will provide the public with additional information about combined sewer overflows, green stormwater infrastructure, and the city's watersheds and waterways.

OPTION A

WARNING SIGNS



EDUCATION SIGNS



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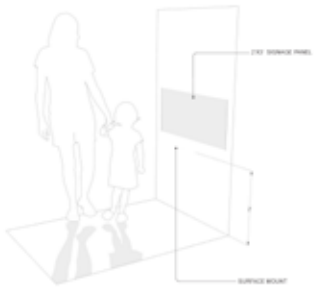
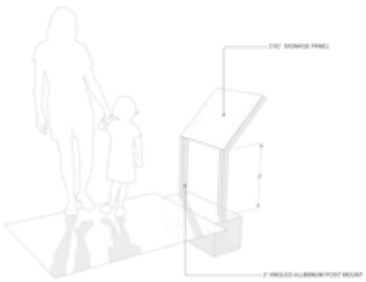
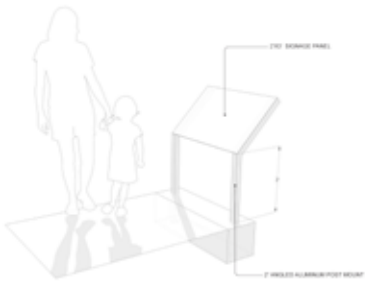


OPTION B

WARNING SIGNS



EDUCATION SIGNS



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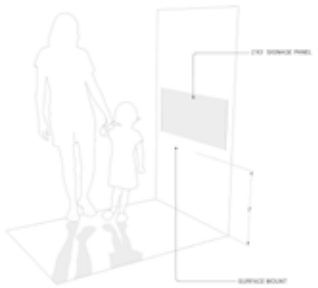
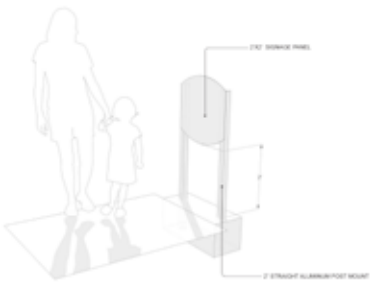
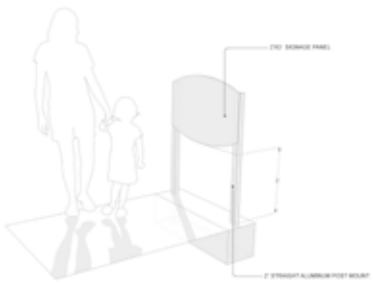


OPTION C

WARNING SIGNS



EDUCATION SIGNS



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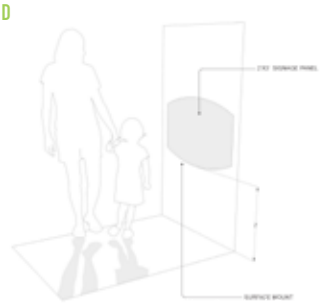
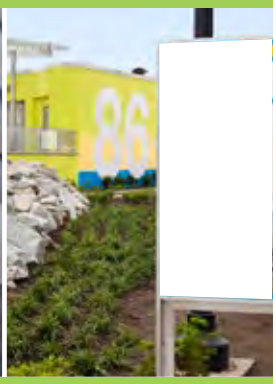


SIGNAGE IMPLEMENTATION PLAN

The EPA requires warning signs to be installed and maintained at every combined sewer outfall. Many of Capital Region Water's current signs are in poor condition, or are difficult to locate and read. With its recent Signage Implementation Plan, Capital Region Water will design and install new signage at all CSO locations. Public notification signage alone will not reduce overflows or pollution; instead it is intended to reduce the public health impact of CSOs, increase public awareness, and increase support for control measures.

PRECEDENT IMAGES

PRECEDENT IMAGES



PRECEDENT IMAGES

Implementation

Capital Region Water is going above and beyond EPA's requirements. Warning and identification signs will clearly indicate the location of combined sewer outfalls, warn the public of the risks associated with combined sewer overflows, and provide a way for the public to report an issue or find out more about how Capital Region Water is working to reduce overflows throughout the system. Each combined sewer outfall has an associated ID number that will be located near the outfall.

New educational signs at key public locations like beaches, boat launches, and trails will include user-friendly and engaging graphics to describe Harrisburg's combined sewer system, stormwater impacts, and what the community can do to reduce negative outcomes on their health and the environment. There will be several different types of educational signs that will incorporate best practices for reducing pollution, stormwater runoff, and combined sewer overflows from ever reaching Paxton Creek and the Susquehanna River.

Be on the lookout for pilot signs in the spring of 2017!

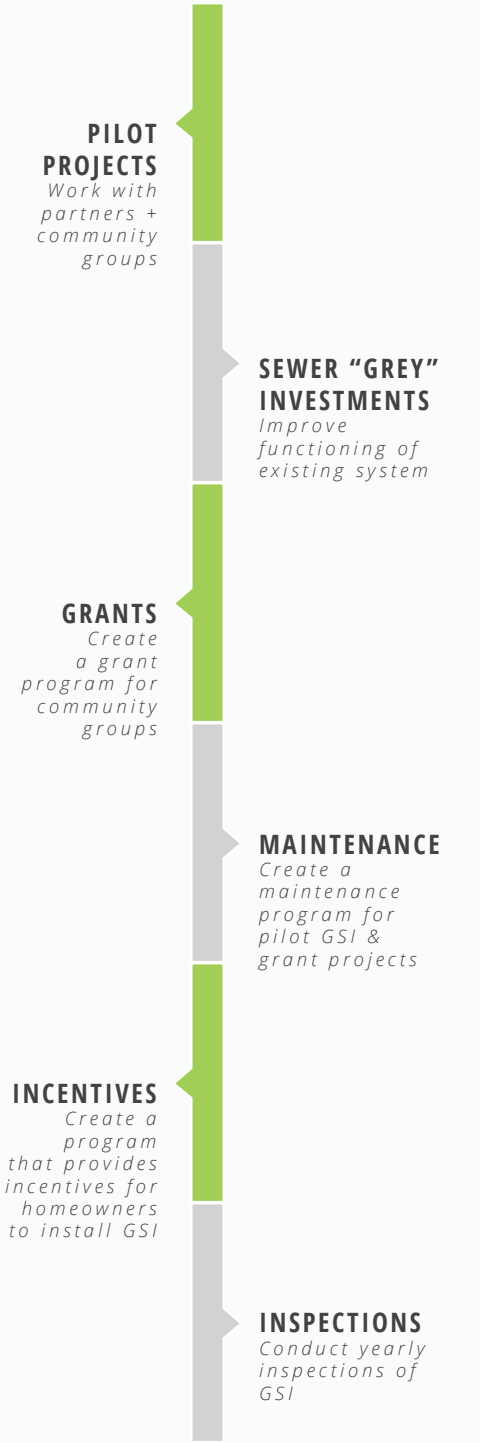
Credit: Flickr // Chesapeake Bay Program

THE PROGRAM

There is no standard for green stormwater infrastructure programs — they range from programs that build GSI on public property to programs that provide incentives for residents to construct GSI on private properties. Cities often employ a combination of strategies, including improvements to grey infrastructure, to create a successful stormwater management program.

Harrisburg needs a mixture of grey and green stormwater infrastructure to manage its stormwater. Capital Region Water is committed to creating a green stormwater infrastructure program that prioritizes investment in green technologies to manage stormwater and leverages infrastructure investment to provide benefits to Harrisburg communities. However, the stormwater management program will need to include some investment to update and repair the current grey infrastructure system. The balance of green and grey will be based on the analysis and modeling results from the upcoming Long Term Control Plan.

POTENTIAL PROGRAM OUTLINE



HOW SHOULD WE INVEST?

PROGRAM OUTLINE

Successful stormwater management programs include a healthy mix of investment in maintaining existing sewer and wastewater infrastructure and funding for green stormwater infrastructure projects. The program to manage stormwater in Harrisburg will include funding for pilot green stormwater infrastructure projects, investments in existing sewer infrastructure, grants and incentives for community groups and homeowners, and maintenance and inspection programs.

Building GSI in the public realm (schools, parks, streets, etc.) will involve Capital Region Water working with partner organizations and neighborhood partners from design through construction. This program would likely be funded through a mixture of Capital Region Water's capital and operating budgets, which are funded through utility fees, a potential new fee, and grants from state and federal organizations, including the EPA Clean Water State Revolving Fund. Public-private partnerships can reduce Capital Region Water's costs of building GSI.

Providing grants and incentives for community groups or residents to construct GSI would give organizations and residents an opportunity to apply for funding from Capital Region Water to build GSI. Programs throughout the country handle these incentive/grant programs in different ways, but there are three basic models — cost-sharing, rebates, and grants. Cost-sharing programs, like the RainCheck program in Philadelphia, share the upfront cost of building GSI with the community organization or resident. Rebate programs, similar to the RainWise program in Seattle, provide the community organization or resident with a rebate after the GSI is installed and inspected. Grant programs, like the Watershed Stewards Grant in San Francisco, issue grants to community organizations or neighbors who work together to propose a GSI project in their neighborhood.

In order to make a GSI program work there must be a system in place to ensure that installed systems are properly maintained and inspected. If GSI is not properly maintained, it may cease to function, negating its environmental, social, and economic benefits. Cities with established programs have employed different

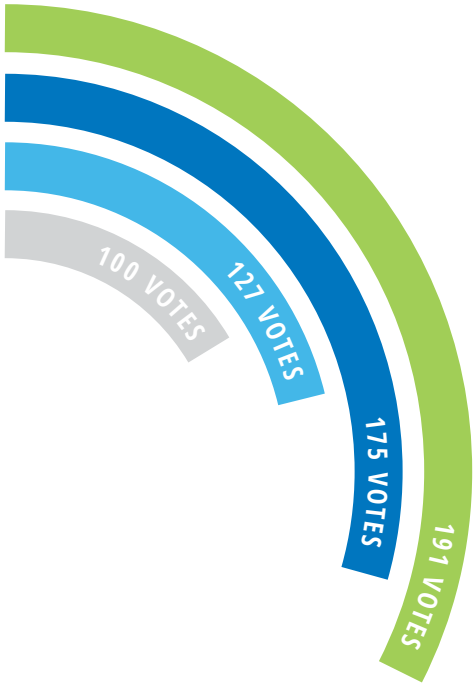
IF YOU HAD $500 TO SOLVE OUR PROBLEM:

Build GSI in the public realm (schools, parks, streets, etc.) **01**

Provide grants/incentives for community groups to build GSI **02**

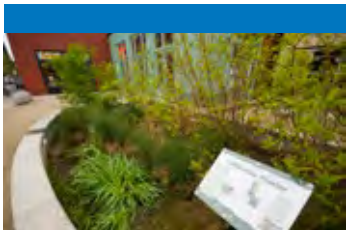
Provide grants/incentives to individuals for GSI retrofits **03**

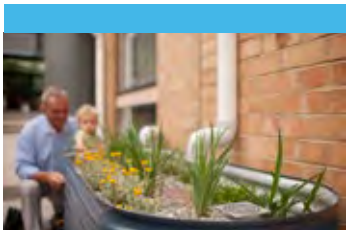
Enhance grey infrastructure/ build bigger sewers **04**

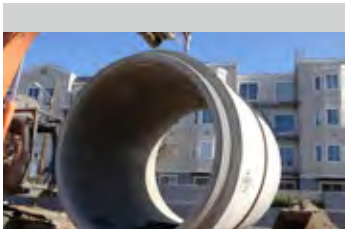


< WE ASKED, YOU ANSWERED!

The voting results of the "money game" include participants at the first series of public meetings at the Camp Curtin YMCA and the Lancaster School.







methods to address maintenance. The RiverSmart program in Washington, D.C. builds inspections into incentive or program agreements. Seattle's RainWise program requires owners to sign an agreement to maintain the GSI for at least five years. In order for Capital Region Water's program to be successful, a clear maintenance and inspection program and schedule must be included in program agreements and guidelines.

PHILADELPHIA WATER STORMWATER FEES

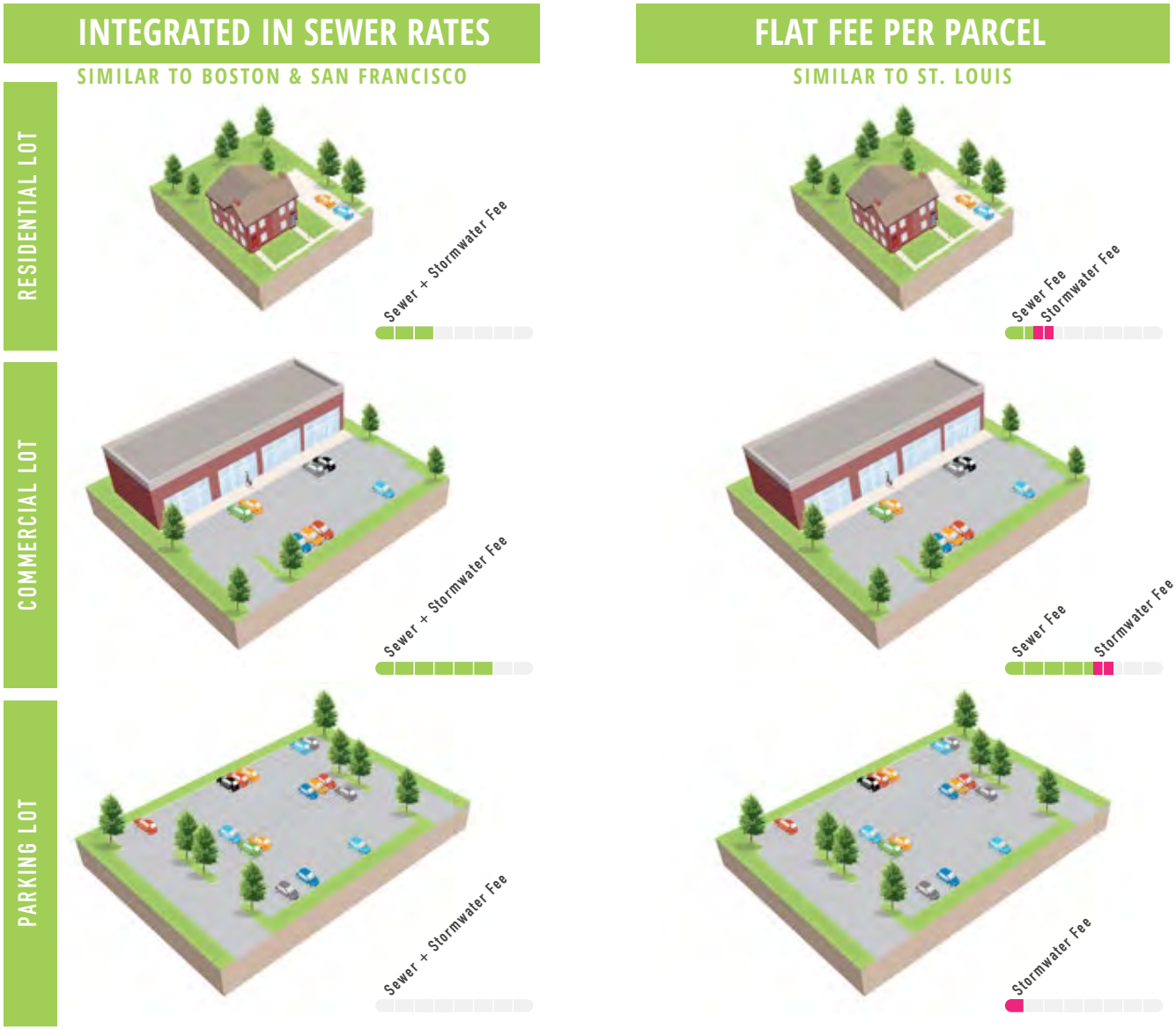
In 2010, Philadelphia Water introduced a new stormwater fee to their existing stormwater ordinance based on the stormwater generated on each parcel in the city. They spent almost a year doing community outreach to inform residents about the fee and ways they can reduce stormwater rates. Residents and business owners can receive stormwater credits that reduce their fee for building projects that reduce impervious surfaces and manage stormwater.

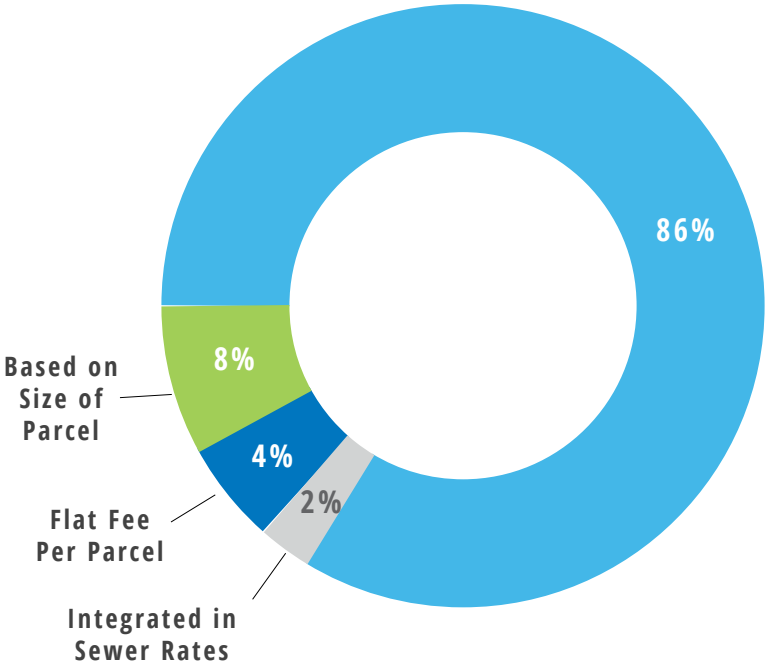
Cities with green stormwater infrastructure programs distribute the cost of improvements and maintenance in a variety of ways.

Integrated in utility rates. This approach, employed by Boston and San Francisco, integrates the cost of stormwater into sewer rates. In this model, land uses that generate the most stormwater are not required to pay for stormwater unless they receive a sewer bill. This means that a parking lot, as pictured in the diagram, that generates a lot of stormwater, but does not currently pay a sewer bill, pays nothing toward stormwater.

Flat fee per parcel. This approach, employed by St. Louis, distributes the cost equally among all parcels regardless of size or amount of stormwater generated. This means that a commercial parcel or a large parking lot ends up paying the same amount as a single family home for stormwater.

Based on the size of parcel. This approach, employed by Seattle and Boulder, bases the amount of stormwater fee on the physical size of the parcel. This means that a large commercial parcel that may only be 30 percent impervious is charged more for stormwater than a smaller commercial parcel that is 85 percent impervious.



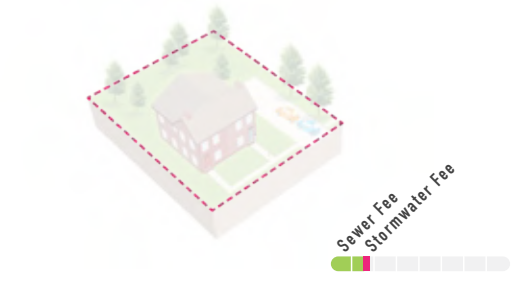


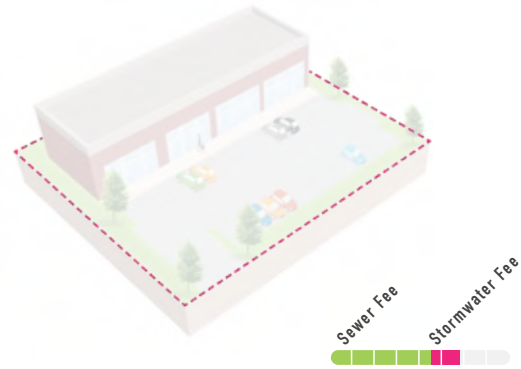
< WE ASKED, YOU ANSWERED!

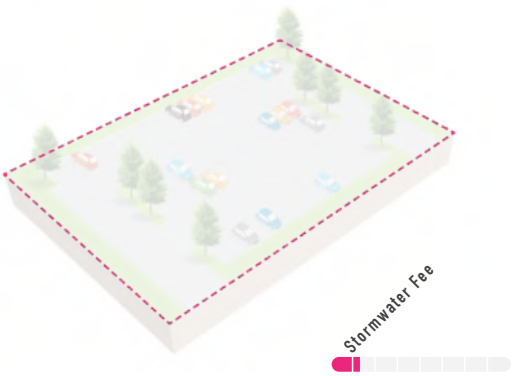
The voting results include participants at the first series of public meetings at the Camp Curtin YMCA and the Lancaster School.

BASED ON THE SIZE OF PARCEL

SIMILAR TO SEATTLE & BOULDER

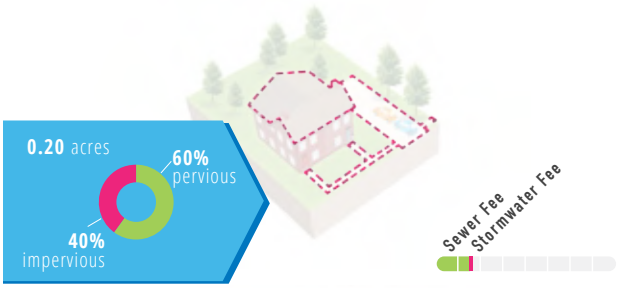


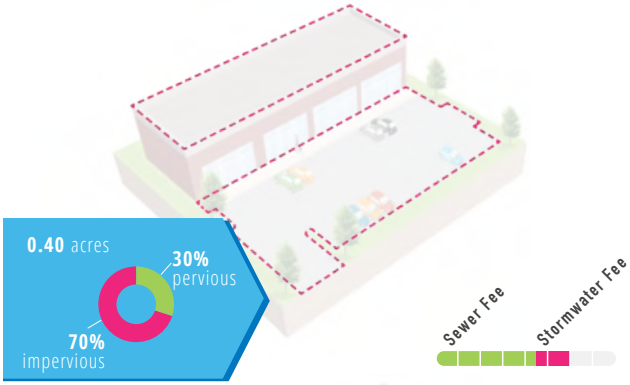


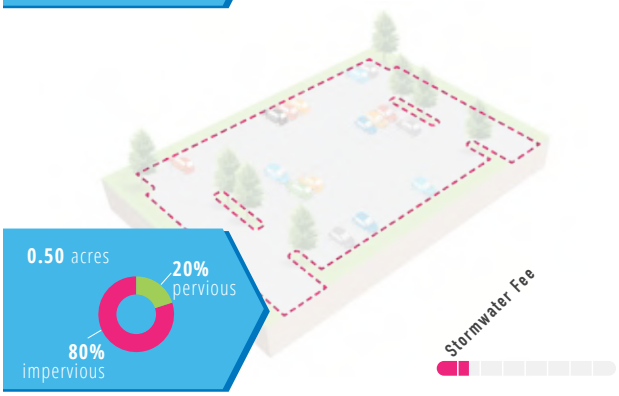


BASED ON STORMWATER GENERATED

SIMILAR TO PHILADELPHIA & LANCASTER



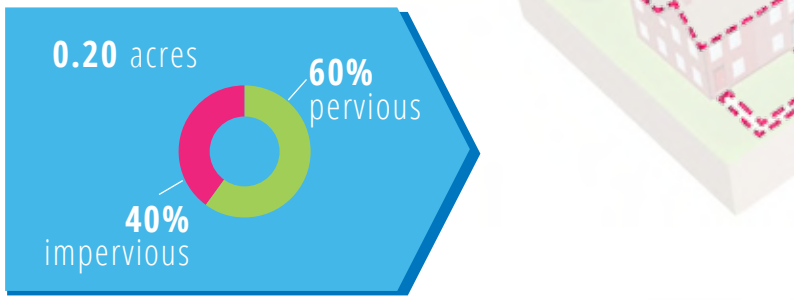


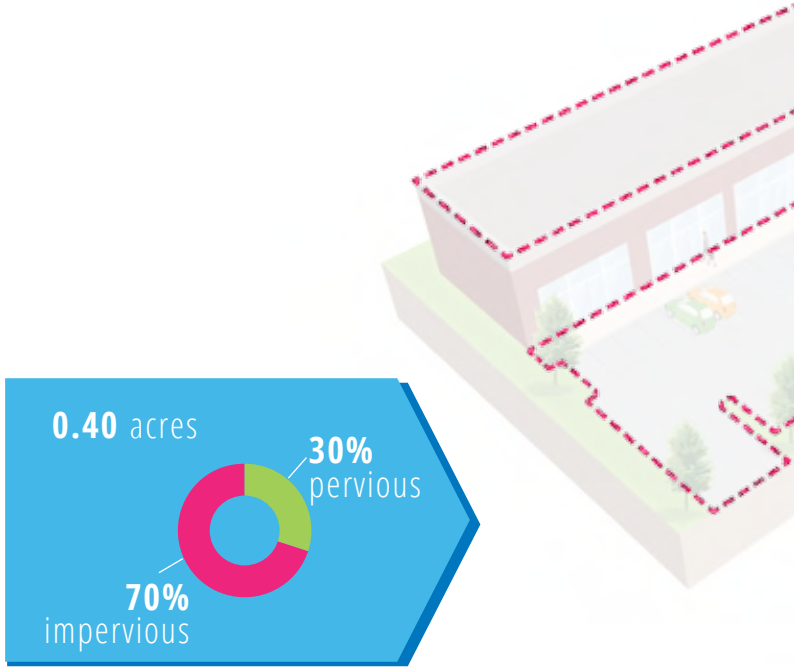


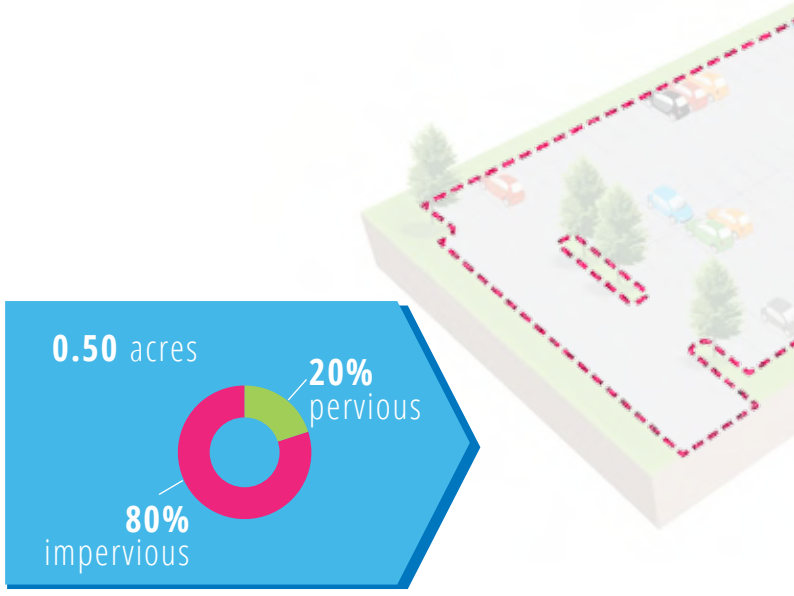
Based on stormwater generated.
This approach, employed by Philadelphia and Lancaster, charges properties an amount for stormwater the property generates. This means that a parking lot that is 80 percent impervious pays a larger, while a residential property that is 40 percent impervious pays a smaller fee.

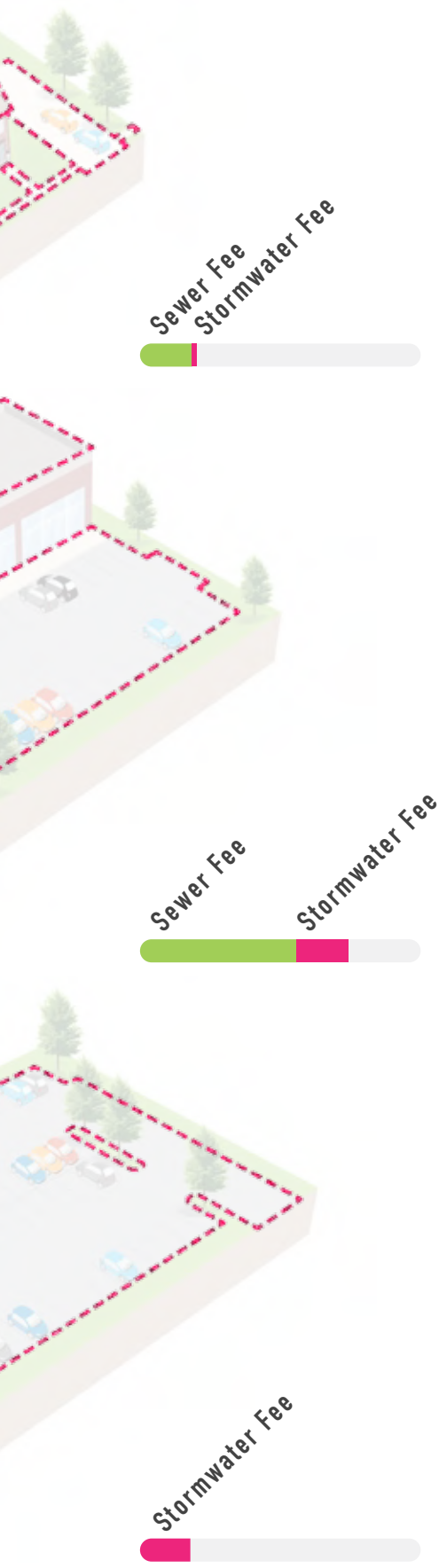
Harrisburg residents overwhelmingly preferred the model that bases a fee on how much stormwater is generated by parcel. This model equitably distributes the cost of stormwater management so that the properties with the most impervious surfaces, which generate the most stormwater, pay the highest fees. Levying this type of fee can also incentivize property owners and businesses to build GSI or partner with Capital Region Water to build GSI in an effort to reduce the fee associated with large amounts of impervious surface. In Philadelphia, the Water Department offers a number of programs to reduce stormwater fees. Property owners can reduce their stormwater fees by implementing green stormwater infrastructure projects that reduce the amount of impervious surface on their property or manage runoff from existing impervious areas.

STORMWATER FEE BASED ON STORMWATER GENERATED









What this means for you

Stormwater fees are a common way for utilities to pay for green stormwater infrastructure investments because they ensure that the properties that generate the most stormwater pay the most to manage it. However, stormwater management needs to be paid for with or without a separate stormwater fee. Without a stormwater fee, residents currently pay for it as part of their sewer bill. Properties with a lot of impervious surfaces, but that do not receive a sewer bill, pay nothing. This leaves properties with a small amount of impervious surfaces to subsidize stormwater infrastructure for properties that generate more stormwater. The good news is that if the fee based on stormwater generated is implemented, properties will only pay their fair share of the stormwater burden.

If Capital Region Water decides to implement a stormwater fee and ordinance, a great deal of community outreach will be conducted to ensure that the public is fully aware of the ordinance and its requirements. For example, Philadelphia began their outreach program for their 2015 stormwater ordinance update a year in advance, while Atlanta started outreach for their first ordinance three years before it was adopted in 2013.


Credit: Flickr // Port of Tacoma

THE MAGNITUDE OF THE PROGRAM

LEVERAGING PARTNERSHIPS

Capital Region Water cannot do this alone. Tackling the issue of stormwater management will require participation from local and state government agencies, community organizations, neighborhoods, and other partners. Capital Region Water plans to leverage funding with partners throughout Harrisburg who have goals that can be furthered by green stormwater infrastructure in an effort to find ways to capitalize on the multiple benefits of green stormwater infrastructure.

Capital Region Water plans to not only partner with community organizations, non-profits, and government agencies, but also with individual property owners. The majority of land in the city is privately owned. This means that while the initial phases of green stormwater infrastructure will focus on public property, where the city has control, Capital Region Water will need to work with private owners to strategize ways to implement green stormwater infrastructure on private property.

Implementation will take innovation. Capital Region Water is committed to innovation as GSI projects are implemented and maintained, but also in how projects are financed. This ensures existing funding, whether it be generated from customer rates or non-rate revenue such as grants and infrastructure funds, are spent in the most effective ways. It means strategic leveraging of funds to see projects come to fruition and creativity in pursuing new or non-traditional sources of revenue. Well-designed public-private partnerships as well as the in-kind contributions of local suppliers and regional experts cannot be overlooked. Capital Region Water recognizes the financial limitations of residents and the significant opportunity to catalyze investment with tangible results.

HOW MUCH WILL IT ALL COST?

The three pilot projects — 4th and Dauphin Park, Big Green Block, and Summit Terrace provide some guidance about the potential cost of implementing GSI in Harrisburg. There may be ways to share costs by creating partnerships. The

< IMPLEMENTATION & MAINTENANCE, WORKFORCE DEVELOPMENT & GSI PLANNING / DESIGN WILL GENERATE JOBS

In order to fully implement the plan, we will need skilled laborers, engineers, architects, landscape architects, technicians, environmental scientists, educators, community outreach coordinators.

"Everyone can do something, and if we all do something, before we know it the job will be done and we will have impacted a generation. Not just this generation but generations to come." – Bishop Roberta Thomas

average cost per acre managed for the pilot projects is $405,500, or $289,000 per acre-inch managed. Pilot projects are typically more expensive because they have not reached an economy of scale. For purposes of comparison, Philadelphia Water targets an average of $250,000 - $300,000 per acre-inch managed.

MOVING FORWARD

STAY TUNED, EXCITING NEW PROJECTS ARE COMING TO A NEIGHBORHOOD NEAR YOU!

Capital Region Water is working hard to implement the projects and recommendations from the Community Greening Plan. "The Next Five Years" outlines some of the key activities slated for this time period.

THE NEXT FIVE YEARS

Over the next five years Capital Region Water will work to implement the Community Greening Plan. Activites will include pilot green stormwater infrastructure (GSI) projects in a variety of neighborhoods, refined GSI targets and programs, further engagement with partners, and job and workforce development related to GSI.

» **COMPLETE THE EARLY ACTION PROJECTS** *(1 - 2 YEARS)*

- Summit Terrace
- Camp Curtin Big Green Block
- 4th & Dauphin

» **COMPLETE PILOT PROJECTS WITH PARTNERS** *(1 - 2 YEARS)*

» **COMPLETE GSI RETROFITS TO 4 DCNR/CITY PARKS** *(1 - 2 YEARS)*

- Cloverly Heights
- Royal Terrace
- Penn & Sayford
- 4th & Dauphin

» **DEVELOP DISTRICT-LEVEL GSI PLANS** *(1 - 5 YEARS)*

- South Harrisburg
- North Allison Hill
- South Allison Hill
- Midtown
- Downtown
- Uptown
- Riverside

< CAMP CURTIN BIG GREEN BLOCK EARLY ACTION PROJECT

The Camp Curtin Big Green Block project includes stormwater planters and streetscape elements along N. 6th Street and a pervious alleyway adjacent to the Camp Curtin Memorial Mitchell Church.

» **REFINE GREEN STORMWATER INFRASTRUCTURE STRATEGY BASED ON THE LONG TERM CONTROL PLAN PROCESS** *(1 - 5 YEARS)*

- Set GSI targets
- Pursue rate restructuring
- Identify priority sewersheds
- Define a residential incentive program
- Update city codes and regulations

» **ENGAGE WITH PARTNERS** *(ONGOING)*

- State
- City
- School District
- Businesses
- Other community organizations
- Residents

» **CONTINUE IMPLEMENTING THE WORKFORCE DEVELOPMENT/GSI TRAINING PROGRAMS** *(ONGOING)*


Credit: WRT

THE VALUE OF GREEN

WEIGHING GREEN VS. GREY

As Capital Region Water works with partners and communities throughout Harrisburg to implement the Community Greening Plan, the following checklist of factors will begin to help weigh the value of green stormwater infrastructure projects beyond the potential to manage stormwater.

While not comprehensive, the checklist includes a number of factors that determine the benefit of a project to a community, the environment, and the economy. The following page includes an example of how the checklist could be used to determine which solution – grey or green – provides the greatest number of benefits for the community, environment, and economy. From this example, the rain garden, or green solution, provides the most value beyond stormwater management. While the pipe, or grey solution, may manage the necessarly volume of stormwater, the investment is buried and is not able to provide additional benefits.

	POTENTIAL SOLUTION	
	Pipe (Grey)	Rain Garden (Green)
HIGH STORMWATER POTENTIAL / EASE OF IMPLEMENTATION RATING (5, 6, 7)	✓	✓
CONCEPT THAT WAS PRIORITIZED BY THE COMMUNITY (PUBLIC MEETING, COMP PLAN, ETC.)		✓
INTERESTED ORGANIZATION / GROUP		✓
LEVERAGES OUTSIDE EXPERTISE OR FUNDING		✓
ADDS TO TREE CANOPY		✓
ADDS GREEN SPACE TO UNDERSERVED AREA		✓
CONNECTS TO NEIGHBORHOOD ANCHOR (SCHOOL, COMMUNITY CENTER, ETC.)		✓
IMPROVES AIR QUALITY		✓
IMPROVES WATER QUALITY	✓	✓
ENHANCES RECREATION		✓
COINCIDES WITH OTHER PUBLIC INVESTMENT PROJECTS (STREET REHAB, ETC.)	✓	✓
MAKES USE OF UNDERUTILIZED LAND		✓
IS IN A LOCATION TARGETED FOR ECONOMIC DEVELOPMENT OR REDEVELOPMENT	✓	✓
IMPROVES PUBLIC HEALTH		✓

Credit: Flickr // Arlanravan

APPENDICES A - E

Appendix A: Educational Materials

COMMUNITY GREENING PLAN

Capital Region Water is completing a **Community Greening Plan** (Green Stormwater Infrastructure) for Harrisburg. We're working with the community to find opportunities in neighborhoods throughout Harrisburg for green projects to reduce street flooding, sewer backups, and combined sewer overflows while beautifying our surroundings and cleaning up our water! The GSI fact sheets provide a glimpse into some of the types of green stormwater infrastructure that can be employed in Harrisburg neighborhoods.

TYPES OF GSI (GREEN STORMWATER INFRASTRUCTURE)

- **Stormwater Planter** - an area with soil and plants surrounded by a curb, typically located at the edge of a sidewalk where it meets a street.
- **Stormwater Bumpout** - an area with soil and plants that extends out from the existing curb into the street, with a new curb at the street edge.
- **Stormwater Tree** - a street tree planted within soil that is lower than street level to capture stormwater from roads and sidewalks.
- **Stormwater Tree Trench** - an underground storage system that connects multiple street trees, typically located at the edge of a sidewalk where it meets a street or under the edge of the street where it meets a sidewalk.
- **Pervious Paving** - a special type of paving that allows stormwater to pass through it instead of running off of it.
- **Green Gutter** - continuous, narrow areas with soil and plants that are put along the edge of a street where it meets a sidewalk, with a new curb at the street edge.
- **Green Roof** - roof that is either partially or fully covered by a system of plants.
- **Blue Roof** - roof that is either partially or fully covered by a system of stone storage trays.
- **Rain Garden** - an area with soil and plants that is not surrounded by a curb.
- **Stormwater Wetland** - constructed area with soil, plants, and marshy water.
- **Stormwater Basin** - a sunken, usually grassy area that is designed to collect and store stormwater.
- **Bioswale** - a long, shallow depression designed to slow the flow of stormwater and allow it to drain into the soil.
- **Flow-Through Planter** - a box with soil and plants that sits on the ground, typically located next to a building.
- **Rain Barrel** - enclosed, typically plastic or metal structures that sit on the ground, typically located next to a building.
- **Cistern** - large, enclosed structures that can sit on the ground or be buried below ground.

STORMWATER PLANTER


Image Credit: Flickr/Center for Neighborhood Technology


Image Credit: Flickr/Chris Hamby

A stormwater planter is an area with soil and plants surrounded by a curb, typically located at the edge of a sidewalk where it meets a street. The soil and plants are lower than street level to capture stormwater from roads and sidewalks. Stormwater planters can vary in size and materials.

med

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces and filters runoff.
- Flexible design and sizing.
- Enhances surrounding landscape/streetscape/ beautification.
- Works well in urban environments.
- Improves pedestrian safety.

TYPICAL APPLICATIONS

- Streets
- Sidewalks
- Parking Lots

low-med

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Initial maintenance can be time-consuming until vegetation is established, afterwards maintenance is relatively low.
- Requires careful selection of native, water-tolerant plants.
- Requires control structures (domed risers) to provide for overflow.
- Variable cost based on soil/site conditions and size.
- Infiltration testing required.

low-med

SIZE/VOLUME

(typical size required/ volume managed by GSI)

STORMWATER BUMPOUT

Image Credit: Flickr/Center for Neighborhood Technology

Image Credit: PWD

A stormwater bumpout is an area with soil and plants that extends out from the existing curb into the street, with a new curb at the street edge. They can be put at the corner of a block, in the middle of a block, or along the entire length of a block. The soil and plants are lower than street level to capture stormwater from roads and sidewalks. Stormwater bumpouts can vary in size and materials.

BENEFITS

- Reduces and filters runoff.
- Flexible design.
- Enhances surrounding landscape/streetscape.
- Works well in urban environments.
- Improves pedestrian safety and calms traffic.
- Relatively inexpensive to retrofit.

TYPICAL APPLICATIONS

- Streets
- Sidewalks

LIMITATIONS

- Initial maintenance can be time-consuming until vegetation is established, afterwards maintenance is relatively low.
- Requires careful selection of native, water-tolerant plants.
- Requires control structures (domed risers) to provide for overflow.
- Variable cost based on soil/site conditions and size.
- Infiltration testing required.

MAINTENANCE

(ease of cleaning/using the GSI)

COST

(typical cost of designing and building GSI)

SIZE/VOLUME

(typical size required/ volume managed by GSI)

STORMWATER TREE

Image Credit: Flickr/Chris Hamby

Image Credit: Flickr/DeepRoot

A stormwater tree is a street tree planted within soil that is lower than street level to capture stormwater from roads and sidewalks. The tree absorbs stormwater through its roots. Some stormwater tree pits have metal grates above them. Others have inlets that direct stormwater to the trees.

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces and filters runoff.
- Flexible design.
- Enhances surrounding landscape/streetscape.
- Works well in urban environments.
- Increases tree canopy (increased air quality).

TYPICAL APPLICATIONS

- Streets
- Sidewalks
- Parking Lots

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Requires careful selection of native, water-tolerant trees.
- Variable cost based on soil/site conditions and size.
- Limited stormwater capacity.
- Long-term maintenance of trees.

SIZE/VOLUME

(typical size required/ volume managed by GSI)

STORMWATER TREE TRENCH


Image Credit: Flickr/DeepRoot


Image Credit: Flickr/DeepRoot

A stormwater tree trench is an underground storage system that connects multiple street trees, typically located at the edge of a sidewalk where it meets a street or under the edge of the street where it meets a sidewalk. The trees absorb some of the stormwater through their roots, while excess water drains down into an underground storage area made of stone, plastic crates, or other materials.

med-high

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces and filters runoff.
- Flexible design.
- Enhances surrounding landscape/streetscape.
- Works well in urban environments.
- Increases tree canopy (increased air quality).
- Can manage a large volume of stormwater.

TYPICAL APPLICATIONS

- Streets
- Sidewalks
- Parking Lots

med-high

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Requires careful selection of native, water-tolerant trees.
- Requires control structures (domed risers) to provide for overflow.
- Variable cost based on soil/site conditions and size.
- Infiltration testing required.
- Long-term maintenance of trees.

med-high

SIZE/VOLUME

(typical size required/ volume managed by GSI)

PERVIOUS PAVING


Image Credit: Flickr/Jarrett M


Image Credit: Flickr/Mike Boucher

Pervious, or porous/permeable, paving is a special type of paving that allows stormwater to pass through it instead of running off of it. Pervious paving can be used in many places where traditional paving is used, particularly areas that do not have a lot of traffic, such as walkways and parking areas. An underground storage system usually sits below the pavement to store the stormwater.

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces runoff from streets and parking lots.
- Wide application.
- Works well in urban environments.
- Can manage a large volume of stormwater.
- Manages stormwater without reducing hardscaped areas.

TYPICAL APPLICATIONS

- Streets
- Sidewalks
- Parking Lots

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Variable cost based on soil/site conditions and size.
- May not be suitable for all locations where traditional pavement is used.
- Not recommended for areas with steep slopes.
- Infiltration testing required.

SIZE/VOLUME

(typical size required/ volume managed by GSI)

GREEN GUTTER


Image Credit: Flickr/Jarrett M


Image Credit: Flickr/DeepRoot

Green gutters are continuous, narrow areas with soil and plants that are put along the edge of a street where it meets a sidewalk, with a new curb at the street edge. The soil and plants are lower than street level to capture stormwater from roads and sidewalks. Green gutters can vary in size and materials.

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces and filters runoff.
- Flexible design.
- Enhances surrounding landscape/streetscape/ beautification.
- Works well in urban environments.
- Minimal space requirements.
- Relatively inexpensive to retrofit.

TYPICAL APPLICATIONS

- Streets
- Sidewalks
- Parking Lots

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Initial maintenance can be time-consuming until vegetation is established, afterwards maintenance is relatively low.
- Requires careful selection of native, water-tolerant plants.
- Requires control structures (domed risers) to provide for overflow.
- Variable cost based on soil/site conditions and size.
- Infiltration testing required.

SIZE/VOLUME

(typical size required/ volume managed by GSI)

GREEN ROOF

Image Credit: Flickr/Chesapeake Bay Program

Image Credit: Flickr/Chesapeake Bay Program

A green roof (or vegetated roof) is a roof that is either partially or fully covered by a system of plants. The plants are put on top of soil or a water storage system. Green roofs vary in size and depth depending on the weight the existing roof can handle.

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces energy costs (heating and cooling).
- Provides aesthetic value (when visible/accessible).
- Captures roof runoff.

TYPICAL APPLICATIONS

- Residential (limited)
- Commercial
- Public Facilities
- Institutions
- Industrial

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Can only manage the rooftop runoff.
- High maintenance until vegetation is established.
- Not all roof structures can handle the load needed for a green roof system.

SIZE/VOLUME

(typical size required/ volume managed by GSI)

BLUE ROOF


Image Credit: HazenandSawyer.com


Image Credit: NYC.gov

A blue roof is a roof that is either partially or fully covered by a system of stone storage trays. The storage trays capture rainwater until it evaporates. Blue roofs vary in size and can be used alongside green roofs.

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces energy costs (heating and cooling).
- Provides aesthetic value (when visible/accessible).
- Captures roof runoff.

TYPICAL APPLICATIONS

- Residential (limited)
- Commercial
- Public Facilities
- Institutions
- Industrial

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Can only manage the rooftop runoff.
- Not all roof structures can handle the load needed for a blue roof system.

SIZE/VOLUME

(typical size required/ volume managed by GSI)

RAIN GARDEN


Image Credit: Andrew Dobshinsky


Image Credit: Flickr/PWD

A rain garden is an area with soil and plants that is not surrounded by a curb. Rain gardens are typically located in grassy areas. The soil and plants are lower than surrounding areas to capture stormwater. The stormwater collects in the rain garden, creating a small, shallow pond until the water drains down through the soil. Some rain gardens have an underground storage system beneath them to hold more stormwater. Rain gardens can vary in size and materials.

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces and filters runoff.
- Flexible design and installation.
- Enhances surrounding landscape/beautification.
- Can manage a large volume of stormwater.

TYPICAL APPLICATIONS

- Residential
- Commercial
- Public Facilities
- Institutions
- Vacant Lots
- Parks/Recreation

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Initial maintenance can be time-consuming until vegetation is established, afterwards maintenance is relatively low.
- Requires careful selection of native, water-tolerant plants.
- Requires control structures (domed risers) to provide for overflow.
- Variable cost based on soil/site conditions and size.
- Infiltration testing required.

SIZE/VOLUME

(typical size required/ volume managed by GSI)

STORMWATER WETLAND


Image Credit: Flickr/PWD


Image Credit: Flickr/Seuss

A stormwater wetland is a constructed area with soil, plants, and marshy water. Stormwater wetlands typically include a small pool that filters some pollutants out of the stormwater and then a larger area of with marshland vegetation that treats and filters the water similar to a natural wetland. Stormwater wetlands can serve as habitat for wildlife.

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces and filters runoff.
- Enhances surrounding landscape/beautification.
- Provides a habitat for wildlife.
- Can manage a large volume of stormwater.

TYPICAL APPLICATIONS

- Public Facilities
- Institutions
- Vacant Lots
- Parks/Recreation

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Initial maintenance can be time-consuming until vegetation is established, afterwards maintenance is relatively low.
- Requires careful selection of native, water-tolerant plants.
- Requires control structures (domed risers) to provide for overflow.
- Variable cost based on soil/site conditions and size.
- Infiltration testing required.

SIZE/VOLUME

(typical size required/ volume managed by GSI)

STORMWATER BASIN


Image Credit: Flickr/Aaron Volkening


Image Credit: PHS

A stormwater basin (detention/retention pond) is a sunken, usually grassy area that is designed to collect and store stormwater. Stormwater basins vary in size and can either slow the stormwater until it is treated elsewhere, or allow it to drain into the soil. Vegetation improves filtering, water quality, and the aesthetics of the basin.

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces and filters runoff.
- Enhances surrounding landscape/beautification.
- Can manage a large volume of stormwater.

TYPICAL APPLICATIONS

- Public Facilities
- Institutions
- Vacant Lots
- Parks/Recreation

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Initial maintenance can be time-consuming until vegetation is established, afterwards maintenance is relatively low.
- Requires careful selection of native, water-tolerant plants.
- Requires control structures (domed risers) to provide for overflow.
- Variable cost based on soil/site conditions and size.
- Infiltration testing required.

SIZE/VOLUME

(typical size required/ volume managed by GSI)

BIOSWALE


Image Credit: Flickr/Montgomery County Planning


Image Credit: Flickr/Aaron Volkening

A bioswale is a long, shallow depression designed to slow the flow of stormwater and allow it to drain into the soil. Swales can be used as an alternative to traditional ditches or as a way to slow stormwater before it gets to other GSI.

BENEFITS

- Reduces and filters runoff.
- Flexible design and installation.
- Enhances surrounding landscape/beautification.
- Can manage a large volume of stormwater (if designed for infiltration).
- Can replace traditional ditches/ gutter systems.
- Works well in sloped areas.

TYPICAL APPLICATIONS

- Residential
- Commercial
- Public Facilities
- Institutions
- Vacant Lots
- Parks/Recreation

MAINTENANCE

(ease of cleaning/using the GSI)

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Initial maintenance can be time-consuming until vegetation is established, afterwards maintenance is relatively low.
- Requires careful selection of native, water-tolerant plants.
- Variable cost based on soil/site conditions and size.
- Infiltration testing required.
- Requires a medium to large amount of space.

SIZE/VOLUME

(typical size required/ volume managed by GSI)

FLOW-THROUGH PLANTER


Image Credit: Flickr/Melbourne Water


Image Credit: PWD

A flow-through planter is a box with soil and plants that sits on the ground, typically located next to a building. The stormwater from the building's roof is directed to the stormwater planter through a downspout. Stormwater filters through the soil in the box.

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces runoff from rooftops.
- Flexible design.
- Enhances surrounding landscape/streetscape/ beautification.
- Works well in urban environments.
- Minimal soil/site consideration.

TYPICAL APPLICATIONS

- Residential
- Commercial
- Public Facilities
- Institutions

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Initial maintenance can be time-consuming until vegetation is established, afterwards maintenance is relatively low.
- Requires careful selection of native, water-tolerant plants.
- Requires control structures (domed risers) to provide for overflow.
- Variable cost based on soil/site conditions and size.
- Can only manage rooftop runoff.

SIZE/VOLUME

(typical size required/ volume managed by GSI)

RAIN BARREL


Image Credit: PWD


Image Credit: Flickr/Center for Neighborhood Technology

Rain barrels are enclosed, typically plastic or metal structures that sit on the ground, typically located next to a building. The stormwater from the building's roof is directed to the rain barrel through a downspout. Stormwater is stored in the rain barrel until it is needed for another use. The collected water is often used for things that do not require drinking water, like watering plants or washing cars.

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces runoff from rooftops.
- Provides additional water for irrigation and other needs.
- Saves money by reducing the amount of water needed for irrigation.
- Easy implementation and maintenance.
- No soil infiltration.
- Minimal soil/site consideration.

TYPICAL APPLICATIONS

- Residential
- Commercial
- Public Facilities
- Institutions

COST

(typical cost of designing and building GSI)

LIMITATIONS

- Can only manage rooftop runoff.
- Additional GSI options are often necessary to manage stormwater for the larger site.
- Requires a use for the stored water.

SIZE/VOLUME

(typical size required/ volume managed by GSI)

CISTERN


Image Credit: PWD


Image Credit: Flickr/Center for Neighborhood Technology

Cisterns are large, enclosed structures that can sit on the ground or be buried below ground. Stormwater is directed to cisterns through downspouts or pipes. Stormwater is stored in the cistern until it is needed for another use. The collected water is often used for things that do not require drinking water, like watering plants or washing cars.

MAINTENANCE

(ease of cleaning/using the GSI)

BENEFITS

- Reduces runoff.
- Provides additional water for irrigation and other needs.
- Saves money by reducing the amount of water needed for irrigation.
- Easy implementation and maintenance.
- No soil infiltration.
- Minimal soil/site consideration.

TYPICAL APPLICATIONS

- Residential
- Commercial
- Industrial
- Public Facilities
- Institutions

COST

(typical cost of designing and building GSI)

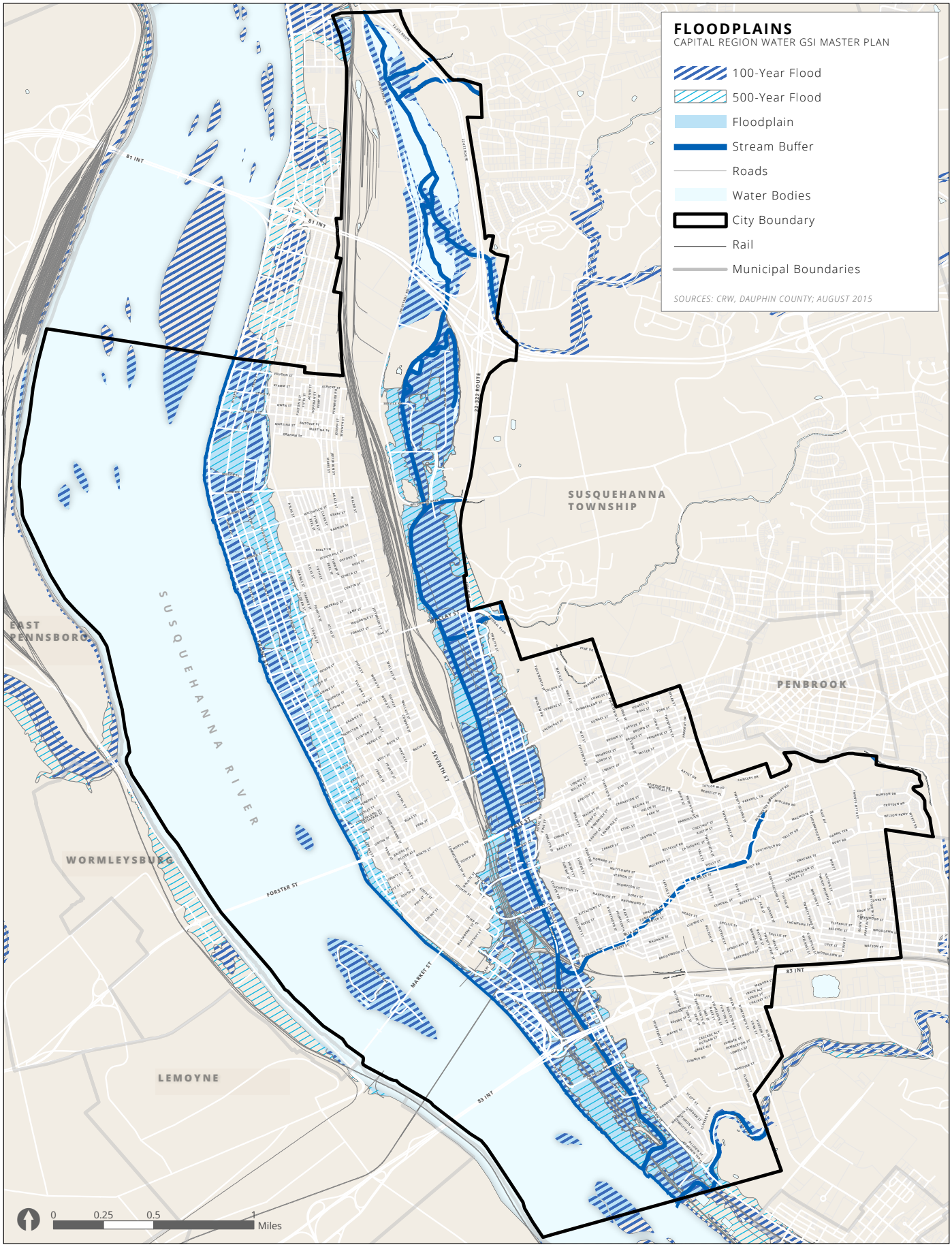
LIMITATIONS

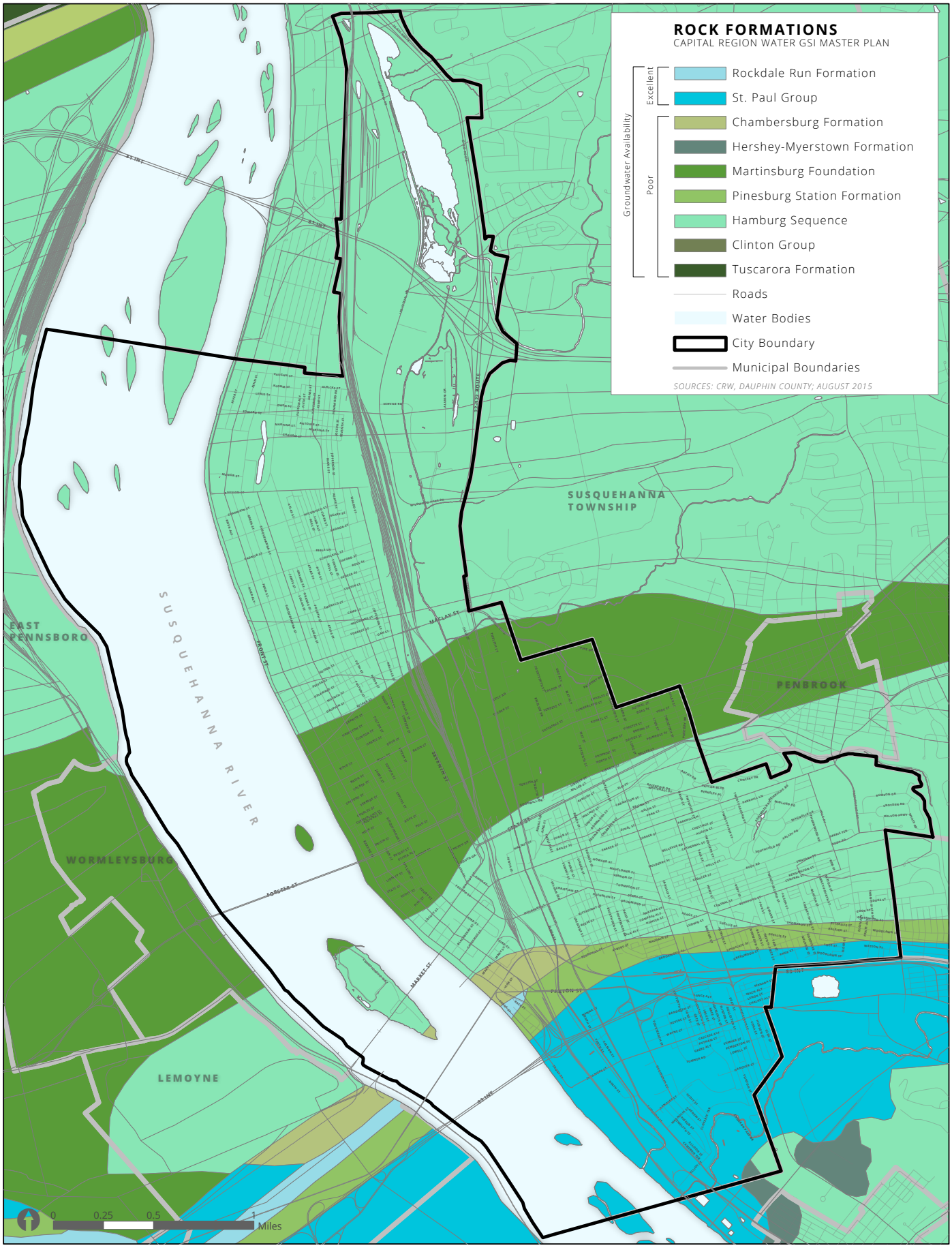
- Additional GSI options are often necessary to manage stormwater for the larger site.
- Requires a use for the stored water.

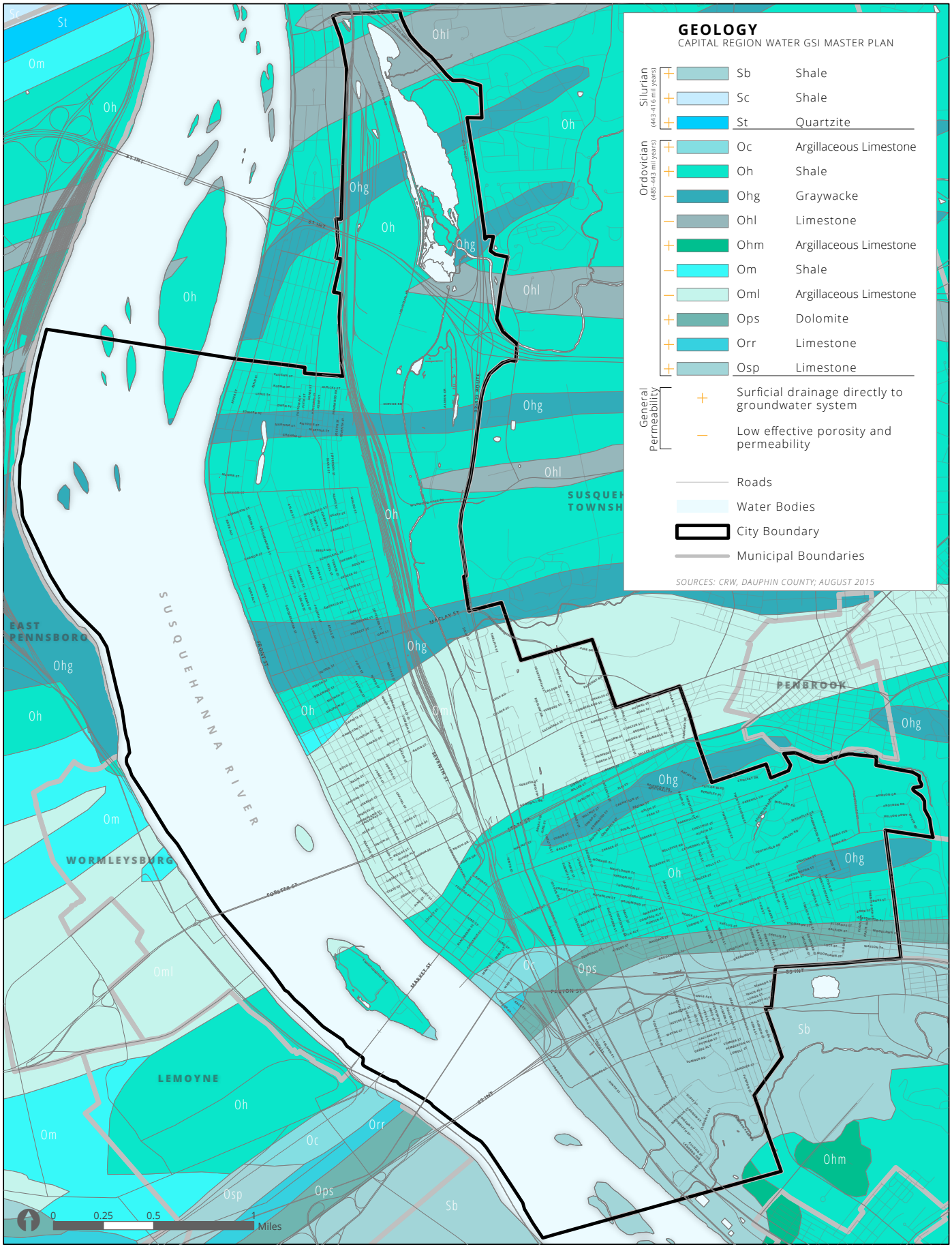
SIZE/VOLUME

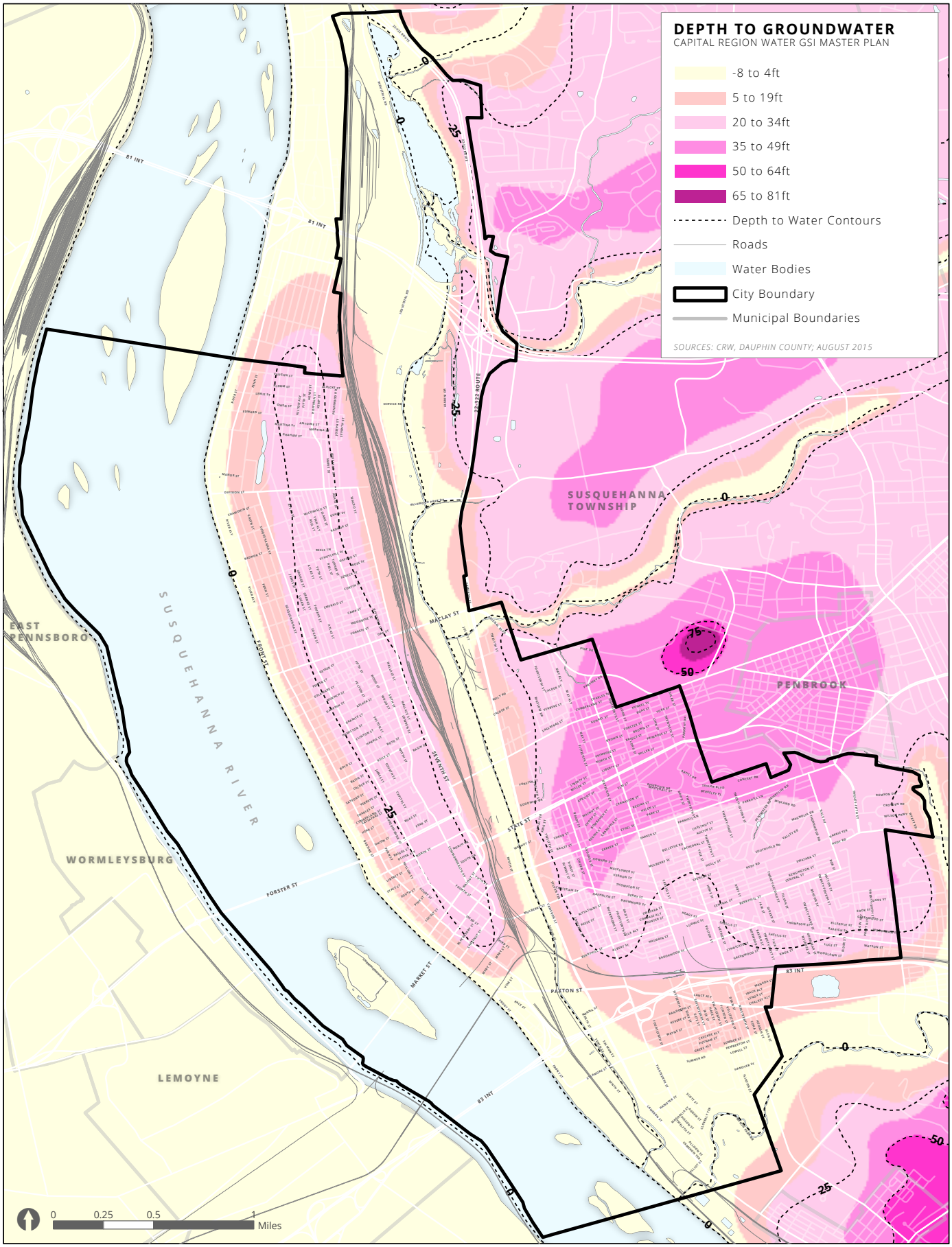
(typical size required/ volume managed by GSI)

Appendix B: Analysis Maps

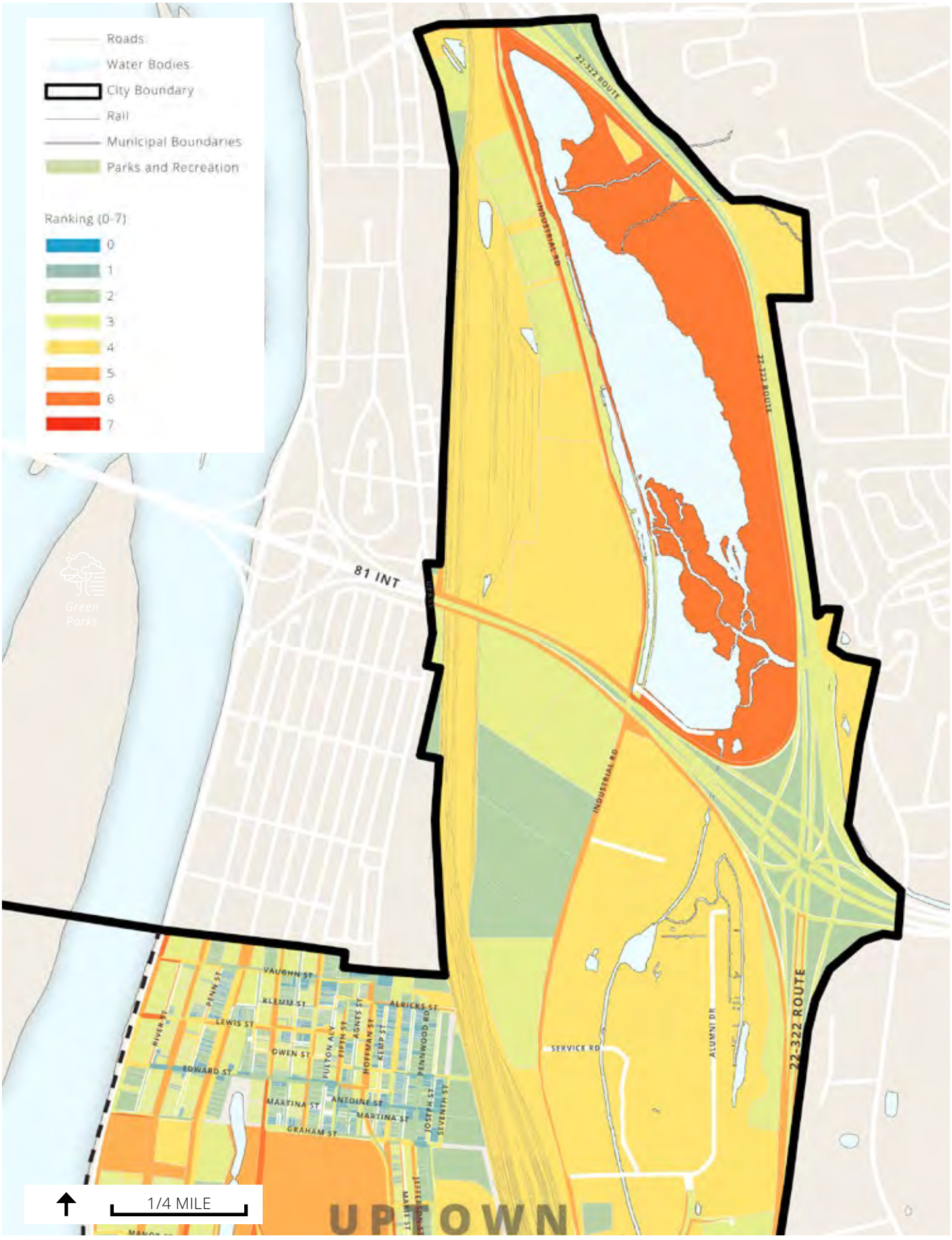

FLOODPLAINS
CAPITAL REGION WATER GSI MASTER PLAN
100-Year Flood
500-Year Flood
Floodplain
Stream Buffer
Roads
Water Bodies
City Boundary
Rail
Municipal Boundaries
SOURCES: CRW, DAUPHIN COUNTY; AUGUST 2015
SUSQUEHANNA TOWNSHIP
PENBROOK
EAST PENNSBORO
WORMLEYSBURG
LEMOYNE
SUSQUEHANNA RIVER
81 INT
83 INT
ROUTE 22
SEVENTH ST
MARKET ST
FORSTER ST
0
0.25
0.5
1
Miles

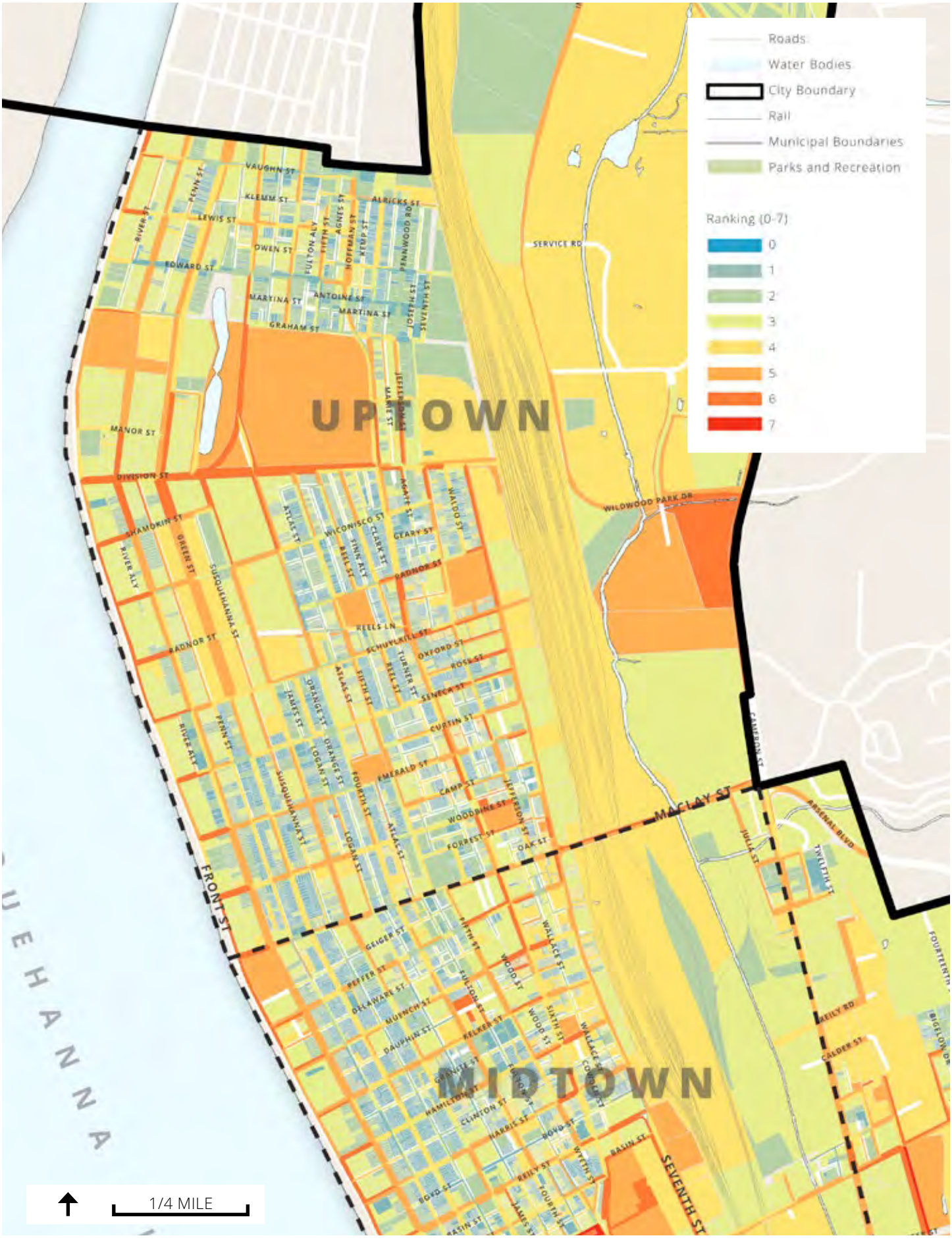

ROCK FORMATIONS
CAPITAL REGION WATER GSI MASTER PLAN
Groundwater Availability
Excellent
Poor
Rockdale Run Formation
St. Paul Group
Chambersburg Formation
Hershey-Myerstown Formation
Martinsburg Foundation
Pinesburg Station Formation
Hamburg Sequence
Clinton Group
Tuscarora Formation
Roads
Water Bodies
City Boundary
Municipal Boundaries
SOURCES: CRW, DAUPHIN COUNTY; AUGUST 2015
SUSQUEHANNA TOWNSHIP
PENBROOK
EAST PENNSBORO
WORMLEYSBURG
LEMOYNE
SUSQUEHANNA RIVER
0
0.25
0.5
1
Miles

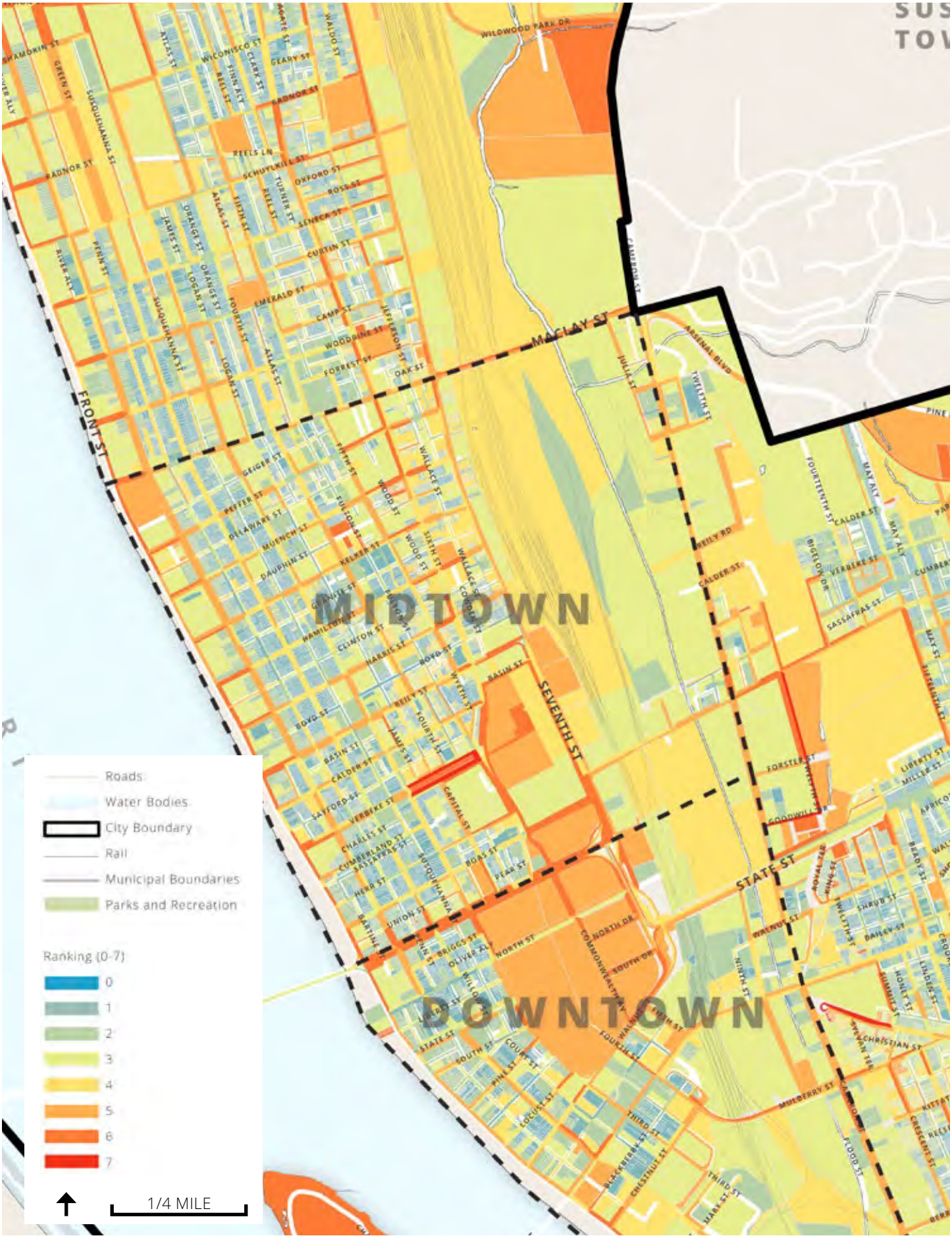

GEOLOGY
CAPITAL REGION WATER GSI MASTER PLAN
Silurian (443-416 mil years)
Sb Shale
Sc Shale
St Quartzite
Ordovician (485-443 mil years)
Oc Argillaceous Limestone
Oh Shale
Ohg Graywacke
Ohl Limestone
Ohm Argillaceous Limestone
Om Shale
Oml Argillaceous Limestone
Ops Dolomite
Orr Limestone
Osp Limestone
General Permeability
Surficial drainage directly to groundwater system
Low effective porosity and permeability
Roads
Water Bodies
City Boundary
Municipal Boundaries
SOURCES: CRW, DAUPHIN COUNTY; AUGUST 2015
SUSQUEHANNA RIVER
EAST PENNSBORO
WORMLEYSBURG
LEMOYNE
PENBROOK
0 0.25 0.5 1 Miles

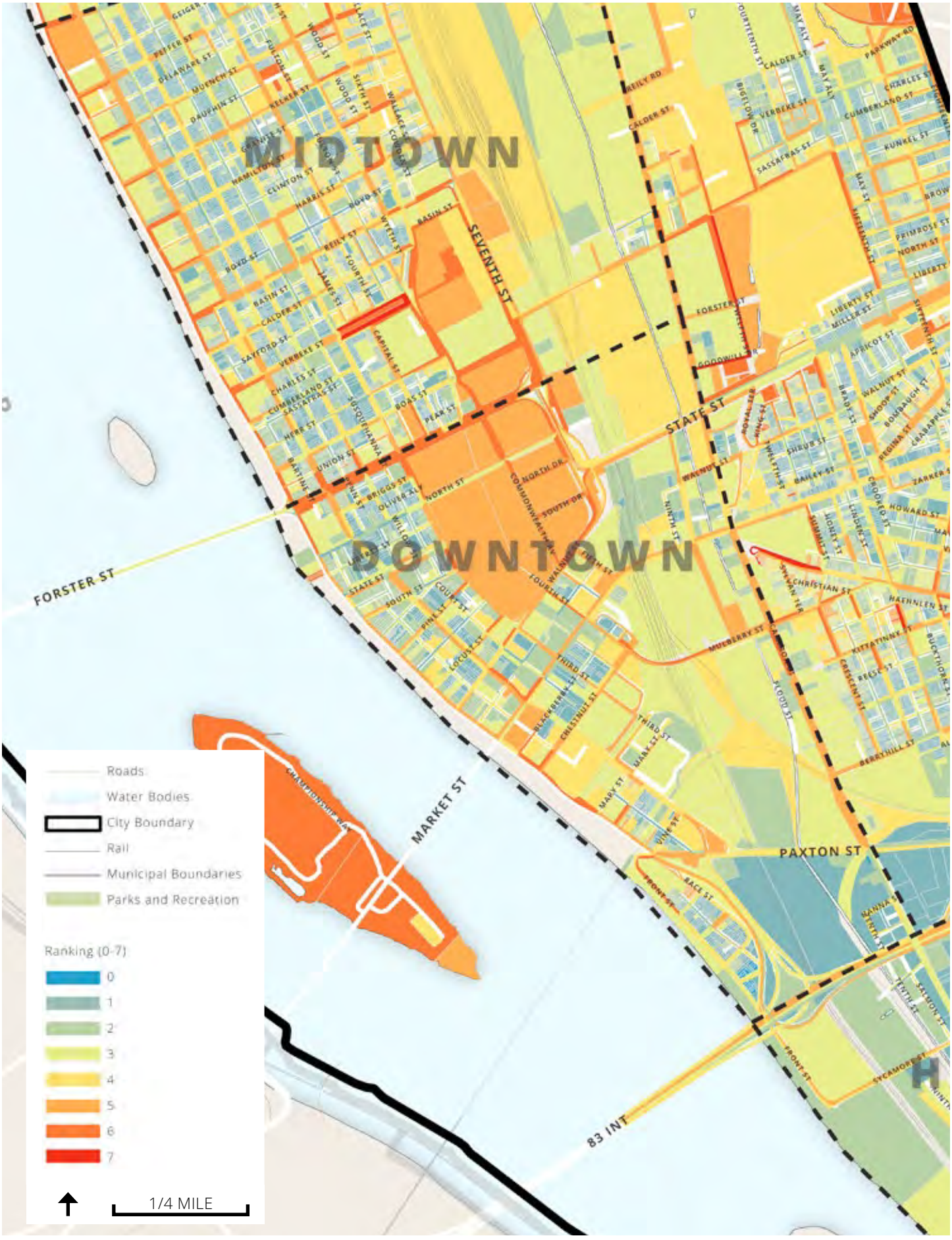

DEPTH TO GROUNDWATER
CAPITAL REGION WATER GSI MASTER PLAN
-8 to 4ft
5 to 19ft
20 to 34ft
35 to 49ft
50 to 64ft
65 to 81ft
Depth to Water Contours
Roads
Water Bodies
City Boundary
Municipal Boundaries
SOURCES: CRW, DAUPHIN COUNTY; AUGUST 2015
SUSQUEHANNA TOWNSHIP
EAST PENNSBORO
WORMLEYSBURG
LEMOYNE
PENBROOK
SUSQUEHANNA RIVER
81 INT
83 INT
MACLAY ST
FORSTER ST
SEVENTH ST
STATE ST
MARKET ST
PAXTON ST
0
25
50
75
0 0.25 0.5 1 Miles

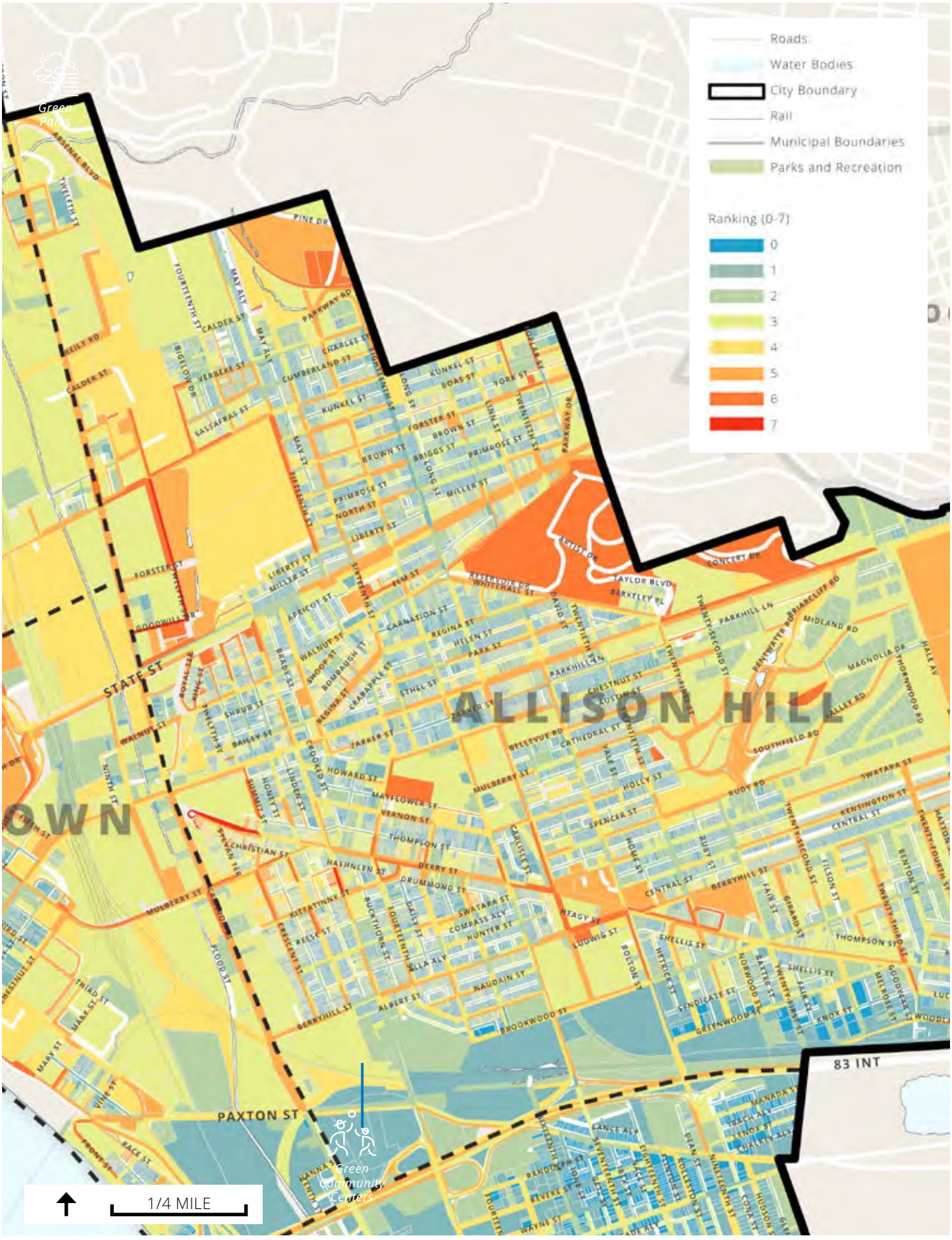
Appendix C: Parcel & Street Opportunities Maps (by District)

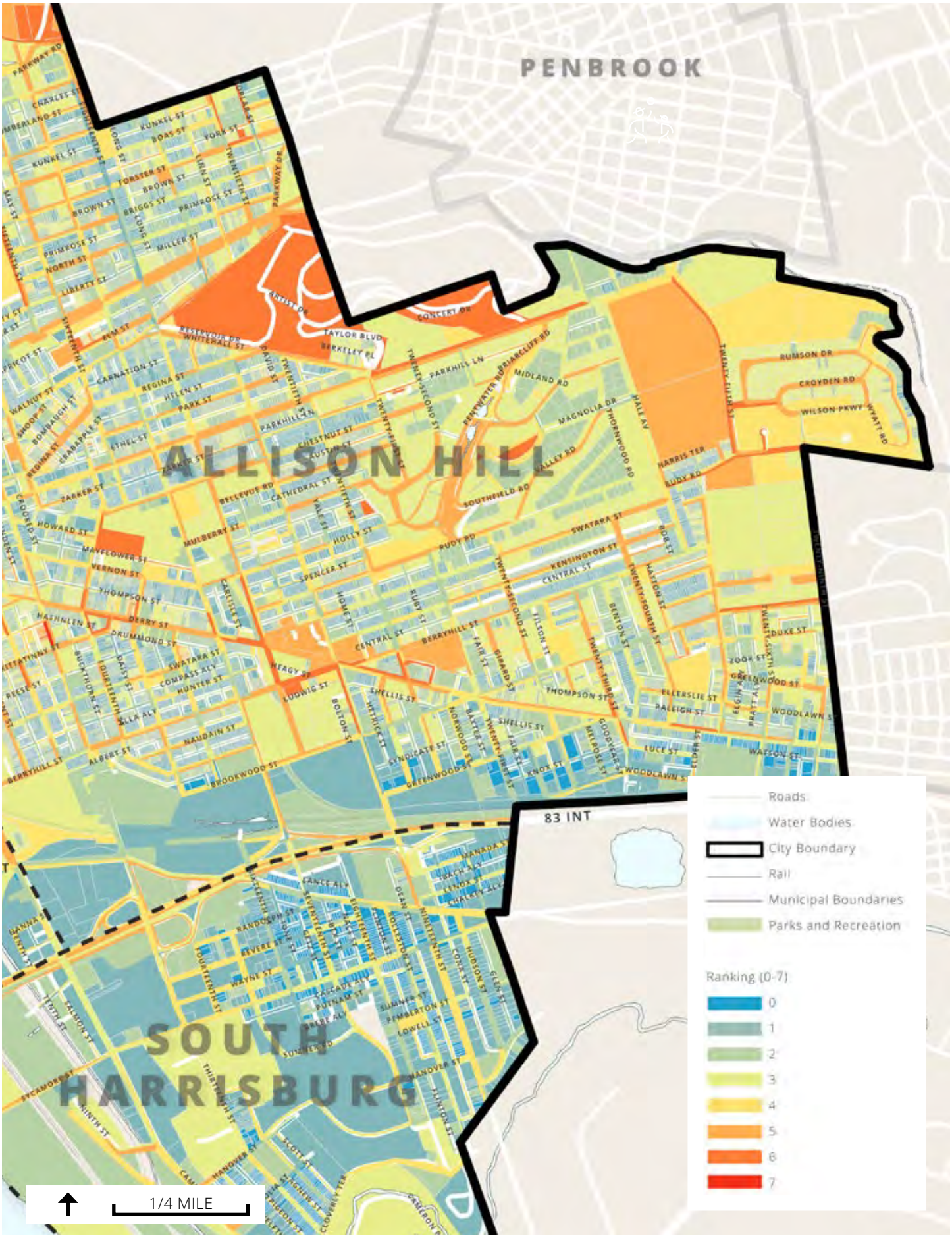

Roads
Water Bodies
City Boundary
Rail
Municipal Boundaries
Parks and Recreation
Ranking (0-7)
0
1
2
3
4
5
6
7
Green Parks
81 INT
22-322 ROUTE
INDUSTRIAL RD
SERVICE RD
ALUMNI RD
VAUGHN ST
KLEMM ST
LEWIS ST
OWEN ST
EDWARD ST
MARTINA ST
ANTOINE ST
GRAHAM ST
ALRICKS ST
PENNWOOD RD
1/4 MILE
UPTOWN

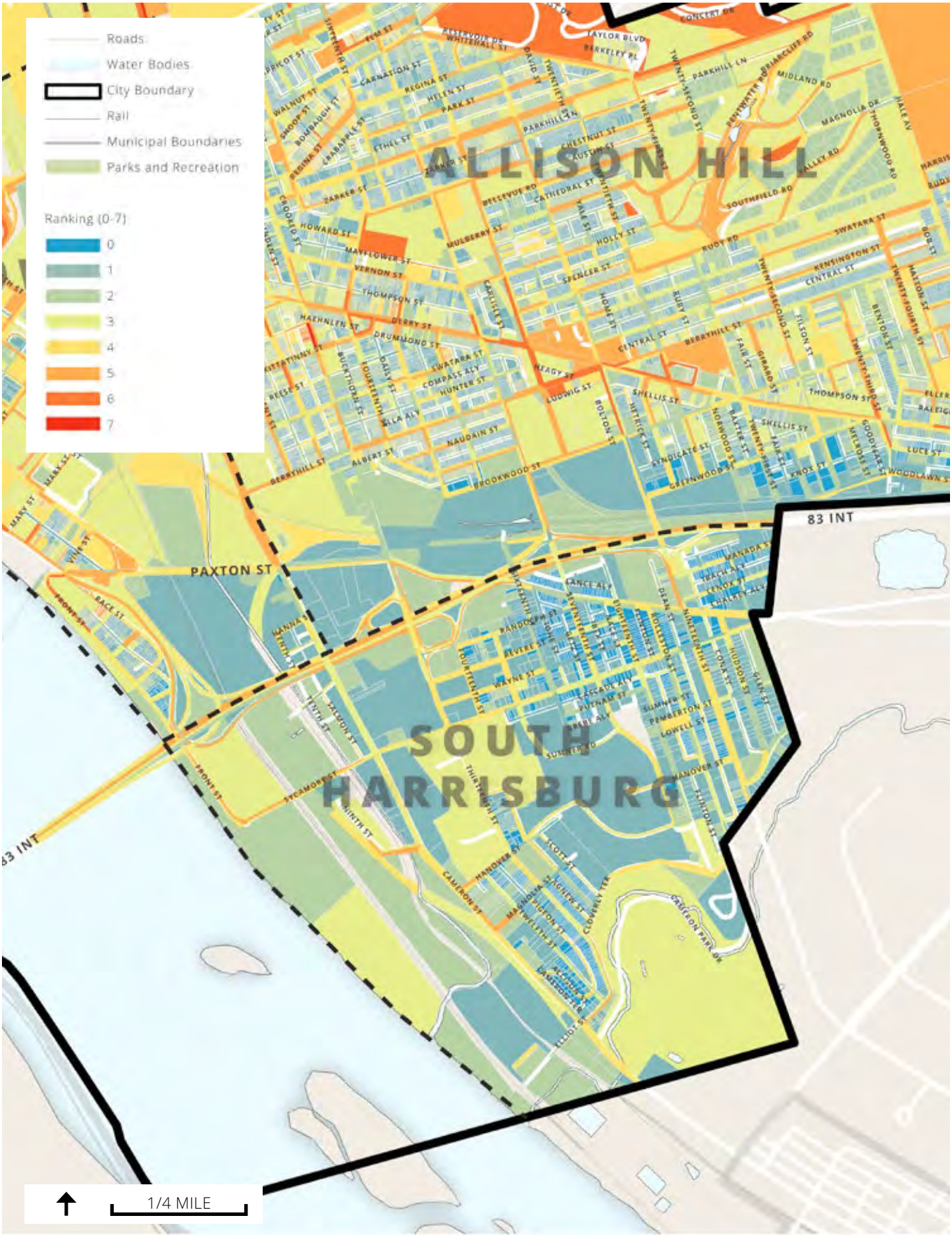

Roads
Water Bodies
City Boundary
Rail
Municipal Boundaries
Parks and Recreation
Ranking (0-7)
0
1
2
3
4
5
6
7
UPTOWN
MIDTOWN
MACLAY ST
FRONT ST
SEVENTH ST
SERVICE RD
WILDWOOD PARK DR
VAUGHN ST
KLEEM ST
LEWIS ST
OWEN ST
EDWARD ST
MARTINA ST
ANTOINE ST
GRAHAM ST
MANOR ST
DIVISION ST
SHAMOKIN ST
RADNOR ST
REELS LN
SCHUYLKILL ST
OXFORD ST
ROSS ST
SENECA ST
CURTIN ST
EMERALD ST
CAMP ST
WOODBINE ST
FORREST ST
OAK ST
GEIGER ST
PEPPER ST
DELAWARE ST
MUENCH ST
DAUPHIN ST
KELKER ST
HAMILTON ST
CLINTON ST
HARRIS ST
BOYD ST
REILY ST
BALIN ST
ARSENAL BLVD
CALDER ST
1/4 MILE


MIDTOWN
DOWNTOWN
MACLAY ST
FRONT ST
SEVENTH ST
STATE ST
Roads
Water Bodies
City Boundary
Rail
Municipal Boundaries
Parks and Recreation
Ranking (0-7)
0
1
2
3
4
5
6
7
1/4 MILE

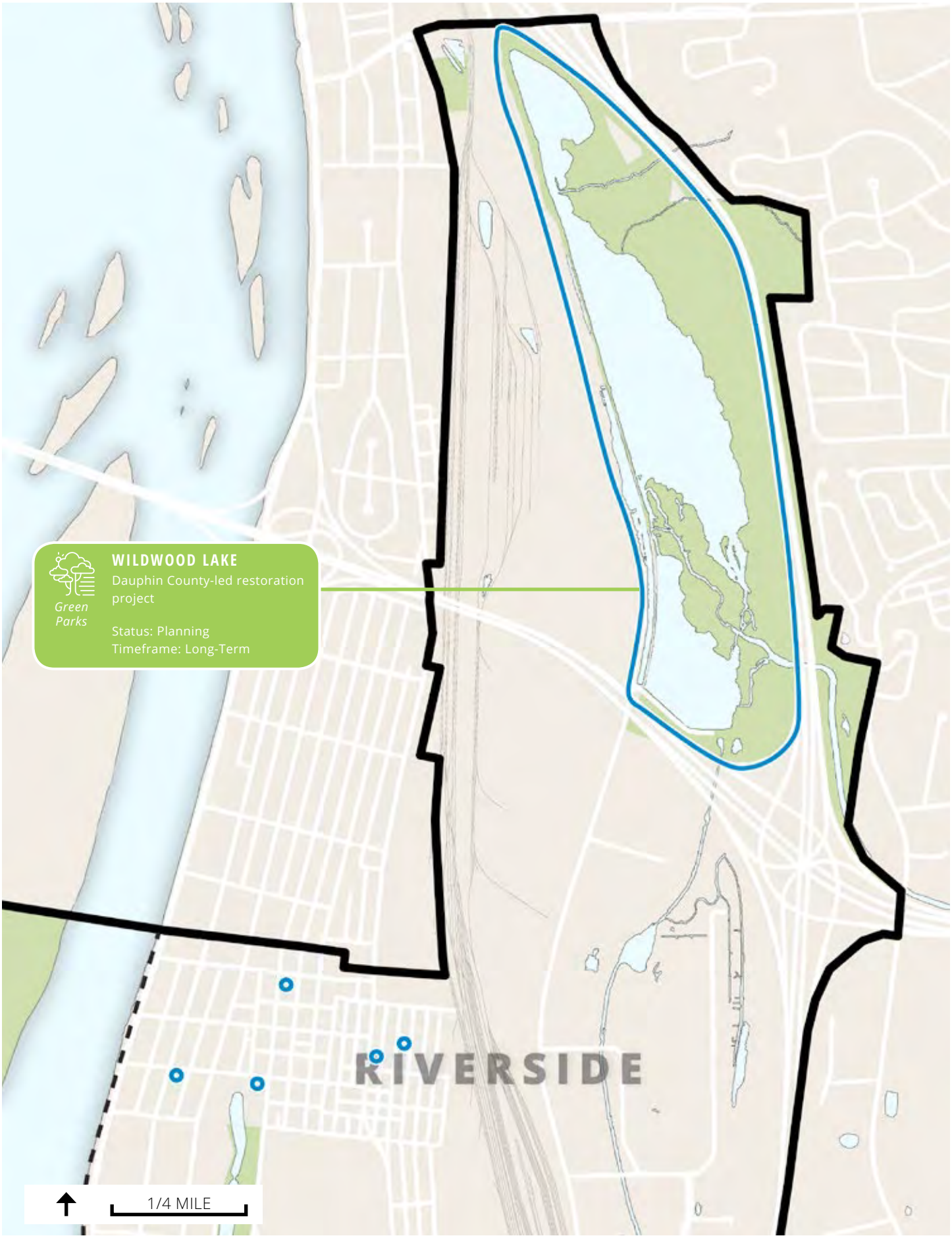

MIDTOWN
DOWNTOWN
SEVENTH ST
STATE ST
FORSTER ST
MARKET ST
PAXTON ST
83 INT
Roads
Water Bodies
City Boundary
Rail
Municipal Boundaries
Parks and Recreation
Ranking (0-7)
0
1
2
3
4
5
6
7
1/4 MILE

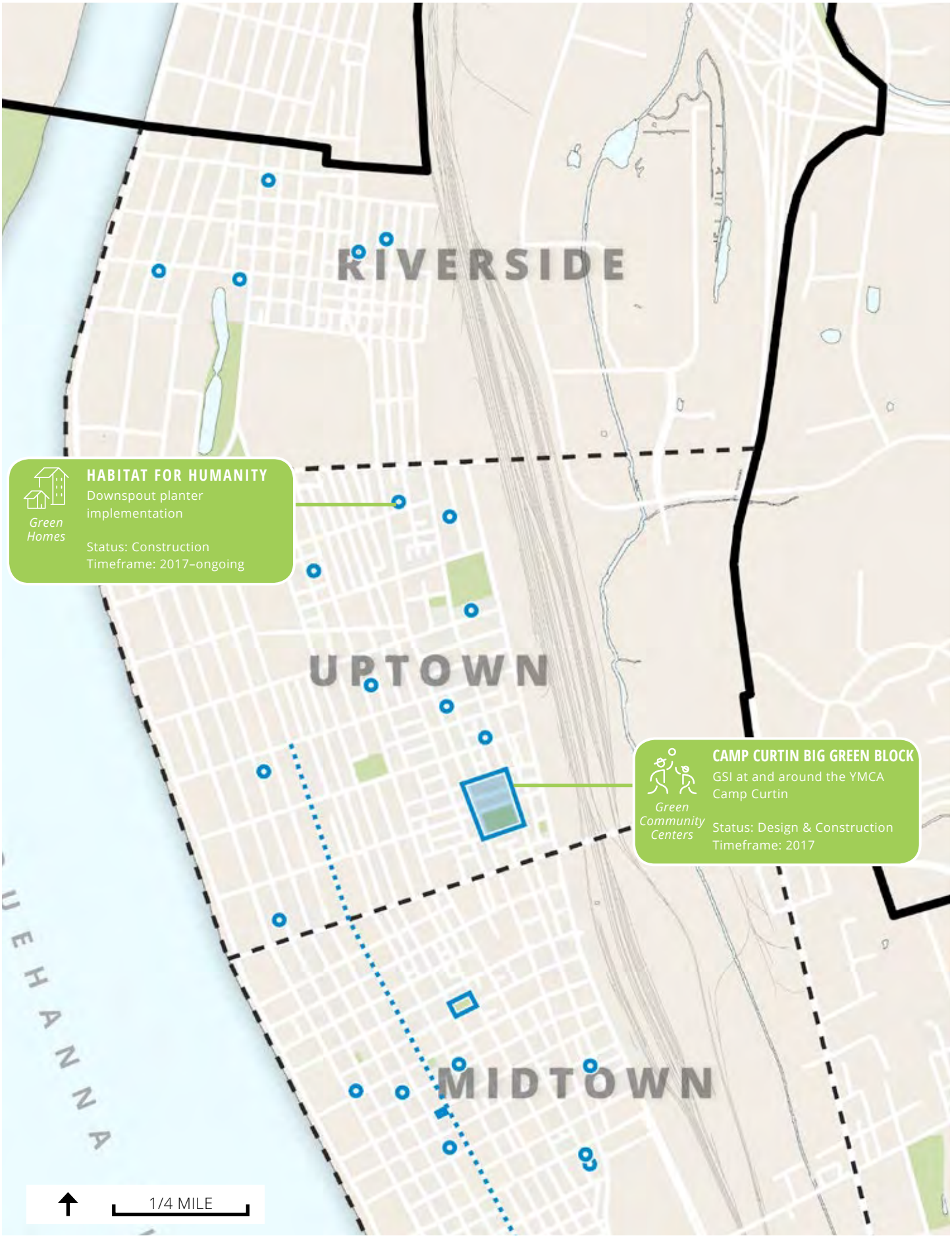

Roads
Water Bodies
City Boundary
Rail
Municipal Boundaries
Parks and Recreation
Ranking (0-7)
0
1
2
3
4
5
6
7
Green Parks
Green Community Centers
ALLISON HILL
STATE ST
PAXTON ST
83 INT
1/4 MILE

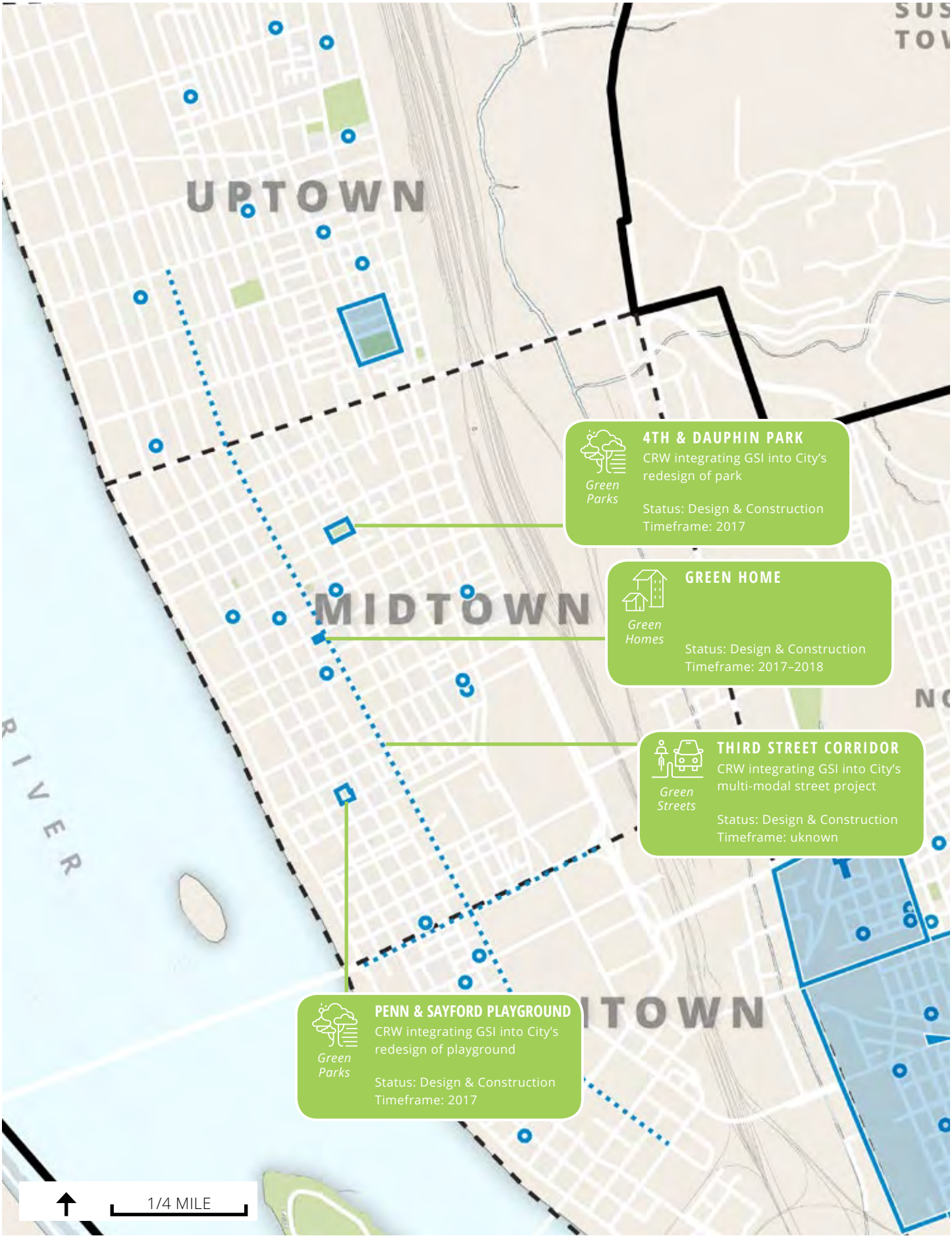

PENBROOK
ALLISON HILL
SOUTH HARRISBURG
83 INT
Roads
Water Bodies
City Boundary
Rail
Municipal Boundaries
Parks and Recreation
Ranking (0-7)
0
1
2
3
4
5
6
7
1/4 MILE

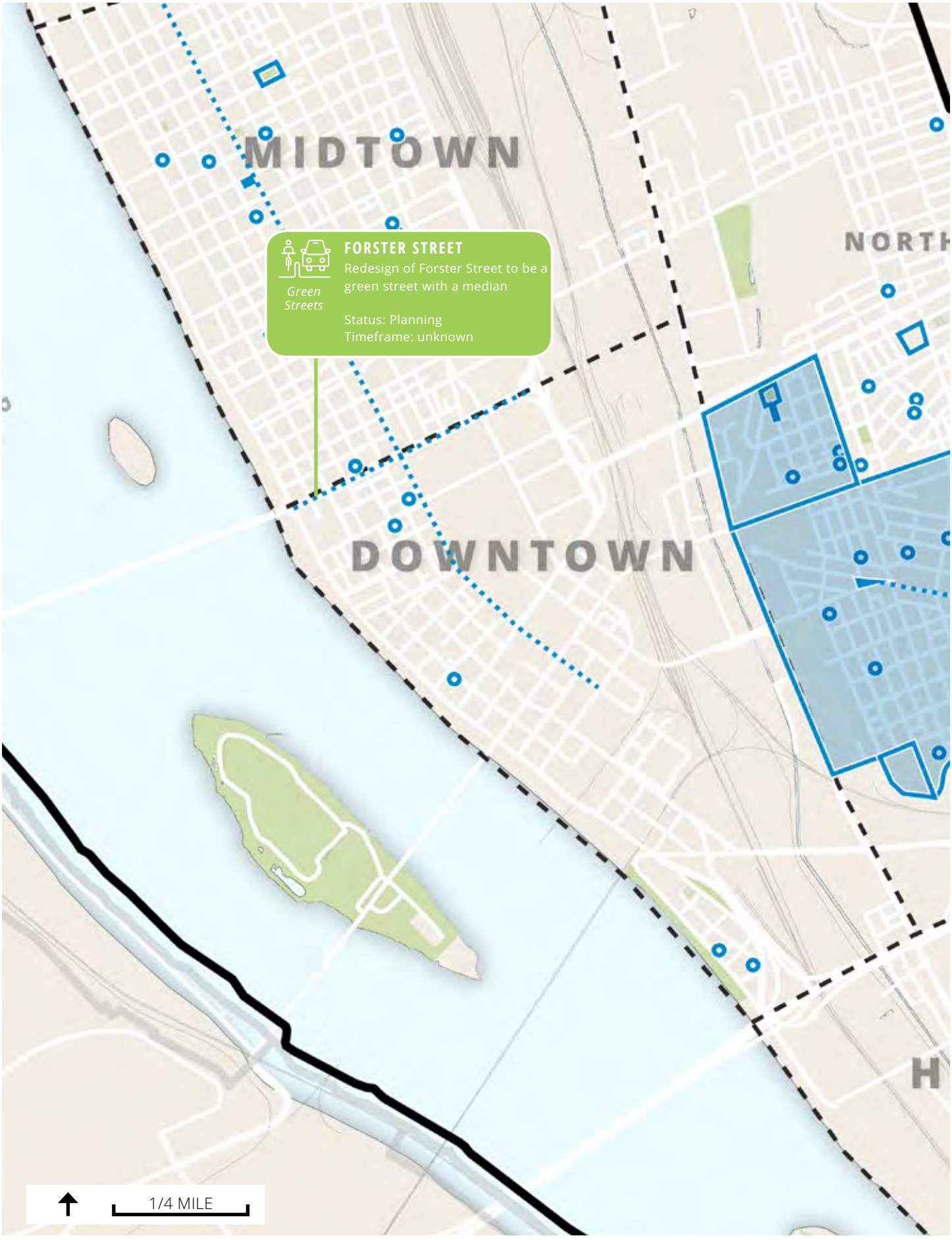

Roads
Water Bodies
City Boundary
Rail
Municipal Boundaries
Parks and Recreation
Ranking (0-7)
0
1
2
3
4
5
6
7
ALLISON HILL
SOUTH HARRISBURG
PAXTON ST
83 INT
1/4 MILE

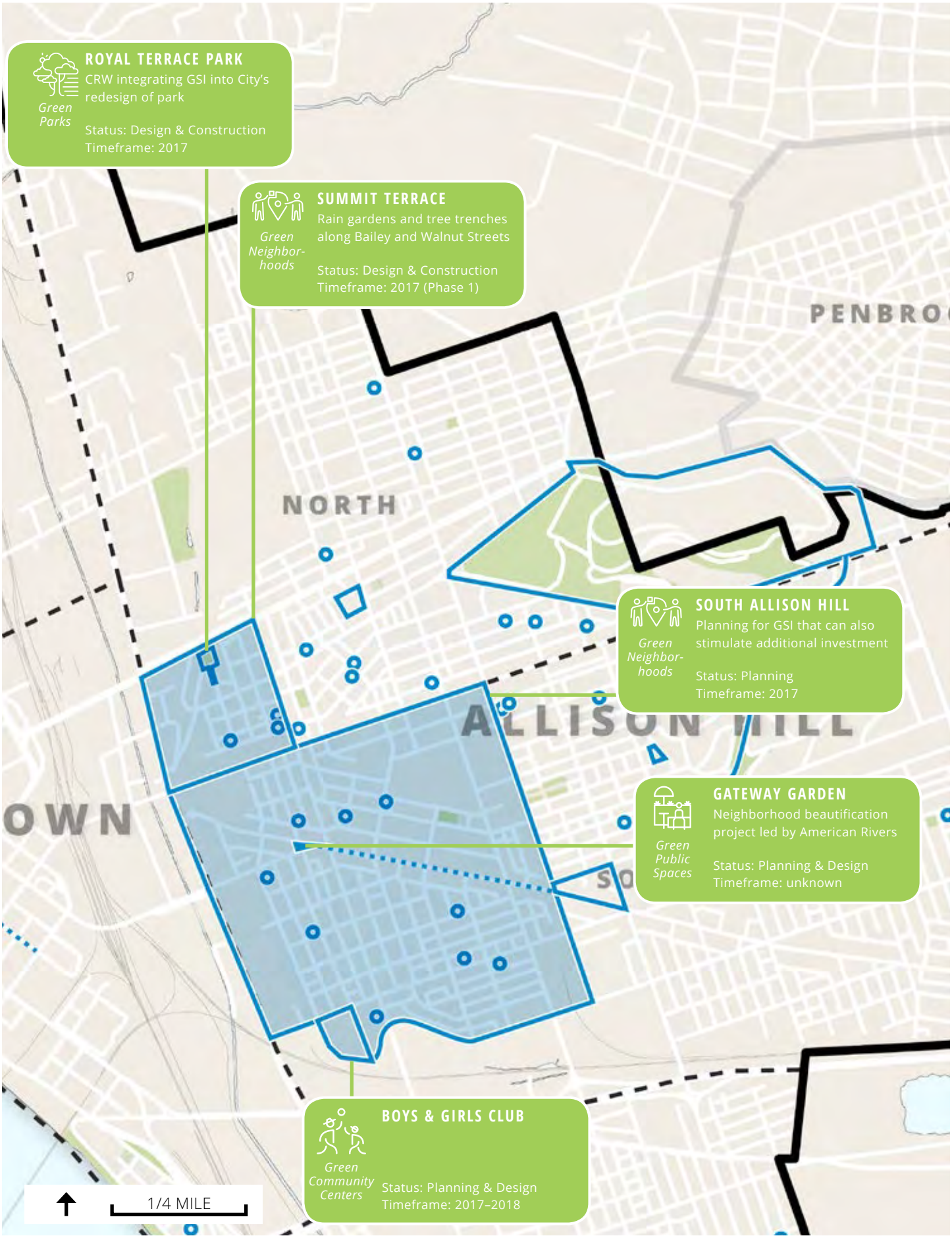
Appendix D: Planned Projects by District

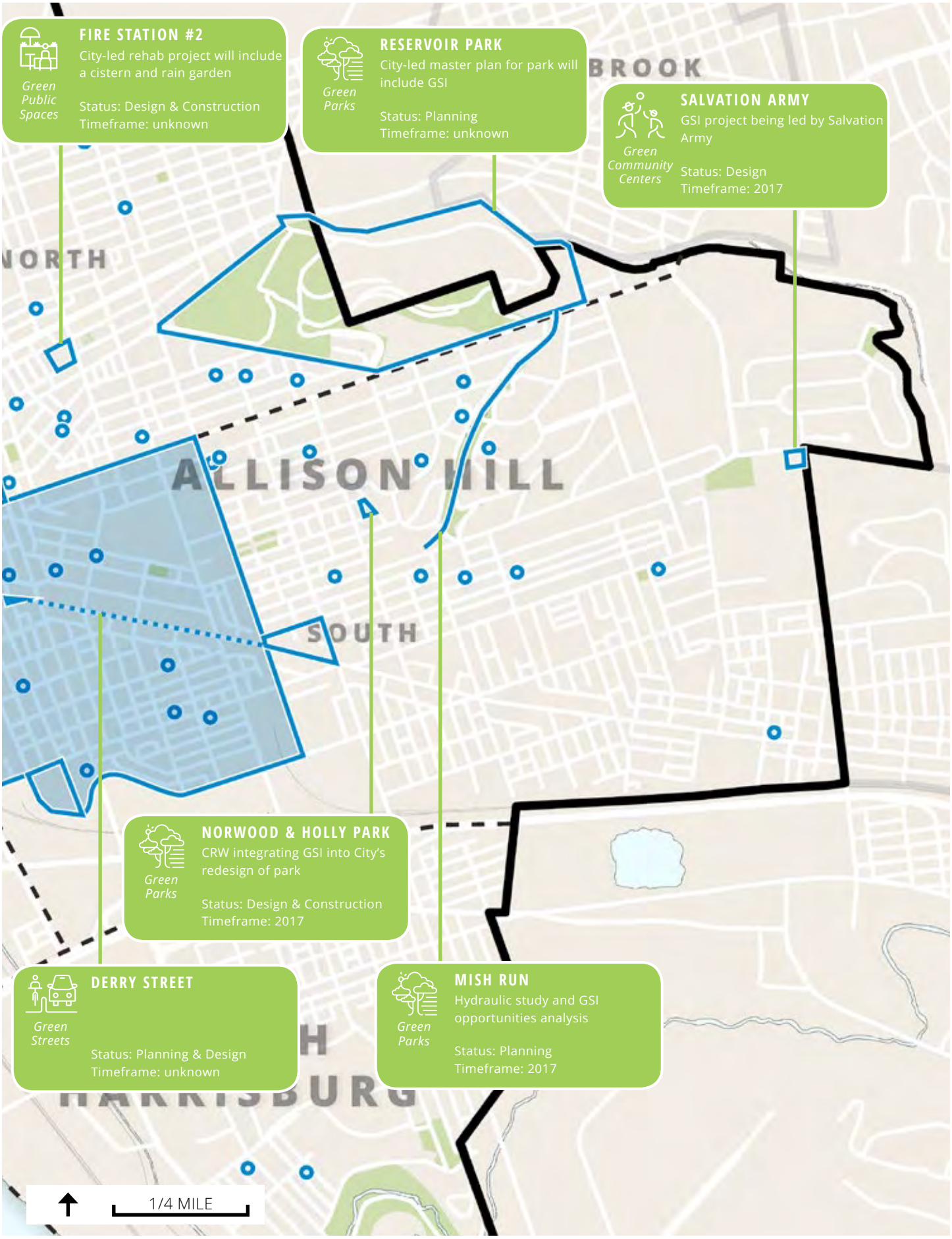

WILDWOOD LAKE
Dauphin County-led restoration project
Status: Planning
Timeframe: Long-Term
Green Parks
RIVERSIDE
1/4 MILE

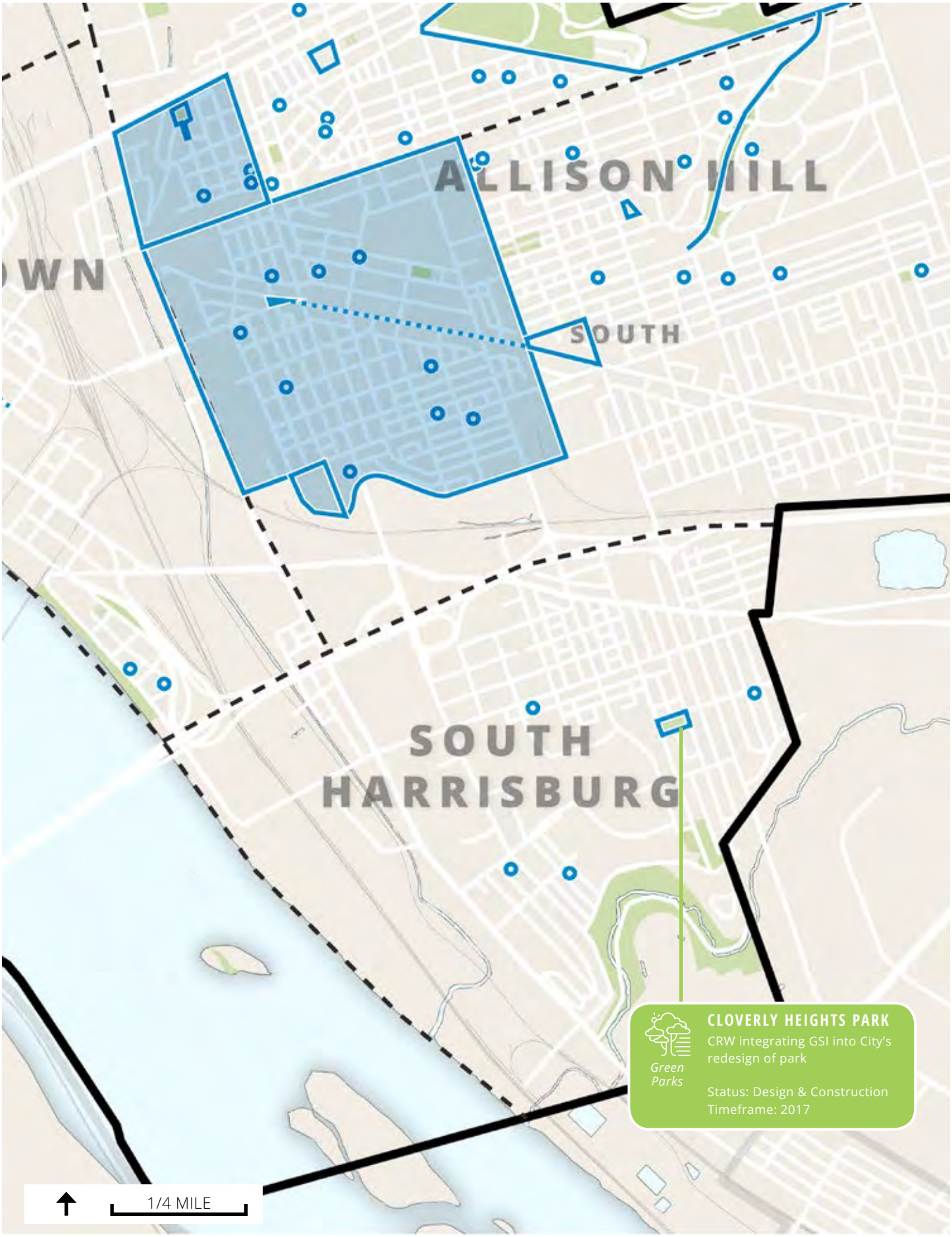

RIVERSIDE
UPTOWN
MIDTOWN
HABITAT FOR HUMANITY
Downspout planter implementation
Status: Construction
Timeframe: 2017–ongoing
Green Homes
CAMP CURTIN BIG GREEN BLOCK
GSI at and around the YMCA Camp Curtin
Status: Design & Construction
Timeframe: 2017
Green Community Centers
1/4 MILE


UPTOWN
MIDTOWN
RIVER
Green Parks
4TH & DAUPHIN PARK
CRW integrating GSI into City's redesign of park
Status: Design & Construction
Timeframe: 2017
Green Homes
GREEN HOME
Status: Design & Construction
Timeframe: 2017–2018
Green Streets
THIRD STREET CORRIDOR
CRW integrating GSI into City's multi-modal street project
Status: Design & Construction
Timeframe: uknown
Green Parks
PENN & SAYFORD PLAYGROUND
CRW integrating GSI into City's redesign of playground
Status: Design & Construction
Timeframe: 2017
1/4 MILE


MIDTOWN
NORTH
DOWNTOWN
H
Green Streets
FORSTER STREET
Redesign of Forster Street to be a green street with a median
Status: Planning
Timeframe: unknown
1/4 MILE


ROYAL TERRACE PARK
CRW integrating GSI into City's redesign of park
Status: Design & Construction
Timeframe: 2017
Green Parks
SUMMIT TERRACE
Rain gardens and tree trenches along Bailey and Walnut Streets
Status: Design & Construction
Timeframe: 2017 (Phase 1)
Green Neighbor-hoods
SOUTH ALLISON HILL
Planning for GSI that can also stimulate additional investment
Status: Planning
Timeframe: 2017
Green Neighbor-hoods
GATEWAY GARDEN
Neighborhood beautification project led by American Rivers
Status: Planning & Design
Timeframe: unknown
Green Public Spaces
BOYS & GIRLS CLUB
Status: Planning & Design
Timeframe: 2017–2018
Green Community Centers
NORTH
PENBRO
ALLISON HILL
OWN
1/4 MILE


FIRE STATION #2
City-led rehab project will include a cistern and rain garden
Status: Design & Construction
Timeframe: unknown
Green Public Spaces
RESERVOIR PARK
City-led master plan for park will include GSI
Status: Planning
Timeframe: unknown
Green Parks
SALVATION ARMY
GSI project being led by Salvation Army
Status: Design
Timeframe: 2017
Green Community Centers
BROOK
NORTH
ALLISON HILL
SOUTH
NORWOOD & HOLLY PARK
CRW integrating GSI into City's redesign of park
Status: Design & Construction
Timeframe: 2017
Green Parks
DERRY STREET
Status: Planning & Design
Timeframe: unknown
Green Streets
MISH RUN
Hydraulic study and GSI opportunities analysis
Status: Planning
Timeframe: 2017
Green Parks
HARRISBURG
1/4 MILE

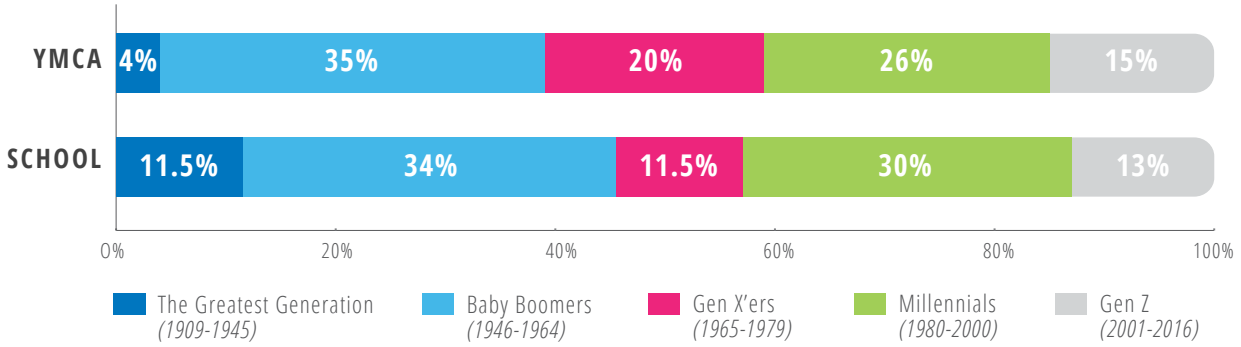

ALLISON HILL
SOUTH
SOUTH HARRISBURG
Green Parks
CLOVERLY HEIGHTS PARK
CRW integrating GSI into City's redesign of park
Status: Design & Construction
Timeframe: 2017
1/4 MILE

Appendix E: Meeting Results

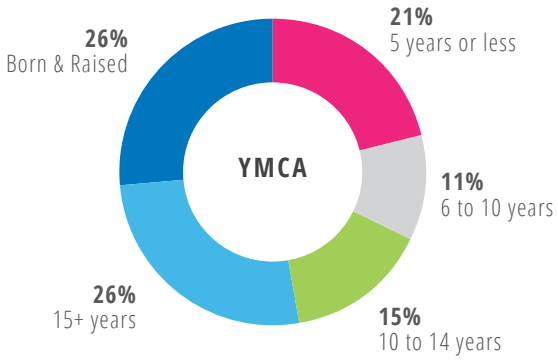
PUBLIC INPUT EVENT 1 RESULTS

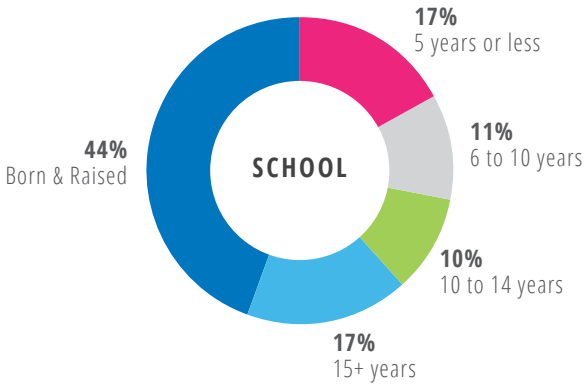
WHO ATTENDED?

GENERATION/AGE

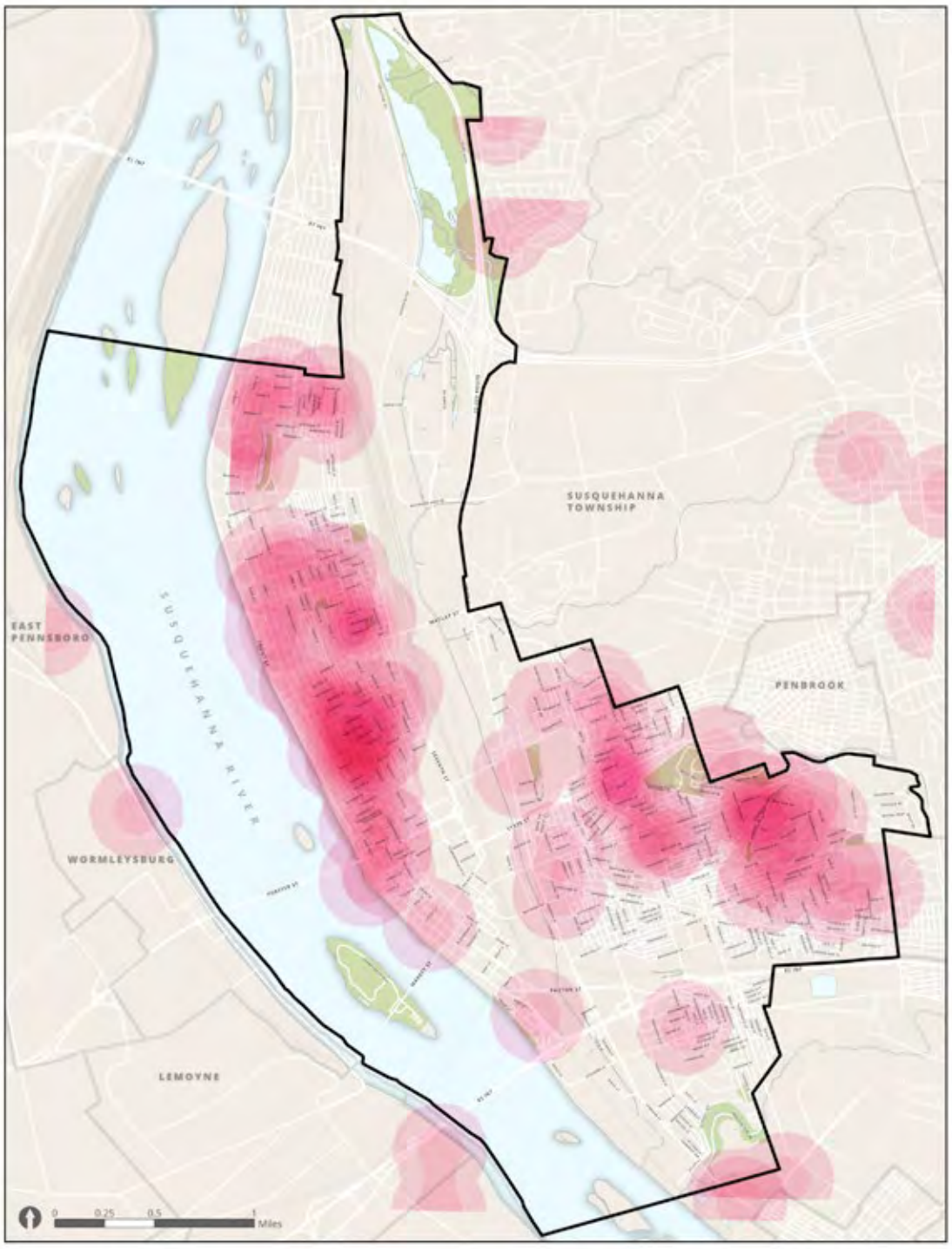


NUMBER OF YEARS LIVING IN HARRISBURG



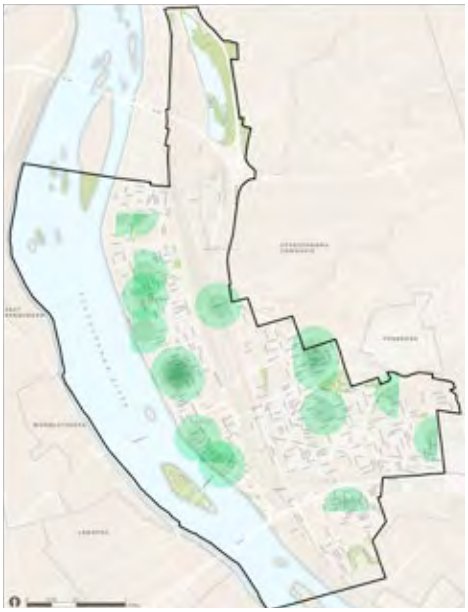


WHERE DID PEOPLE COME FROM?



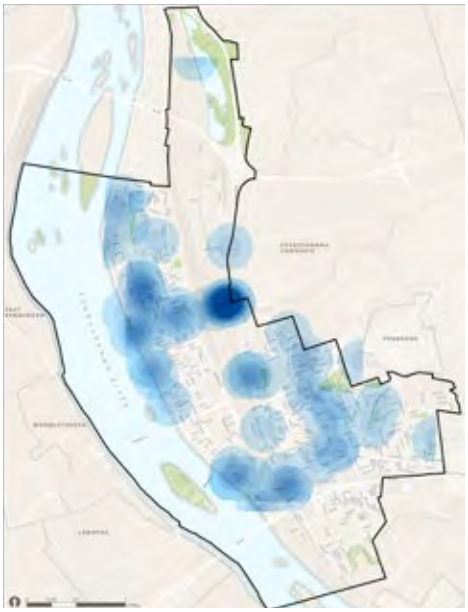
54 @ YMCA
70 @ LINCOLN SCHOOL

WHAT ISSUES WERE IDENTIFIED?



SEWER BACKUPS

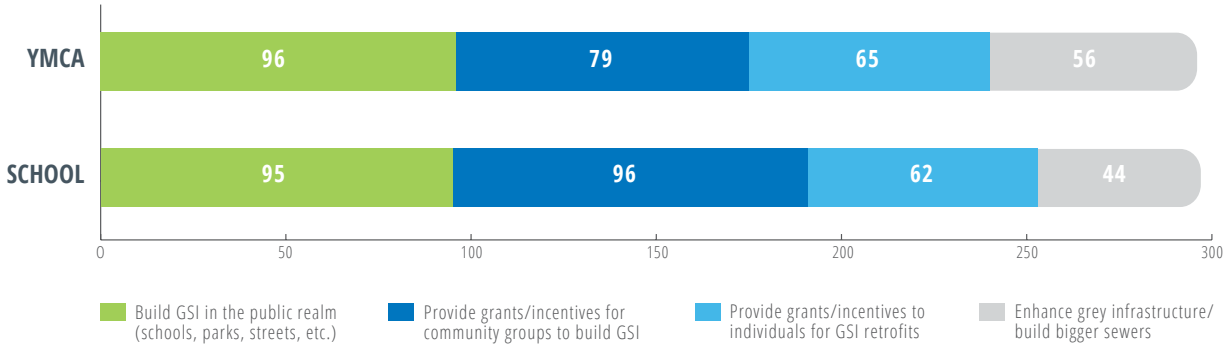
FLOATABLES/POLLUTION IN THE RIVER



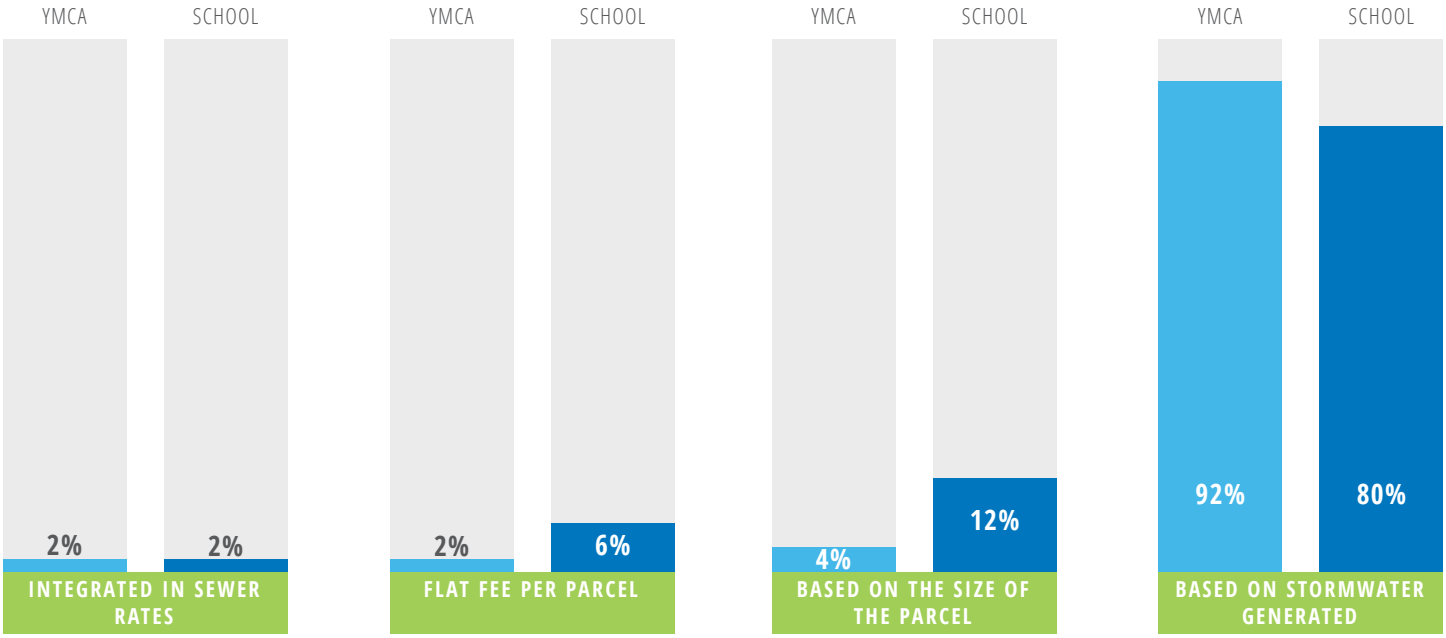
FLOODING INCIDENTS

WHAT WERE THE PRIORITIES?

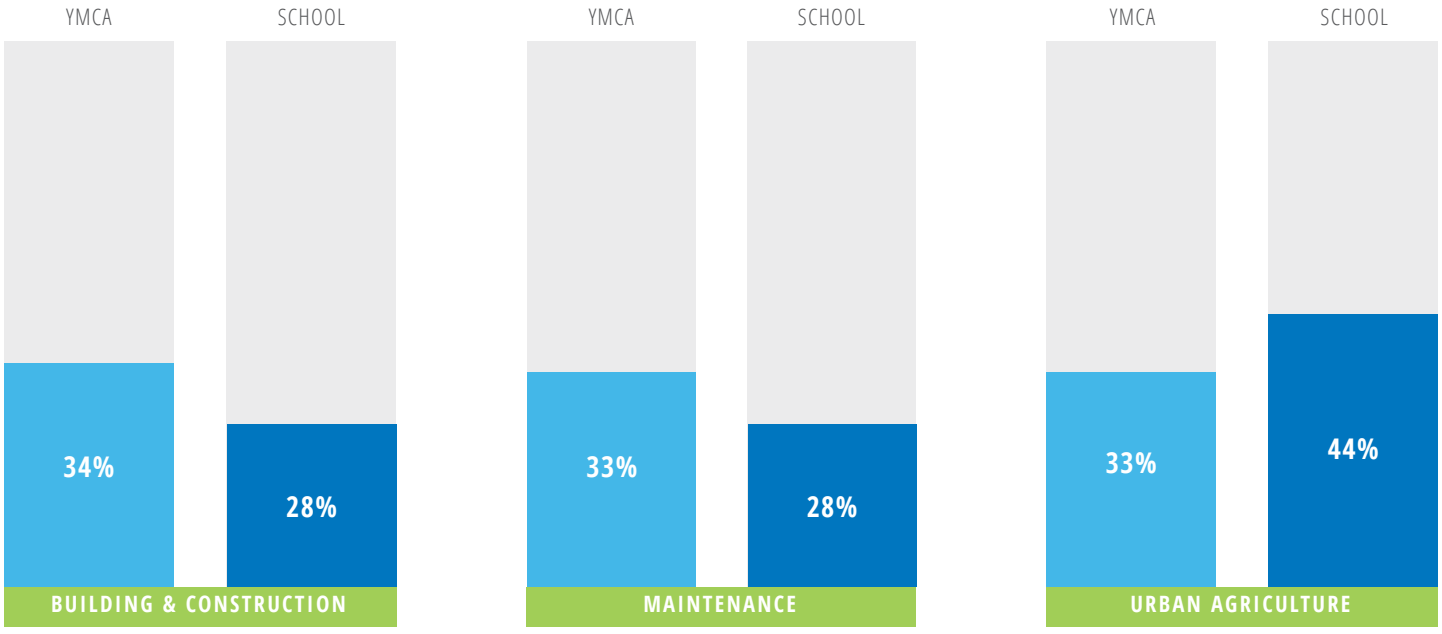
WHERE SHOULD WE INVEST? IF YOU HAD $500 TO SOLVE OUR PROBLEM:



WHICH MODEL DID PEOPLE PREFER?



WHAT OPPORTUNITIES WERE PEOPLE INTERESTED IN?



WHERE DID PEOPLE WANT TO SEE COMMUNITY GREENING?

WHERE DID PEOPLE WANT TO SEE ADDITIONAL INVESTMENT?

WHERE DID PEOPLE WANT TO SEE COMMUNITY GREENING?

- Rain garden on Brookwood behind Brookwood Market and Bath
- 5th and Hamilton
- Will commonwealth owned properties be exempt?
- Greenbelt and Stream restoration
- 16th and Carnation, right and left sides
- Better parks / clean, sustainable neighborhoods / better ways to recycle trash
- In lieu of payments available?
- Paxton Creek overflow needs to be fixed
- Mish Run / Spring Creek / Paxton Creek
- South Allison Hill
- 13th and Berryhill / Hall Manor
- External CRW to pay SW fees? Other CRW customers and communities to pay?
- City needs enforcement officers that make sure property absentee landlords/owners take care of their property.
- City-wide!!
- Parking Garages
- Storm drain at Race and Nagle Streets needs to have a larger pipe and needs to drain to the river. The water starts spouting up from the drain and Paxton Creek floods.
- Community greening
- Cameron Street / Allison Hill
- Cameron / Allison Hill / Paxton
- Bellevue Park restoration of Mish run and ponds
- Bellevue Park restoration to ponds
- Clean up Green Belt
- 3rd Street Corridor / 6th or 7th Street
- Allison Hill and Uptown
- South HBG
- Reservoir Park, Harrisburg, PA
- Restoration of Bellevue Ponds
- Massive amounts of stormwater is generated by Susquehanna Twp., especially along Elmerton. This water all rolls downhill into Cameron Street. This is a BIG problem.
- Landmark N.O. (uptown)
- 15th and Derry Streets to 15th and Naudain Streets
- Plant more trees!
- Bellevue Park pond restoration / stormwater management
- Restoration of Bellevue Ponds
- Flooding at 18th and Derry Streets
- Greening of Rooftops
- 3rd Street
- Allison Hill
- Help the whole city! Spread money around
- Allison Hill / Mulberry and Derry Streets
- Bellevue Park / Restoration of Mish Run and Bellevue Park Ponds
- Trees in Brookwood Street / 2600 block / Pervious pavement
- Cameron Street / Corridor greening
- Along Cameron Street
- Bellevue Park pond area
- Green roofs on warehouses
- Plant trees
- More trees to replace those lost in storms
- Inner City (i.e., Hill / Uptown)
- 2nd Street
- Harrisburg / 17th Street
- Cameron and Front streets
- Bellevue Park Ponds
- Rooftops: Start with city/public buildings (i.e., garages, city hall)
- 2nd Street (visible)
- 3rd Street
- Greenspace near 17th and Market Streets
- Restoration of Bellevue Ponds
- Boulevards and Main avenues
- Green Roofs / Green borders / More trees – all downtown where the most stormwater is generated (impervious structures)
- Permeable parking lots / Integration of rain gardens
- Pervious and green alleys like Granite Street / Shipoke area alleys
- All City parks
- 6th and Division Streets/ Camp curtain
- All neighborhoods
- Flooding on Cameron Street

- Riverfront
- State Street Corridor
- City (HBG) HBGSD
- Harrisburg State Hospital / Paxton Creek
- Parks
- Row Home Areas
- River / Streams\
- South Allison Hill / Downtown
- Allison Hill Section
- Uptown
- Allison Hill / Eco / impoverished / ?????
- Green the area around Scott and Rowland Schools!!
- Everywhere
- Uptown / Allison Hill
- Paxton Creek
- On the large wide streets that are all pavement today
- City Owned lots
- Education
- Vacant Lots
- Midtown
- Call Pat Stringer for ideas / 418-1702
- Uptown
- Demonstration in each neighborhood and Education demonstration in Riverfront and Reservoir Parks
- Midtown! / Midtown! / Midtown!
- Schools
- More green spaces / gardens / rain gardens
- Schools
- Downtown near Cameron
- Container Greening downtown
- Uptown / 6th & 7th
- 4th Street
- Schools and around the Harrisburg Area
- Parks
- Education
- Schools
- Streets / Parks / Vacant Lots
- City Schools
- Paxton Creek
- Allison Hill
- Commercial Buildings / Greenroofs / Vacant Lots
- At the Park
- Midtown
- South Harrisburg
- Vacant lots
- Trash Riverfront
- School
- Vacant Lots
- Demonstration in each neighborhood
- A Garden in my backyard
- 3rd Street
- Street trees / Parks / Streams and Floodplains
- Green up vacant lots – Allison Hill / Market Street

WHERE DID PEOPLE WANT TO SEE ADDITIONAL INVESTMENT?

- Streambank restoration / Floodplain reconnection
- Schools / Homes / Parks
- Parks
- When City paves streets, pay attention so grades don't change – pay attention to stormwater inlet
- Separating sewer and rainwater drainage
- Residential / Schools / Parks
- Bellevue Park / Streambank and Pond Banks restoration
- Flood overflow
- Garden / Saucany to Emerald Street
- Job Training
- Green walkway over Forster Street
- City needs enforcement officers for absentee landlords that do not take care of their property. Market Street /19th to Cameron Streets / Market is one of the gateways into our City and it is always dirty and run down.
- Rainwater to use for gardening
- Schools / Parks / Community organizations
- Bellevue Ponds and Park area
- Street trees / Bump-outs
- More Street lights
- Pervious parking lots
- 15th Street / Homes / Parks / Derry to Naudain
- Street Trees
- Streetscapes
- City / N. 18th (1004-1006)
- CSO Separation / Paxton Interceptor
- Churches / Houses
- Parks
- Plant more trees
- Schools / Susquehanna River / Lakes / Homes abandoned / Streets (potholes)
- Paxton Creek Restoration / Area Revitalization
- Green infrastructure
- Streambank and Pond bank Restoration
- Bump-outs on Market / Traffic calming
- Aging pipe / holding tanks
- Street Greening: Boulevards, more green in sidewalks
- Streets
- Community Courtyard
- Bellevue Park / Pond / Streambank Restoration
- Street Trees
- Whole City!!
- Improve sewer lines
- Plant more trees
- More green space and trees
- Aging pipe infrastructure
- Rain Gardens
- Youth projects: grow and eat
- Trees
- Restoration of Bellevue Park Ponds
- Removal of Blighted property
- More green space / less paved
- Would like to see more Community Gardens in area
- Streambank Restoration
- Previous alleys / parking lots / Parks: BB courts, playgrounds
- Streets / Parking
- Teaching residents what they can do to improve water
- Susquehanna River clean up
- Ending pollution
- Rain gardens
- Green Roof / Bulk trash removal / weekend education about environment for children
- Environmental education early
- Illegal dumping enforcement
- Roof top gardens / more fresh veggies and fruits
- Trees
- Upgrade community gardens
- Parklet / Community courtyard
- Sidewalks that are designed with SW storage
- More people to partake in making the world a better place
- Neighborhood park with chess and trees
- Trees
- Innovative high capacity residential rainwater capture for row homes
- A better reason to live other than make money
- Education / trees
- LOVE
- Community rain gardens

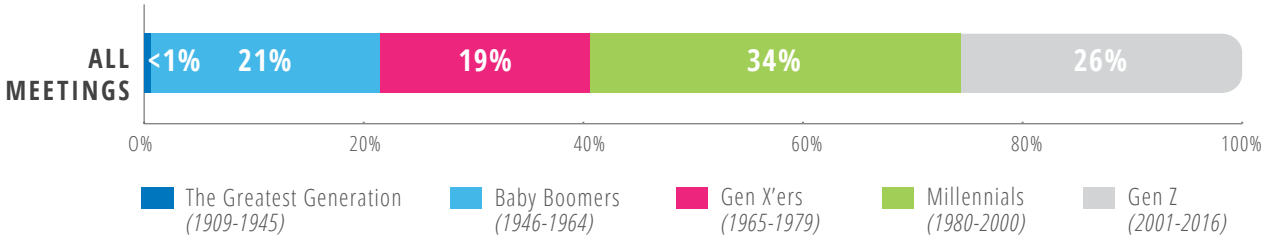
- Removing litter
- Collapsing sewer pipe
- More animals in the river and not...
- Green space / rooftop gardens / tree lined walk only streets
- More trees
- Greens, trees, bushes, etc.
- More trees
- Reducing hardscape
- LOVE
- Trees
- Rain swells / Street trees
- Rooftop parks on large buildings / old railroads
- Streams / Street trees
- Trees
- Rain gardens in public parks
- Rain gardens / Litter clean-up
- Education
- Arboretum park
- Large trees
- Green roofs / Rain gardens
- Vacant lots put to use
- Trees / Trees / Trees
- Even just giving street trees more room to grow would be great!
- Eradicating litter
- Abandoned buildings torn down
- Streets
- Education
- More greenery
- More schools
- Keeping litter our of streets and gutters / Education
- Education and children
- Education
- Playgrounds / trees / education
- Public education
- Street trees
- Trees
- Educate residents
- Playgrounds / More trees
- Playgrounds / Parks /Fruit Trees / Vegetable Plants
- Clean streams and rivers
- Existing / Green, Open spaces

COMMUNITY GREENING PARTY RESULTS

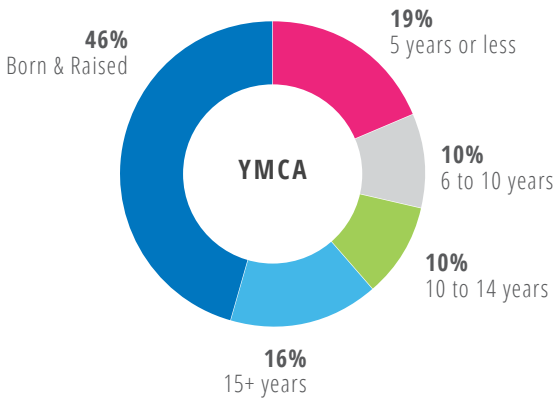
The following summarizes three Community Greening Parties and an online survey held in the Summer of 2016. Community Greening Parties were held in Uptown, South Harrisburg, and South Allison Hill.

WHO ATTENDED?

GENERATION/AGE



NUMBER OF YEARS LIVING IN HARRISBURG



HOW SHOULD WE ENGAGE WITH YOU AND YOUR COMMUNITY?

PUBLIC MEETINGS/EVENTS	51	12%
SOCIAL MEDIA	69	17%
ONLINE SURVEYS	15	4%
EDUCATIONAL SEMINARS	20	5%
SCHOOL OUTREACH	48	12%
DOOR-TO-DOOR	48	12%
CRW ATTENDING PUBLIC MEETINGS/EVENTS	10	2%
WATER BILL INSERTS	32	8%
FLYERS	31	7%
COMMUNITY AMBASSADORS/ NEIGHBORHOOD LEADERS	12	3%
EMAIL	29	7%
LOCAL TV/NEWSPAPERS	39	9%
OTHER	10	2%
	414	**100%**

ON WHAT STREETS WOULD YOU LIKE TO SEE GSI?

Full, map-based results are available in the Community Greening Concepts section of the plan.

- 6th St
- Broad Street Market
- S. 18th St
- Chestnut
- S 13th St
- Fulton St
- Reily St
- 2nd Street (restaurant row)
- Verbeke
- Market
- Derry
- 7th
- Cameron
- 100 and 200 block of Herr
- 3rd St
- Forester Street
- State street in Allison Hill
- 5th
- 6th and Maclay
- Emerald St
- State St Bridge
- Green St

IN WHAT PUBLIC SPACES WOULD YOU LIKE TO SEE GSI?

Full, map-based results are available in the Community Greening Concepts section of the plan.

- Parking lots
- HACC Midtown Parking Lots
- 13th & Derry
- Midtown Cinema
- Reily Street
- Fire Museum
- State Street
- Market (13th - 16th)
- 7th (Forester - Division)
- Uptown Plaza
- Cameron Street
- 15th and Derry
- Hall Manor
- Penn DOT
- Susquehanna Art Museum
- Verbeke St. Median
- State St. Median
- HACC Parking Lot
- 6th and Reiley,
- 4th Street vacant Lots
- William Penn Campus
- Italian Lake
- Governors Parking Lot
- Hospital by Farm Show
- Riley + 3rd HACC Midtown
- Broad St Market
- Resevoir Park
- 13th & Derryhill
- Capitol
- City Island
- Market Square

IN WHAT ALLEYS WOULD YOU LIKE TO SEE GSI?

Full, map-based results are available in the Community Greening Concepts section of the plan.

- Verbeke btw Cumberland and 17th
- Orange St
- Logan St, Basin St
- Atlas St
- Rhoads Alley
- Myers Alley
- Dauphin St
- Fulton St
- Wherever the public won't have a problem accessing their property
- Jefferson St
- Green St
- Susquehanna St
- Alley off of 4th
- Agate St
- Behind Fulton St
- Fourth St
- Penn St
- Behind Hamilton
- Derry
- Downtown YMCA
- Front & Miller
- Front St
- Behind Vernon St
- New Hamilton Health
- Hamble & Crescent
- Evergreen
- 13th and Derry

AT WHAT BUSINESSES WOULD YOU LIKE TO SEE GSI?

Full, map-based results are available in the Community Greening Concepts section of the plan.

- Café 1500
- Strawberry Square
- Midtown Scholar
- Sayford Market
- RHEAA, Jackson Lick
- 3rd Street
- Bus Station
- Division St. Market area
- Mt. Pleasant
- Dollar Tree
- Uptown Plaza
- Uptown Harrisburg Mall
- Mc Donalds
- Chans
- Rite Aid
- Gov. Square Building
- HACC
- Sayford Market
- Kline Plaza
- Plaza with TM Value 25th St
- Walmart
- Uptown Shopping Center Center
- Kline Village Shopping Center
- Broad Street Market
- Parks

IN WHAT NEIGHBORHOODS WOULD YOU LIKE TO SEE GSI?

Full, map-based results are available in the Community Greening Concepts section of the plan.

- All high density neighborhoods
- Allison Hill
- 13th St
- Derry
- Market
- Herr
- 17th St
- Allison Hill
- Downtown
- Riverside
- Capital Heights
- Calder St (towards 3rd)
- Derry St & 13th
- South Allison Hill
- 3rd St Uptown-Downtown
- Downtown
- Uptown Camp Curtain
- Market Place
- Calder (3rd - 6th)
- Fulton
- Midtown
- Olde Uptown
- 12th ward
- Strawberry Square
- Historic Midtown
- Allison Hill Market St (14th-15th)

AT WHAT COMMUNITY CENTERS WOULD YOU LIKE TO SEE GSI?

Full, map-based results are available in the Community Greening Concepts section of the plan.

- Lower income areas of the city
- Heinz Menecher
- 3rd Street Library
- 29th Street Library
- Camp Curtin YMCA
- 3rd & Kelker Neighborhood Center
- Boys & Girls Club
- Derry St Church
- Star City Zoo Crescent
- Walnut St
- Boys and Girl Club Allison Hill + S Hamilton
- South Harrisburg Church
- Susquehanna Market
- Mission Youth Center

ON WHAT VACANT LOTS WOULD YOU LIKE TO SEE GSI?

Full, map-based results are available in the Community Greening Concepts section of the plan.

- Susquehanna between Reily & Calder, 1400 block, 1700 Block
- Susquehanna and Hamilton
- Susquehanna and Granite
- 5th and Reily
- 2200 Block of Logan
- 6th Street between Divison and Reily, near Broad Street Market
- 4th and Kelker
- 5th and Kelker

- 6th Between Reily and Maclay
- 15th and Hunter
- Munech St
- 6th st
- 5th & Keuker
- 6th & Munech
- Emerald St Playground
- Penn & Susquehanna
- Front St Verbeke Sayford
- Next to Sayford Market- 3rd & Sayford
- South side playgrounds
- Evergreen & Chestnut
- AHCM Vernon St
- 1200 Block of Derry
- Market St
- William & Sayford
- Crescent St
- Pine Village Shopping Center
- 15th & Naudain St
- S. 14th St Sinkhole
- 14th St Near Market
- 18th St
- Chestnut St
- 13th & Hanover
- Derry St
- Cloverly Rd at 13th St
- 13th & Magnolia
- 17th and Hanover
- 13th and Vernon St
- 13th & Hanover

AT WHAT PARKS AND PLAYGROUNDS WOULD YOU LIKE TO SEE GSI?

Full, map-based results are available in the Community Greening Concepts section of the plan.

- Better Access to river; Radnor Access
- 19th and Boas St Playground
- 5th and Radnor (Steel School)
- Better Access
- All
- Green & Verbeke

AT WHAT SCHOOLS WOULD YOU LIKE TO SEE GSI?

Full, map-based results are available in the Community Greening Concepts section of the plan.

- All Schools
- Premier Art & Sciences

CAPITAL REGION™

WATER