

A stylized, light blue map of Pittsburgh's waterways is overlaid on a background that transitions from dark teal on the left to a bright yellow-orange on the right. The map shows the Allegheny River, Monongahela River, and their confluence into the Ohio River.

Pittsburgh Water
and Sewer Authority (PWSA)

Strategic Plan for Stormwater

Final Plan
December 2023

Stormwater Strategic Plan Team

- PennPraxis**
planning, engagement, design and communication
- The Water Center at Penn**
water systems analysis, planning and policy
- AKRF Inc.**
engineering and technical engagement
- Grounded Strategies**
stakeholder engagement
- Heather Sage**
local policy communication
- Moonshot Missions**
water economics and equity strategies
- Andropogon Associates**
land use planning and design

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Introduction by the Pittsburgh Water and Sewer Authority

In October 2020, the Pittsburgh Water and Sewer Authority (PWSA) and the City of Pittsburgh launched a global search to develop an innovative stormwater approach to address stormwater management in Pittsburgh.

With support from the Heinz Endowments, the Richard King Mellon Foundation, and the Hillman Foundation, we embarked upon the first phase of this long-term planning effort.

Penn Praxis and The Water Center at Penn were selected by PWSA to lead the stormwater planning efforts, with support by a team of sub-consultants having national expertise and a deep knowledge of local water issues. In selecting the team, PWSA looked for extensive experience in helping similar utilities manage the inherently competing needs for stormwater quantity and quality controls with visionary thinking and approaches.

The PWSA Strategic Plan for Stormwater builds off past planning efforts by using climate data, previous regional studies, community input, and best practices by our peer utilities to provide recommendations that consider equity, the environment, priority sites, and water quality. In addition to tried-and-true technical approaches, the plan is aspirational in its recommendations for PWSA's consideration and use in

future detailed stormwater planning endeavors that will provide a more detailed stormwater management approach within Pittsburgh's neighborhoods and watersheds.

Since the plan is aspirational, the recommendations – conceptual sketches, guiding principles for level of service approaches, instituting a joint task force, etc. – are strategic stepping stones to help PWSA and our stakeholders develop a final workable stormwater management plan. This plan should be viewed as an initial strategic step towards stormwater management. PWSA intends to use the Plan recommendations to eventually design and implement specific projects that meet a determined level of service to manage stormwater quantity at a rate PWSA customers can afford. As such, this plan presents a strategy to be used in reaching our final goal of delivering cost-effective and environmentally-compliant stormwater service.

PWSA has an ongoing commitment to public engagement and outreach and will provide a process for our community to provide input into our ongoing stormwater planning and implementation. An active and defined community participation process will help to ensure that the Authority's stormwater service meets the needs of the community. The plan is an exciting and timely effort for a cost-effective, inclusive, and sustainable way to address local stormwater problems and ensure that all Pittsburgh neighborhoods are represented.



Strategic Plan for Stormwater

This Strategic Plan has been developed to guide PWSA and its partners in developing core stormwater strategies and investments, and for maximizing both engineering performance and public benefit.

The Pittsburgh Water and Sewer Authority (PWSA) added stormwater management as an explicit part of its mission in 2019. These responsibilities intersect with a variety of regulatory water quality obligations such as combined sewer overflow (CSO), sanitary sewer overflow (SSO), Municipal Separate Storm Sewer System (MS4), National Pollution Discharge Elimination System (NPDES), to name a few regulatory permits – as well as managing public stormwater runoff within its service area. Addressing these complex, interrelated obligations will be an enormous, multi-decade process. To succeed in this undertaking, PWSA must maintain the support of the community and coordinate and leverage its efforts with local and regional agencies, and county, state and federal regulatory and funding partners.

A stormwater fee was implemented in 2022 as a more equitable way to charge for stormwater and fund stormwater projects and initiatives needed to improve stormwater management in Pittsburgh.

The Stormwater Strategic Team has developed this Strategic Plan for PWSA as a recommendation on how to create a framework for prioritization of investments, core strategies for maximizing both engineering performance and public benefit, and approaches for success at scale. These are based in part on an assessment of which innovative approaches deployed successfully across a number of peer cities are appropriate for Pittsburgh's unique combination of physical, governance, and resource challenges. This is a high-level planning document that helps provide a strategy for PWSA for stormwater management.

The intent is to follow up with a more detailed Stormwater Master Plan(s) with specific approaches and areas.

New Priorities

In light of ALCOSAN publishing the Clean Water Plan, PWSA has re-evaluated priorities for projects initially developed through its City Wide Green First Plan to ensure that the siting of PWSA's projects are complementary to ALCOSAN's plan and cost-effective to our rate-payers. Since PWSA became a stormwater agency, PWSA has broadened its focus beyond untreated overflows and regulatory requirements to also include stormwater management issues. Stormwater fee dollars must address core PWSA obligations, but investment can be targeted/leveraged to unlock other public benefits.

A New Investment Strategy

The scale of required investment and Pittsburgh's varied topography call for a simplified approach including: defining replicable typologies (classification based on general types), scalable efforts, a focus on life cycle cost, and community benefit.

Focus on Leveraging Resources

Stormwater is a greater challenge that cannot be addressed by PWSA alone with traditional public works delivery mechanisms. It must leverage multiple funding streams, partner with other public and private entities for mutual

benefit, and explore innovative funding approaches and delivery mechanisms.

Setting Service Expectations

PWSA will develop realistic, consistent Level-of-Service goals for stormwater that incorporate updated climate change scenarios, in coordination with other agencies such as the Department of Mobility and Infrastructure (DOMI), the Pennsylvania Department of Transportation (PennDOT), the Department of Public Works (DPW), and others. It will also commit to communicating this complex topic to ratepayers in a consistent, open fashion. This cuts to the core of the PWSA value proposition: what can the City expect for its investment?

Consistent, equitable, authentic communication and engagement with the community

PWSA must pursue a partnership-driven model, where PWSA makes decisions in conjunction with established community organizations, residents, and other agencies. Watershed task forces and community ambassador models are the core of a permanent engagement approach.

Stronger Partnerships

As stormwater is an issue that is the responsibility of many entities, PWSA cannot succeed in this effort without excellent cooperation with City agencies, ALCOSAN, and other

key organizational stakeholders. This suggests the need for a standing Joint Task Force model to address areas of overlapping responsibility, gaps in responsibility, continuity of planning, and leveraging resources. Creating meaningful representation between the watershed task forces and the Joint Task Force will add transparency and equity in ongoing decision-making regarding strategic stormwater projects. *See page 16 for more information on the recommended Joint Task Force.*

Time is of the essence for PWSA to demonstrate its ability to deliver a return on its ratepayers' stormwater fee investment. PWSA must be prepared to adapt – to a changing climate, to changing technologies, to a changing funding landscape, and innovations in practice. This does not mean however, that PWSA can afford to wait for perfect clarity.

PWSA's stormwater challenges are significant and complex. Stormwater and sewer infrastructure in the City is in many cases well beyond its design life. Decades of underinvestment and deferred maintenance, increasing regulatory obligations, and increased volumes and intensity of rainfall will require significant, thoughtful investment in long-term solutions on a large scale. This investment can, if undertaken with the guiding "P4" Principle Framework (People, Planet, Place, and Performance), be used to leverage a broad range of community benefits while also cost-effectively addressing PWSA's specific obligations.

PWSA and the City have invested significant planning efforts in assessing overflow reductions in parallel with ALCOSAN. With more clarity as to ALCOSAN's path forward, PWSA is re-evaluating its priorities for projects initially developed through the City Wide Green First Plan, to ensure that the siting of PWSA's projects complement ALCOSAN's Clean Water Plan and are cost-effective to PWSA's rate payers. Instead of continuing forward with projects with the main goal being CSO reduction, PWSA will be re-evaluating to select projects that not only reduce overflows but also address a broader range of stormwater challenges. Grounded in the P4 principles, this plan provides an analysis of these challenges through four lenses:

Water Quality:

PWSA investment will be necessarily driven by its regulatory obligations under the Clean Water Act. The specific breadth and timing of these obligations is taking shape, but details are under negotiation with applicable state and federal regulatory agencies.

Localized Flooding:

Pittsburgh faces a City-wide litany of challenges related to localized street flooding, undersized stormwater conveyance, and basement backups which affect the quality of life of its residents on a regular basis. Addressing these challenges will require close coordination with Allegheny County, the Department of Mobility and Infrastructure (DOMI), the Department of Public Works (DPW), the Pennsylvania Department of Transportation (PennDOT), City Planning, Permits, Licensing and Inspection (PLI), and other entities with responsibility for surface conditions and land development.

Socioeconomic and Environmental Justice:

Many neighborhoods in Pittsburgh have endured decades of disinvestment and underinvestment in infrastructure and public amenities. Pittsburgh's historic development patterns and topography mean many of these communities also bear the brunt of flooding and other environmental challenges. PWSA's stormwater investments can be crafted in conjunction with economic development groups and the community to spur economic and workforce development while cost effectively addressing PWSA's performance goals.

Stormwater Siting Challenges:

Pittsburgh's challenging topography and geology for water management, as well as its dense historic development patterns, constrain the size and types of stormwater solutions which can be deployed at a scale sufficient to deliver cost-efficient results. Identifying parcels of public and private land in the right locations, with the right characteristics, and of sufficient size to host these investments is a key challenge for PWSA.

Six Key Actions

The scale of this challenge also means PWSA must direct its limited resources to activities which will prepare it to perform at scale and address multiple issues. Based on the experience of high-performing peer utilities with similar challenges, PWSA should focus its broader stormwater strategy on six key actions

1. **Develop and Implement a Communication Framework to Increase Transparency and Understanding of the PWSA Strategy and the Stormwater Fee Value Proposition**
2. **Institute a Joint Task Force to Develop City-Wide Action Plans for More Coordinated and Effective Management of Stormwater**

3. Analyze Priority Areas for Investment

4. Define Initial Investment Strategies

5. Establish Guiding Principles and Comprehensive Approach to Stormwater and Flooding "Level of Service"

6. Leverage Stormwater Fee Impact Through Public and Private Investment, Innovative Partnerships and Technologies, and Job Training Programs

These key actions are outlined in detail with specific, actionable recommendations in the following pages of this plan.

The implementation of these actions should parallel the ongoing negotiation of state and federal Consent Decrees, and technical work undertaken as part of PWSA's Wet Weather Program Manager. This multi-year detailed engineering effort commenced in November 2021 and involves the negotiation of a Consent Decree with the United States Department of Justice, United States Environmental Protection Agency, and the Pennsylvania Department of Environmental Protection. The effort is aimed to address the control of CSOs, and elimination of SSOs from PWSA's system, among other regulatory driven priorities.

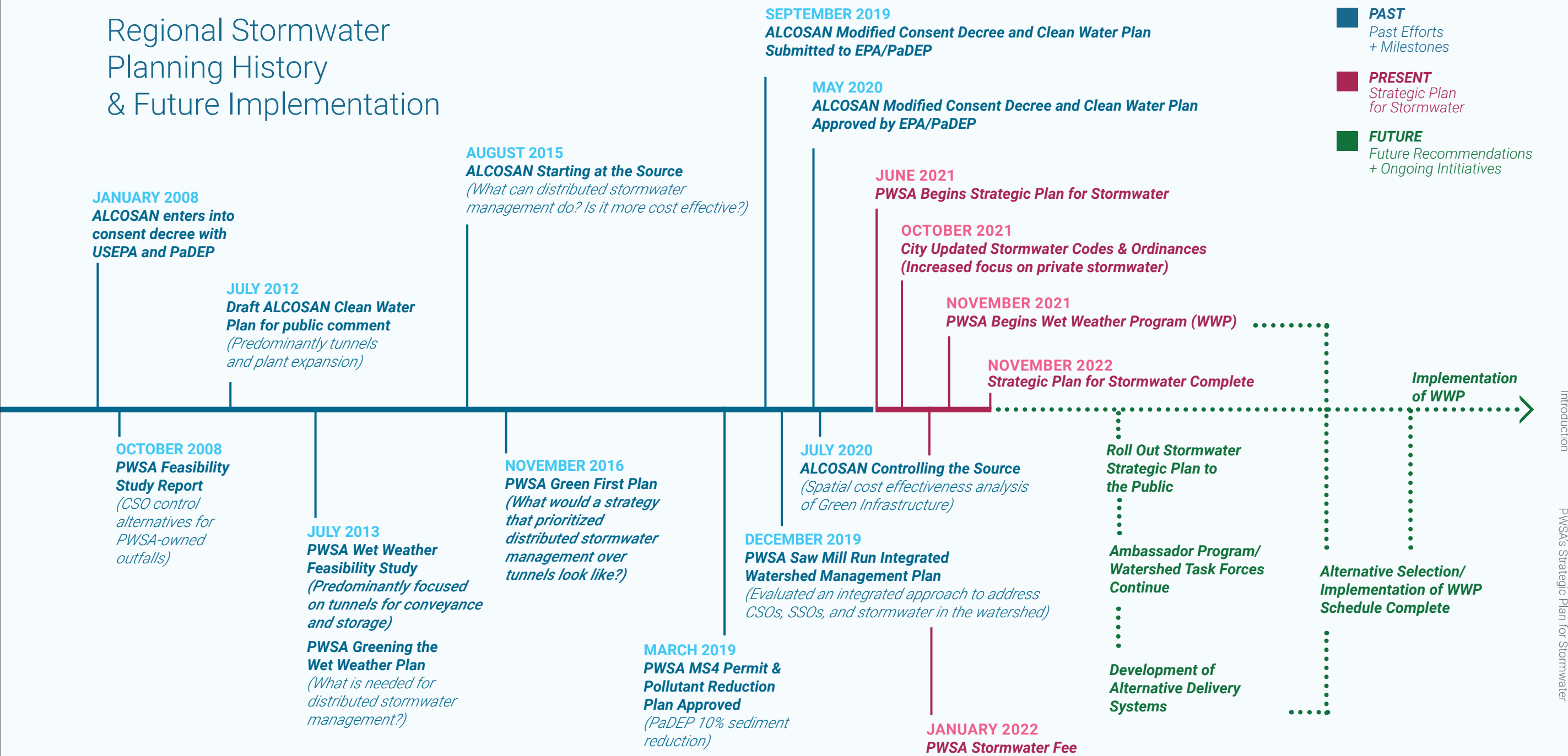
The Wet Weather Program Manager will:

- Evaluate the existing sewer system,
- Develop, evaluate and select alternatives to address problems (CSOs, SSOs),
- Develop affordability analyses based on overall costs.

PWSA expects the development of these detailed plans and associated regulatory negotiations will require multiple years to complete. While these detailed plans are developed, PWSA will focus on developing the technical, contracting, and financial capacity; community support; interagency cooperation; and clarity of purpose to act at a large scale when armed with the required information.

In developing the Strategic Plan for Stormwater, the consultant team reviewed, incorporated recommendations, and followed the spirit of numerous local and regional stormwater plans completed in recent years. These plans are detailed in the Regional Stormwater Planning History and Future Implementation on p.9. This diagram also includes concurrent and forthcoming implementation steps, to demonstrate that work, conversations, and partnerships will continue beyond this plan.

Regional Stormwater Planning History & Future Implementation



The P4 Initiative

Investments in stormwater management can – if undertaken with the P4 Initiative of People, Planet, Place, and Performance as a guiding concept – be truly transformational: catalyzing a broad range of community benefits while also cost-effectively addressing PWSA’s obligations.



- Leverage the basic investments PWSA and other agencies are making in stormwater to produce bigger, more comprehensive benefits for more people
- Lift up community plans wherever possible
- Create a place at the table for community members throughout the process
- Increase collaboration of public and private partners to achieve the goals
- Strengthen two-way communication and transparency of the long-term process of change

- Manage flooding
- Treat stormwater as a resource, not waste
- Promote biodiversity and health of natural systems through contributions to water quality
- Invest in solutions to mitigate climate change

- Show what people, planet, and performance can add up to in exemplary places
- Develop examples of catalytic projects centered on quality of life and places that have local flavor, participation, and resonance with people
- Make stormwater planning human and lift up local vision in a Citywide plan

- Incorporate more kinds of benefit into definition of performance
- Layer or cluster projects to achieve bigger outcomes
- Collect and analyze data for sound technical and policy thinking about delivery
- Deliver more impact for the money (and more clarity about what impact fees and investments will produce)
- Anticipate climate change
- Increase coordination, implementation speed, and quality

→ Top Six Priority Actions

The scale of this challenge means PWSA must direct its limited resources to activities that will prepare it to perform at scale. Based on the experience of high-performing peer utilities with similar challenges, PWSA will focus its broader stormwater strategy on six key actions:

1
**Develop a
Communications
Framework**

2
**Institute a Joint
Task Force on
Stormwater**

3
**Analyze
Priority Areas
for Investment**

4
**Define Initial
Investment
Strategies**

5
**Establish Guiding
Principles for
Level of Service
& Flooding**

6
**Leverage
Stormwater
Fee Impact**

These Key Actions are outlined in detail with specific, actionable recommendations in the following pages of this plan.



Develop a Communications Framework

Driving the Strategic Plan is a new model for communication and project development, involving purposeful and enduring partnerships between agencies, watershed advocacy groups, and grassroots community organizations.

Equitable outcomes for stormwater rely on inclusive, accessible, and transparent communications and engagement at all times, not only when there is an active planning process or project underway. The starting place for strong communication and community partnership involves beginning all efforts by acknowledging and taking time to understand that poverty, class, racism, trauma, and other social inequities are real and have ongoing effects. These experiences apply to stormwater management as much as any other community needs.

PWSA and its partners in this work must recognize this and consistently work to address it. True partnership can be achieved, in part, by welcoming community-driven ideas and projects to the table, ensuring that opportunities for authentic participation exist, and that decisions are shaped through that participation.

This framework extends to data-gathering and sharing, and it means that people who have been historically neglected or are most challenging to reach and involved in processes are purposely engaged and involved throughout. These ideas are present in many of the frameworks PWSA already works within, but must continually be calibrated as projects, processes, and learning evolve. **Specific recommendations are presented below:**

1A. Create a formal and sustainably-funded structure for community involvement at the watershed scale.

This can continue to take the form of watershed task forces, watershed ambassadors, and can be supported with staff community engagement positions within PWSA. Leveraging support from outside partners such as the Pittsburgh Parks Conservancy, Grounded Strategies, community development organizations, universities, and philanthropy ensures that existing

watershed task forces can flourish and achieve both a local and City-wide role.

A community engagement structure involving both ambassadors and watershed task forces that align with the strategic plan — defined Pittsburgh watersheds will complement the intergovernmental and interagency stakeholder structure of a Joint Task Force (see Action 2). Ambassadors are individuals willing to commit to training and neighbor-to-neighbor communications and education, and receive compensation for their time and growing expertise. Watershed task forces are a diverse mix of stakeholders within a particular watershed, and include members from public agencies. Creating meaningful representation between the watershed task forces and the Joint Task Force will add transparency and equity in ongoing decision-making regarding strategic stormwater projects. These structures will provide both continuity and resilience, and will ensure that good decisions are

I think communication is important. But I think, more importantly, is that the stakeholder group and the rate payer group have input on how the money's being spent, not just a bureaucratic process.

- Mike, Ambassador, S. 21st Street Watershed

not only technically sound, but are also shared by community stakeholders.

PWSA should seek to satisfy the fundamental goals of equitable communications and authentic engagement. Neighbor-to-neighbor communications via ambassadors and task force members helps to minimize the “distrust in government” that can and does pervade. Tools that are widely employed are dynamic, visual, local, interactive, and up-to-date. Story mapping offers a pliable platform to achieve those aims. Considering ways to link and embed this information within partners’ communications is also important. Community members should have access to information through many channels.

Good communications and engagement relies on an equity-driven, sustainable structure that centers and responds to the needs of community stakeholders. What is said is often less important than how it’s said, and clear and consistent information flows are not uni-directional

I think it's really valuable to have children and schools involved. When your kids or your grandkids get excited and talk about this stuff, it stays top of mind. As they grow they remember these projects from when they were younger and see them come to fruition.

- Community Ambassador

Watershed Task Forces and the staff that serve as stormwater point people within each watershed are the backbone of the successful water work. The district utilizes a Cost Share Program where 25% of the stormwater utility fee goes directly back to local communities [in the form of projects] – a way to ensure that local groups have control to improve their contributions, and reductions, to the larger system.

- Keith McClintock, Manager of Watershed Programs at Northeast Ohio Regional Sewer District

It's important for the City to understand that when their constituents complain, this is why – they're not just calling and saying, 'my basement keeps flooding every time there's a storm,' if they don't know that their basement's flooding because they're in the middle of a watershed and there's problems with the piping in the watershed. They need to listen to the community that are calling in and say, 'Okay, I hear you now. Here are the solutions that could benefit you.'

- Pomaj, Ambassador, Negley Run

I think the most effective way to communicate is through organizing our communities and actually like communicating with our neighbors. I don't think any number of PWSA mailers or emails are going to communicate all this effectively, it's gotta come from the people in the community... Also, every project that PWSA does, including things like replacing the water line on my street, which is going to happen soon, should have signs so people walking around their neighborhoods get to learn at their own pace what's going on – a couple paragraphs, a couple pictures – more of this neighborhood signage I think is really needed.

- Community Ambassador during May 9th Feedback Session

(i.e. from PWSA to stakeholders), but indeed multi-directional and dynamic.

1B. Communicate with transparency about priorities.

Certain areas for stormwater management investment will receive more investment than others, but improvements across the system will also happen. Communicating about this means being straightforward about the approach, in an effort to help stakeholders understand that strategies:

- Focus where there is a convergence of multiple challenges and the best opportunities for co-benefits.
- Create the biggest return on investment where activities are sustainable and equitable.
- Significantly reduce the biggest burdens to the system of stormwater management and help improve the system as a whole.
- Rely on individual ratepayers of all types joining the effort to manage stormwater.

1C. Continue building engagement structures that reinforce key messages.

The recommended community engagement structure helps to support and reinforce messages in a number of ways:

- An underlying shared governance model underlines that stormwater challenges are not the responsibility of one agency (PWSA) alone, but a shared, Citywide challenge among all sectors. Ensuring that this Citywide task force connects well with the local planning units, via watershed task forces and community ambassadors, is important. It is also important that this governance structure improves communications while at the same time improving operations, maintenance, and undertaking project development.
- Using the stormwater fee as a baseline revenue stream, partners have opportunities to leverage that base source to help increase investments, co-benefits, and impacts.

Catalytic site investments will help to build enthusiasm and demonstrate what collaborative, community effort and shared investments can do.

- Watershed-specific personnel, localized task forces, and community ambassadors work together to clarify information that is hyper-local and to engage and empower shared investments.
- These governance, communication, and community engagement structures offer a long-term, sustainable and equitable framework that is adaptive.
- Ongoing education and community empowerment helps to build a shared understanding of system performance, limitations, and needs.



◀ PWSA Tabling with Negley Run Watershed Ambassadors (Grounded Strategies)



◀ Stormwater Strategic Plan Ambassador Training Onboarding (Grounded Strategies)

Engagement During the Stormwater Strategic Plan Development

This planning process optimized the principles of equitable communications and engagement in structuring opportunities for information sharing and gathering input for the plan itself.

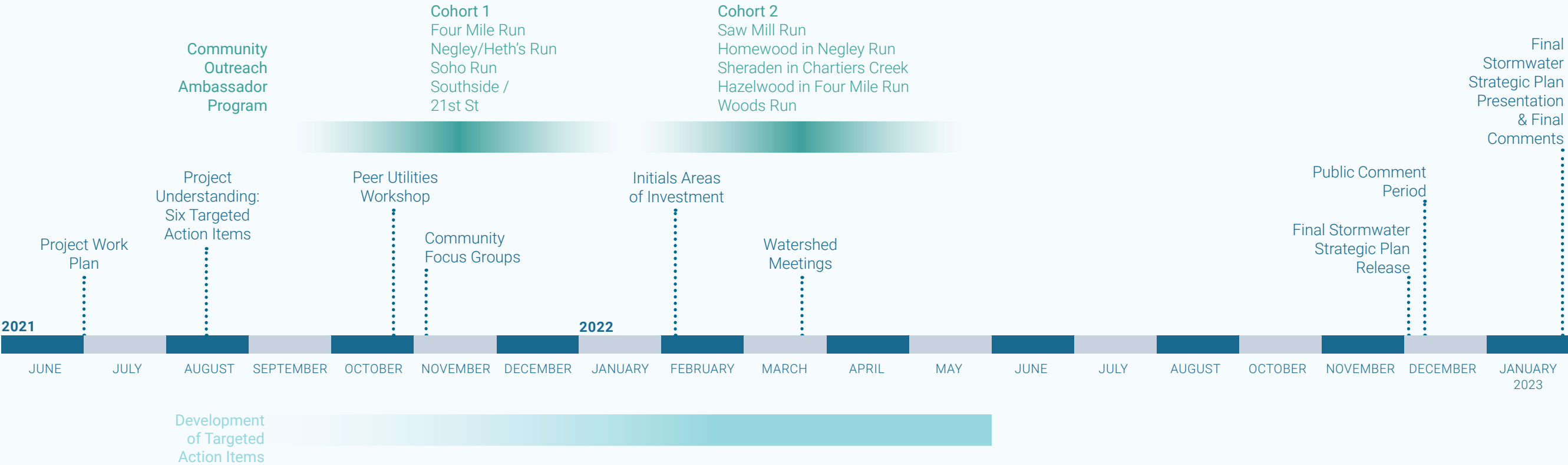
Focus Groups
Early in the planning process (see timeline below), PWSA sought input from key stakeholders (ex. City departments, ALCOSAN) through interviews; from peer utility representatives through a Peer Utilities Workshop (Philadelphia, Washington D.C., Atlanta, New York City, and Cleveland); and in three Community Focus Group sessions (in Fall 2021) including non-profit, business, public sector, and community representation). These sessions helped to shape the six priority actions for the plan, potential priority areas for investment, and to add depth and clarity to the approaches taken.

In all cases, stakeholders emphasized the importance of community involvement.

Ambassador Program
In addition, 13 residents were hired as ambassadors for the strategic plan. Residents were recruited from areas that had long been known to have chronic stormwater management challenges, that aligned with existing Watershed Task Forces, and from the additional priority investment areas identified through the strategic plan analysis (summarized in the Task 3 deliverables). These Ambassadors were charged with: identifying communications needs, broad public information sharing and input gathering, and on site-specific feedback related to catalytic sites and highest priority investment areas. Throughout, existing Watershed Task Force members were involved and offered additional breadth and reach to communication and engagement activities. The Stormwater Strategic Plan (SWSP) team also conducted extensive research, including interviews, with cities across the country (see Appendix A). The community engagement model found in Cleveland embodies most of the elements recommended for Pittsburgh.

Priority Action 1: Communications Framework

PWSA's Strategic Plan for Stormwater





Four Mile Run Watershed Ambassador Chris Zurawsky (Grounded Strategies)



Frick Environmental Center (Grounded Strategies)



S. 21st Street-Watershed Ambassador Mike Clark (Grounded Strategies)



CommunityCare Pilot Program participant (Grounded Strategies)



Negley Run Walking Workshop (Grounded Strategies)



PWSA SWSP Ambassadors at Negley Run Clean Water Action Event, left to right: Jo Anne Tippet, Dana Fowler, Ix Pomaj Yajalaji (Grounded Strategies)

Institute a Joint Task Force on Stormwater

Managing stormwater and localized flooding is a whole-of-government challenge.

PWSA has assumed significant responsibility for management of water quality and quantity within the City, and the recent implementation of the stormwater fee cements the perception of PWSA's responsibility in the eyes of ratepayers. However, in reality, PWSA exercises little control over many of the key factors that contribute to these challenges and complicate the implementation of solutions (e.g. impervious public and private landscapes, overlapping utilities, etc.).

Across City government, current siloed roles and responsibilities inhibit effective planning, funding, and execution of needed investment. Furthermore, given PWSA's limited resources in this regard, without leveraging the knowledge, capability, and resources of other departments/authorities, PWSA's efforts will not succeed.

2A. Institute a Joint Task Force on stormwater, according to the following structure and implementation steps.

The scope and terms of PWSA's engagement with City government is outlined in a series of agreements and memoranda, with a specific memoranda of understanding (MOU) governing responsibility for MS4 permit compliance. In addition, it is expected that both PWSA and the City will be parties to the pending consent decree with respect to ongoing CSO/SSO compliance. The relatively recent change in mayoral administration provides a window for broadening, accelerating, and formalizing this cooperation.

New York, Washington, DC, and Philadelphia have implemented similar approaches in response to distributed compliance responsibility and major flooding events, with promising results. While the specific governance contexts vary, many of the challenges are similar. There is an opportunity to

learn from what has worked there, and apply lessons learned from some of their initial missteps. As the specific scope and operation of the proposed task force takes shape, PWSA can draw on specific input from utilities in other cities.

PROPOSED GOALS FOR JOINT TASK FORCE:

1. Accelerated negotiation and adoption of applicable MOUs governing responsibility for stormwater compliance and management of flood risk
2. Improved collection and sharing of flooding and stormwater data
3. Coordination of public input and development of accurate, consistent messaging around localized flooding and stormwater issues
4. Identification and elimination of existing barriers to effective implementation of investment at scale, such as:
 - Development of streamlined review and approval processes for PWSA-led stormwater projects in public spaces
 - Criteria for inclusion of stormwater investments/benefits in other City-led projects
 - Coordination of incentives and enforcement for stormwater activities undertaken as part of private investment
 - Coordination of evaluation and approval for alternative delivery mechanisms of stormwater services
5. Identification of opportunities for shared investments with stormwater/flooding benefits by aligning stormwater planning, budgeting, and funding strategies with other capital investments in affected communities, especially transport, housing and recreation, education



Heth's Run Workshop, 2016 (Susan Rademacher & Heather Sage)



McKinley Park, Great Urban Parks Community Input, 2016

PROPOSED STRUCTURE OF JOINT TASK FORCE:

Stormwater management is a shared responsibility among various agencies. A Joint Task Force is recommended that will be responsible for coordinating Capital Projects and how stormwater management can be integrated into designs to build a more resilient and flood-safe City. While the head of each department would not necessarily serve as a task force member, experience elsewhere has shown that the various representatives should have sufficient seniority and decision-making authority within their respective groups to allow for meaningful negotiation and ability to commit their groups to a specific course of action.

Entities may include:

- PWSA
- Mayor's Office (COO or CoS)
- City Planning/Resiliency
- DPW/Parks and Rec
- DOMI
- Department of Public Safety (DPS) / Office of Emergency Management and Homeland Security (OEMHS)
- City Finance
- Urbans Redevelopment Authority (URA)
- Pittsburgh Schools

Insofar as significant coordination of activities will be required with entities beyond the City, a larger group of stakeholders would be invited to participate, to mention a few:

- PWSA Functional Area Mgmt (Ops, Eng, Finance, Environmental Compliance)
- ALCOSAN
- PennDOT
- Duquesne Light
- People's Gas
- Allegheny County Health Department (ACHD)
- Allegheny County Conservation District (ACCD)
- Regional Federal Emergency Management Agency (FEMA)
- Local Army Corps of Engineering (ACOE)
- Interested Labor, Business, and Community Organizations
- Upstream Municipalities

RECOMMENDED INITIAL ACTIONS FOR TASK FORCE:

- Secure Mayoral and Council buy-in, including any necessary executive orders or actions
- Public announcement regarding the Joint Task Force

- Consensus on Goals/Objectives and associated schedule
- Commitment to information sharing, and public interaction
- Inventory current efforts/ responsibilities and agreements among parties. Solicit Joint Task Force member and public input for identifying impediments and opportunities
- Coordinate planning for Capital projects to leverage partnership opportunities.



Is there any way that community organizations can work with PWSA to set guidelines or expectations? Like in Homewood, there's a whole bunch of vacant land and since development is coming, this would be the time to actually have that done in the alliance with PWSA.

- Diane, Ambassador, Negley Run

Analyze Priority Areas for Investment

With new priorities in mind and a focus on affordability, The Strategic Plan for Stormwater envisions investments in stormwater that reflect the intersection of four primary lenses of focus.

The focus and priority for investments in stormwater has evolved in Pittsburgh in a number of ways including the escalation of the climate crisis, a renewed nationwide focus on equity in the wake of heightened racial justice movements and, locally, the release of the ALCOSAN Clean Water Plan. Consequently, the investment focus outlined in PWSA's Green First Plan must be re-examined to ensure alignment with these new realities. Yet, with an eye toward affordability, the plan must still respond to and leverage every opportunity to deliver projects that are cost-effective to ratepayers and stakeholders.

Key Recommendations for Priority Action 3 are on page 27.



Grounded (formerly GTECH) stewards and staff posing at Cats Corner in the Hill District.

”

Most of the time, you know, you're working, you're dealing with your kids — who has time to deal with stormwater? You just get upset because you see your bill go up, but you don't know why... Right now we're just trying to build a coalition just to get more voices to the table, find those few people who can help invest more in the neighborhood.

- Joseph, Ambassador, Woods Run

I wanted the experience going door to door and talking to people... It's almost a thing people are just kind of resigned to — when it rains we flood, we just deal with it. You know, we're Pittsburghers. We're self sufficient. We don't want it to stay broken, we're just resigned to the fact that this is just the thing that's going to happen.”

- Ben, Ambassador, Saw Mill Run

There are only so many resources, so we have to prioritize areas where people have lost their lives, lost their homes, suffered severe damage — those things have to come first. We know we don't have infinitely deep accounts to do everything simultaneously. I think people understand that — if you want infinitely deep accounts, then you have to pay infinitely.

- Matt, Ambassador, Woods Run

The Four Lenses



Ameliorating the ill effects of flooding is a heightened priority for PWSA's future investments in stormwater. While past efforts have focused on managing water quality, in large part due to regulatory mandates, worsening storms and aging infrastructure mean that flood mitigation and reduction must be placed on equal footing with water quality objectives moving forward. While investments in flooding are needed throughout Pittsburgh, new flood control projects must be directed toward areas with the most widespread, severe, and persistent flooding problems. Additionally, new resources must be allocated to enhance mapping and modeling of where, how often, and how much flooding is occurring, down to the individual impacts.

The adoption of ALCOSAN's Clean Water Plan changes the geographic priorities for managing CSOs, the focus of Pittsburgh's prior stormwater planning effort, Green First Plan. Under the ALCOSAN plan, the construction of three large storage tunnels will provide mitigation of CSOs across the City, including many of the priority sewersheds identified in the Green First Plan. PWSA investments must therefore shift to complement ALCOSAN's plan to manage overflows and meet regulatory requirements and manage localized flooding and sewer capacity issues. Outside of the CSO areas, PWSA, as a Municipal Separate Sewer System (MS4) co-permittee with the City has ongoing responsibilities for implementing pollutant load reduction projects in streams and rivers within watersheds where PWSA and the City have stormwater outfalls such as Saw Mill Run and Chartiers Creek.

Investments in stormwater must be targeted toward neighborhoods that are the most vulnerable to the ill effects of flooding, not simply equally distributed based on problem severity. While flooding is not solely a PWSA responsibility but touches on the functions of many local and state agencies, PWSA acknowledges that the size and condition of its existing stormwater conveyance systems can contribute to flooding problems throughout the City, mainly in the form of nuisance flooding and basement backups. PWSA's system was not designed for the stormwater management demands for this era. It was designed for a time with fewer people and far fewer impervious surfaces. While these issues occur in both wealthy and struggling neighborhoods, lessening the impacts of flooding on less affluent communities of color, who are less able to adapt to and recover from flooding in addition to facing myriad other challenges, is of heightened importance.

The need to keep investments in stormwater affordable for ratepayers means that PWSA must prioritize areas where opportunities exist to manage large amounts of stormwater. Economies of scale in engineering, construction, and maintenance means focusing investments on larger scale stormwater management investments such as regional wetlands and larger bioretention systems located in parks, schools, and vacant lands, rather than in highly distributed networks of small bumpouts and planters. Compared with larger systems, these systems are more costly to install per unit of stormwater management, and can be highly vulnerable to sedimentation and a variety of other stresses that impact performance and increase long term costs.

Defining Priority Areas for Investment

To use the four lenses to define geographic priorities for investment, the strategic planning process divided the City into 19 planning units that correspond with local watershed boundaries of smaller creeks, major sewersheds, or direct drainage areas to the large rivers. These planning units are subdivisions of current hydrologic units established by the U.S. Geological Survey and align

with the historic watersheds of streams and runs that have been diverted underground. The Strategic Stormwater Plan Team inventoried available data to map locations corresponding to each of the four lenses of focus. These maps and locations were reviewed closely to create priority scoring for each of the 19, looking at each planning unit through the four lenses individually and together as a composite.



Maps from the Report of the Flood Commission of Pittsburgh Pennsylvania, 1912



Existing Sewersheds



Proposed Planning Units

LOCALIZED FLOODING

Although it is a serious and escalating problem, there is no single authoritative mapping of flooding in Pittsburgh. To develop a map of where flooding appears to be most problematic, the Stormwater Strategic Plan Team layered together mapping from multiple sources and then vetted the maps. Some of the datasources used were:

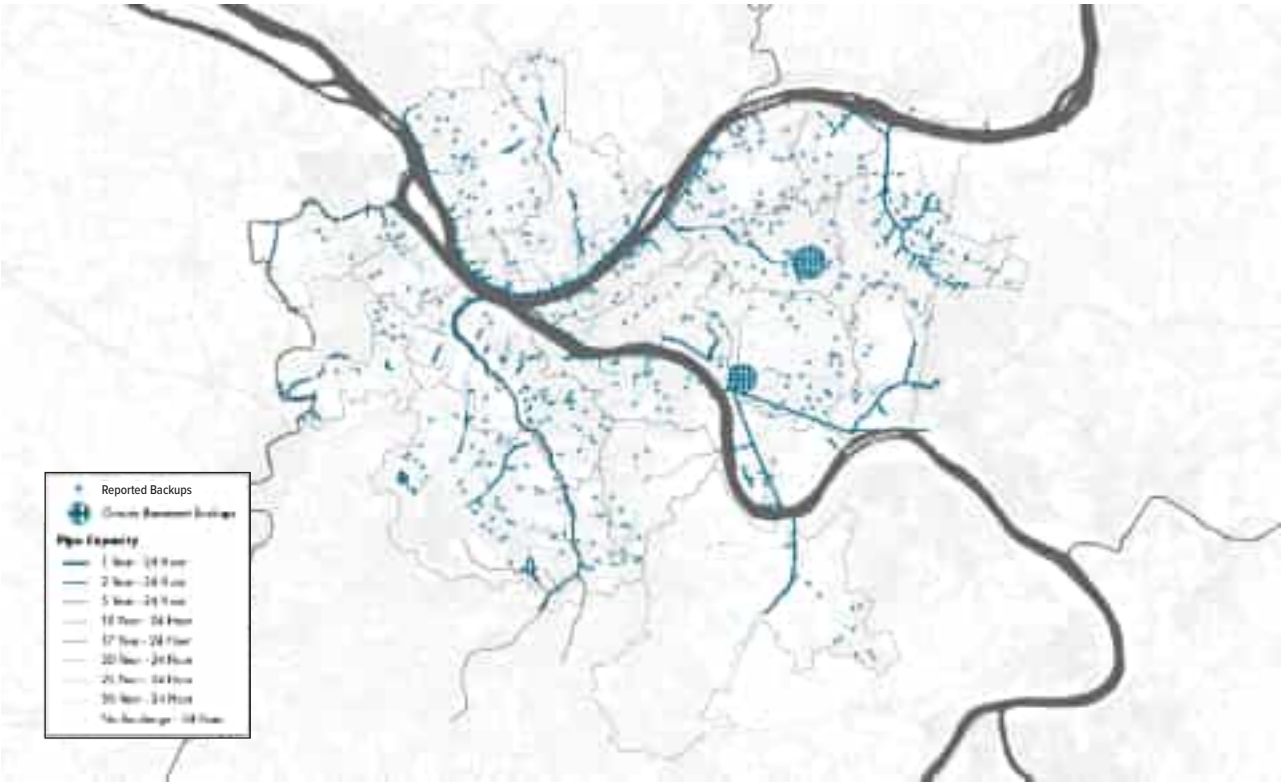
- **FloodFactor Data** – Mapping of flood prone properties during a major storm (1 in 100 chance event) under projected 2050 climate conditions from a nationwide study by the First Street Foundation. See <https://firststreet.org/flood-factor/> for

details on their methodology. FEMA maps and hazard layers, as well as historic information from NOAA were included as part of this analysis.

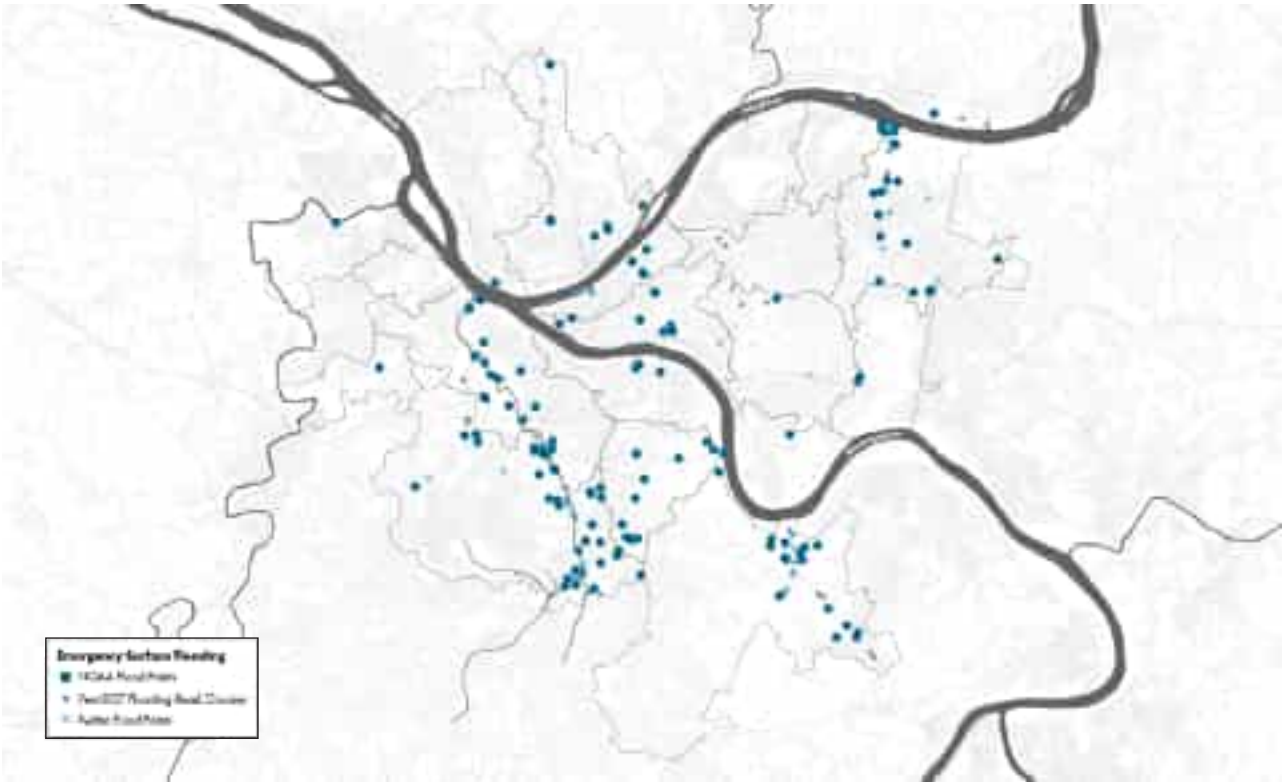
- **Twitter Flood Data** – Line and points corresponding to geocoded tweets mentioning keywords like flooding, flood, etc. Twitter data gives additional insight into where flooding was severe enough to warrant communication but may not represent all areas equally.
- **PennDOT Road Closures** – Data on flood-related road closures provided by PennDOT

- **Pipe Surcharging** – Mapping of conditions when the pipes are flowing full within major sewer lines based on PWSA storm simulation models. Surcharging conditions occur when the pipes are flowing full and are under pressure. In many, but not all cases, surcharging pipes lead to surface flooding.
- **Reported Backups** – PWSA's own mapping of where basement backups have been reported by residents to PWSA.

It is recommended these areas be further refined based on flood modeling.



Localized Sewer Flooding (pipe surcharging, basement backups, etc.)



Overland Stormwater Flooding (road closures and flood reports)

MAPPING THE FOUR LENSES - CONT.

WATER QUALITY STREAMS AND RIVERS

The water quality lens integrates CSO outflow volumes and MS4 reduction requirements. A cumulative impact of each outfall is considered from 2022 until the projected completion of ALCOSAN's Interim Measures Wet Weather Plan in 2037. ALCOSAN projected outfall volumes for current conditions and conditions after the Interim Wet Weather Plan interventions were used and shown in the graphics below. Based on data from September 2021 provided by ALCOSAN, sewersheds were ranked based on remaining CSO volumes post-tunnel. However, as the program evolves this should be reassessed.

Sewersheds that are part of the MS4 program were ranked higher to illustrate

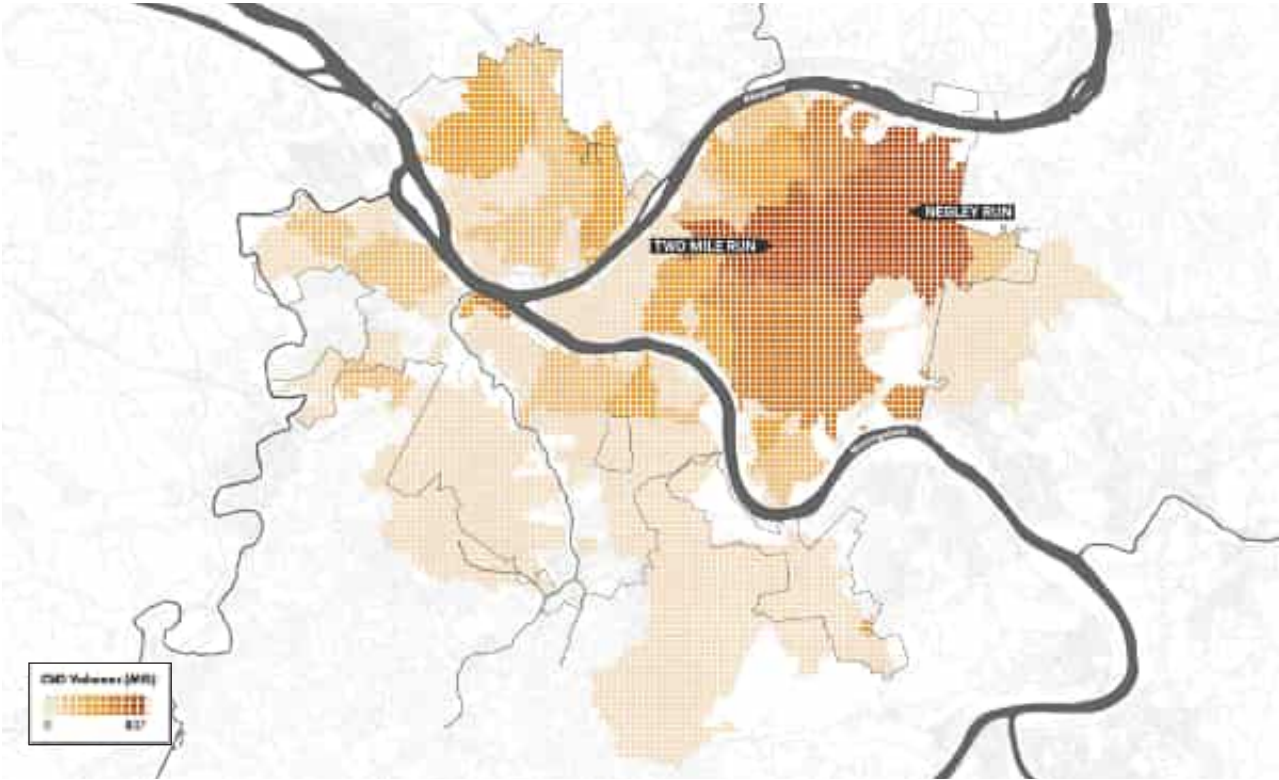
opportunities for intervention to meet MS4 compliance as they are not related to CSO.

Additionally, ALCOSAN began evaluations of regionalizing intermunicipal trunk sewers for its 83 municipal customers. Regionalization is the term for ALCOSAN taking sole ownership of larger diameter sewer lines that cross multiple municipalities. While the program is being evaluated, PWSA continues to assess the condition of the inter-municipal trunk sewers and is making good faith effort in repairing/replacing any significant defects. Given the fluidity and uncertainties of the regionalization program, it is recommended the investments be targeted to areas draining to outfalls that PWSA owns while the benefits of the ALCOSAN

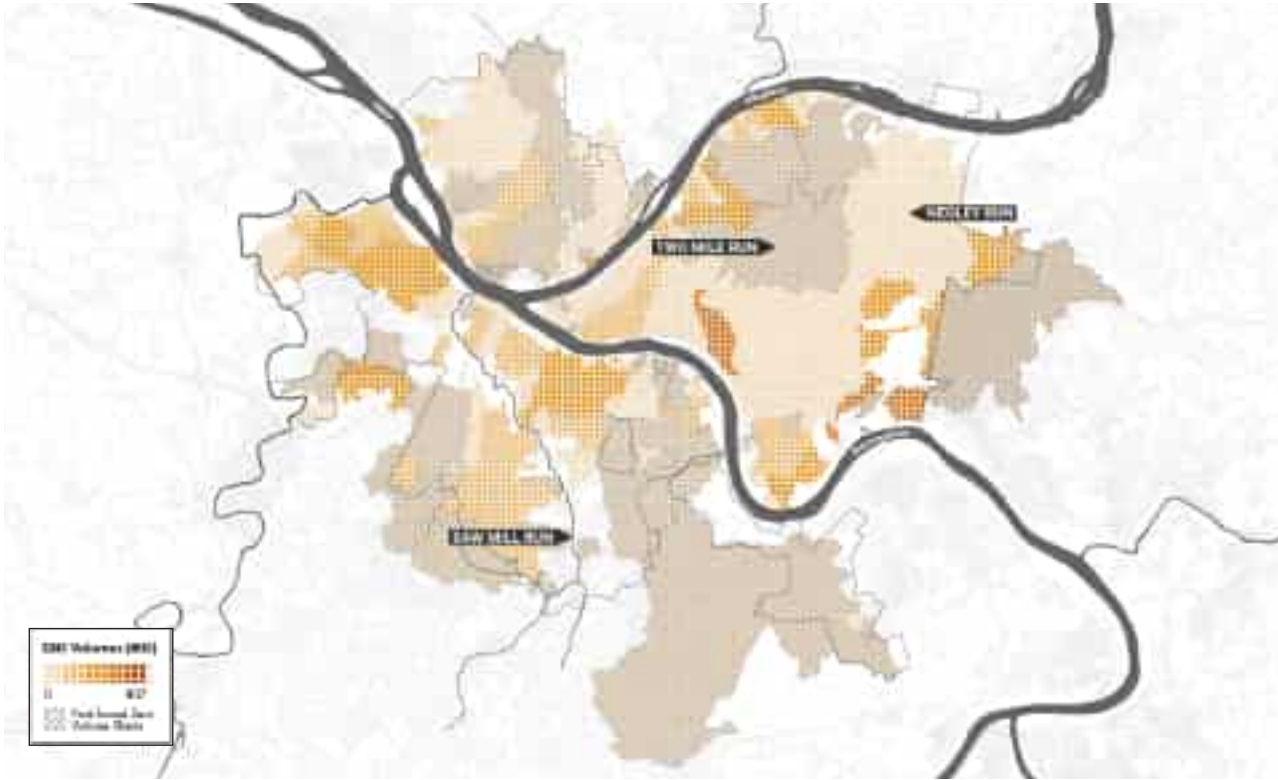
tunnel is further evaluated and understood. Lastly, PWSA has MS4 pollutant reduction requirements that will remain an ongoing priority.

It is recommended that, as part of this strategic plan, PWSA focus on pollution reduction in separate sewer areas and combined sewer overflow that will remain PWSA's primary responsibility after regionalization and tunnel construction. Updated water quality priority mapping developed for the strategic plan incorporated several factors including:

- Whether an area drains to an outfall that is recommended to be transferred to ALCOSAN as part of regionalization;
- If an area is located in a combined sewer or separate sewer area;



Current CSO Volumes



Post ALCOSAN Tunnel CSO Volumes

- If in a combined sewer area and the area drains to a planned ALCOSAN tunnel, by what year the tunnel will be built, and what the total volume of combined sewer overflow will be post-tunnel. It is assumed that areas draining to future tunnels that are built sooner are lower priorities.

Here's a look at how water quality priorities stack up:

Highest Priorities

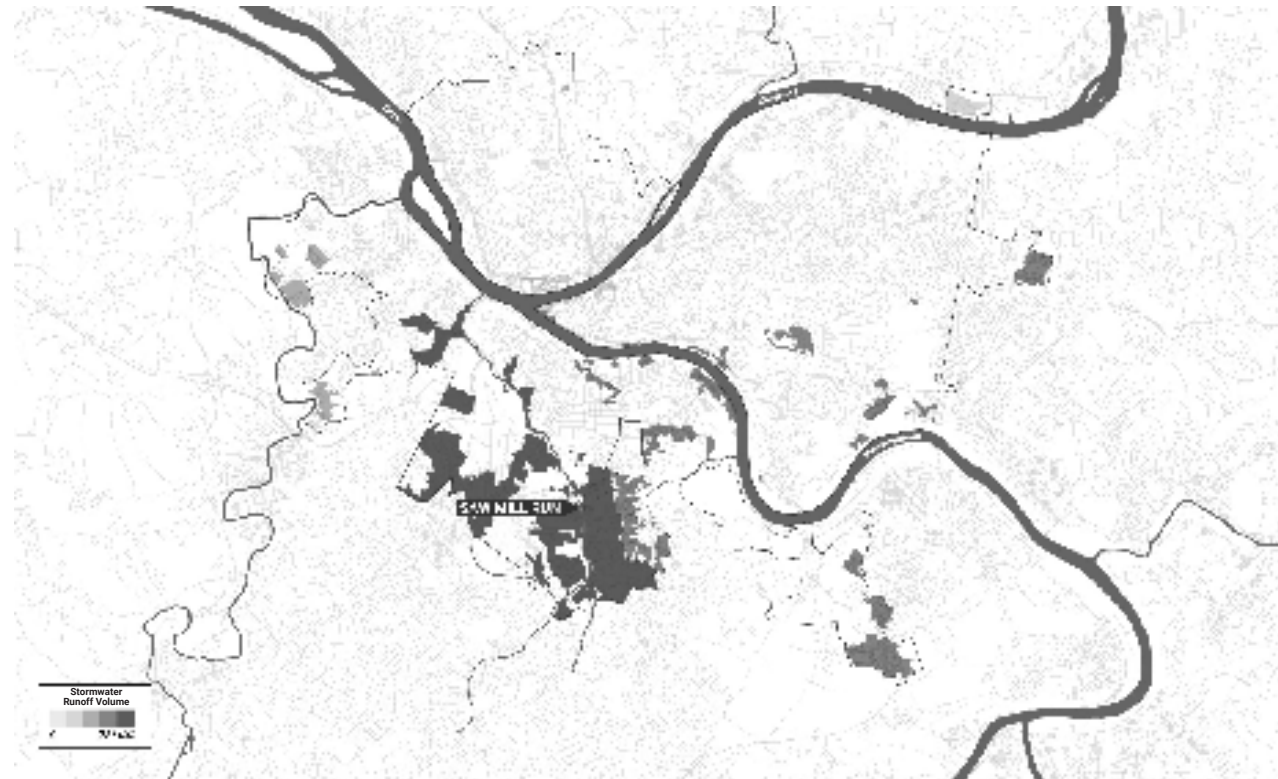
- Separate Sewer Areas
- Combined Sewer Areas that are **not** draining to future ALCOSAN Tunnels

High Priorities

- Combined Sewer Areas that are not draining to ALCOSAN Tunnels but **may be** draining to outfalls that will be transferred to ALCOSAN responsibility

Medium Priorities

- Combined Sewer areas draining to proposed ALCOSAN Tunnels — prioritized by the: 1) date of the tunnel construction and 2) amount of combined sewer flow)



Separated Sewersheds



CSO vs MS4 Pollution

Pittsburgh has both a Combined Sewer System (CSS) and a Separate Sewer System (SSS). The combined sewer system collects stormwater runoff, sewage, and other wastewater flows into a single pipe system and transports it to a wastewater treatment plant. During heavy rainfall events, the volume of wastewater can exceed the capacity of the sewer pipes and will discharge into the waterways through Combined Sewer Overflow (CSO). A separate sewer system has two different pipe systems; a separate sanitary system transporting sewage and industrial wastewater to the treatment plant and a separate storm sewer transporting stormwater runoff to the surrounding waterways.



Both types of systems are regulated by the EPA through National Pollutant Discharge Elimination System (NPDES) permits under the Clean Water Act. A water utility or municipality with an NPDES permit for a combined sewer system must implement the nine minimum controls stipulated by the EPA and develop a long-term CSO control plan. Any municipality with a separate storm sewer system that lies fully or partially within a US Census Bureau Urbanized Area must comply with the EPA's Municipal Separate Storm Sewer System (MS4) regulations, which include obtaining an NPDES MS4 permit and developing a stormwater management plan that implements the EPA's six minimum control measures.

Left: Warning from ALCOSAN that this area periodically experiences sewer overflows. Photo by Meredith Bennett, 2019.

Right: Example storm outfall part of an MS4 system

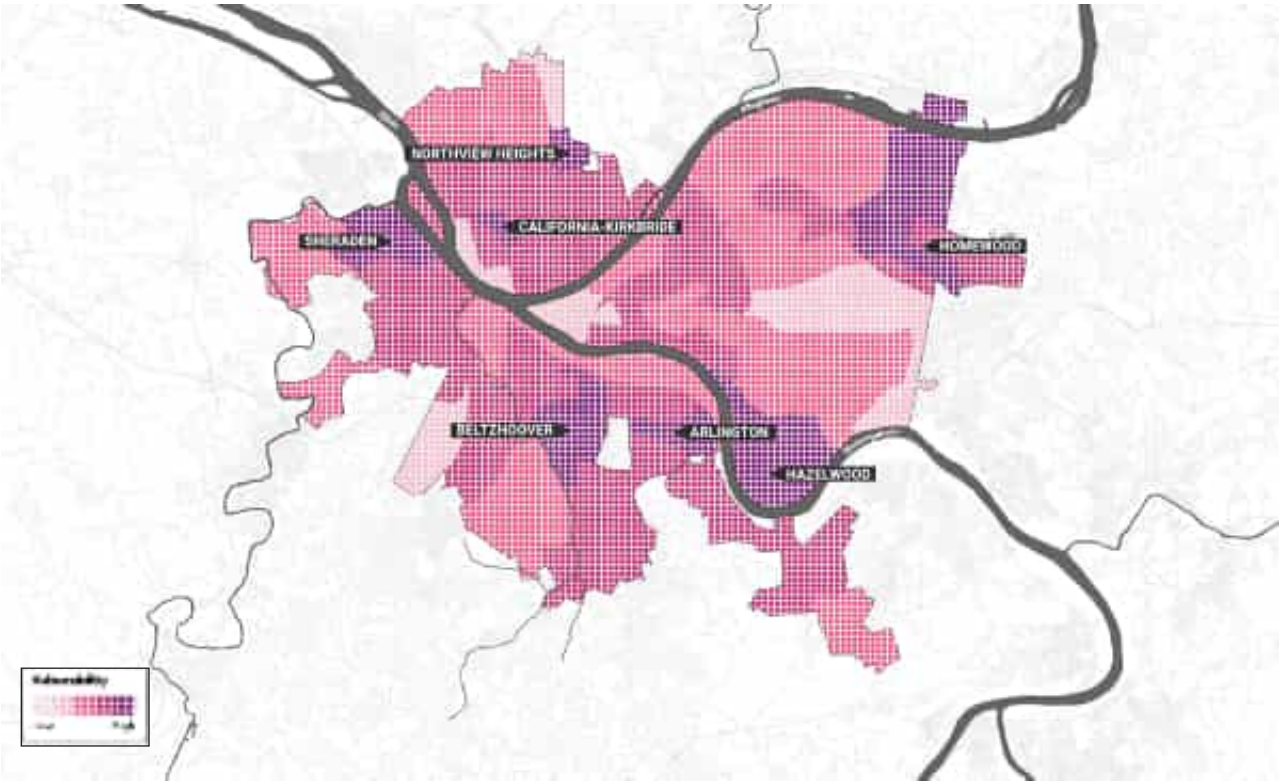
EQUITY

Equity mapping was performed at the census block level using the Allegheny County Environmental Justice Index, published in 2019. This index captured the socio-economic data and environmental conditions that are specific to Pittsburgh and the region. In addition, the Stormwater Strategic Plan Team reviewed the EPA Environmental Justice Screening (ejscreen.epa.gov.mapper), as it is a nationally recognized resource for environmental justice mapping used

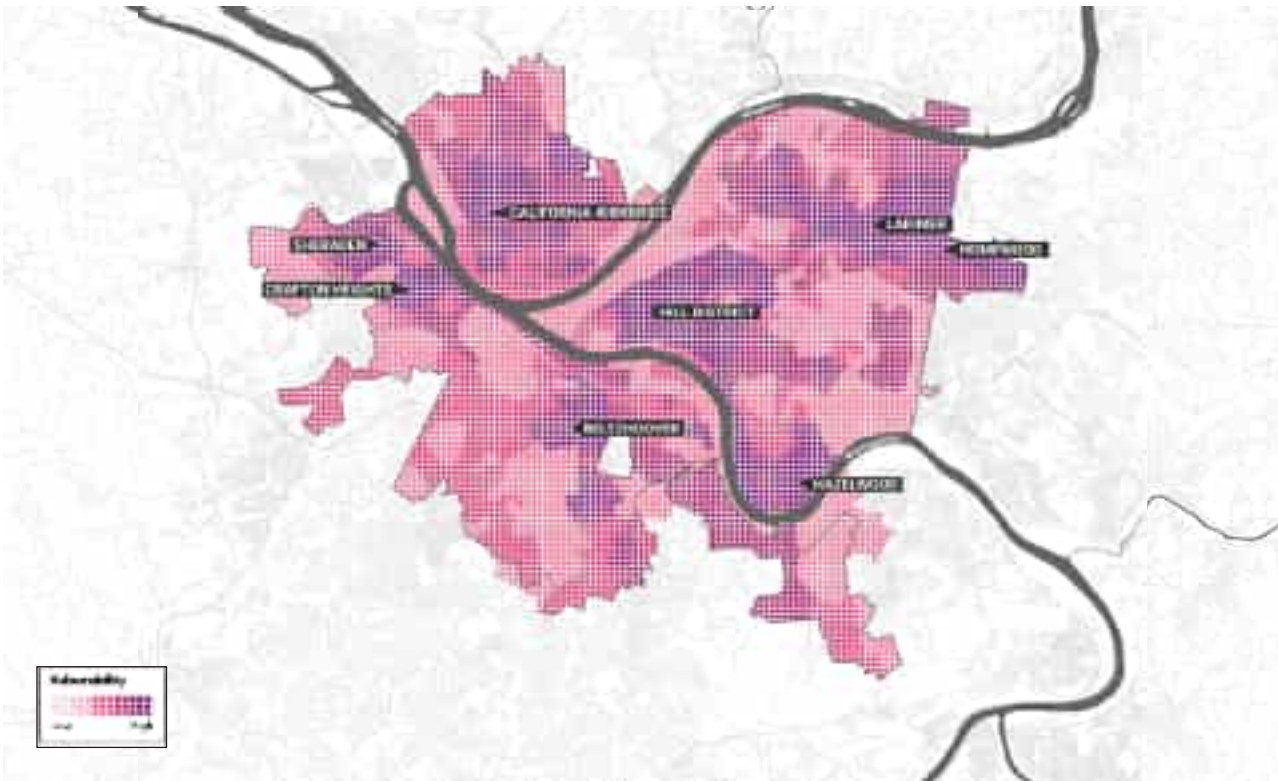
across many states and jurisdictions. This screen includes several factors relating to environmental justice and quality such as socioeconomic indicators, environmental hazards such as particulate matter and hazardous waste sites. The factors and areas of greatest need are nearly identical between the Allegheny County Environmental Justice Index, and the EPA EJ Screen.

- Allegheny County Environmental Justice Index Data Sources:*
- Median Household Income (MHINC)
 - Diesel Particulate Matter (DPM)
 - Particulate Matter $\leq 2.5 \mu\text{m}$ (PM2.5)
 - Percent of the population identified as a racial minority
 - Proximity to Greenspace
 - Educational Attainment
 - Miles of Railroad Track Coverage
 - Housing Vacancy

- EJScreen (EPA) Data Sources:*
- Low Income
 - Particulate Matter (PM2.5)
 - Ozone
 - Diesel Particulate Matter (DPM)
 - Air toxics cancer risk and respiratory hazard index
 - Traffic proximity and volume
 - Housing cost burden
 - Proximity to hazardous waste
 - Wastewater discharge
 - Leaking underground storage
 - Linguistic isolation
 - Educational Attainment
 - Under age 5 and over age 64
 - People of color



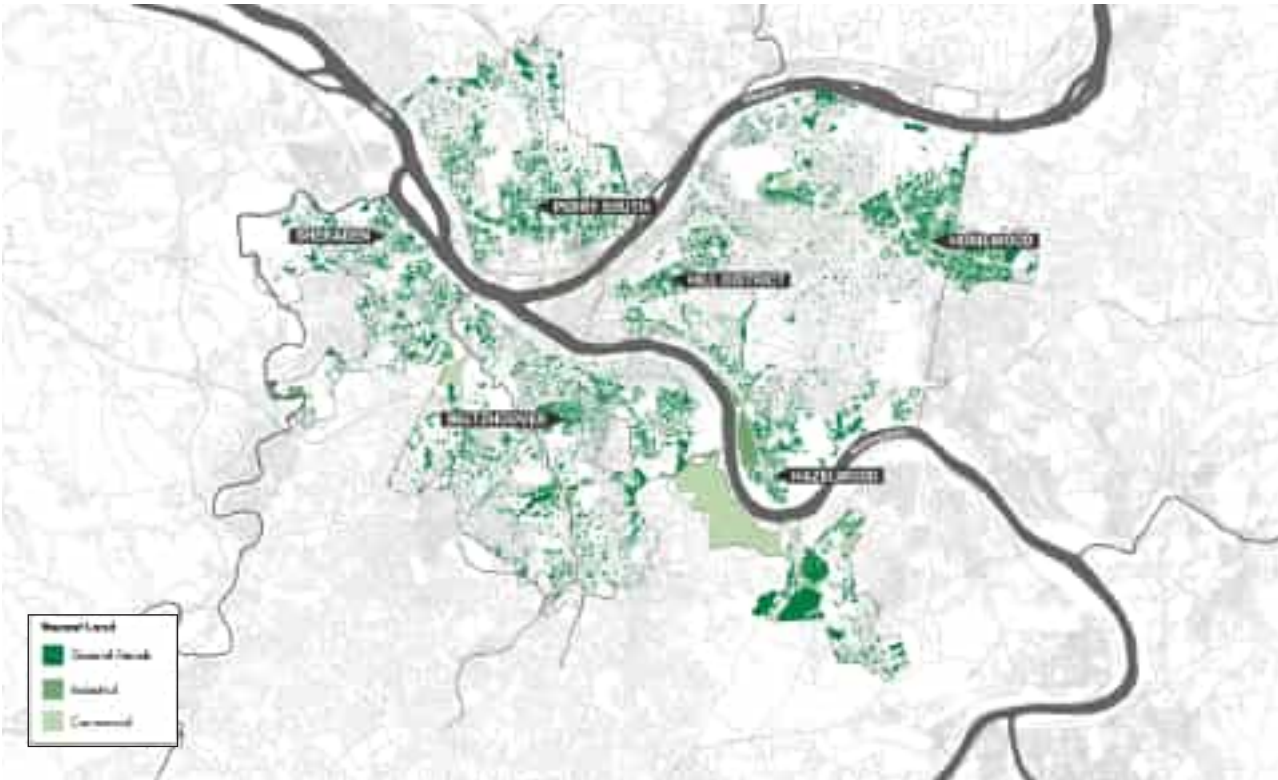
Prioritization by Allegheny County Environmental Justice Index



Prioritization by EPA Environmental Justice Screen

AREAS OF STORMWATER OPPORTUNITY

Parks and greenways have the potential to manage stormwater at scale. Opportunities were mapped to identify suitable sites for stormwater management. This lens highlighted areas of opportunity, such as availability of vacant land, or proximity to existing open space features, which is a key ingredient in project feasibility and affordability. Accordingly, the opportunities mapping informed the selection of investment strategies and project types, which are discussed in Action 4: Define Initial Investment Strategies (Page 29).



Areas of Opportunity



Stormwater Management

In recent years, the discussion around stormwater, wastewater, and CSO management in Pittsburgh has at times been framed as a choice between innovative green infrastructure and traditional grey infrastructure. However, to effectively address its stormwater challenges in an equitable, cost-effective manner PWSA will need to invest in plenty of both.

As described elsewhere in this plan, when done well on a large scale, green infrastructure is an extremely effective tool for managing stormwater close to its source and can also produce a broad array of additional benefits for communities. However, green infrastructure is not a replacement

for grey infrastructure or vice-versa. There is not a clear line between these two categories – virtually all “green” solutions have a strong element of grey. There will always be a need for some traditional grey infrastructure – especially in a City with Pittsburgh’s challenging terrain, changing climate, and complex legacy infrastructure.

PWSA’s systems will work best when green and grey are selected, designed, and optimized to work well in concert with one another – each delivering on its very real strengths – to help create a vibrant, resilient, and more livable City well into the future.



Left: 2021, Maryland Avenue Stormwater Project which installs portion of underground storage on Kentucky Avenue in Shadyside. (Photo: PWSA)

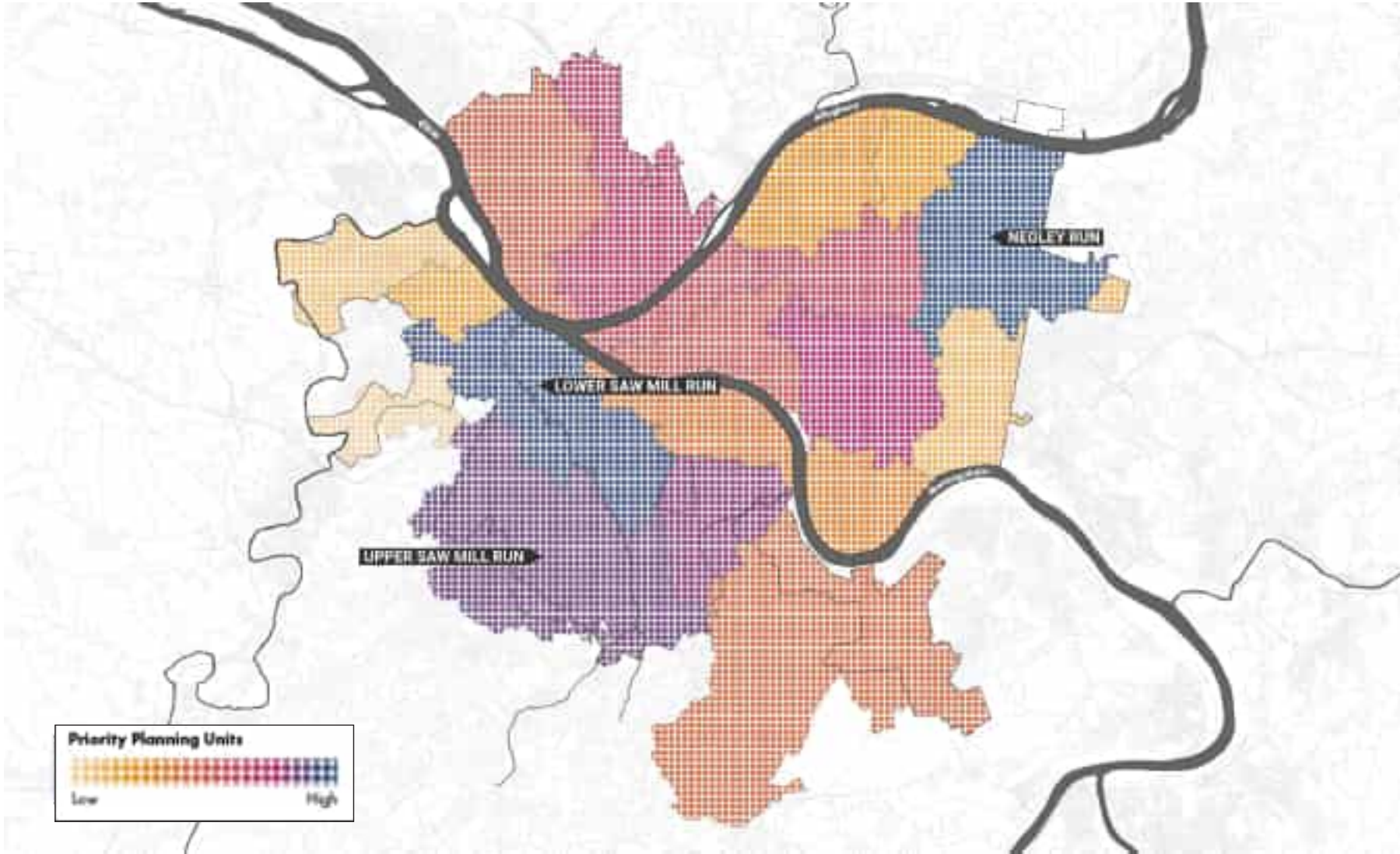
Right: In 2017, PWSA constructed the Centre and Herron Stormwater Project that used a combination of subsurface detention and above ground elements such as bioswales to capture and detain road runoff and slowly release into the sewer system. (Photo: PWSA)

Proposed Priority Watersheds/ Planning Units

To translate the four lenses of focus into geographic priorities for investment, the Stormwater Strategic Plan Team divided the City into 19 planning units that correspond with local watershed boundaries of smaller creeks, major sewersheds, or direct drainage areas to the large rivers. Concurrently, we inventoried available data to map locations corresponding to each of the four lenses of focus. The resulting maps were overlaid to yield priority scoring for each of the 19 watersheds for each factor and in aggregate.

Within each of these units, there will be localized, acute issues that PWSA will address as well — no one is a “low priority.”

Priority Shed	Rank
Negley Run	1
Lower Saw Mill Run	2
Upper Saw Mill Run	3
Becks Run	4
Four Mile Run	5
Lower Allegheny North	6
Two Mile Run	7
Lower Allegheny South	8
Lower Monongahela North	9
Woods Run	10
Streets Run	11
South Side Slopes	12
Upper Monongahela	13
Allegheny South	14
Heths Run	15
Ohio	16
Nine Mile Run	17
Lower Chartiers Creek	18
Upper Chartiers Creek	19



Priority Areas of Investment Recommendations

3A. Concentrate investments in priority areas.

Planning Units with high priority scores reflect a convergence of water quality, flooding, and equity concerns, or, at minimum, a high scoring in at least two areas. Projects within these areas should be considered strong priorities for capital improvements for stormwater management. Simply put, concentrating investments into priority planning units will help to solve the most pressing problems the soonest. Showing a track record of solving problems will in turn set the stage for increased public acceptance and enhanced funding opportunities.

Note that while efforts should be concentrated in these areas, there will be investment to solve problems in other areas as well for implementation in lower priority areas.

3B. Update priorities based on Wet Weather Program.

Flooding data available for this study provides a first comprehensive look at where flooding is most common and severe, but lacks the accuracy and completeness to be used for detailed planning and project development. The PWSA Wet Weather Program Manager team is currently expanding a model of the existing PWSA collection system for evaluations that will aid in understanding of the level of service throughout the service area. This team will also evaluate how increased level of service will impact other wet weather planning objectives, including controls of CSOs and SSOs. As this information becomes available, ranking of the 19 planning units should be revisited and adjusted as needed to ensure consistency with this new information. Water quality scoring should be updated upon completion of these activities to ensure consistency with PWSA's evolving goals.

3C. Develop collaborative master plans for priority planning units.

Implementation of effective stormwater projects within priority areas is what comes next, and requires careful evaluation and planning beyond the scope of this study. Informed by a robust community and inter-agency engagement process, more detailed GIS and site assessments of candidate sites, and enhanced wet weather models, the planning unit master planning process will enable PWSA to develop a cohesive plan for each planning unit that will, in turn, fold into PWSA's overall capital improvement plan for stormwater.



^ Grounded volunteers helping spread soil at a CommunityCare site in the Hill District.



4th Ward Floodable Park in Atlanta, Georgia. Photo by Steve Carrell.

Define Initial Investment Strategies

Illustrating the multiple co-benefits of stormwater investments in key sites is essential for demonstrating what is possible through a concentrated investment strategy connected to People, Planet, Place, and Performance.

A key goal of the strategic plan is to illustrate the value that investments in stormwater can provide to the City and its residents, and to make PWSA's investments go further. Based on the analysis of PWSA's current investments, and proposed investment strategy, as well as the four lenses mapping, the strategic plan suggests watersheds within the City that could yield the greatest impact in terms of managing stormwater and achieving the greatest comprehensive P4 benefit. To make these proposed investments resonate with a broad public audience, the Stormwater Strategic Plan Team chose three example locations in proposed priority sheds that illustrated the range of possible investments, the highest degree of co-benefits, and leveraged well-documented community priorities. These are exemplary, and do not represent planned projects, but are meant to demonstrate the broad potential and far reaching benefits of stormwater projects, including potential community amenities that could be provided by other partners.

4A. Use catalytic investment framework as a tool for PWSA, other City departments, watershed task force groups, and residents to gain support for future stormwater investment.

The following section includes examples of three potential catalytic design sites, one in Negley Run, and two in Saw Mill Run – the two highest priority sheds based on the strategic plan analysis. Each explains the rationale for choosing these sites, documentation of past planning efforts and community support for these projects, and how the sites would work to manage stormwater and provide visible and exciting community benefits.

Recognizing that there are many places within the City that are in need of stormwater management strategies that do not fall within these three example locations, the strategic plan also provides guidance on possible interventions that can occur throughout the City, in a range of terrains, from hilltops, to runs and ravines, to sloped hillsides, to river flats. These are discussed as “terrain typologies.”

The three catalyst sites are contained on pp. 40 through 49 of this document, and the typical project types for different terrains common in Pittsburgh are discussed on pp. 31 through 39.



Center For Sustainable Landscapes, Phipps Conservatory and Botanical Gardens, Pittsburgh

”

We developed a NYC stormwater design manual and identified a priority list of ROW GI asset types (porous pavement, infiltration basin (grass or concrete top), rain garden) that the applicant (project owner) has to incorporate into new developments.

- Pinar Balci, Assistant Commissioner of the Environmental Planning and Analysis at the NYC Department of Environmental Protection

City-Wide Terrains + Networks

Pittsburgh is a City known for its stunning natural elements, and with that comes lots of different types of “terrain,” or land types. Many Pittsburgh neighborhoods are characterized by water as well– and not just the prominent three rivers. Numerous runs and streams weave throughout the City, many of which have been buried or disturbed over time, creating many of the stormwater issues experienced by residents today. The Stormwater Strategic Plan Team looked closely at these natural features, including existing parks and open

space systems, and large areas of vacant land, to define five distinct terrain types, and typical stormwater interventions that could be used within each to manage stormwater. Incentives, policies, and case studies for each terrain type are also included. Implementing these types of projects throughout the City will multiply impact over time. Some policy and implementation approaches to these project types are included in the Leveraging the Stormwater Fee section.

LAYERS



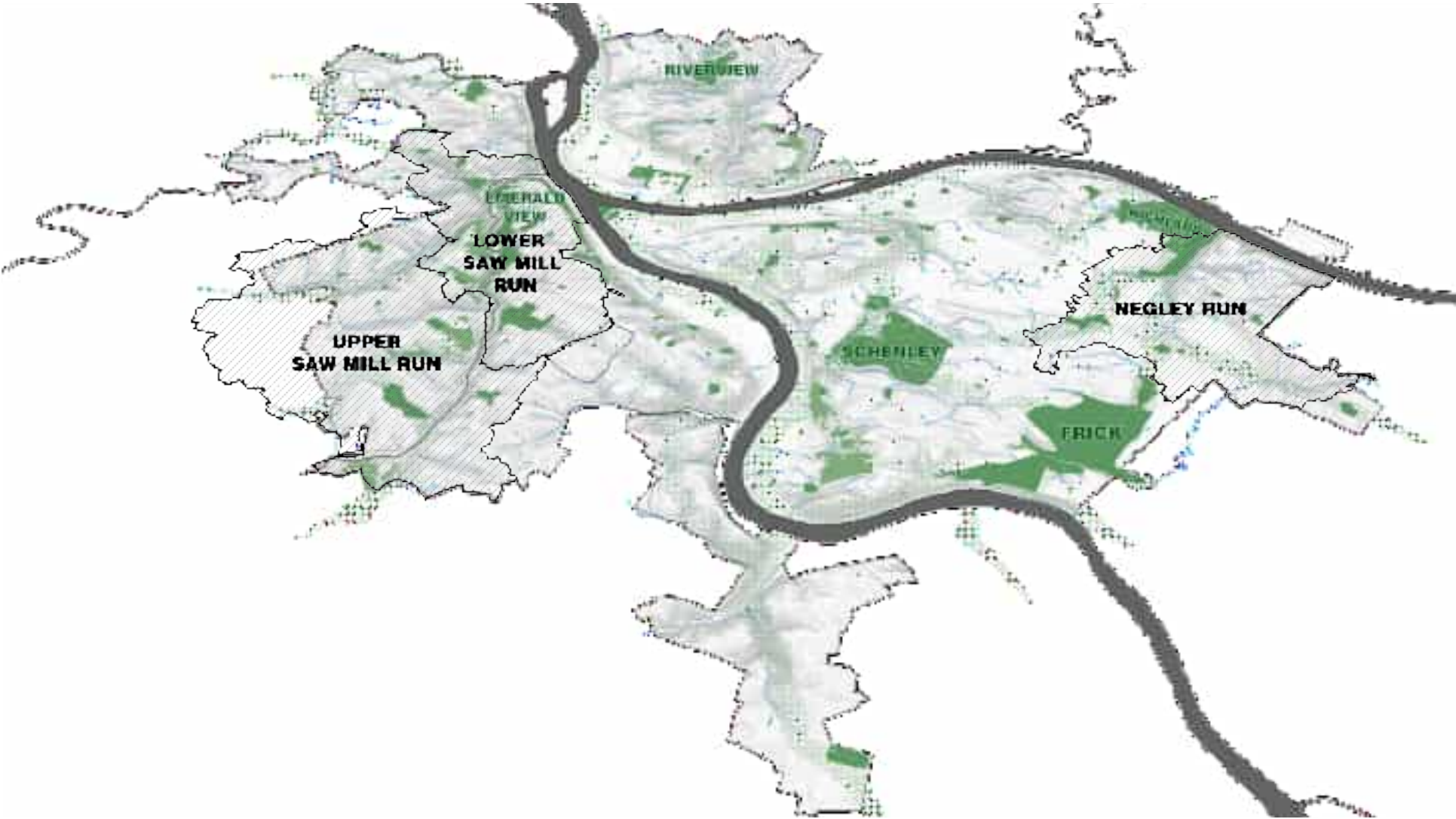
Historic Streams



5ft Contours



Existing Parks



Terrain Types

OBJECTIVE

**CATCH
HOLD
USE**

**CONVEY
MOVE**

**SLOW
INFILTRATE**

**RESTORE
REVITALIZE**

**CELEBRATE
ACCESS**

TERRAIN TYPE



Hilltops and Plateaus

Flat, sometimes economically distressed neighborhoods on higher ground

Sloped Hillside

Sloped streets and dense housing

Hollows / Pocket Ravines

Steeply sloping confined valleys, often with forested cover and public space

Floodplains

Flat, floodprone areas next to small to mid-size creeks

Riverflats

Flat, developed areas next to Pittsburgh's Main Rivers

EXAMPLES

Homewood, Larimer, Point Breeze, Morningside, Knoxville/Beltzhoover, Lower Garfield/Friendship, Upper Hill District, Squirrel Hill

Brighton Heights, Upper Garfield, Polish Hill, Lower Hill District, East Hills, South Side Slopes, Carrick

Heth's Run, Woods Run, McKinley Park/Bausman Street, Moore Park, Naylor Run, Southside Park

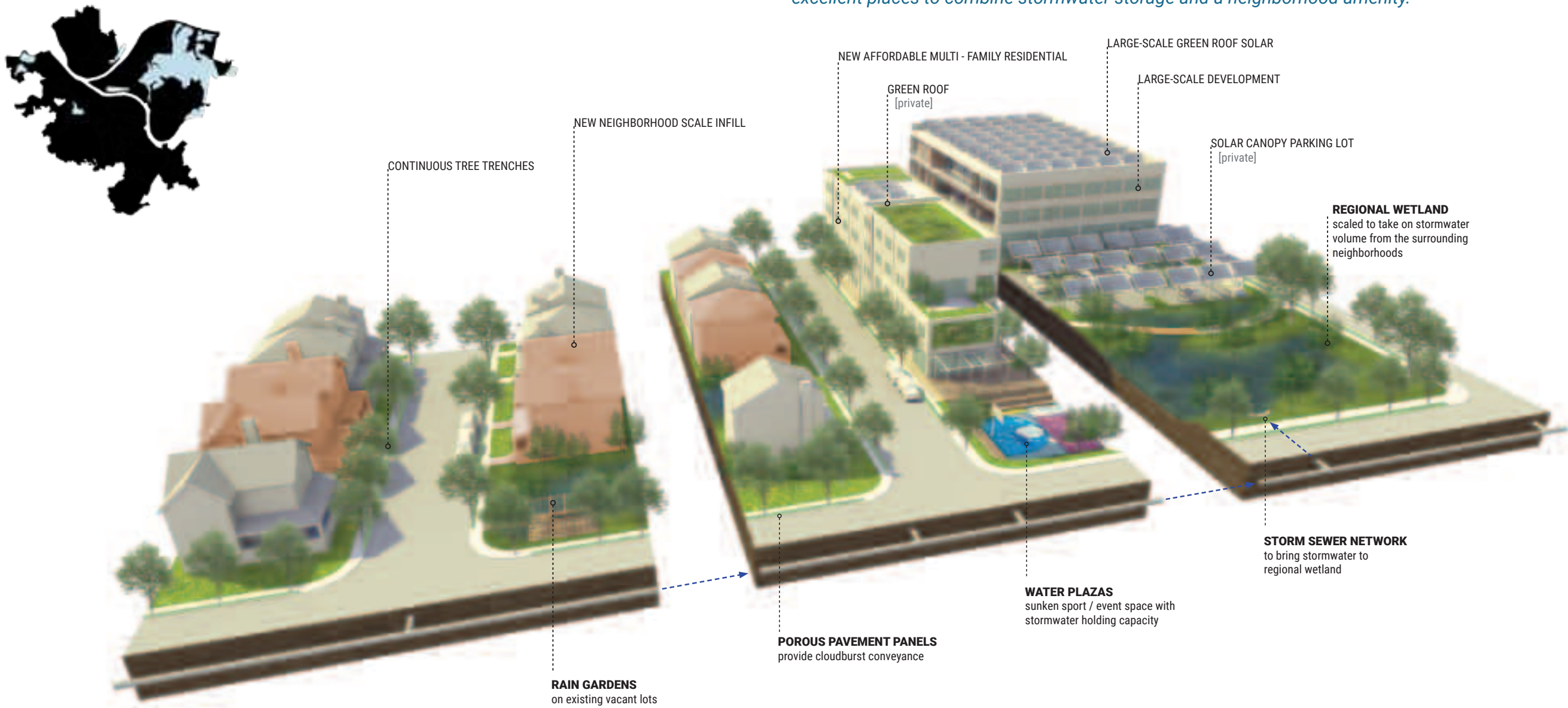
Lower Four Mile Run, Saw Mill Run, Streets Run, Washington Boulevard, Lower Chartiers

Southside Flats, Northside, Strip District, Lawrenceville, Hazelwood

TERRAIN TYPE:

Hilltops and Plateaus

Hilltop Plateaus are defined as areas located in the upper watershed typically with ground slopes ranging from 0 to 5 percent. This is where most of the City's neighborhood development has historically occurred, and through retrofits on existing parcels and streets, and new opportunities that come with new development, they are excellent places to combine stormwater storage and a neighborhood amenity.

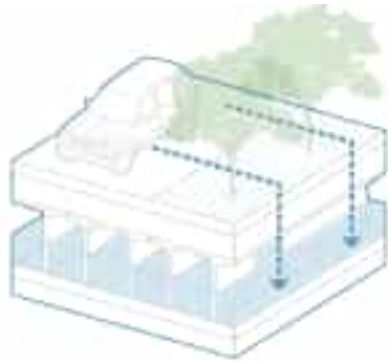


STRATEGIES



Regional Wetland

Where possible, large, regionally-focused wetlands can take on very large volumes of stormwater, holding and cleaning the water in open, usable green spaces



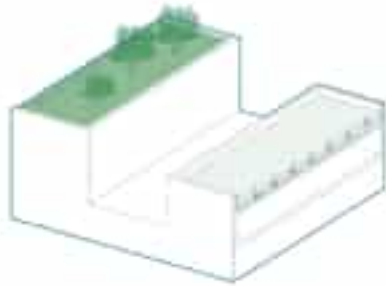
Subsurface Storage

Wherever possible, collecting and holding large volumes of stormwater underground will help to alleviate downstream problems



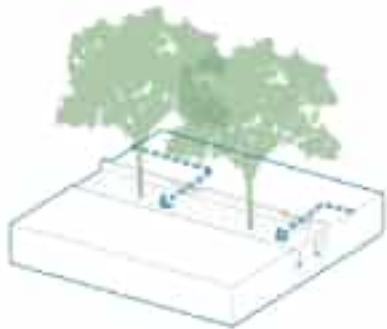
Floodable Park Features

Sunken areas, paved or soft-scaped, can serve as storage volume in intense rain events, slow-releasing the water into the system once the initial rush has passed



Green Roofs (Private)

Promoting green roofs retrofits and installation on new construction offer a great opportunity for amenity space, habitat creation, as well as being able absorb and hold rainwater



Street Tree Retrofits

Promoting the use of continuous tree trenches and sunken planting surfaces, planted areas can also take on water from the street, holding and cleaning it

** These are some public and private strategies that can be implemented*

IMPLEMENTATION RECOMMENDATIONS

Priority should be given to larger vacant tracts, especially in MS4 areas, where a high volume of water can be filtered and stored in large-scale wetland facilities that require lower maintenance. Coupling that green space with new development, this wetland ecosystem / public open space / affordable housing / renewable energy generation hub could demonstrate how stormwater investments are able to support other City-wide sustainability initiatives, while also helping to grow local communities. While far less cost-effective, much can also be done on a smaller scale. In existing neighborhoods, regrading roads to pitch water to new street trees and planted basins, as well as installation of new, right-sized storm drains, can help to alleviate

downslope issues. In medium-sized new developments and vacant lots, floodable park features and sunken green spaces can collect water not only from the buildings, but from surrounding streets.

Common Issues - Overland flooding, basement backups, water quality, contribution to downstream issues

Technologies - Distributed storage, new piping, new inlets, partial separation, surface conveyance improvements

Implementation challenges - Utility constraints, urban uses, lack of sufficient drainage area, lack of slope

Co-benefits - Passive recreation, urban heat island reduction, repaving, streetscape improvements, complete streets, cost sharing, environmental justice

CASE STUDY: TOWERSIDE DISTRICT, MINNEAPOLIS, MN

The system includes a first-of-its-kind stormwater agreement between four private landowners. The system collects storm water runoff from six development parcels totaling eight acres, conveying that runoff into two biofiltration basins for treatment, storage, and reuse on nearby development sites and community garden.

The agreement made by property owners makes it possible to manage stormwater for future development jointly and reduce each individual property owners' expense, while also freeing up a portion of their property to allow more flexibility for development and reducing surface and groundwater pollution.

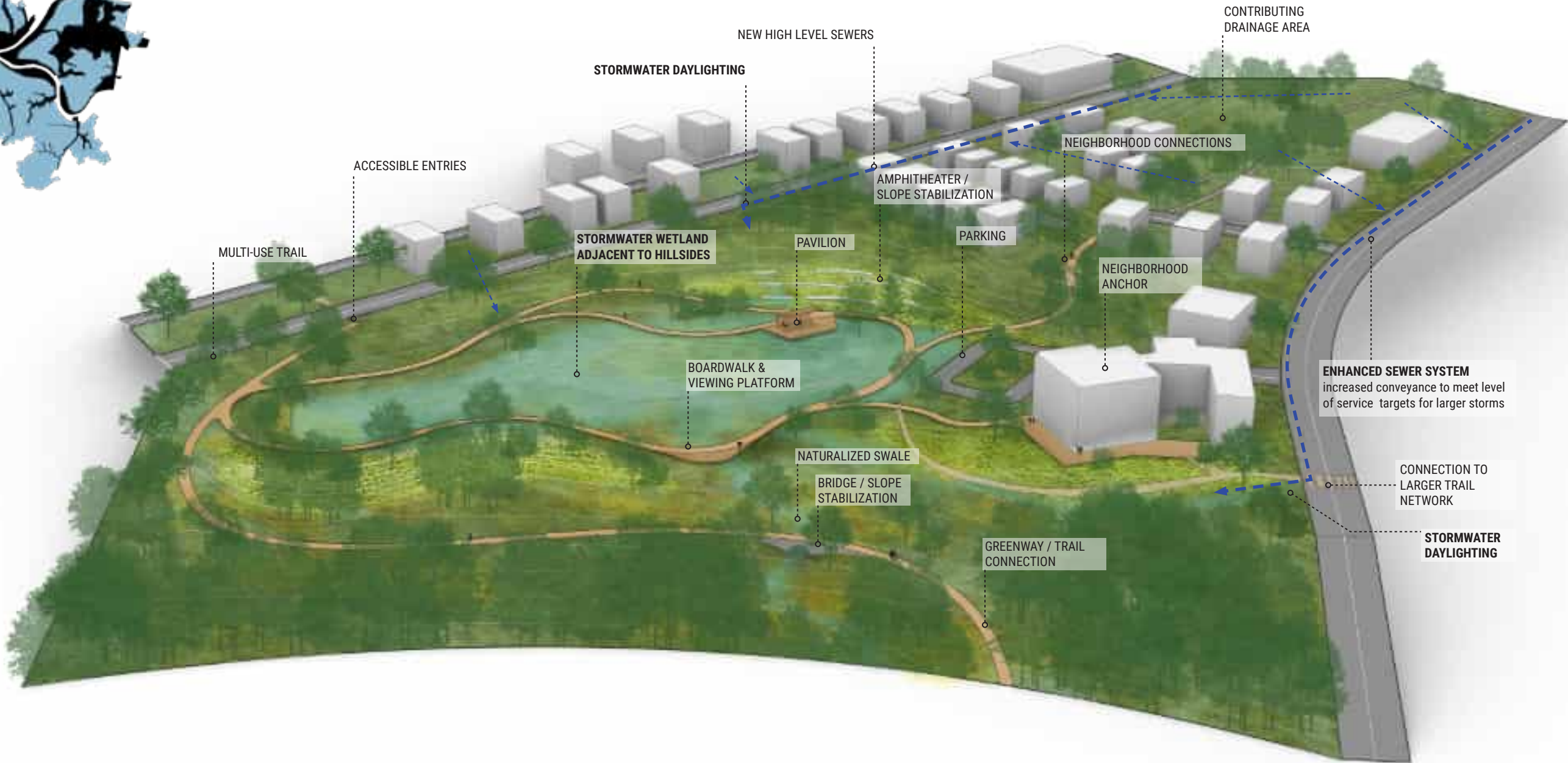


^ Towerside District Stormwater, Minneapolis, MN

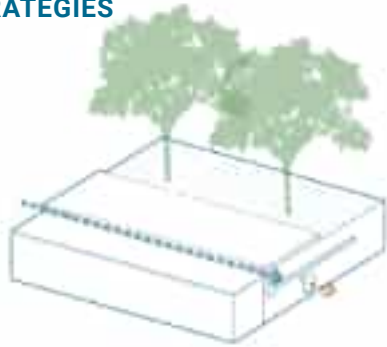
TERRAIN TYPE:

Sloped Hillsides

The sloped hillsides throughout Pittsburgh occur within the transition zone between the upper plateaus and the hollows. The slopes in these areas range from 5 to 20 percent. These steep slopes add the natural beauty of the Pittsburgh terrain, but they also create a strong erosive force that can lead to hydrological issues at lower elevations. Common issues include: overland flooding, landslides, groundwater seeps and springs, and water quality issues.



STRATEGIES



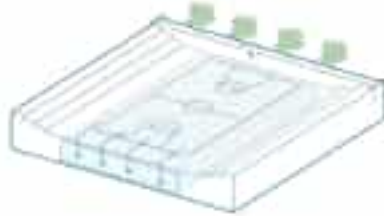
Sewer Separation

Separate sewer systems involve two separate pipes for sanitary and stormwater flows, greatly increasing the capacity to hold water during storm events



Parking Lot Improvements

Permeable paving and tree pits allows water to slowly enter the system rather than flowing directly downstream. Solar panels provide shade and provide alternative energy solutions



Floodable Park Features

Sunken areas, paved or soft-scaped, can serve as storage volume in intense rain events, slow-releasing the water into the system once the initial rush has passed



Storage Wetland

Where possible, large wetlands can take on significant volumes of stormwater, holding and cleaning the water in open, usable green spaces



Naturalized Channel/Swale

A system of smaller-scale check dams and ponds across the slopes can help collect and slow the movement of water

** These are some public and private strategies that can be implemented*

IMPLEMENTATION RECOMMENDATIONS

Because many of these areas are densely developed and steeply sloped, most storage opportunities are fairly small, and conveyance to flatter, more open areas should be prioritized. Where there are larger, perched, and fairly flat lands adjacent to these hillsides, particularly around neighborhood anchors like schools, churches, recreation centers, etc., it may be possible to create larger wetland areas that have the capacity to store and treat large amounts of water while also serving as recreational space for the neighboring communities.

In areas where more storage space is not available, it is important to provide protective flood mitigation in various forms. This includes increased

surface (new curbing and inlets) and subsurface conveyance and storage if possible, as well as raising roads.

Common Issues - Overland flooding, landslides, groundwater seeps and springs, water quality and abandoned mine drainage (AMD)

Technologies - Larger storage in flat areas, smaller storage along slopes, larger sewers, new sewers, surface conveyance improvements, new inlets

Implementation challenges - Wooded or naturalized areas, steep slopes

Co-benefits - Active Recreation, Passive Recreation, Cost Sharing

CASE STUDY: HILLCREST GREEN STORMWATER INFRASTRUCTURE, PITTSBURGH

This project includes curb, gutter and drainage improvements to existing roadways as well as new storm sewers and inlets to manage stormwater. It also features a series of distributed storage areas along the sloped topography. These storage areas include impermeable liners, check dams, and flow junction boxes. It does however have a higher cost per acre for maintenance over its full life cycle. Other projects include: Centre and Herron, Wightman Park, Melwood and Finland, and Lower Hill District Sports Authority street tree trenches.

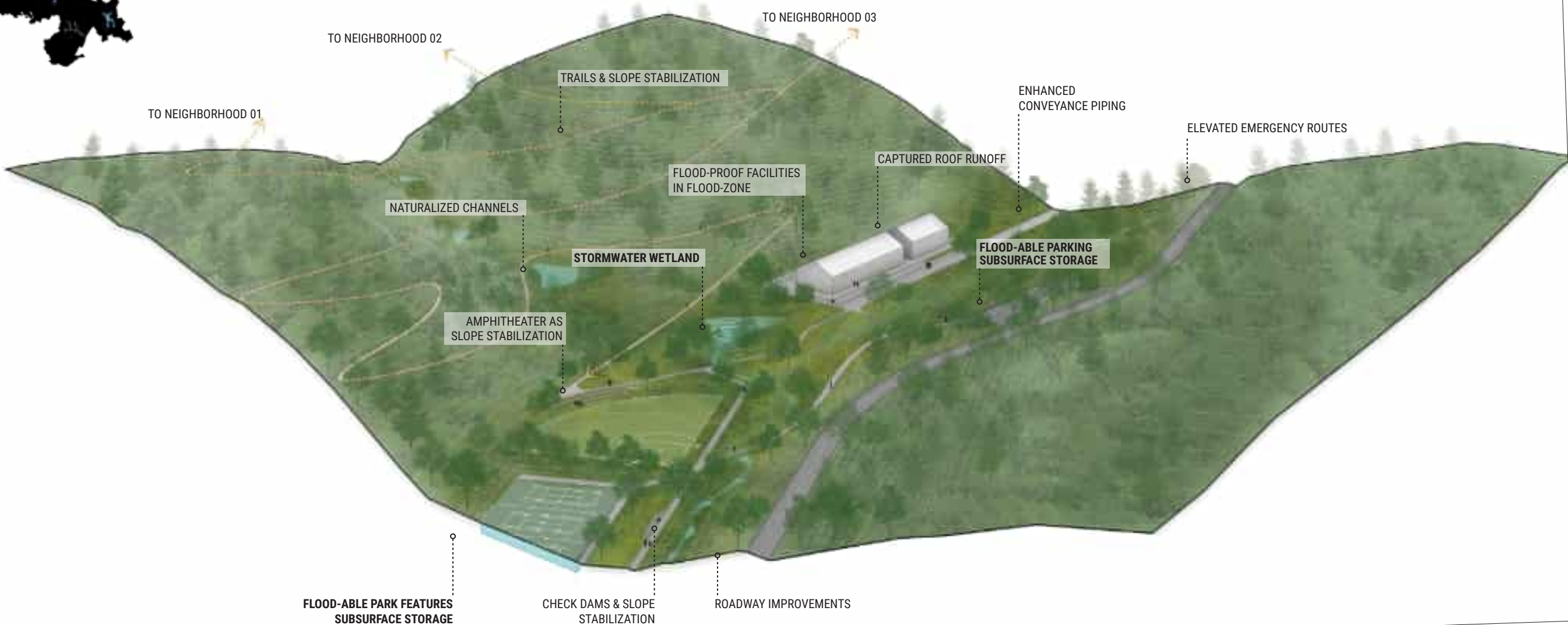


Hillcrest Green Stormwater Infrastructure, Pittsburgh

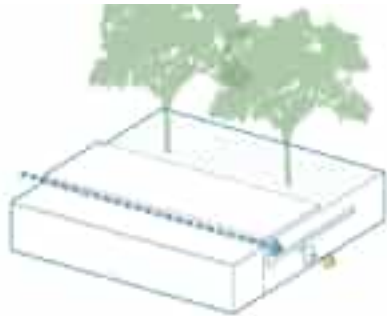
TERRAIN TYPE

Hollows / Pocket Ravines

Pittsburgh's hollows are recognizable by their tight valleys and steeper slopes, typically containing culverted historic waterways or seasonally ephemeral streams. These areas act as funnels for stormwater generated from the upper plateaus and sloped hillsides. Stormwater concentrates and moves quickly in these areas, especially during intense rain events. The common issues in this terrain include: overland flooding, flash flooding, landslides, water quality concerns, abandoned mine drainage, and groundwater seeps and springs.



STRATEGIES



Sewer Separation

Separate sewer systems involve two separate pipes for sanitary and stormwater flows, greatly increasing the capacity to hold water during storm events



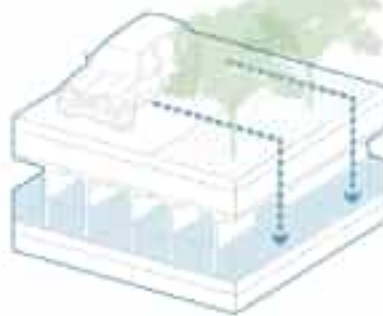
Roadway Improvement

As roads are rebuilt or require maintenance for any reason, there are opportunities to combine them with water storage and flood prevention projects



Floodproof / Floodable Buildings

Strategies include creating berms around buildings and waterproofing the foundation. Elevating or relocating buildings would be an effective but more expensive alternative.



Subsurface Storage

Wherever possible, collecting and holding large volumes of stormwater underground will help to alleviate downstream problems



Slope Stabilization

The construction and improvement of trails can be a catalyst of incorporating slope stabilization methods along steeper slopes. In addition, the flow of water along trails could be managed through the construction of naturalized channels with check dams.

** These are some public and private strategies that can be implemented*

IMPLEMENTATION RECOMMENDATIONS

Many of Pittsburgh’s smaller streams flow through steep forested hollows before connecting with major rivers. Although sometimes steep, many of these areas are already publicly owned and just downstream of built up urban spaces that generate lots of stormwater. This creates an ideal opportunity to fuse ecological restoration, regional stormwater management, and floodable green space.

In areas where it is not possible to store water due to narrow valleys or access constraints, it is important to create naturalized channels for the safe movement of water to the downstream floodplains. It is also important to provide flood protection, increased conveyance without negatively impacting

downstream neighborhoods. In addition, slope stabilization methods can be incorporated with the improvement and construction of new trails along these Hollows to be completed by partners. This would help prevent further erosion and provide improved access from each of the surrounding neighborhoods to one another. These trails could also be used to create smaller-scale check dams and ponds across the slopes, and serve as access ways and starting points for woodland ecological restoration.

Finally, opportunities for stormwater management in the areas upland from the Hollows should be explored to help manage runoff at its source.

Common Issues - Overland flooding, flash flooding, landslides, water

quality, groundwater seeps and springs, acid mine drainage

Technologies - Smaller floodplain and storage creation (subsurface storage and wetlands), increased conveyance (subsurface piping and naturalized channels), limited ephemeral stream restoration, storm sewer separation

Implementation challenges - Wooded or naturalized areas, steep slopes, equipment access, landslide prone

Co-benefits - Active Recreation, Passive Recreation, Complete Streets, Cost Sharing

CASE STUDY: ATLANTA'S FOURTH WARD PARK

Historic Fourth Ward Park is an example of how a combination of elegant design and technical engineering can solve pervasive issues in combined sewer overflows and the need for more public

green space in an underserved part of the City. It has subsequently resulted in significant urban transformations and provides an enjoyable public asset for both nearby residents and visitors.

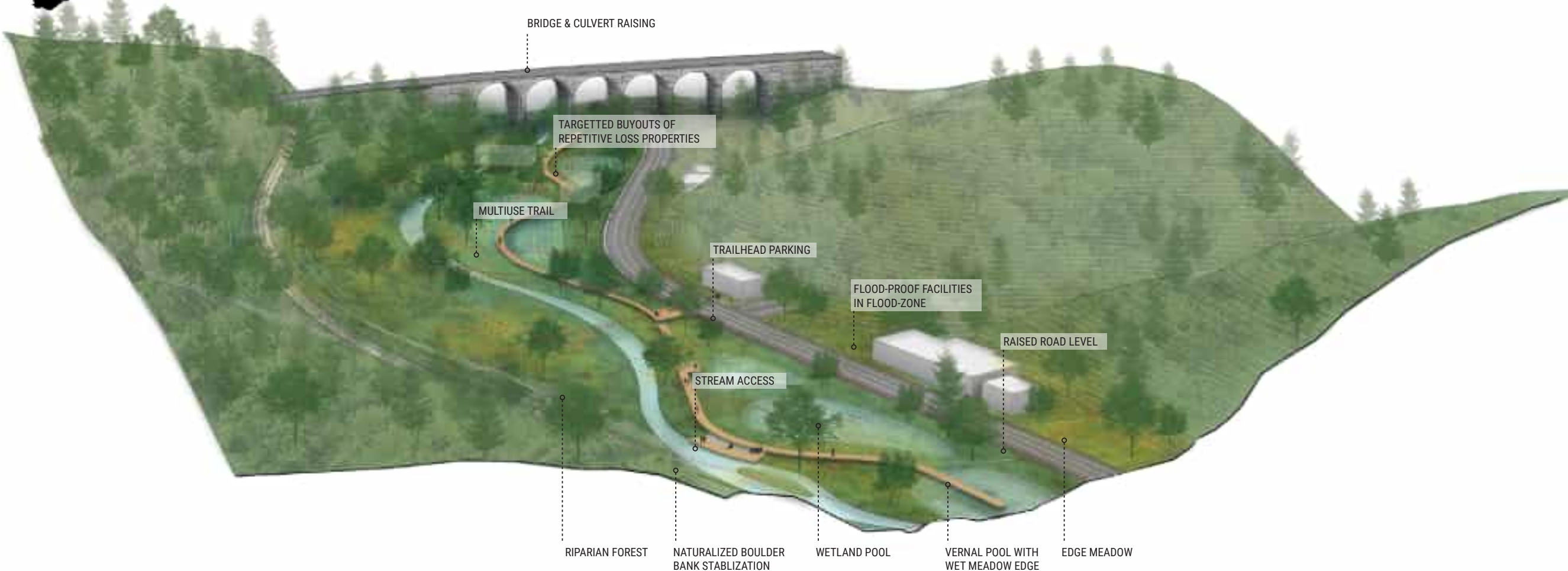


Atlanta's Historic Fourth Ward Park

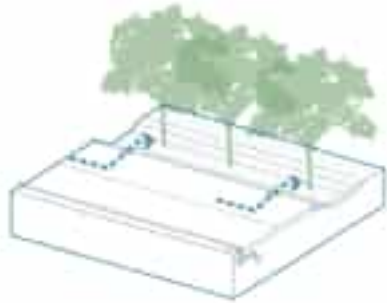
TERRAIN TYPE:

Floodplains

Floodplains have been defined as medium to larger valleys containing larger streams with perennial base stream flows. These areas act as the second funnel from water originating from smaller pocket Hollows and hollows. Historically, these floodplains have been Pittsburgh's active industrial corridors, and as time has gone on, these once wide, lush, meandering stream channels have been hardened and narrowed, with nowhere for flood water to go but into roads and buildings. In these areas stormwater is often dangerous and sometimes life threatening.



STRATEGIES



Roadway Improvement
Any time roads need to be fixed for any reason, there are opportunities to combine them with water storage and flood prevention



Floodproof / Floodable Buildings
Strategies include creating berms around buildings and waterproofing the foundation. Elevating or relocating buildings would be an effective but more expensive alternative.



Slope Stabilization
Stepped terraces can be used instead of retaining walls to create more usable and programmable space



Wetland Pools/Vernal Wetlands
Where possible, large, regionally-focused wetlands can take on very large volumes of stormwater. If water is filtered as it enters the system, these wetlands can return to ecologically rich habitats.



Floodplain/Streambank Restoration
Increasing native vegetation along the floodplain will help protect against erosion and help store additional water in the soil. This will also help restore native habitats in the region.

** These are some public and private strategies that can be implemented*

IMPLEMENTATION RECOMMENDATIONS

The major goal in the floodplain type is to reconnect the streams with their adjacent floodplains. Maximizing storage in the floodplain allows for flood relief as well as water quality treatment. It also couples with stream restoration and bank stabilization for pollutant reduction credits in MS4 areas.

Many of Pittsburgh’s natural floodplains are occupied by properties that flood over and over again. Targeted buyouts to create natural floodplains has the potential to transform a flood problem into an opportunity for ecological rejuvenation, flood storage, and community recreation.

With major roads and train lines running through these same floodplains, coordination with adjacent

transportation agencies opens up opportunities for larger projects that also take into account infrastructure repair, traffic alleviation measures, elevating bridges and road crossings above flood levels, and floodproofing roads and less vulnerable buildings.

Common Issues - Severe overland flooding, dangerous flash flooding, water quality

Technologies - Regional storage, floodplain creation, storage retrofits, buy-outs, flood proofing, road raising, storm sewer separation

Implementation challenges - Wooded or naturalized areas, existing occupied structures/floodplain encroachment, utility conflicts, transportation conflicts

Co-benefits - Active Recreation, Passive Recreation, Urban Heat Island Reduction, Economic Development, Repaving, Streetscape Improvements, Complete Streets, Cost Sharing, Environmental Justice.

CASE STUDY: FOSTER FLOODPLAIN NATURAL AREA - PORTLAND, OREGON

For this project, the City obtained a \$2.6M FEMA grant via its Pre-disaster Mitigation Program (now BRIC) to buyout 60 repeatedly flooded properties and relocate the families. The resulting space was used for large-scale flood storage, and layered on top of that storage were large-scale habitat enhancements, neighborhood amenity spaces, and a suite of new trails and recreational opportunities.



^ Foster Floodplain Natural Area, Portland, Oregon

Saw Mill Run

CATALYTIC SITES IN A PRIORITY WATERSHED

When the Stormwater Strategic Plan Team asked what area of Pittsburgh exemplified the most severe flooding challenges within the City, Saw Mill Run was mentioned again and again by numerous stakeholders and residents. Similarly, as the strategic plan analyzed the City through the four lenses, Saw Mill Run emerged again through those features.

Strong Intersection of the Four Lenses:

Saw Mill Run exhibits severe flooding, is at the intersection of environmental justice communities including Beltzhoover, Knoxville, and Beechview, includes numerous existing parks and open spaces, connected to regional networks and community-identified opportunity areas for future open space, a high amount of vacant land, and contributes to both SSS and CSS areas.

Measurable Performance with Modest Investment:

Given existing and potential public lands within the watershed, opportunities exist for measurable water management interventions, without the need to acquire significant amounts of private land or alter land

uses. However, significant co-funding and external funding will be required for the level of investment shown.

Alignment with plans and advocacy: Watersheds of South Pittsburgh, an existing watershed organization, and the Pittsburgh Parks Conservancy (PPC) have been working ardently for years to advance stormwater projects in the watershed. The Saw Mill Run Integrated Watershed Management Plan (SMR IWMP) was completed in 2019 and stakeholders have been continuing to advance the implementation of those recommendations. This plan identified high priority zones for increased retention storage, which included both McKinley Park and Seldom Seen Greenway. PPC led the McKinley Park Masterplan process, completed in 2016, which included many recommendations for stormwater infrastructure as well as park improvements, supported by extensive community and engagement. Meanwhile, in December of 2021, the City of Pittsburgh acquired the Seldom Seen Greenway, making this existing

open space available for additional funding and public awareness.

Catalytic Sites: The catalytic projects for Seldom Seen Greenway and McKinley Park both communicate the holistic values of People, Planet, Place, and Performance. They create spaces that will be visible and enjoyed by the people of Pittsburgh, particularly close to communities who currently do not enjoy the benefits of high-quality parks and open space. They are capable of achieving major outcomes in performance that will make impact visible in the lives of local residents. They can manage flooding, celebrate the value of water in highly visible ways, and integrate design elements that anticipate the increased flooding that will occur with climate change. Further planning and engagement as these projects come closer to reality will be driven by solid partnerships with community organizations that are already invested in these projects and places.

These two sites, especially when seen as part of a connected network, can multiply impact in several ways. First,

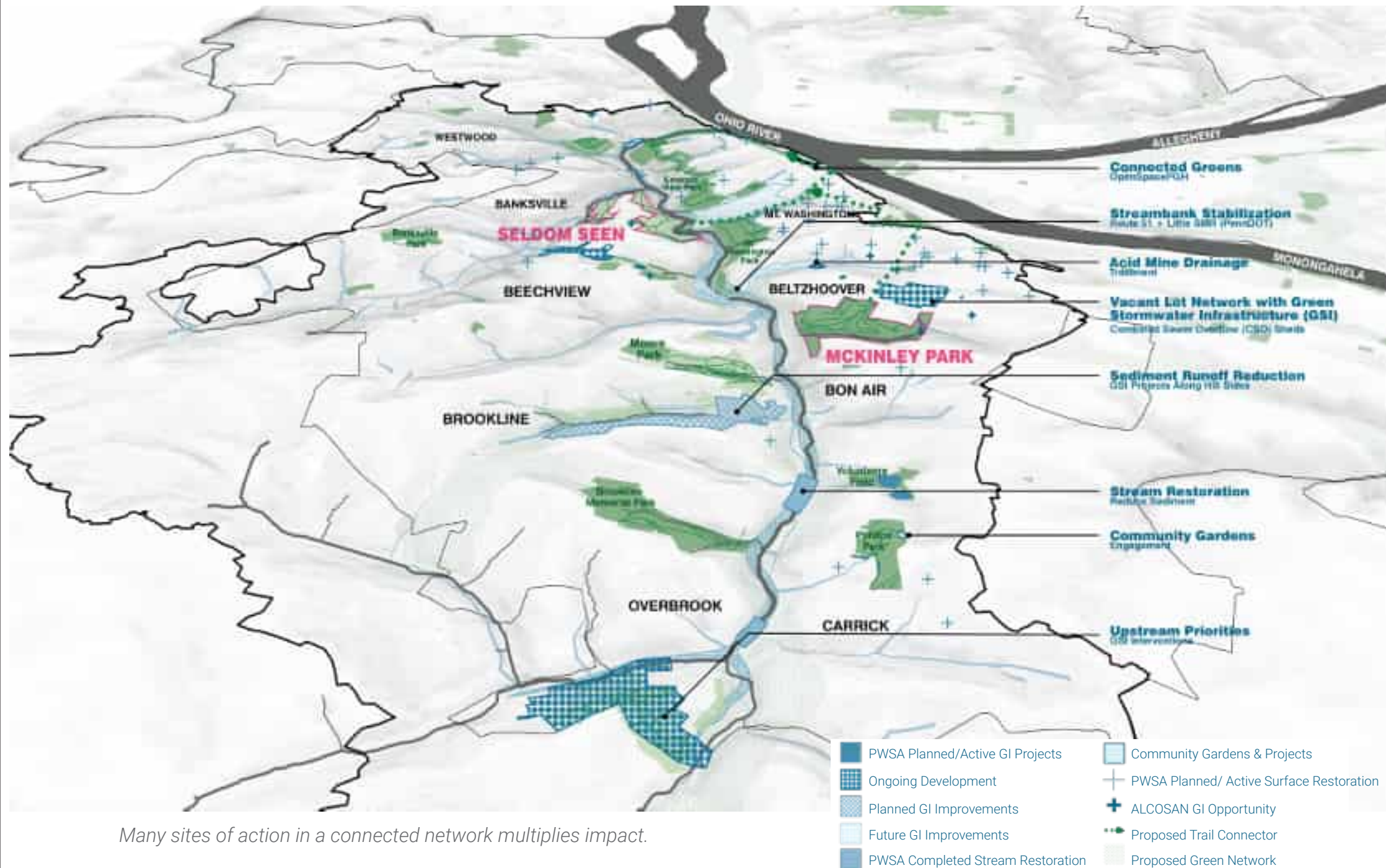


I would say the biggest issue and constraints in the Sawmill Watershed and in my neighborhood would be the topography – the hills are very steep and straight. Deciduous trees and leaf litter in the streets jam up storm inlets. I see opportunities that we do have, given the topography and blighted property, there are a lot of places that could be used for retention purposes.

- Ben, Ambassador, Saw Mill Run

SELECTION CRITERIA FOR CATALYTIC SITES

- ✓ Strong intersection of **flooding, water quality, equity** and **green space potential** (4 lenses)
- ✓ **Alignment with plans and advocacy** of community organizations, watershed, the Parks Conservancy, City agencies and other stakeholders and partners—building on the work of others and inviting collaboration
- ✓ High probability of achieving **measurable gains in performance** with modest investment (and no fatal flaw or high level feasibility issues)
- ✓ Site conditions and community goals allow for exciting examples of People, Planet, Place, and Performance that **communicate vision and value to citizens paying stormwater fees.**
- ✓ Visualization of wider potential in the same priority water/sewersheds can **catalyze future investment** and multiply the performance impact



Many sites of action in a connected network multiplies impact.

LAYERS



Historic Streams



5ft Contours



Existing Parks

by illustrating how projects like this can be realized in other parts of the City. Secondly, increasing focus on this area can increase interdepartmental coordination, highlighting opportunities for long-term transportation and transit improvements, integration with land use and zoning recommendations, and upstream and downstream coordination.

MCKINLEY PARK

Proposed interventions at McKinley Park include a combined approach of responding to challenges in hilltop neighborhoods, nearby roadways, and within the park itself, building off of the existing project completed by the Parks Conservancy. It exemplifies the merging of numerous terrain types as discussed earlier: hilltops, sloped hillsides, and hollows.

Starting in hilltop neighborhoods, (see terrain types), incremental stormwater interventions in vacant lots and infill development could absorb and clean water, decreasing the amount of runoff flowing downhill into the park. Slope stabilization measures on the steep hillsides on the park's north edge would reduce runoff, erosion, and other hazards, as well as beautify the landscape. A

naturalized channel could be developed between the hillsides to enable a better, controlled flow of water into downslope streams, rather than into the park, creating flooding issues. This would be integrated into check dams and roadway improvements along Bausman Street, to include green infrastructure.

Within the park itself, subsurface storage could be placed directly underneath the fields and track, the area of frequent flooding issues, creating soggy, unusable conditions. Other design elements could be added to the park that add public amenities, while also being resilient to occasional floods, such as lawn areas, event spaces, or picnic areas.

Building on the community conversations that resulted in the McKinley Park Master Plan, residents from nearby neighborhoods of Bon Air, Knoxville and Beltzhoover should be central to discussions about improvements in the near term. The planning process can include addressing cleanliness and litter issues in the park, as well as flooding that affects nearby Route 51/Saw Mill Run Boulevard. This comprehensive approach could solve water issues throughout Saw Mill Run, while reinforcing neighborhood use and ownership of the park.



Diagram of the example site, showing potential features and stormwater engineering strategies, including subsurface storage, with additional improvements by others.



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I see the small towns and boroughs like Mount Pleasant Borough in Westmoreland County, they have put a lot of green stormwater structures into their school parking lots and everything. I would assume that there would be more of these projects. It's kind of surprising for Pittsburgh to not have something like that.

A lot of people have no idea what 'green infrastructure' or anything like that is. They're gonna say, 'What are you talking about?' Finding some way to show all of the projects, implementation, completed stage, and maybe showing the stats, the performance measures — like, it's retaining this many gallons of water — we should brag about it, and show that off.

- Ryan K, Ambassador, Saw Mill Run



Slope Stabilization



Subsurface Storage



Floodable Park Features



COVID really made a lot of people realize how important agriculture is — growing food and having access, food policy — those things are now at the forefront, which they should have been a long time ago. A lot of these gardens are gonna be really beneficial to the communities moving forward as we become smaller, and more reliant upon local produce. These communities can benefit from rain catchment water collection, like they've done in Larimer creating a rain garden — it still needs work, but that is a model.

- Pomaj, Ambassador, Negley Run



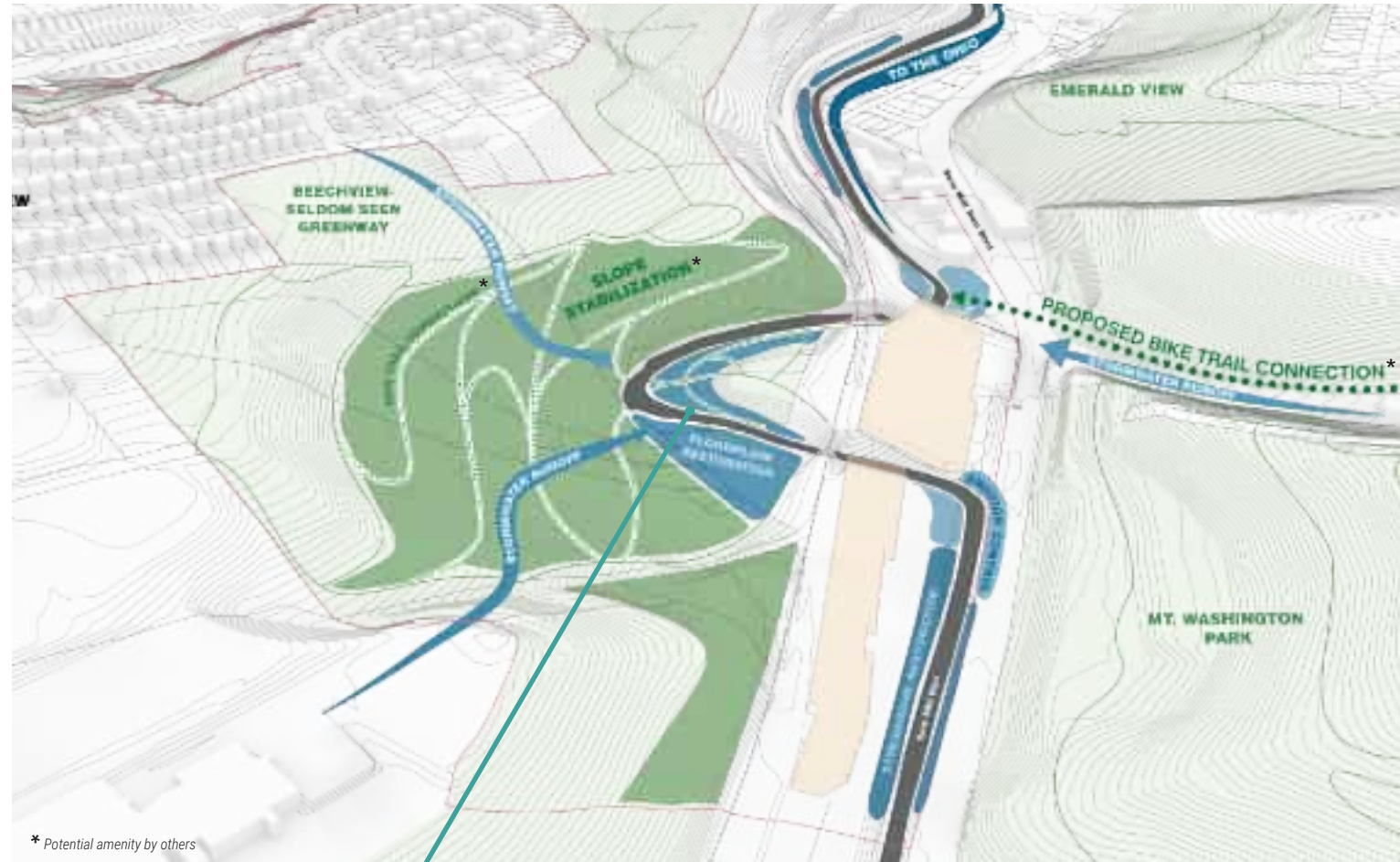
Streambank/Floodplain Restoration



Wetland Pools



Erosion Control



* Potential amenity by others

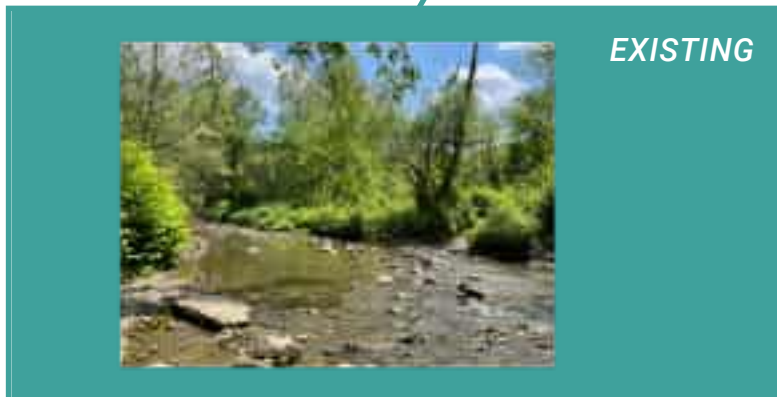


Diagram of the example site, showing potential stormwater engineering strategies and features, including slope stabilization, floodplain restoration, erosion control, and trail improvements.

SELDOM SEEN GREENWAY

Across Route 51/Saw Mill Run Blvd to Seldom Seen Greenway, interventions could also be approached through a holistic lens of combining public amenities, hardworking stormwater infrastructure, and widespread community benefit in terms of flood abatements throughout the shed. The key feature would be a floodplain restoration as Saw Mill Run passes through Seldom Seen, improving upon an already stunning natural feature with broader views, and easier public access. This focal area could include activities like fishing, historical markers and interpretive signage about the history of nearby neighborhoods and Pittsburgh's historic streams, making this place attractive for a wide range

of uses. As in McKinley Park, the steep slopes surrounding the park could be stabilized to reduce erosion and control runoff naturally. Woven throughout these slopes are trail connections to the greenway, while a bike connection proposed in the City's 2017 Greenways Plan would connect Hilltop neighborhoods to the improved park, safely across Saw Mill Run Blvd. Along the Run itself, the project would include streambank restoration on both sides, paired with erosion control. When paired with the interventions in McKinley Park, these measures would drastically improve the flooding challenges along Route 51, complete gaps in the Citywide trail and bike network, and provide improved public spaces to be enjoyed by all Pittsburghers as well as nearby residents.

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The key would be, whether it's somebody from PWSA or community resource members, to actually be able to show people practical applications of where the money is being spent. It's that visual justification of, oh, that's where my money's going in my neighborhood.

- Ryan W, Ambassador, Lower Chartiers Creek

Negley Run

CATALYTIC SITE IN A PRIORITY WATERSHED

The Negley Run Watershed has received a great deal of planning attention in recent years, but many opportunities remain for investment, including stormwater, open space, and affordable housing, among others that have been voiced by community advocates. Negley Run includes the neighborhoods of Homewood, Larimer, Lincoln-Lemington-Belmar, and East Hills, and is adjacent to Point Breeze, East Liberty, and Shadyside. These neighborhoods vary greatly in terms of neighborhood character and many have been the focus of recent investments contributing to neighborhood change. When analyzed by the Stormwater Strategic Plan Team, Negley Run was chosen as a priority watershed due to several factors.

Strong Intersection of the Four

Lenses: Areas of the Negley Run watershed experience significant flooding challenges, especially on the eastern edge in Homewood; it contains a high amount of vacant land, much in contiguous parcels that offer opportunities for land assemblage for

public space or community-aligned development, and is connected to rich existing parks and public spaces.

Alignment with plans and advocacy: The Negley Run Watershed Task Force has been active in advancing stormwater projects since 2017. They completed a 2019 watershed plan that identified several opportunity sites, each with robust stormwater management calculations and cost estimation by eDesign Dynamics. This plan included the restoration of Silver Lake and improvements to the Westinghouse High School field as key sites. RAND also conducted a cost estimation for the restoration of Silver Lake. The Homewood Comprehensive Plan, completed in 2020, included numerous recommendations that are relevant to the goals of the strategic plan. It highlighted the opportunity to promote and preserve African American heritage, improve access to and quality of open spaces, and the expansion of stormwater management. A prior 2015 Homewood Cluster Plan, identified several key sites for stormwater management, neighborhood

preservation, vacant lot strategies, infill development, and neighborhood event space. All of these groups are active and ready to carry forward these ideas as part of a comprehensive vision, in concert with PWSA.

Catalytic Sites: Community advocates have been working for years to incrementally advance projects throughout the watershed. When presented with design opportunity locations as part of the strategic plan process, residents within the Negley Run watershed strongly supported a continued incremental approach, supporting projects already in the pipeline, or projects throughout the watershed that could contribute to a greater whole, rather than one, large, signature site. This approach – interventions throughout the watershed that together decrease flooding, increase quality of life, provide safe and accessible public spaces for residents to enjoy, anticipate climate change, increase biodiversity, and leverage investment across multiple partners – strongly exemplifies the P4.

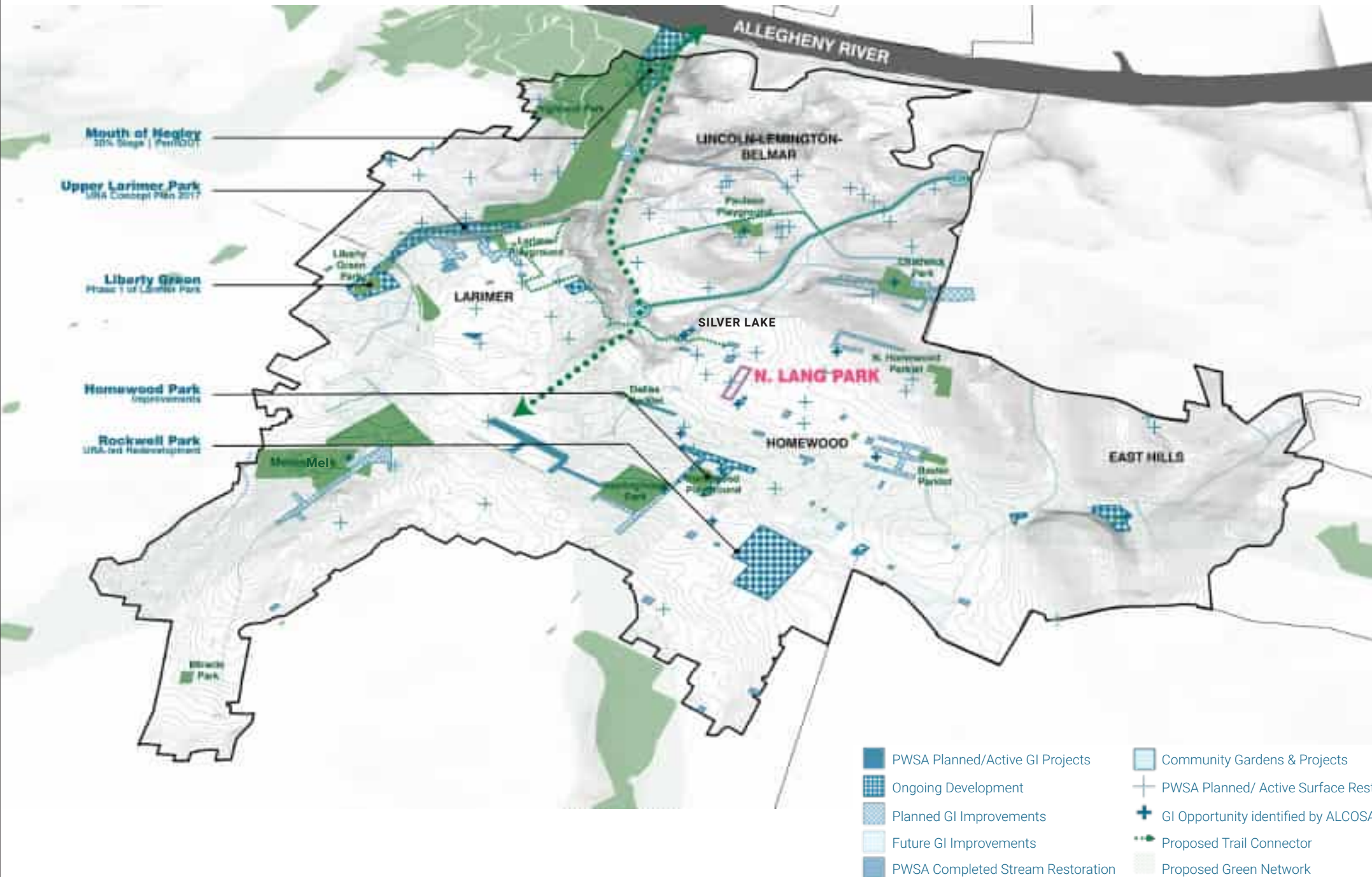
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It's happening not only at the bottom of the hills – I'm up on a hill, and people have flooding in their basement when it rains, so it's throughout our communities that people are having flooding even in higher elevated areas. This is an issue that needs to be brought to the forefront, and a commitment to each community.

- Dana, Ambassador, Negley Run

SELECTION CRITERIA FOR CATALYTIC SITES

- ✓ Strong intersection of **flooding, water quality, equity** and **green space potential** (4 lenses)
- ✓ **Alignment with plans and advocacy** of community organizations, watershed taskforces, the Parks Conservancy, City agencies and other stakeholders and partners—we are building on the work of others and inviting collaboration
- ✓ High probability of achieving **measurable gains in performance** with modest investment (and no fatal flaw or high level feasibility issues)
- ✓ Site conditions and community goals allow for exciting examples of People, Planet, Place, and Performance that **communicate vision and value to citizens paying stormwater fees.**
- ✓ Visualization of wider potential in the same priority water/sewersheds can **catalyze future investment** and multiply the performance impact



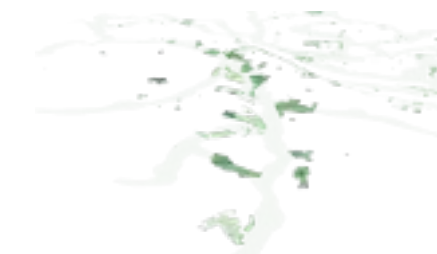
LAYERS



Historic Streams



5ft Contours



Existing Parks

Future investment catalyst that multiplies impact: As projects can be supported by PWSA and other partners within this priority watershed, together they will lead to measurable impact that will be both seen and experienced. This watershed provides numerous locations for alternative delivery strategies that can yield neighborhood investment, on the community's terms, in years to come. Combining these investments can signal successful early action, and garner support for future bigger transformational projects. This approach can serve as a model in other watersheds throughout Pittsburgh.

Measurable Performance with Modest Investment: As documented in previous plans and analyses by RAND, eDesign Dynamics, ALCOSAN, and Living Waters Pittsburgh, key sites throughout Negley Run have the ability to effectively manage stormwater while also delivering quality open space and public realm improvements.

There are multiple sites in the neighborhoods of Negley Run that have been identified as potential sites for stormwater investment, infill, and other community priorities. One location that

exemplified the aspirations voiced by residents in previous plans, as well as the strategic plan engagement, is the series of parcels along N Lang Avenue between Frankstown Avenue and Monticello Street. This site of 4 combined parcels has been recommended as an ideal location for public space, and is already in use by Operation Better Block Junior Green Corps, among others. Design interventions include places for shade and seating, play structures for kids, bioswales that could be installed both within the space, and along street edges. Gathering spaces would be designed so they could be flooded without producing harmful detention problems and soggy conditions. Residents voiced the need for water sources to support nearby community gardens, including the Homewood House Community Garden and the Homewood Historical Farm, so water cisterns could also be included. The site is just a few blocks from Silver Lake and Westinghouse High School, so interventions here could be paired with proposed recommendations for those sites, to achieve widespread co-benefits. The example recommendations could be applied at this site, and numerous other locations throughout the Negley Run watershed, and elsewhere in Pittsburgh.

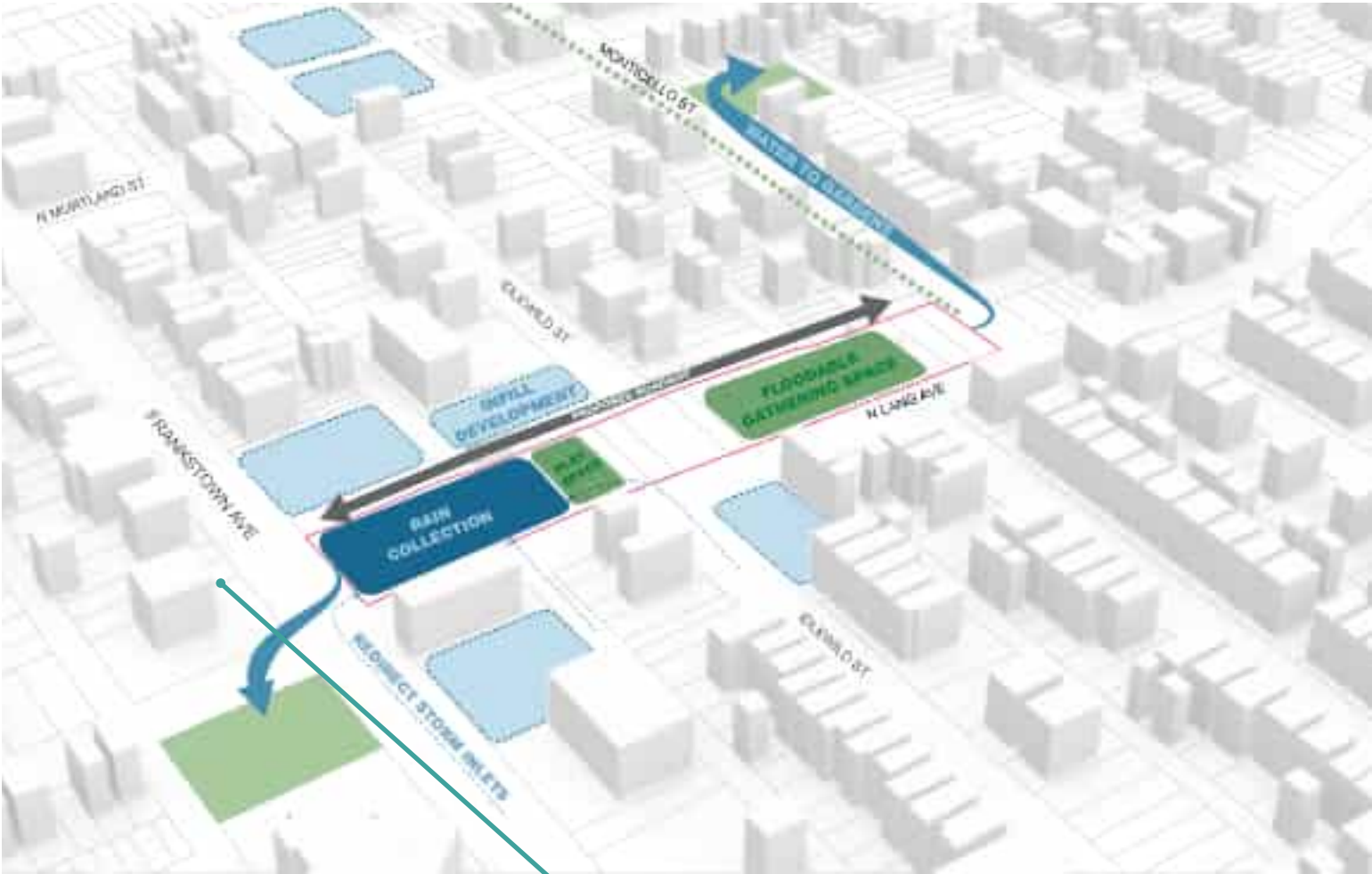


Diagram of the example site, showing potential recreation and stormwater engineering strategies, including floodable park features and gathering spaces.



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The thing I've noticed about our watershed is that it has ranging topography — through steep hills and flatter areas that come to low points in valleys. So we have water rushing down steep hills, that floods streets, and we also have water gathering at low points.

- JoAnne, Ambassador, Negley Run

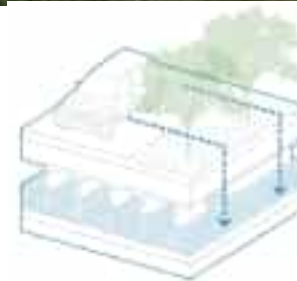
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We have to look at the whole watershed holistically, and while it might seem best to think about implementation at the mouth of the watershed, you also need to concentrate in the neighborhoods at the top of the watershed. I think N Lang Ave is a good example of working at the top of the neighborhood, and as others have pointed out, there's other sites within Homewood and Lincoln-Lemington where this approach may be viable, so this is a nice example. I know another block with a lot of vacant lots close to Westinghouse High School so that too could be another possible site. I think this is a good sort of illustration, but the next step will be to explore these ideas more with community groups and within these neighborhoods.

- Community Ambassador during May 24th Feedback Session on Catalytic Sites



Street Tree Retrofits



Subsurface Storage



Floodable Park Features

Establish Guiding Principles for Level of Service & Flooding

PWSA’s Level of Service policy for stormwater aims to keep pace with peer cities, while maintaining affordability for rate-payers.

Level of Service is a technical term that is used in various ways within the wastewater and stormwater utility industry. For the public, it can be confusing to relate the concept to more direct questions such as “how is PWSA helping to solve flooding” and “when will water quality improve?”.

*In the context of the Strategic Plan, Level of Service (LOS) refers to the **overall set of services provided and outcomes achieved by the stormwater program (not the sanitary sewer system).***

A baseline or minimum level of service, for instance, could consist of PWSA just maintaining its existing network of pipes, inlets, and other infrastructure, replacing them over time when needed.

In contrast, a more aggressive LOS might consist of an accelerated replacement of inlets and pipes before their end of life so that they can carry more stormwater. These investments could in turn reduce the frequency of flooding of roadways and basement backups but are much more expensive. **Specific recommendations by the Stormwater Strategic Plan Team are presented below:**

5A. Optimize costs to balance performance and affordability.

In an ideal scenario, PWSA’s resources for investment would be unlimited and therefore an ideal level of service could be implemented. Roadways would never flood and basement backups would be eliminated overnight. However, PWSA’s investments must also be affordable for rate payers. This need

for affordability constrains the level of service that can be achieved as well as how fast it can be achieved.

Simply put, the higher the LOS and the more quickly PWSA implements a higher level of service, the higher the financial burden on rate payers. Recommendations in Action 6 provide a set of strategies for optimizing investments to keep costs down. These strategies will allow PWSA to achieve a higher LOS while keeping rates reasonable.

5B. Benchmark level of service targets based on peer cities.

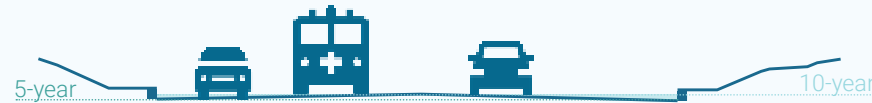
In developing recommendations for Level of Service, the Stormwater Strategic Plan Team needed to balance PWSA’s aspirations to provide the highest level of service possible for its customers with the need to keep rates affordable. As a starting point for creating LOS recommendations, the Stormwater Strategic Plan Team first looked to benchmark the Level of Service provided by peer cities.



Standard Level-of-Service for Non-Emergency Route



Standard Level-of-Service for Emergency Route



Part of the proposed work of the Stormwater Joint Task Force could be to work together, for example, for the renewal of curb reveal within the City and define a Level of Service for surface flooding for different roadway types. A simplified example is shown above where emergency and non-emergency routes have different level of service requirements for various flood events. Once this is established for roadways in the City, PWSA investments to increase capacity will be clearer.

5C. Level-up the level of service by focusing on key priorities moving forward:

Expanded System Capacity. PWSA is currently evaluating the existing LOS for the system and what the future target should be based on affordability. Recommended improvements may include replacing and upsizing or steepening pipes or adding watershed storage to reduce flows. More analysis is needed to understand the rate of implementation that will maintain affordability, but PWSA estimates an approximate rehabilitation rate of around **1% of the PWSA-system per year**, with upgrades occurring when existing

pipes reach the end of their useful life. If outside funding can be leveraged, the pace of implementation could be higher.

Meeting Water Quality Mandates.

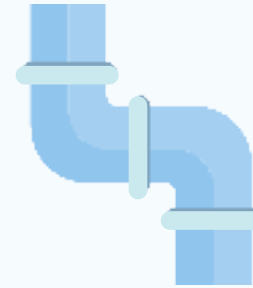
PWSA's Level of Service will also include investments needed to meet ongoing regulatory obligations. The specific nature and location of PWSA's water quality projects will be further developed as part of the Stormwater Master Plan and Wet Weather Planning processes but will generally target projects that reflect the Project Types and Priority Sheds in Actions 3 and 4.

Flood Mitigation. In addition to capacity upgrades, it is recommended PWSA evaluate the use of backwater valves,

property buyouts, and other flood mitigation measures to relieve flooding in the most highly affected areas. Given that PWSA's resources are limited, these investments will be made in collaboration with other City-wide investments via the Joint Task Force as discussed previously in this document, outlined in Action 2.

Added Maintenance. Where funding allows, PWSA should look to implement targeted increases in maintenance frequency, where debris and other maintenance issues could be contributing to increases in local flooding. As with current practices, PWSA should address this in partnership with DPW, particularly regarding debris from hillsides clogging inlets.

How Big Should the Pipe Be?



The Stormwater Strategic Plan Team looked at Level of Service for 13 peer cities to benchmark pipe capacity for separate stormwater and combined sewers. Although the results varied most communities were close to these averages.

Separate Storm Sewers

10-25 year storm

Combined Sewers

5 year storm

5D. Model technical solutions and capital improvements to guide investment.

Gap Analysis + Hydraulic Modeling. As part of a next step, it is recommended that PWSA should study where existing pipes and other infrastructure fall short of Level of Service goals. This gap analysis will require both field inspections and hydraulic modeling to understand the current level of service for each segment of PWSA's storm system. An analysis will need to be performed to determine an affordable level of service for stormwater and effort it will take to get there.

5E. Partner with City, State, and Federal Agencies to reduce flooding.

PWSA understands the significance of solving flooding to improve the quality of life for its customers and wants to do its part. While PWSA can implement some modest increases to Level of Service over time, the improvements will need to be phased in slowly to keep rates affordable. Even when implemented, these investments alone won't be enough to tackle flooding completely, particularly with the added effects of climate change. To solve flooding problems, PWSA is going to need to forge and expand partnerships with City, State, and Federal Agencies who can provide additional funding for floodproofing, roadway enhancements, bridge replacements and other infrastructure improvements that are outside of PWSA's responsibilities. It is recommended through future plans, PWSA work to develop a Level of Service.

Distinct from PWSA's Level of Service Policy for its own infrastructure, the City-Wide policy will set standards based on affordability and goals. This policy should be flexible so that investments can be targeted where they are needed most. For instance, emergency roadways should receive the highest Level of Service in terms of the depth, length, and frequency of flooding. Less frequented roadways or roadways with many alternative routes could be allowed to flood somewhat more frequently.

Leverage Stormwater Fee Impact

In addition to upgrading and maintaining PWSA’s aging stormwater collection system, stormwater investments will focus on cost-effective, high-impact, community-driven projects that will make measurable differences in water quality and flooding within priority watersheds.

Within that broader set of investment targets, a wide variety of possibilities exist, both in terms of the level of improvements that are possible and affordable and over what time frames these are possible. Also, with respect to both water quality and flooding, there are significant uncertainties that will ultimately shape the exact location and extent of improvements.

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In my mind, if someone told me what the stormwater fee was for, I would gladly pay more than \$6 a month. If then I couldn’t maybe I could call and ask to put me back down to the set rate for now. I want to pay more, because what it’s for is so needed.

- Khadijah, Ambassador, Negley Run

Developing an actionable strategic plan requires some quantification of the investments required, even if significant questions remain regarding the level of investments needed to solve the problems, what PWSA’s cost share will be, or how long the investment period will need to be. In addition, communication about fees to residents requires that they be clear and known. PWSA investments in stormwater will continue to be significantly constrained by the need to keep rates affordable, so the extent and speed of implementation is going to be largely a function of how effectively PWSA can offset costs through innovative partnerships, new technology, outside funding, and related strategies.

PROJECTED IMPLEMENTATION COSTS

The analysis of the likely investments needed to implement the strategic plan centers around projecting the range of needed investments in three primary areas, linked to the discussion of terrain types in Action 4:

Watershed Storage: projects, mainly in Hilltop and Hollow Terrains, that collect, detain, and treat stormwater through a combination of detention (treat and release) and retention (infiltrate and/or evapotranspirate)

Conveyance Enhancements: Enhancing the ability of PWSA’s combined and storm sewer networks to convey stormwater, particularly for larger events. Specifically identifying an affordable level of service as discussed in detail within Action 5

Floodplain Restoration: Restoration of natural floodplains along the Saw Mill Run and others is an important aspect of PWSA’s integrated approach to managing stormwater

Projected costs for these investments are shown below, and their assumptions are listed by watershed in Appendix O. Estimates should be interpreted as “order of magnitude” and may change due to a variety of factors including: future Consent Degree negotiations, additional and refined

flood mapping, final Level of Service policies, and master planning specific to each sewer or watershed. **Specific recommendations are presented below:**

6A. Invest in watershed storage projects, especially in Hilltop and Hollow/ Pocket Ravine terrains.

It is recommended that investments in watershed storage occur principally within Hilltop and Hollow Areas upslope of major flooding areas. Watershed storage investments will work in concert with other flood mitigation strategies such as floodplain creation, road elevation, conveyance enhancements, and other measures to provide flood relief for major flooding areas. Additionally, watershed storage will help to address localized flooding at intersections that happen on a more frequent basis. Note that the tunnels in ALCOSAN’s Interim Wet Weather Plan (IWWP) are sized for typical year scale water quality level of service objectives, rather than to control flooding.

➤
Sewer
separation
project in
Hartford,
Connecticut



In addition to Capital Improvement Projects by PWSA, these investments, like others outlined in this plan, are conceived as part of a larger overall funding strategy, rather than as stand alone investments.

6B. Make incremental investments in enhancing stormwater conveyance.

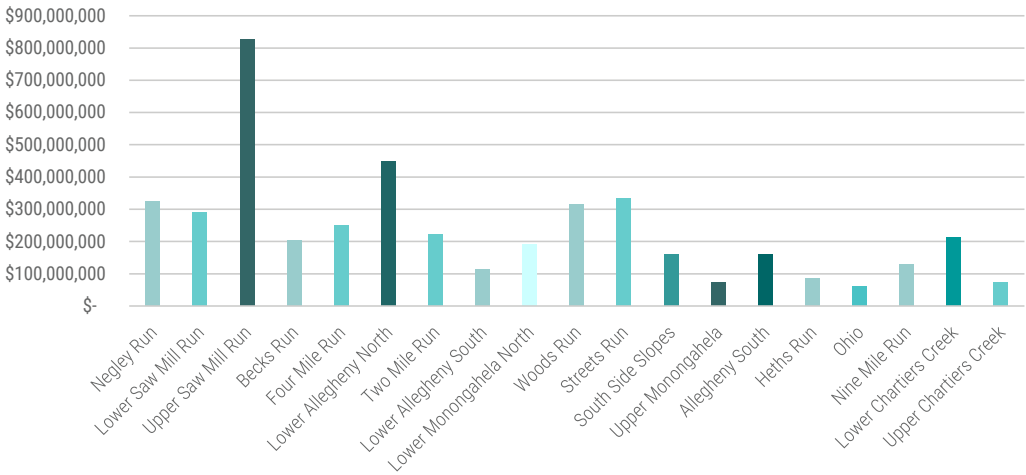
PWSA's network of storm sewers and combined sewers are undersized in some locations, which contributes to problems like basement backups and surface flooding. As discussed in Action 5, it is recommended that PWSA develop a strategy for improving level of service and conveyance by focusing on incremental investments by watershed. The investment costs associated with these upgrades is likely to be funded in large part through rate payer investments. Other support may be available from PennVest through low interest loans that can reduce costs. Other projects may qualify for federal flood mitigation grants such as the FEMA BRIC program.

6C. Invest in the restoration of natural floodplains in stream areas.

Floodplain restoration envisions excavation of existing streamside areas to create new floodplains at lower elevations than currently exist. This will require the removal of large quantities of material, as well as private land acquisition and demolition of existing structures. In short, these are ambitious, high cost projects that, while having a high level of benefit for flood reduction, will require extensive investments from PWSA, the City, and a range of other funding sources. Given the high costs associated with these interventions, estimates that only 10% of the costs will be provided by PWSA, while the remaining 90% will be funded through other means.

Projected implementation costs for the strategic plan show total costs allocated among three investment types above over a 50 year planning horizon. Cost allocations were made assuming that

Figure 6.1 Projected cumulative design, O&M, and construction costs for Strategic Plan implementation by priority watershed.



- Notes on cost estimates:*
- Costs are based on an assumed level of implementation of watershed storage, conveyance enhancements, and floodplain restoration over a 50-year period.
 - Between 10% and 30% of the City's impervious surface (depending on watershed priority) managed through watershed storage projects
 - 25% of the City's major floodplains restored
 - Undersized sewer systems upgraded where needed (up to 30% of the entire system) to convey the 5-year (CSO) or 10-year storm events (MS4)
 - Costs assume that PWSA would fund 100% of the sewer system improvements, 10% (under 6C) of the floodplain restoration costs, and 70% of the watershed storage costs. The balance would be funded by other City agencies or external funding partners.
 - Unit costs for watershed storage, conveyance, and floodplain restoration projects were developed using conceptual-level designs to generate quantities and line item costs mainly sourced from PWSA's own database of contractor unit costs from 2021 projects.
 - Costs include construction, design and O&M for the 50-year implementation period.

Priority 1 and 2 watershed investments occurred at a rate of 20% per decade, while Priority 3, 4, and 5 watersheds occurred at a rate of 10% per decade for decades 1-3, 30% for decade 4 and 40% for decade 5. Within a decade, investments were assumed to occur evenly among years. A list of high priority watersheds is found in Action 3.

Yearly and cumulative costs for full program implementation are shown in Figures 6.2 and 6.3. Cumulative investments are shown by watershed in Figure 6.1. The magnitude of the investment required to achieve full implementation of the plan will require a substantial increase in revenues over time, including external funding, and to some extent, higher stormwater fees. Increases in fees can be further moderated by extending the length of the implementation period. The investments presented should be "right sized" based on more detailed analysis of project needs, external funding resources, and affordability.

Figure 6.2 Projected annual design, O&M, and construction costs for Strategic Plan implementation over a 50 year time frame.

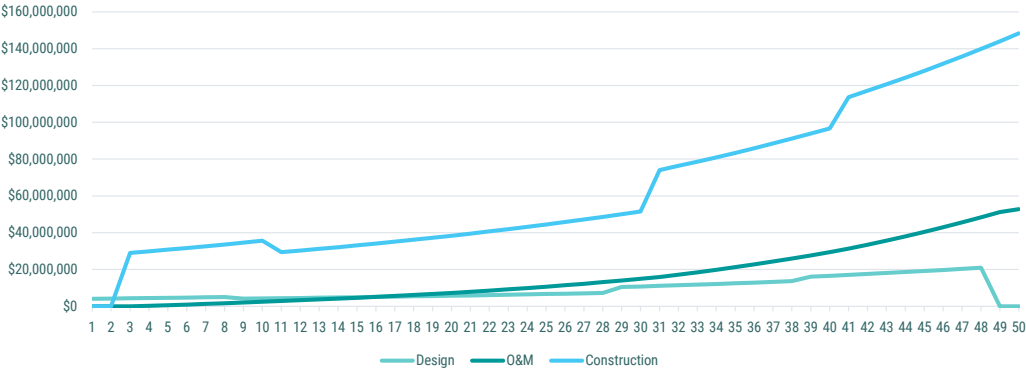
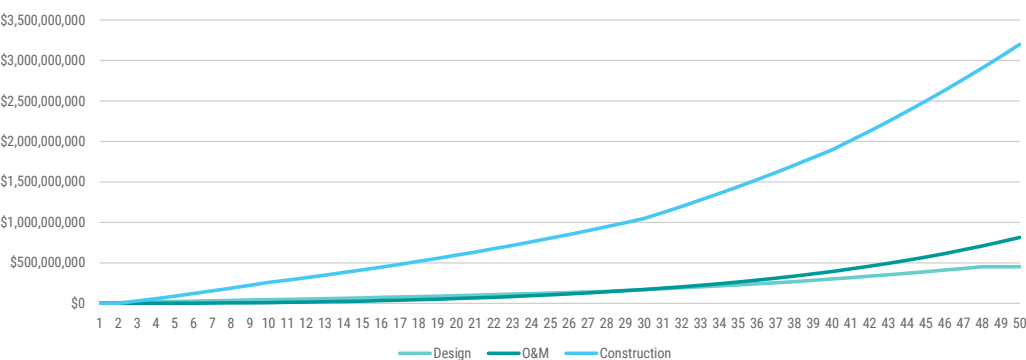
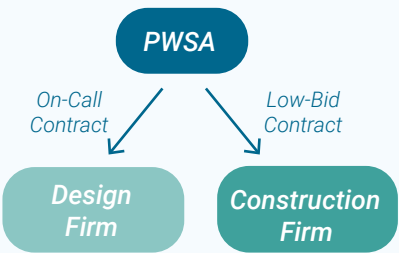


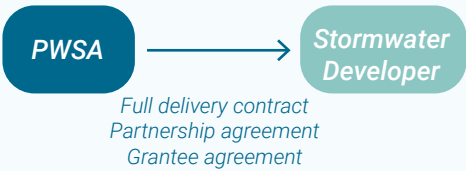
Figure 6.3 Projected cumulative design, O&M, and construction costs for Strategic Plan implementation over a 50 year time frame.



Design-Bid-Build



Alternative Delivery



Modernizing How Projects Get Done

Alternative Delivery — including Full Delivery, Grant, or Public-Private Partnership models — can bring down the cost of implementing stormwater projects, allowing PWSA to stretch stormwater fees further. Similar agencies and jurisdictions across the region including Washington D.C., New York, Philadelphia, Anne Arundel County, MD, and Prince Georges County, MD are implementing similar approaches, providing a range of experiences from which to learn and benefit from.

6D. Reimagine project delivery to better leverage funding resources.

PWSA's financial resources are limited by the need to keep stormwater fees affordable for ratepayers. A key part of this plan is finding ways to leverage PWSA's own funding to get more done in the community and to get projects finished more quickly. These leveraging strategies include:

- Streamlining the delivery of projects through alternative delivery mechanisms such as pay-for-performance contracts,
- Requiring private developers to contribute to stormwater investments in compliance with recently updated stormwater code,
- Adopting innovative technologies, and

- Leveraging regional, state, and local grant funding.
- Also critical is engaging the City's workforce in helping to build and, in particular, maintain, the growing list of stormwater projects throughout the City. In all of these examples, the key focus for PWSA should be, to the extent possible, leveraging the use of disadvantaged and local businesses in helping to build trusted partnerships with agencies, outside funders, private implementation partners, and product vendors.
- A number of cities around the country have successfully shifted who delivers projects, and how, and especially how fast. In implementing the strategic plan, it is recommended PWSA look into the ability to use alternative ways of delivering projects to accelerate pace and lower

costs. Traditionally, most stormwater projects built by water utilities use a design-bid-build delivery model in which projects are designed, usually by engineering consultants, and then bid for construction. In recent years, several alternatives to this process have emerged, including grant programs that disperse funding to non-profits or private landowners, and aggregator programs. These programs provide pay-for-performance contracts to developers, who provide the up-front financing, land acquisitions, and full delivery services to produce a complete stormwater project or group of projects.

As part of the strategic planning process, the Stormwater Strategic Plan Team reviewed multiple project delivery models, including several examples from peer-cities like Philadelphia and New York. These models also included public private partnerships, banking and trading, and watershed district-related models.

Launching a Stormwater Development Industry

Cities including Philadelphia, New York, and D.C. have used alternative delivery programs to spark a new type of private development oriented around stormwater management. PWSA stands to gain from the diversity of programs and approaches employed:



Philadelphia – Stormwater Grants Programs provide up to \$25 Million in Annual Funding to landowners and/or third-party developers. Local foundations provide additional support to help nonprofits target projects.



Washington D.C. – A stormwater credit trading program incentivizes stormwater developers to build stormwater projects that generate salable stormwater credit. The District also offers planning credits to help cover the cost of finding good projects.



New York – The City's Resilient Partners Program provides dedicated funding for stormwater projects on private properties. A fixed cost per managed acre creates an incentive to lower costs of delivery through innovative approaches like stacking funding sources. Matching City funds with state grants and owner investments in tech like EV Charging Stations helps to reduce overall cost and stretch investments further.

- **It is recommended PWSA investigate the ability to pursue a delivery contract as a key alternative delivery option for the stormwater program.**

This contracting option can be developed at a moderate scale, and advanced relatively quickly. Starting with a moderate scale will help attract a diversity of bidders, including local providers. This initial offering could be within one or more high priority watersheds identified in Action 3. Additional components to be incorporated into this process include:

- **Early discussions with landowners and residents.** This approach will ensure that local residents and landowners are partners in project implementation, streamlining the development process.
- **Market analysis to understand the availability of stormwater projects at various price points, assuming various rates of landowner participation.** This will help PWSA set cost expectations per unit of stormwater managed delivered, both internally and with the development community.
- **Industry awareness events prior to advertising solicitation.** Many experienced stormwater developers may not be aware of PWSA's intended offerings and so a long lead time and upfront communication will help these experienced providers prepare

for a solicitation. Likewise, local providers who lack experience also need time to establish relationships and form delivery teams.

- **Workforce and local participation requirements.** Requirements and incentives for participation of locally based businesses and workers will ensure projects help Pittsburgh on several levels. Hyper-local requirements (e.g.: within watershed or neighborhood) could help to further intensify the connection between projects and the community.
- **Best-value or qualifications-based selections.** Philadelphia and Washington D.C. have used best value solicitations to procure design-build and other typically low-bid services. This legal construct should be evaluated for PWSA and used as a preference for full-delivery contracting. This approach will ensure that PWSA can weigh both developer qualifications and approach, as well as cost, in selecting a provider.
- **Criteria for design and acceptance.** PWSA should establish predictable and consistent design acceptance requirements, which should be clearly communicated within any project solicitation. Clear and simple criteria will attract more bidders and avoid disputes.
- **Pre-engineered systems to reduce engineering requirements.** It is

recommended PWSA work with City Planning to offer developers streamlined approval processes for systems that use PWSA-pre-approved construction details for several pre-engineered stormwater management alternatives. This approach will help to streamline delivery and better align projects with PWSA standard and neighborhood contexts.

6D. Leverage external funding to make investments more financially feasible.

Action on all priorities requires more money. There are some sources that can augment PWSA's current gaps between revenue and forecasted investments needed to meet the objectives of the strategic plan. Securing these external funding sources will be crucial to getting to a higher level of service faster while keeping stormwater fees affordable for customers. With the passage of the Infrastructure Investment and Jobs Act (IIJA), federal funding opportunities will be particularly strong over the next 5 years, while local and state-based programs such as the ALCOSAN Green Revitalization of Our Waterways (GROW) program and Pennsylvania DEP Growing Greener will continue to be effective and important sources of funding that can be used as non-federal match (see Figure 6.4).

A more detailed description of potential external funding sources is provided in Appendix B.

Figure 6.4 Potential External Funding Sources

Program	Type	Geography	Funding Level	Application Period	Strategic Plan Funding Priorities	Cost Share
ALCOSAN GROW	Grant	Allegheny County	\$10 million per year (average since 2016)	Annually in Fall	Sewer separation projects that feed regional hilltop or ravine storage projects, particularly in watersheds that are not draining to proposed ALCOSAN tunnels	15%-85% of the total eligible project cost
Growing Greener	Grant	Pennsylvania	18.2 million (2021) ¹	4/22/22-6/24/22 (FY22)	Watershed storage in equity communities, Nature-based floodplain projects that incorporate pollutant load reduction in TMDL (i.e. Saw Mill Run) areas	15% local match
PennVest Clean Water State Resolving Funds	Loan	Pennsylvania		Quarterly (May 4, 2022 August 3, 2022 November 2, 2022, February 1 2023, May 3, 2023)	Separate and combined sewer capacity enhancements	
FEMA BRIC	Grant	National	\$1 billion (FY21)	9/30/21-1/28/22 (FY21)	Nature based floodplain restoration and associated property acquisition, particularly for Saw Mill Run	25% non-federal

¹ The recently passed 2022 PA Budget allocates \$500 million in federal American Rescue Plan funds to the Growing Greener program, which should result in higher annual funding levels for 2023 and beyond.

6E. Task the Joint Task Force for stormwater with developing a joint funding strategy.

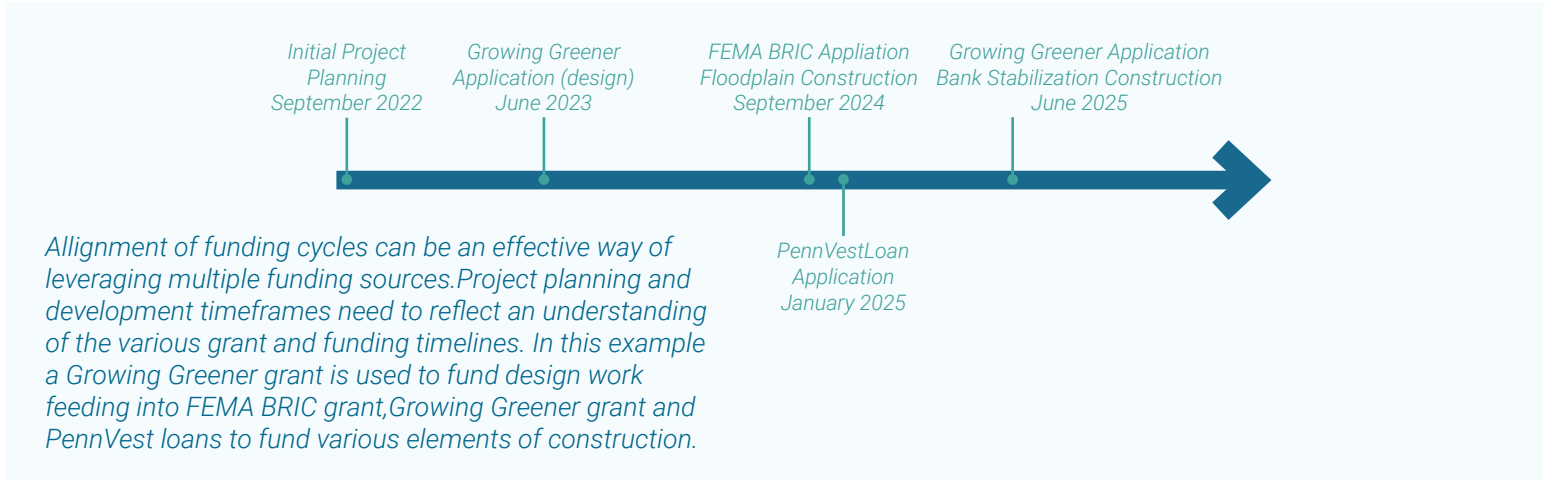
As part of the Joint Task Force, PWSA and other agencies should aim to develop a stormwater and resilience funding strategy. This strategy would build on the grant opportunities identified above to build out specific agency roles, target projects, and application timelines. Key to this effort will be to identify multi-objective, nature-based projects that can meet both PWSA's needs and meet the goals of other agencies and neighborhood-based plans. Projects will need to be developed with a full understanding of funding preferences to improve the chances of receiving competitive national funds like FEMA BRIC. Leveraging multiple outside funding sources will also be critical. This will require careful alignment of project development, project timelines, grant application, and implementation timelines through a collaborative planning process. For instance, obtaining Growing Greener funds to provide design resources (and non-federal match) and subsequently pursuing a FEMA BRIC grant and/or PennVest financing would be strategic sequencing.

Additional considerations with respect to alignment of funding streams include:

- **Alignment of Priorities** – developing a nuanced idea of how funding preferences interact will allow PWSA to plan for projects that appeal to multiple funders. For instance, if PWSA is developing a project for Growing Greener funding for design, but to BRIC or PennVest for construction, the concepts in the Growing Greener Grant must also reflect FEMA and/or PennVest funding preferences and requirements.
- **Procurement, Matching and Other Requirements** – Each grant program has individual requirements for how design and construction services must be procured, what qualifies as matching funds, and topics such as prevailing wages and minority/woman owned business requirements. Understanding these requirements upfront is critical to deploying grant resources effectively. For instance, if competitive bidding is required, then an alternative delivery project delivery model may not be possible.

6F. Collaborate with City to apply for grants.

Applying for external funding is often limited by internal capacity. Given the anticipated high levels of funding available over the next several years, it is recommended PWSA, in collaboration



with other City partners, collaborate on obtaining grants working with a funding coordinator or consultant. This coordinator would initially develop a funding strategy and assist with the development of individual grant applications. This dedicated resource could bring the time and expertise to the grant development process required to optimize project selection and design to enhance funding possibilities. Local foundations could also provide grant development support, possibly through a consultant contract.

6G. Partner with developers to expand stormwater features.

PWSA recently partnered with the City of Pittsburgh to update the City's stormwater ordinance. As part of these updates, developers who trigger the stormwater regulations are required to provide enhanced levels of stormwater management versus the previous version of the ordinance.

These enhanced requirements include adjustment of rainfall values used in stormwater management calculations to account for climate change, one of the first stormwater regulations in the Country to do so, as well as requiring enhanced levels of rate control within flood prone areas of the City, termed Public Health and Safety Areas (PHS).

As the City redevelops over time, the percentage of impervious private property managed by improved stormwater systems will increase. These investments will be funded by developers, with property owners responsible for operation and maintenance. While PWSA supports the program through participating in engineering reviews of technical submissions, the costs to PWSA are far lower than direct investments in stormwater management. For cost projection purposes, it is estimated that approximately 15% of the City's total impervious area will be managed due to redevelopment of the plan's 50

year planning horizon. While this is an approximation that will vary significantly from watershed to watershed, stormwater investment as a result of development and redevelopment will substantially reduce the direct PWSA investment required to achieve water quality and flood mitigation goals.

City Planning has established an incentive program where developers are eligible for a grant payment per additional cubic foot of storage volume provided. This presents a significant opportunity for PWSA to partner with developers to manage, for instance, runoff from the surrounding right-of-way of a development project by "upsizing" the stormwater feature(s) installed to meet minimum regulatory requirements. It is possible that PWSA could provide additional funding to make up any gaps between the additional cost of the expanded project and the incentive payment, depending on future funding scenarios. PWSA may want to specifically engage with developers

that are implementing projects within priority sheds. Riverflat areas, as outlined in the “terrains” section of this document, provide particularly attractive opportunities for integrating with redevelopment projects given the level of redevelopment activity in several of these areas and the larger scale of these projects. Integrating with redevelopment projects on vacant properties within Hilltops represents another potential opportunity to leverage the City’s new incentive structure.

6H. Expand a workforce development program using peer cities model.

The expansion of stormwater investment to include green infrastructure and alternative delivery approaches has been used with great success in peer cities to spur workforce development. However, the scale of innovation and investment required of PWSA means the

workforce development opportunities for the region over the coming decades reach well beyond entry-level green infrastructure maintenance jobs.

An orientation to workforce development for this broader required skill set in all functional areas and at all levels of the PWSA organization, in both union and non-union roles, is required. This focus on workforce development is important not only for PWSA but for its “ecosystem” of contractors and service providers. Ultimately,

community support for PWSA’s plans are enhanced if the PWSA workforce mirrors the rate-paying community: each new employee becomes a PWSA ambassador in their neighborhood.

These positions are ultimately public health, environmental protection, and climate resilience jobs. Developing a skilled local workforce keeps more of PWSA’s investments local to the community. Moreover, the scale of investment required not only by PWSA but by surrounding communities facing

their own challenges can allow the Pittsburgh region to become a regional hub for stormwater innovation.

PWSA can partner with the many active, well managed job training and career development programs managed by local organizations, community colleges, and universities for these programs. Developing stronger partnerships with these providers allows PWSA to leverage existing skillsets and community connections, and leverage a broader array of funding sources, as opposed to putting its limited resources into creating a stand-alone program.

A more detailed discussion of peer-City experiences with workforce development programs can be found in Appendix M of the plan.

6J. Leverage technological innovation to stretch investments in stormwater projects.

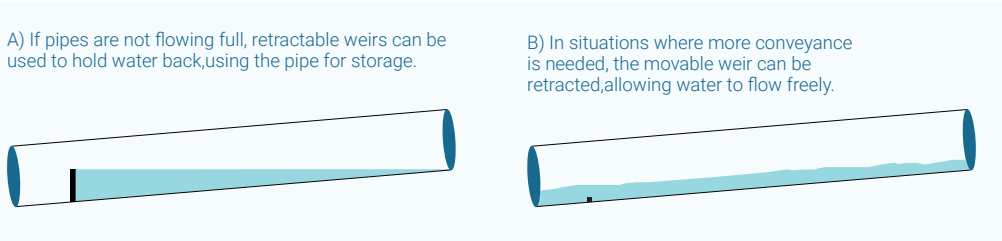
Leveraging technological innovation will help PWSA stretch its investments in stormwater further. In particular, integration of real time control systems, which actively control stormwater systems through smart valves, and integrated technologies that span the energy/water divide, such as green roof solar installations, are both nascent technologies that can significantly benefit stormwater installations based on the strategic plan.

Real Time Control Systems

Traditionally most sewer systems and stormwater controls function passively, using the force of gravity to move water through the landscape through pipes, inlets, and other static structures. Real



PowerCorps Camden is both a catalyst for environmental stewardship and a source of economic opportunity. The program recruits and trains young people from the City to conserve and revitalize public lands, simultaneously equipping them with the resources and skills necessary for career success.



Realtime control systems can be used to maximize the use of existing pipes to either convey water or hold back water, depending on where water is needed most.

time controls (RTC) integrate active control into stormwater systems. Active controls include orifices or weirs that open, close, or change in size. These systems can react to changes in environmental conditions, creating the ability to change how water moves through the systems as conditions evolve.

In recent years, several peer cities such as South Bend, IN, Cincinnati, OH, Buffalo, NY, and Albany, NY have used real-time controls to increase wet weather capture efficiency and reduce the costs of CSO mitigation programs. For instance in Buffalo, the Buffalo Sewer Authority reduced the cost of their CSO long term control plan from \$525 million to \$380 million, while Albany, NY reported 93% capital savings and 6.5x improvement in wet weather capture for a smart network of stormwater systems in the Beaver Creek Sewershed.

Based on these models, there are a number of ways PWSA could explore and adopt this technology:

- PWSA's Wet Weather Program Management team should further evaluate the use of RTC systems as a combined sewer overflow tool and to provide enhanced performance for flood control systems,
- Focus initially on enhancing the performance of PWSA existing pipe and storage network, focusing on demonstrating the effectiveness of the approach within one or two pilot areas in conjunction with ALCOSAN and regulators,
- Provide detailed hydraulic simulations that accurately model the complexities of Pittsburgh's existing sewer system to evaluate in which areas RTC systems are feasible, and optimal locations for installation,

- Evaluate RTCs to enhance the performance and/or reduce the cost of watershed storage projects. RTC systems can also be used to reduce the footprint needed to achieve a given level of performance, expanding the range of sites usable for watershed storage.

Combining Stormwater and Renewable Energy

Integrating renewable energy and stormwater management can further help PWSA leverage the stormwater fee. Projects can co-locate stormwater retrofits with solar arrays or battery storage. Among the most promising of these technologies are solar green roofs – integrated rooftop installations that include both a green roof and solar arrays. These technologies have been in wide use within Europe, but have only been recently introduced commercially into the U.S.

a) During dry weather, the control orifice for pond is closed to maximize water retention for recreation and habitat value.



b) Prior to a storm event, the control orifice for a pond is opened to draw down the water level and increase storage capacity.



c) Following the event, the control orifice for a pond is partially opened to facilitate a slow draw down to maximize water quality benefits.



Real time control systems provide flexible operations to optimize the performance of stormwater systems as conditions change. A similar strategy can be used to maximize storage within existing pipes.

Using Pipes to for Smart Storage in South Bend

- The City of South Bend, IN developed a real time control and real time decision support system (RTDSS) in partnership with Ille University of Notre Dame and Purdue University to optimize the use of its existing infrastructure. The success of the South Bend program demonstrates the powerful role that RTC systems can play in optimizing the use of existing assets to achieve water quality goals.
- Dry weather overflows have been completely eliminated and combined sewer overflow volumes were reduced by more than 70 percent annually (1000 MG/year).
- The smart sewer program required 60 percent less infrastructure investment compared to their original long-term control plan, which saved the City \$400 million in capital expenditure spending.
- The project cost \$7 million to implement and costs an additional \$280,500 per year for data collection, operations, and maintenance fees. The project was completed in four years, between 2007 and 2011, which included the development of software and hardware.
- The project managers recommend that cities seeking to adopt smart sewer technologies focus first on installing sensors and collecting data to help understand the existing system capacity, as well as “investing more, earlier”.
- Having good communication between the smart sewer infrastructure contractor, the City, and the water authority(s) is crucial, as is having clearly defined operation procedures and designated responsibilities.



▲ The collection system in South Bend, Indiana, contains approximately 160 sensors, enabling real-time monitoring of flow and level measurements.

To further this approach, PWSA should:

- Engage with City Planning on co-locating stormwater and energy generating facilities that advance the City’s Energy Strategy.
- Engage with the Urban Redevelopment Authority (URA) regarding the inclusion of supplemental stormwater management and solar generation in developer RFPs (see Alternative Delivery section)
- Evaluate the potential for incorporating private stormwater retrofits, electric vehicle charging stations, and battery storage projects into a single incentive program that could reduce the installation costs of all types and provide more revenue streams for customers.

Solar Green Roofs

Solar green roofs provide the potential to “stack” subsidies for property owners. For instance, an installer of a green roof solar system for stormwater compliance (e.g., as part of new or redevelopment) may qualify for a volume or rate control incentive grant under the new Pittsburgh Stormwater Ordinance, provided the green roof can provide additional management beyond the required volume or rate control. This incentive could be paired with other renewable energy incentives, like the federal tax credit.

Installation of the solar roof system can also be funded privately through a power purchase agreement, in which the solar provider pays for the cost of the system and then sells power to the owner or back to the grid for a period of time, typically 20 years. In this instance, the inclusion of a green roof component can increase the efficiency of the solar array, helping to reduce the return on investment. This can make smaller roof surfaces better candidates for a Power Purchase Agreement (PPA)-funded solar installation than might normally be possible. The increase in the efficiency of the solar array is due to the cooling effect of the green roof, which can increase solar capture efficiency during the summer months. Additionally, as the green roof provides a structural role in the solar panel array, acting to ballast the solar panels, the green roof itself can be funded through the PPA as an integral system component. Further, the ballasting function of the green roof means that the solar array can be installed without puncturing the waterproof roof membrane.

Stormwater Retrofits, Battery Storage, and EV Technology

Beyond solar green roofs, the emergence of battery storage incentive programs as well as investments in EV charging technology could create additional opportunities to combine stormwater management and renewable energy

infrastructure. Some jurisdictions are now implementing incentive programs to encourage the deployment of battery storage projects and EV charging stations. One such program is Energy Storage Solutions, a new statewide program targeted at incentivizing battery storage projects within vulnerable communities in Connecticut. Enabled by state legislation, the program began on January 1, 2022, and will continue for nine years. The program provides an upfront subsidy (up to 50% of project costs for commercial customers) as well as incentive payments based on energy contributions back to the grid.

The emergence of programs like Energy Storage Solutions could provide an opportunity for co-location of stormwater retrofit projects that provide stormwater fee credit. Additional benefits of combining projects could include:

- By combining or “stacking” subsidies, customers can realize revenue/ savings from multiple streams with a single capital project.
- Implementation costs could be lower due to economies of scale and lower mobilization and close out costs.
- Programs could benefit from cross-marketing as well, helping to increase the uptake of both energy and stormwater retrofit projects.



Solar green roofs installed in conjunction with affordable housing offers a particularly potent combination of environmental and social benefits as well as multiple revenue streams and subsidies. Source: livingroofs.org



Solar canopy projects over parking areas provide another opportunity to incorporate stormwater management and renewable energy projects. Source: Moss & Associates

Conclusion

The path ahead is long, but Pittsburgh is up to the challenge.

PWSA's stormwater challenges are significant and complex. Decades of underinvestment and deferred maintenance, increasing regulatory obligations, and increased volumes and intensity of rainfall will require significant, thoughtful investment in long-term solutions on a large scale.

While this challenge is daunting, Pittsburgh is up to the task. These investments can, if undertaken in partnership with community advocates and partner agencies, leverage the lessons learned from peer cities, and the sound research and community input that informed this plan, be transformational

for the City, its residents, and other cities. Through the guidance of the six actions outlined in this strategic plan, PWSA and the City of Pittsburgh can become a model for the effective implementation of stormwater infrastructure, utilizing state of the art funding and project delivery models, creating projects that define the four Ps of People, Planet, Place, and Performance, with community priorities as their foundation. While the process will be long, the benefits to Pittsburgh will be well worth the effort.



Appendices

- A. Communications Framework and peer cities analysis (Action 1)
- B. Interim Strategies (Action 2, Action 3, Action 6)
- C. Level of Services memo and peer cities analysis (Action 5)
- D. Mapping and methodology memo (to come)
- E. Catalytic sites mapping analysis
- F. Typologies Analysis
- G. AKRF Impervious analysis
- H. AKRF Catalytic sites analysis
- I. Negley Run Engagement Focus Group
- J. Saw Mill Run Engagement Focus Group
- K. Priority Mapping Ambassador Presentation
- L. Community Ambassador Feedback
- M. Workforce Development Memo
- N. List of reports and resources reviewed
- O. Projected Implementation Costs
- P. Public Engagement and Comments

