# 6. Urban Planning and Green Infrastructure Plan

## 6.1 Green First Approach and Process

During dry weather, the ALCOSAN Wastewater Treatment Plant (WWTP) receives 197 MG per day from its 83 customer municipalities. Of this total dry weather flow, it is estimated (based on percentage of the total population) that the City of Pittsburgh (City) contributes roughly 72 MG daily to the ALCOSAN WWTP, or about 36.5% of their total gallons processed, with the remainder coming from the 82 other municipalities. However, during a rain event of as little as 0.1 inches, ALCOSAN's capacity is exceeded and the stormwater overwhelms the system capacity, causing overflows of rainwater and sewage into the rivers. In a typical year approximately 9 BG of sewage overflows during rainfall events into our rivers, causing the US Environmental Protection Agency to require action from ALCOSAN, PWSA and the City, and the 82 other municipalities.

Green infrastructure, or rainwater installations that use vegetation and natural hydrologic processes to manage and treat rainwater, needs to be a key part of our combined sewer overflow solution. This report is part of the ongoing work to find the best ways to implement green infrastructure projects that both manage stormwater and support communities and follows Mayor Peduto's leadership around the P4 initiative: People, Planet, Place, and Performance.

Green infrastructure enhances communities by creating beautiful and high performing landscapes that weave our open space assets into a thriving ecological network. In the process, there will be opportunities for workforce development that will empower Pittsburgh residents and drive neighborhood revitalization. Where once we saw open space as the leftover areas in and between our neighborhoods, Pittsburgh is now consciously shaping our green-space to be ecologically high performing streetscapes, parks, and other amenities that are an economically viable complement to traditional gray infrastructure.

In addition, this report is framed to support the City's resiliency pursuits. Climate change creates a dynamic environment and projections for increased rainfall and number of extreme weather events need to be accounted for in our infrastructure planning. Combined with smart cities technology, surface-based green stormwater infrastructure has the potential to be quickly mobilized and more easily adjusted to allow for adaptive management.

This report focuses on the range of technical solutions that could be installed to reduce our CSO problem. In many cases, these solutions cannot be implemented without significant reexamination of how our stormwater resources are regulated. We need to integrate water-first planning into existing planning efforts, enable multiagency and multi-partner action, and develop economic incentives and long term workforce opportunities to achieve the required performance levels and the desired community benefit. Pittsburgh will not be the first city to implement green infrastructure, but we can strive to be the most innovative in its design, implementation, and integration with our communities.

Previous sections have focused on critical performance goals that ensure a successful city-wide green infrastructure plan. This section defines the process used for strategic urban planning on a sewershed scale. This process is focused on developing a holistic "green infrastructure-first" approach. This approach emphasizes the identification of opportunities that support both resilient infrastructure strategies and are catalytic redevelopment opportunities within each Pittsburgh sewershed.

### 6.1.1 A Prioritized Approach to CSO

The purpose of the City-Wide GI Assessment is to create a stormwater overlay to inform responsible development and redevelopment through the stormwater lens. The City-Wide project intends to:

- Identify high-yield stormwater runoff areas as CSO reduction opportunity sites for green infrastructure interventions
- Coordinate with City departments and agencies to ensure a comprehensive evaluation is conducted
- Strategize urban planning based on stormwater management
- Explore and assess potential stream separation and daylighting opportunities

The process is part of PWSA's larger strategy to meet EPA compliance and includes an Investigation Phase that assesses surface issues and contributions to the combined sewer system. Sewershed surface issues are then overlaid onto the urban context to find opportunities for high performing projects. PWSA will develop an implementation program that will be monitored and evaluated to ensure long term performance.

The Urban Planning portion of the GI Assessment focused on the sheds that generate the most combined sewer overflow volume and consist of six highly urbanized sewersheds. The sheds vary in size and configuration and do not have contributions from separated upstream sewer systems.

The sheds were selected with an "80/20 approach" that recognizes that the 80% of stormwater is coming from 20% of the sheds, thus the focus on 6 sheds out of a total of the roughly 200 sheds in the City boundaries. The six sheds represent approximately 13,800 acres and over 10,000 stormwater inlets. 40% of all stormwater inlets in Pittsburgh are within these six sewer sheds and together they contribute over 3.0 billion gallons of CSO each year.

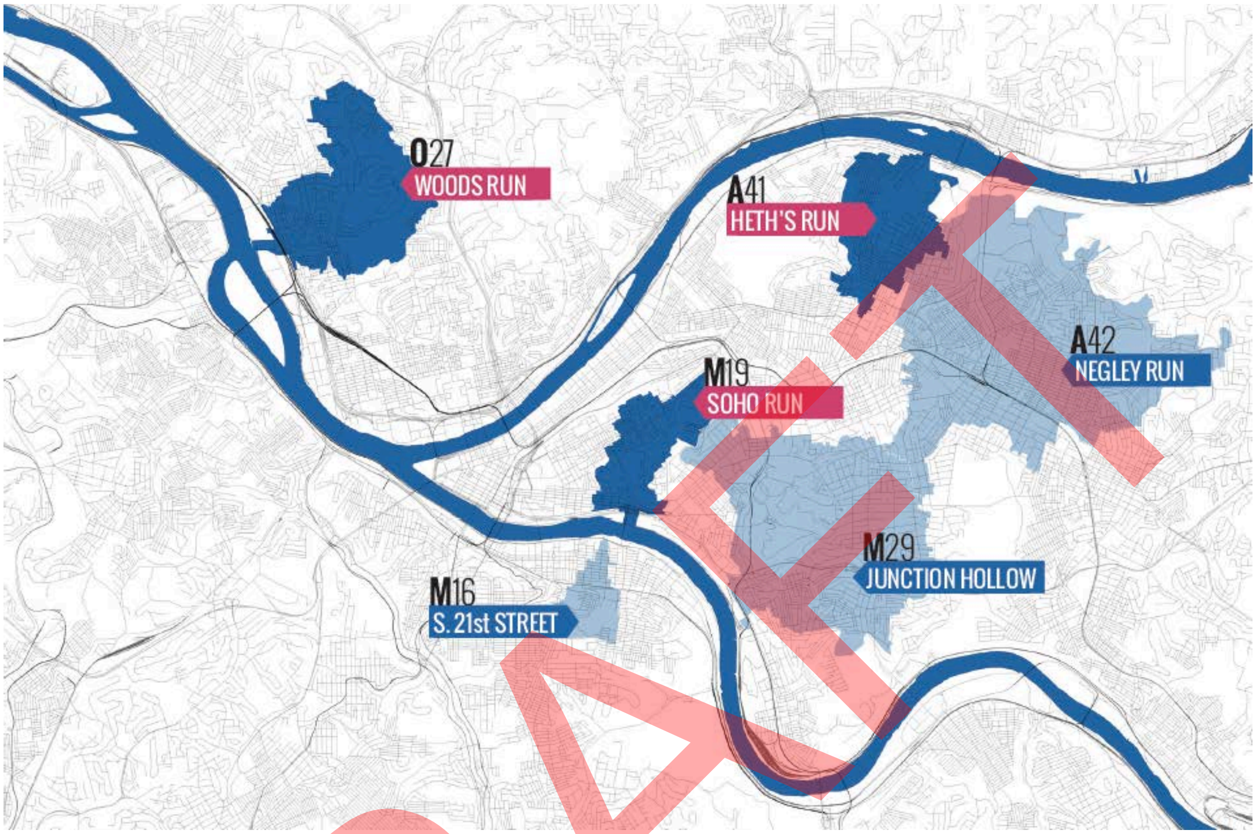


**Figure 6-1**

The six selected areas are shown in Table 6-1.

| TABLE 6-1<br>GI AND URBAN PLANNING ANALYSIS LOCATIONS | | |
|---|---|---|
| **City Area/Neighborhood** | **Sewershed Point of Connection (POC)** | **River Basin** |
| Four Mile Run | M-29 | Monongahela River |
| Washington Blvd & Negley Run | A-42 | Allegheny River |
| South Side | M-16 | Monongahela River |
| Woods Run | O-27 | Ohio River |
| Heth's Run | A-41 | Allegheny River |
| Hill District/Uptown | M-19 | Monongahela River |

The largest contributing sewersheds included Woods Run (O-27), South 21st Street in the South Side (M-16), the Hill District or Soho Run (M-19), Junction Hollow (M-29), Heth's Run (A-41), and Negley Run (A-42). Each of these sewershed spans multiple neighborhoods and the character of the upstream urban fabric determines the quantity, quality, frequency, and speed of stormwater into the system. The study looked for opportunities to implement upstream green infrastructure to delay or prevent water from entering the system while improving our streetscape and green-spaces.

### 6.1.2 Beyond the Technical: Guiding Principles for an Integrated GI Approach

The team established a set of Guiding Principles to further assist in the selection of the GI locations with the sewersheds that combined the data driven, technical metrics used to measure the effectiveness of CSO reduction within the priority sewersheds discussed in the previous section. These Guiding Principles emerged from discussions with the Mayor's office and his staff, multiple City departments, and key community stakeholders.

Many of these guiding principles support the quantitative outcomes for CSO reduction discussed in the previous sections; others, however, serve to broaden the lens and establish qualitative outcomes to improve the communities where these investments are being made, further complementing the redevelopment efforts proposed in these areas. The Guiding Principles offer an additional benefit: they better leverage the limited resources of each City department into a shared effort.

The seven Guiding Principles are outlined below along with a brief description for each:

1. **Cost-Effective Public Realm Investment:** By investing in City-owned property within the public realm the cost of acquired private property for GI is avoided. Furthermore, improvements can be more efficiently shared across City departments when other planned improvements are coordinated.
2. **Create Workforce Development Opportunities:** Investment in GI should be viewed as an opportunity to provide jobs, especially within communities that would best benefit from access to new or better employment opportunities. Ideally, workforce development will encompass all segments of the populations to develop lifelong careers, from the PhD's researching and monitoring the effectiveness of GI, to the "Ph-Do" working to implement the construction of proposed GI in addition to maintaining it.
3. **Re-Establish Riverfront Connections:** As Pittsburgh further redevelops and enhances its numerous riverfront areas, opportunities to improve and create new riverfront connections should be explored in conjunction with proposed GI, providing pathways linking people and runoff to the City's three rivers.
4. **Complete Streets Approach:** Pittsburgh is looking to develop a network of key City corridors into Complete Streets, which are streets that focus multiple modes of transportation, placing emphasis on public transit, bicyclists, and pedestrians. GI should be incorporated within these Complete Streets as many of the corridors also have the highest potential to reduce CSO.

5. **Focus on Healthy, Walkable Communities:** Emphasis should be placed on enhancing corridors to improve access to recreation and healthy food, and encourage walking beyond the Complete Street corridors. GI can be leveraged to further enhance the effectiveness of improving the overall health and safety of a community.
6. **Resilient Infrastructure:** GI can be used to support the efforts of the City in becoming more resilient by reducing flooding, decentralizing runoff capture, and upgrading the aging infrastructure. Creating a smart system that more effectively and efficiently handles stormwater today and in the future.
7. **Align with People, Planet, Place and Performance (P4) Metrics:** Pittsburgh's P4 initiative looks to forge a new model for urban growth and development that is innovative, inclusive and sustainable. GI addresses all four of the components of this framework.

These principles were used to develop plans for each of the six sewersheds that show how stormwater could be managed in a way that generates long-term benefits for each neighborhood.

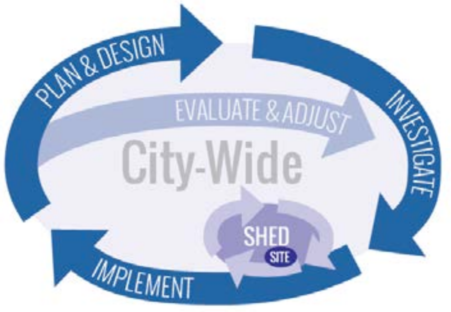
### 6.1.3 Managing Water at Three Scales

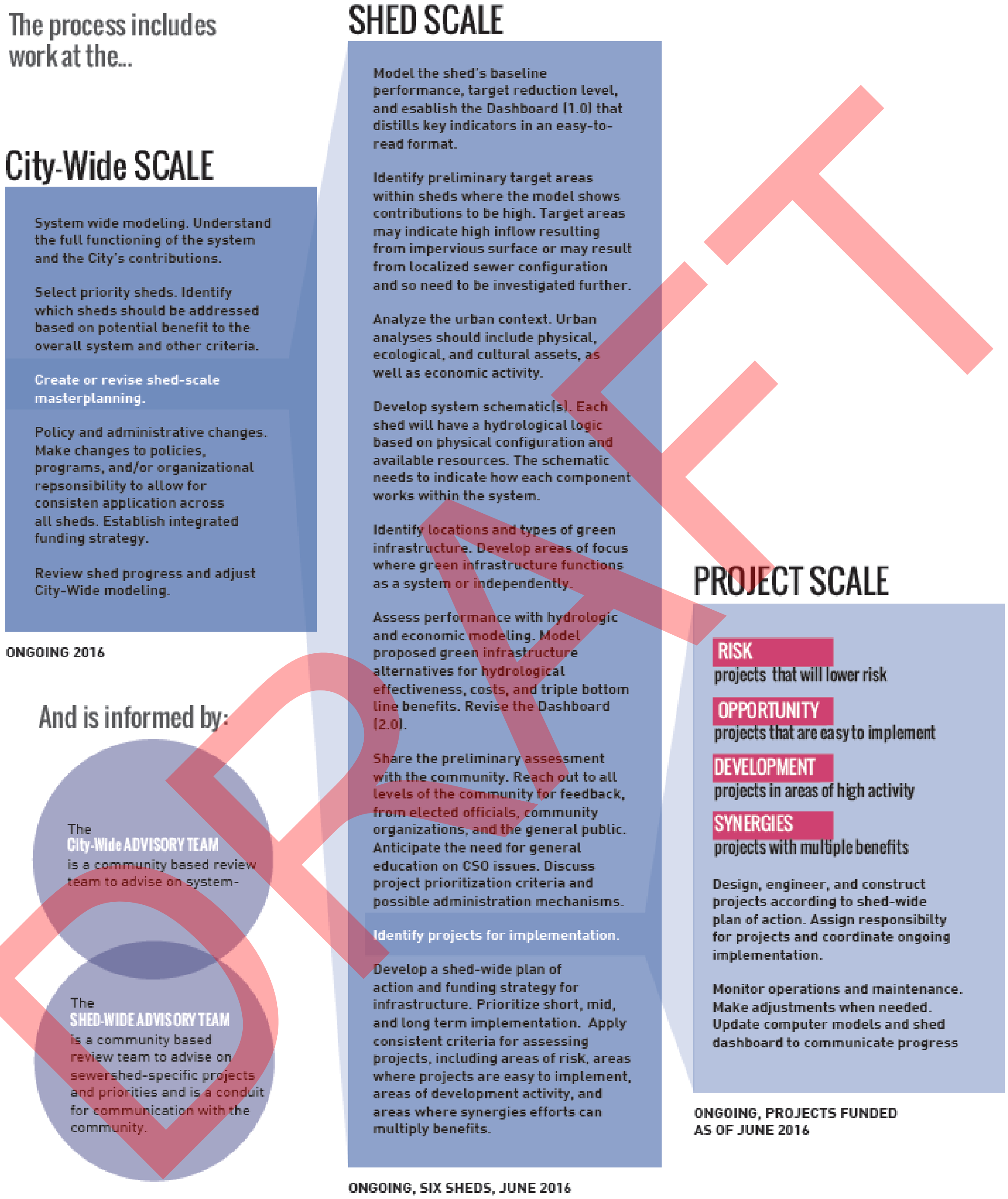
To establish a city-wide stormwater plan, we need a system that is structured for managing constantly changing resources and flows. Adaptive management is a structured, iterative, and emergent process of decision-making and action that may inform the management system. Adaptive management describes management systems that are well suited for dynamic systems where conditions are constantly in flux and where there is a high degree of uncertainty. Adaptive management is best known for its application to the management of natural resources, such as species populations, but can be applied to any organization that is in an uncertain and emerging context.

Through the evaluation of the first six sheds, a replicable method of analysis has been established that can yield consistent data to inform city-wide modeling. This process creates a Shed Management Plan, which can then be referenced and implemented by agencies, collaborators and stakeholders. The management of the Shed Management Plan needs to be iterative and will cross political, neighborhood, and agency boundaries.

Currently, our city's stormwater management does not enable easy implementation of the plans identified in the City-Wide process. The existing organizational structures, policy, and responsibilities do not enable collaborative decisions and streamlined action. An Adaptive Management model should be considered when structuring the policy, processes, and administrative structure for the control of rainwater as a resource.

Green infrastructure challenges the way we manage our cities. For the City-Wide GI Assessment recommendations to be successful, institutions, policies, and processes need to be structured around an adaptive management model that addresses issues at the appropriate temporal and spatial scale, creates a constant feedback loop of information and action, and has organizations that are structured for collaborative action.





The process includes work at the...

## City-Wide SCALE

System wide modeling. Understand the full functioning of the system and the City's contributions.

Select priority sheds. Identify which sheds should be addressed based on potential benefit to the overall system and other criteria.

**Create or revise shed-scale masterplanning.**

Policy and administrative changes. Make changes to policies, programs, and/or organizational repsonsibility to allow for consisten application across all sheds. Establish integrated funding strategy.

Review shed progress and adjust City-Wide modeling.

**ONGOING 2016**

And is informed by:

The **City-Wide ADVISORY TEAM** is a community based review team to advise on system-

The **SHED-WIDE ADVISORY TEAM** is a community based review team to advise on sewershed-specific projects and priorities and is a conduit for communication with the community.

## SHED SCALE

Model the shed's baseline performance, target reduction level, and esablish the Dashboard (1.0) that distills key indicators in an easy-to-read format.

Identify preliminary target areas within sheds where the model shows contributions to be high. Target areas may indicate high inflow resulting from impervious surface or may result from localized sewer configuration and so need to be investigated further.

Analyze the urban context. Urban analyses should include physical, ecological, and cultural assets, as well as economic activity.

Develop system schematic(s). Each shed will have a hydrological logic based on physical configuration and available resources. The schematic needs to indicate how each component works within the system.

Identify locations and types of green infrastructure. Develop areas of focus where green infrastructure functions as a system or independently.

Assess performance with hydrologic and economic modeling. Model proposed green infrastructure alternatives for hydrological effectiveness, costs, and triple bottom line benefits. Revise the Dashboard (2.0).

Share the preliminary assessment with the community. Reach out to all levels of the community for feedback, from elected officials, community organizations, and the general public. Anticipate the need for general education on CSO issues. Discuss project prioritization criteria and possible administration mechanisms.

**Identify projects for implementation.**

Develop a shed-wide plan of action and funding strategy for infrastructure. Prioritize short, mid, and long term implementation. Apply consistent criteria for assessing projects, including areas of risk, areas where projects are easy to implement, areas of development activity, and areas where synergies efforts can multiply benefits.

**ONGOING, SIX SHEDS, JUNE 2016**

## PROJECT SCALE

**RISK**
projects that will lower risk

**OPPORTUNITY**
projects that are easy to implement

**DEVELOPMENT**
projects in areas of high activity

**SYNERGIES**
projects with multiple benefits

Design, engineer, and construct projects according to shed-wide plan of action. Assign responsibilty for projects and coordinate ongoing implementation.

Monitor operations and maintenance. Make adjustments when needed. Update computer models and shed dashboard to communicate progress

**ONGOING, PROJECTS FUNDED AS OF JUNE 2016**

**Figure 6-2**

### 6.1.4 A Green-First Planning Approach

Each of the sheds went through a rigorous analysis that synthesized stormwater performance criteria with urban design and community development.

Early in the process, PWSA initiated and conducted multiple meetings with the Urban Redevelopment Authority (URA), the Department of City Planning, and associated City agencies to obtain the relevant development plans for the City. Examples include existing community-driven redevelopment plans, engaged stakeholder development plans, and city department progress reports on current initiatives being pursued. Where these plans were not yet incorporated into GIS, PWSA collected and developed the information using GIS to display the data for use in overlaying with the identified GI locations.

Once the digital database was established and organized, plans were studied in conjunction with characteristics of sewershed areas. These characteristics focused on existing conditions both natural and built. Natural conditions included soils, vegetation, historic streambeds, and slopes. Built conditions included corridors, undermined areas, parks, open space, and the existing sewer system. The next step synthesized this information (planned redevelopment + existing conditions) with high yield areas. From the synthesis of factors (planned redevelopment, existing conditions, and high yield) the six priority sewersheds were selected. The first six sheds were established where proposed GI would best complement the strategic urban development plans, existing characteristics, and high yield areas to most effectively achieve a "green first" approach.

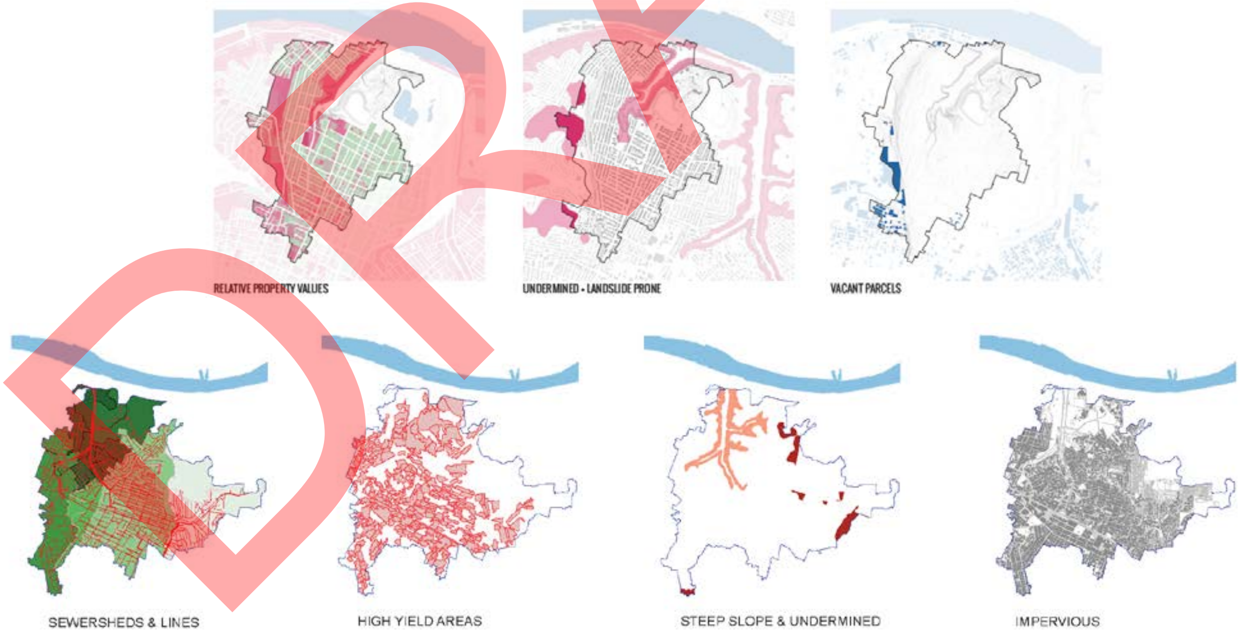


**Figure 6-3**

The next step for integrating GI into the City-Wide GI Assessment was establishing the metrics to measure capture potential for GI within the priority sewersheds. PWSA overlaid the redevelopment plans and proposed GI locations with the digital terrain model, ArcHydro analyses, and with identified stream removal locations. To the greatest extent possible, these known development plans were utilized to inform the ArcHydro results. However, because of the expedited timing of this project, the ArcHydro analyses were conducted in parallel with the synthesizing of development plans. The overlays were used to understand how known development plans align with the identified GI and stream removal locations, and to highlight coordination opportunities. PWSA produced maps and GIS shapefiles to display the overlays and coordination opportunities, and met to discuss the findings with regard to coordinating with urban planning.

**Figure 6-4: Example Community Development Plan with Coordination Opportunities for Green Infrastructure: 2015 Community Consensus Vision Homewood Cluster Planning, Operation Better Block, Inc.**

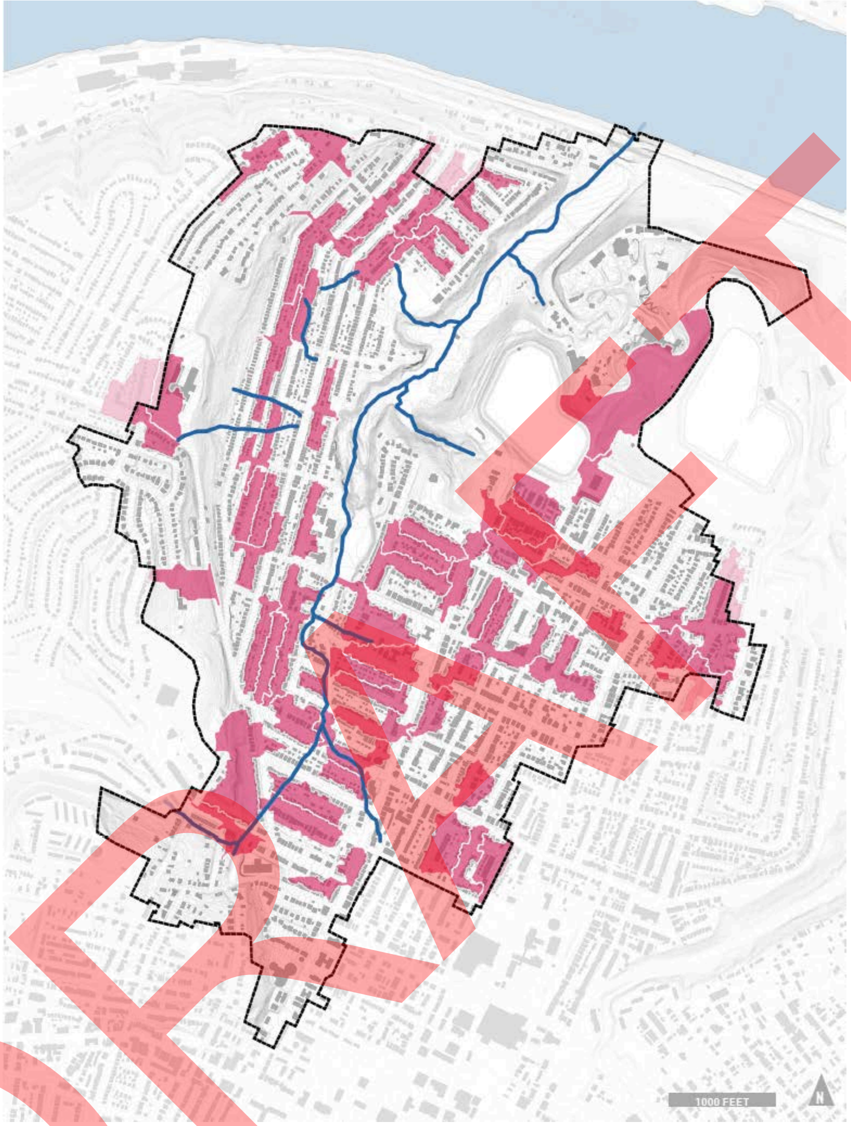


Figure 6-5

Based on the findings of identified GI locations and the known development plans, work was conducted to align the various locations, using GIS tools and assessments performed using ArcHydro software and hydrologic and hydraulic (H&H) SWMM model runs, performed to update the stormwater runoff and CSO reduction benefits previously determined and discussed in Section 3. On the basis of aligned GI locations and development plans, modified ArcHydro results and SWMM runoff files were generated. Then, the SWMM modified runoff files were used to run the SWMM models for the typical year of precipitation, and thus, updates were derived for the stormwater runoff and CSO reduction benefits.

The identification of high yield GI locations and stream removal locations led to indications of additional new and redevelopment opportunities, and also opportunities to reimagine areas of the City. PWSA identified the likely locations and general concepts for the development areas and features that could be merged with the management of storm and surface waters. These general concepts will be used by others as part of the urban planning and market studies to be conducted in parallel with this work (separate from the City Wide GI Assessment). In short, the GI concepts, strategic urban planning approach, and CSO reduction were tested and refinements made to ensure the most effective combination.

The team applied a process of overlay analysis to the six priority sewersheds to create an Urban Design Framework. The Urban Design Framework served as a synthesis of the redevelopment plans, key corridors, and important nodes within the community. Nodes could be important intersections of corridors or key areas within the community like business districts, institutions, or open space well positioned to capture high yield areas. Furthermore, emphasis was placed on Complete Streets, connectivity to rivers, high risk areas, and areas within each community where redevelopment had been proposed.

This initial framework was shared with multiple City departments, the Mayor’s office, and key community stakeholders. When commentary necessitated changes to the Urban Design Framework, refinements were made. These refinements served to inform the next steps and to identify specific opportunities for GI within the six sewersheds.

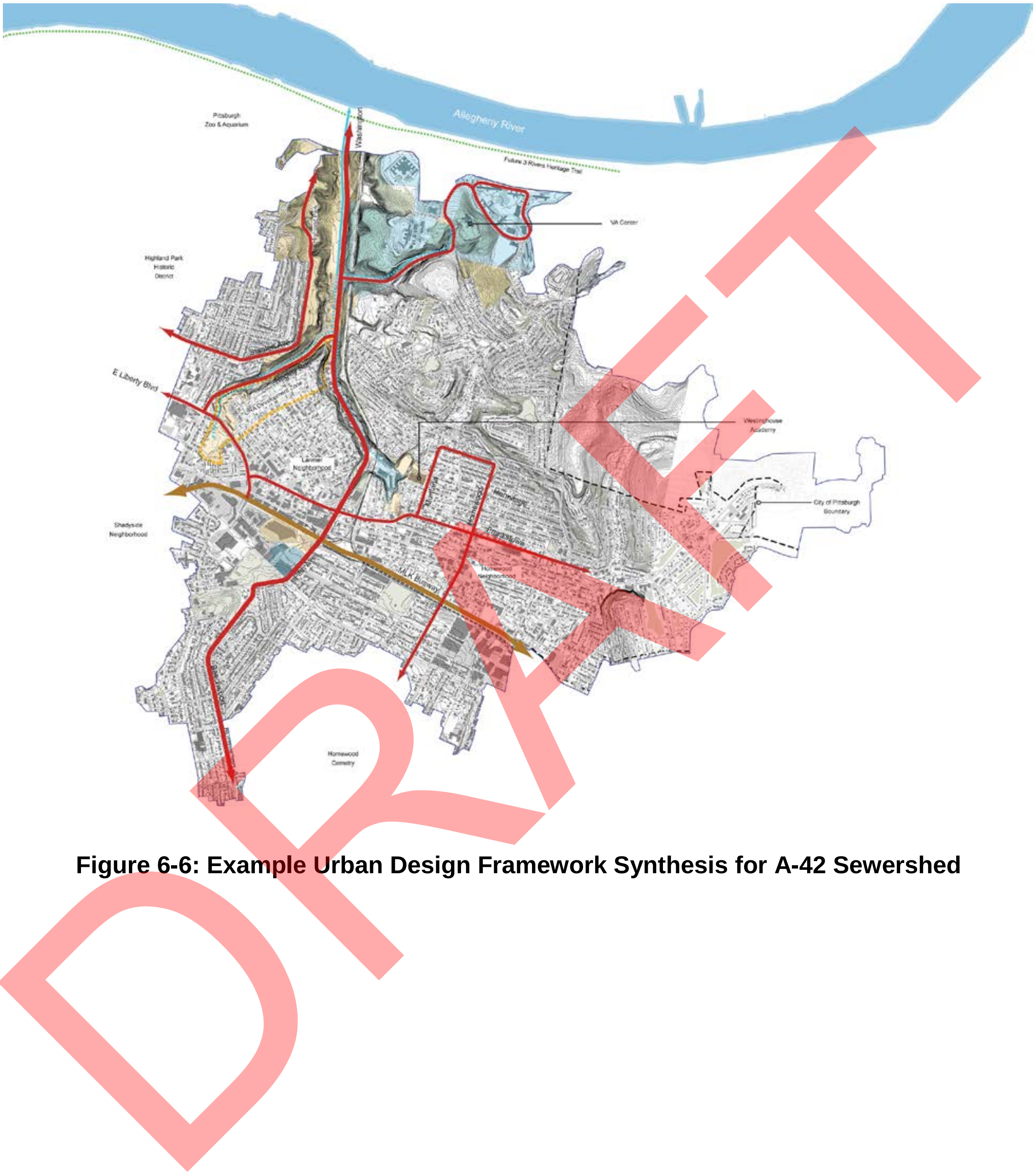


Figure 6-6: Example Urban Design Framework Synthesis for A-42 Sewershed

### 6.1.5 Finding: Sewershed Morphology

Historically each shed was the location of a stream or run that connected upstream areas to the primary river waterway, through a series of secondary creeks and runs, and tertiary channels and seasonal waterways. Though this pattern can sometimes be difficult to read in the current topography, the historic topography can still be read in maps of the subgrade sewer networks that were originally constructed in the valley floors.

Today this primary-secondary-tertiary conveyance remains the dominant morphological structure for all of the sheds. This allows for a common set of strategies to establish a hierarchy of green infrastructure, including:

- direct river reconnection
- valley surface storage and conveyance on distributed sites
- upstream surface conveyance and capture in the public right of way
- net zero or offline sites
- green infrastructure to improve the performance of private properties with pay-for-success or other models

To reach the required overflow reduction levels for each sewershed, the strategies have to be evaluated as a networked system with two goals. First, the infrastructure improvements should detain 1.5” of water during a storm event, releasing the water slowly back into the system after a 72 hour period, likely after the storm event has passed and without triggering an overflow event. Second, and more ambitiously, the infrastructure should prevent the water from reentering the sewer system, thus preventing the need for treatment at the ALCOSAN plant. Both of these are significant changes and require extensive analysis, including modeling for future climate change projections.

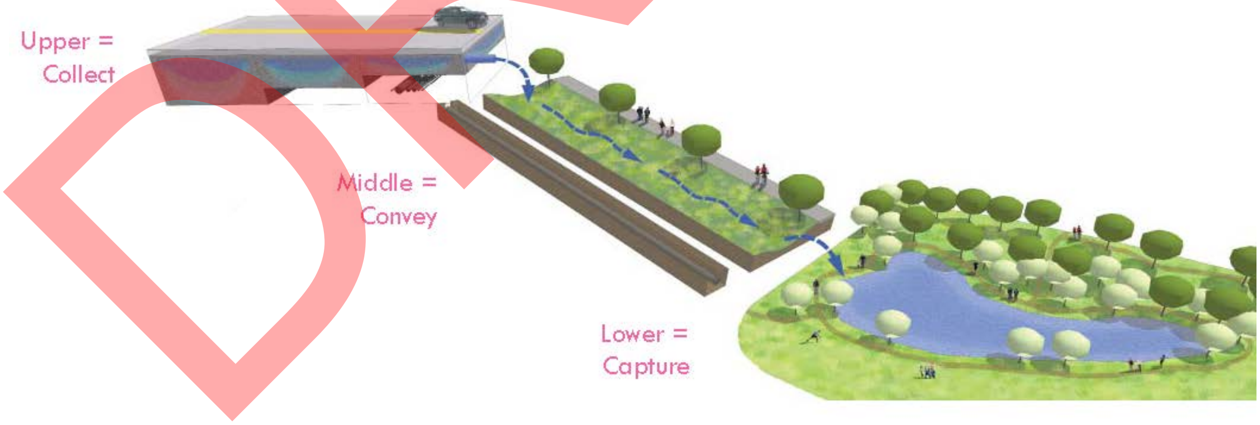


Figure 6-7

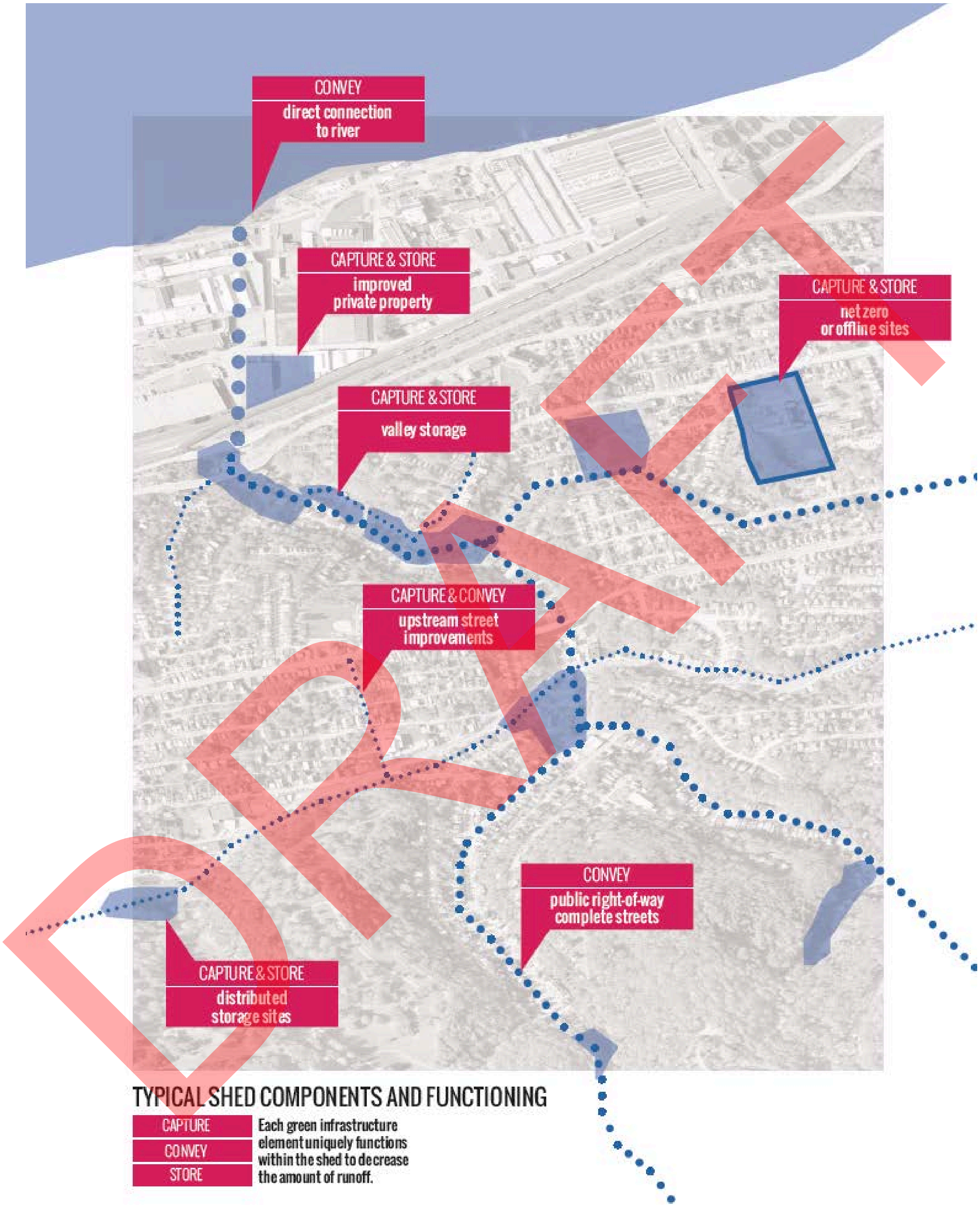
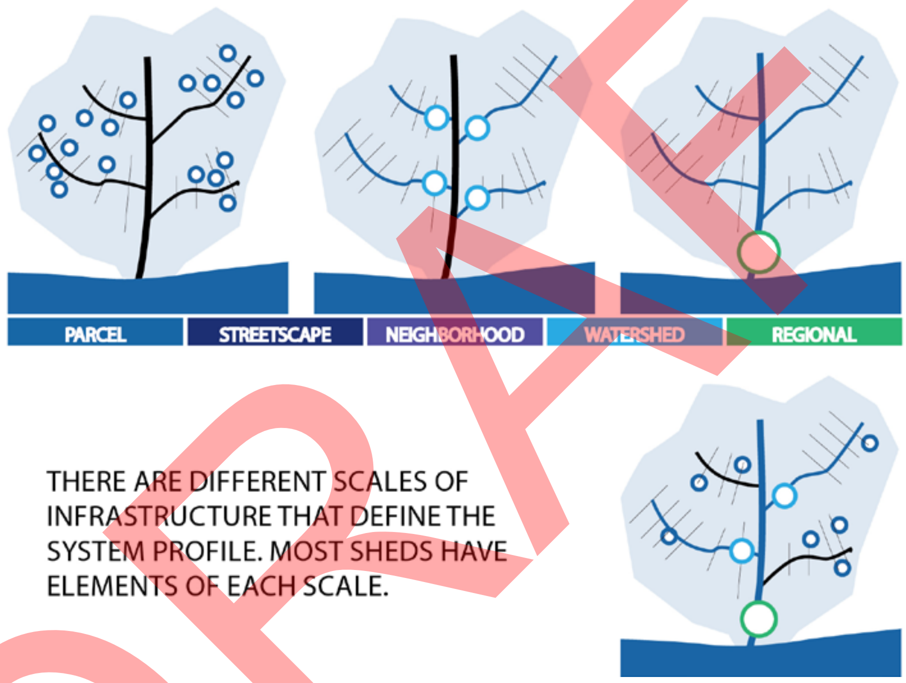

CONVEY
direct connection to river
CAPTURE & STORE
improved private property
CAPTURE & STORE
net zero or offline sites
CAPTURE & STORE
valley storage
CAPTURE & CONVEY
upstream street improvements
CONVEY
public right-of-way complete streets
CAPTURE & STORE
distributed storage sites
TYPICAL SHED COMPONENTS AND FUNCTIONING
CAPTURE
CONVEY
STORE
Each green infrastructure element uniquely functions within the shed to decrease the amount of runoff.

Figure 6-8

### 6.1.6 Finding: Centralized, Decentralized, or Hybrid System Design

While each shed is unique in its balance of large scale or small scale installations, there are some principles common to all sheds.

The degree of centralization or distribution of the system components affects the type, costs, and operations of each shed's system. Each shed needs to work as a system with a focus on the interrelatedness of upstream and downstream systems. For example, some sheds may be focused around a central valley or primary gathering point for the water with an extensive capture and conveyance system. Other sheds may have more opportunity for distributed locations that can be taken offline, thus eliminating the need to connect the sites. Different types of infrastructure will be needed to dynamically regulate flows.



THERE ARE DIFFERENT SCALES OF INFRASTRUCTURE THAT DEFINE THE SYSTEM PROFILE. MOST SHEDS HAVE ELEMENTS OF EACH SCALE.

**Figure 6-9**

Redundancy needs to be integrated into each system design. Redundancy can allow for a factor of safety, providing excess capacity in case of an overload in any one element. Redundancy can also account for long term system stressors such as increased precipitation due to climate change. Lastly, redundancy creates the flexibility required for long term system implementation. Since there are multiple ways that the system can be implemented, redundancy allows for short term and long term changes without compromising performance.

Green infrastructure components are interdependent and some are more important in determining the performance of the system. To use an ecological analogy, the functioning of an "old growth forest" is driven by the 200 year old trees that allow for the presence and behavior of other species. Some sheds have significantly large elements that will enable or drive the capacity of other elements. Centralized valley storage, such as a naturalized wetland, allows for upstream storage infrastructure to be minimized, reducing the infrastructure's footprint in a dense urban environment. Valley infrastructure is dependent on upstream capture and conveyance—if the valley infrastructure is not in place, the nature of the upstream systems changes dramatically. Conversely, the valley cannot function as a wetland without the upstream infrastructure to deliver the water.

### 6.1.7 Finding: Managing Broader Benefit and Scales of Time

Green infrastructure challenges the way we manage our cities because it assigns economic, ecological, and social value to natural services, it needs to be designed and managed as dynamic flows over time, and it emphasizes opportunities for shared value instead of segregated systems. The City-Wide GI Assessment presents a new paradigm for how the City designs and manages infrastructure and is distinguished by a few key principles.

First, the City-Wide Analysis assigns economic, ecological, and social value to the natural services that can be provided in the landscape, such as water capture and storage. The functioning of green infrastructure such as wetlands or bioswales can be monetized and compared to the performance and cost of more traditional engineered systems. In addition, the improved ecological systems improve other areas of performance. At the largest scale, cleaner water quality allows for compliance with regulations, but also greater biodiversity. At the scale of the neighborhood, the increased tree coverage from tree wells in sidewalk plantings can have a very real effect on localized urban heat island effects and decrease property owners' costs to cool their buildings. Studies also show that green infrastructure improvements also have measurable effects on property values and improve resident perception of safety and satisfaction; and furthermore, emerging research shows that the presence of plants in our everyday experiences boosts personal health and wellbeing. The City-Wide GI Assessment makes the case for improved hydrological performance with green infrastructure and also takes into account the collateral benefits of "triple bottom line" thinking.

Second, the systems need to be designed and managed as a network of flows over time, not just as a series of physical facilities. This requires thinking in different timescales and will be facilitated through technology that allows us to model, simulate, and make midcourse adjustments as needed.

At the smallest timescale, the day, green stormwater installations can have controls that dynamically respond to weather or storm events. Sensors can predict direction and severity of storms, triggering smart infrastructure to anticipate impact, such as lowering the level of an existing reservoir in anticipation of a storm event. Seasonal performance can be directed with similar technology.

At the next timescale, the systems need to be designed and phased in over decades of time, with modeling and flow analysis constantly revised to allow for networked components. For example, an upstream development that changes the runoff profile of a shed needs to be modeled to understand the performance of other parts of the system and to be able to consistently record benefits from continued improvements.

Lastly, the systems need to be designed for generation-scale evolution. Both green and gray systems age over time and have profiles of growth and decay. Understanding the performance relative to maintenance and replacement milestones is key to maintaining biotic systems. The maintenance regimen, both in time and in tasks, evolves through the life cycle of the infrastructure, and the net present value of infrastructure needs to be considered accordingly.

Third, the City-Wide GI Assessment emphasizes opportunities to create shared value instead of isolating or segregating systems. Green infrastructure projects should rarely be considered in isolation but should be integrated into other infrastructure investments. For example, the city's commitment to Complete Streets means that stormwater conveyance can more easily be advanced at these locations. Scheduled improvement in the city's parks should be reviewed for opportunities to incorporate green infrastructure, giving character and functionality while achieving multiple benefits for the same dollar spent. In areas of rapid development, instituting incentives and controls would encourage green infrastructure that helps meet the City's goals while creating higher performing, beautiful places.

### 6.1.8 Finding: Managing Risk and Resiliency in Climate Change

The City of Pittsburgh is addressing resiliency and climate change through the Office of Sustainability's initiatives like the Rand Corporation's Study on Resilient Stormwater Management in Allegheny County. While the goal of the study is to support improved stormwater management and resiliency in the entire county, the early findings have raised questions about the targets set for city-wide planning. According to the Rand Corporation's preliminary presentations, stormwater models based on an average year may not be reflective of emerging data on climate change statistics. Their research suggests that precipitation models may need to be adjusted to account for a greater frequency of more severe events and that the "average year" may have already been exceeded in the majority of the past 10 years.

While the frequency of rain events may be increasing, there is evidence that the intensity of some of those events is also increasing, releasing large amounts of water in very brief events. Sometimes referred to as "extreme rainfall," the events make it very difficult to design systems that can handle both the small and frequent events as well as the intense but less frequent events. In many cases we can find old newspaper headlines about previous flooding events on flood prone sites. These sites may have seemed to be free of problems in recent decades, but with the confluence of failing infrastructure and shifting climate patterns, we are seeing issues at these sites arise again.

Many other cities, such as those along coastlines or in arid climates, are addressing water issues with a greater sense of urgency. For example, Copenhagen has developed a Cloudburst Plan (2012) as part of the Danish capital's Climate Action Plan. The Cloudburst Plan addresses frequency and intensity of events with shedwide planning and a commitment to major infrastructure replacement. New York City has pledged millions of dollars to major design and engineering initiatives that will change the way their waterfronts function.

Places like New York and Copenhagen are using a similar set of criteria for ranking initiatives including:

- Risk: Measures that will lower risk
- Opportunity: Measures that are easy to implement
- Development: Measures in areas of high activity
- Synergies: Measures with multiple benefits

These cities also face similar administrative and funding challenges that limit system-wide adoption. Other cities that do not have the same risk profile, such as Chattanooga, Tennessee, may not need the same existential level of investment, but do need to reinvent their administrative systems to account for the risk of failure by inaction. Chattanooga has adopted a full range of policies and programs to support distributed strategies for green infrastructure.

Although flooding and water quality are two of the major reasons for green infrastructure, the City should also consider long term risk and resiliency around an adequate supply of safe drinking water. All of the City's drinking water supply comes from the rivers and, while the rivers are much cleaner than before, there is a growing risk of upstream pollution contamination related to extractive industries. Currently the City-Wide approach to stormwater is to use green infrastructure to retain or slow it for use on site with infiltration or biotic systems. However, future studies could also examine the potential of stormwater conveyance and storage for reuse as a potable water source with integrated microfiltration and distribution, instead of just delayed release back into the rivers. Decentralized water treatment and supply is already a reality in many places and is something that PWSA could evaluate in relation to its core service model.

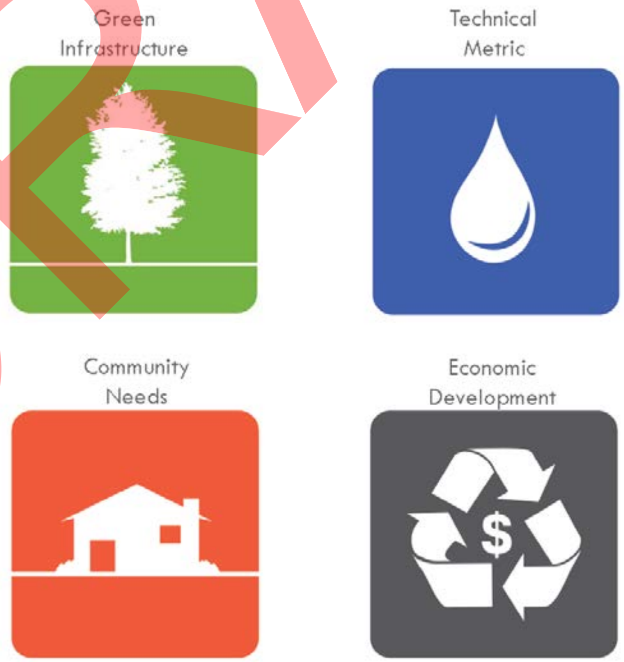


**Figure 6-10**

### 6.1.9 Finding: The Evolution of Policy and Administrative Structures

The biggest challenge to successful green infrastructure networks is not necessarily with the technologies themselves, but with the regulations, responsibility, and financing of the systems. Though this report was focused on the technical implementation and not on administrative structure, it has become apparent that the full range of solutions can only be enabled with changes to governance of the system.

Over the course of this project through internal and external meetings a number of concerns have consistently risen to the top as major issues that could inhibit a strong and effective green infrastructure network. Many focus on the distributed control of system components, making it difficult to act in an integrated way. There is both vertical zoning of the systems as they pass from the surface through pipes administered by various agencies while horizontally moving across municipal boundaries in a way that requires coordinated action. Because this report focused on sheds within a single municipality, the City of Pittsburgh, the focus will be on the vertical zoning and the associated interagency jurisdictional issues.

Today, stormwater's journey begins at the surface where the Department of Public Works and private property owners control its flow, each under different legal requirements. Once the water enters the combined sewer system it becomes the responsibility of PWSA until it enters ALCOSAN's conveyance and treatment system. Green infrastructure challenges the clear boundary between the agencies who control flows on the surface and the agencies who control flows in below grade systems.

Green infrastructure extends the responsibility for water quality and quantity into a realm in which responsible agencies traditionally do not have control. It is not necessarily a lack of will but a lack of administrative infrastructure for coordinated action that inhibits full implementation. Many of these issues are challenges for other cities as well.

Issues to be resolved include:

- There are no rainwater management plans and it is unclear who would administer them and how they would be legally binding.
- Planning and projects are loosely coordinated between siloed agencies, including Public Works, City Planning, PWSA and others.
- Perceived gaps in planning or coordination capacity of these organizations are filled with nonprofits who advocate for coordinated efforts but do not control the process or the assets.
- Existing planning and administrative practices across the country are not often suited to address dynamic or adaptive resource flows. Current controls are better suited to regulating placemaking, not monitoring and adjusting to the dynamic flows or performance of these places (this is a challenge for other resource flows such as energy or parking).
- In addition, the City is a part of ALCOSAN's larger cohort of municipalities and may need different administrative structure than others in this cohort.

Effective and innovative green infrastructure and rainwater control will be limited unless these issues can be drawn into the design problem. There are a few possible responses and it is likely that some combination would be necessary:

- Reshape the agencies to create a structure that allows for coordinated action and adaptive management.
- Change the jurisdictional boundaries to allow for existing agencies to have increased authority.
- Create market or regulatory mechanisms to incent or require action.

### 6.1.10 Process + Approach: Green Infrastructure Concept Plans, Beyond the Framework and Analysis

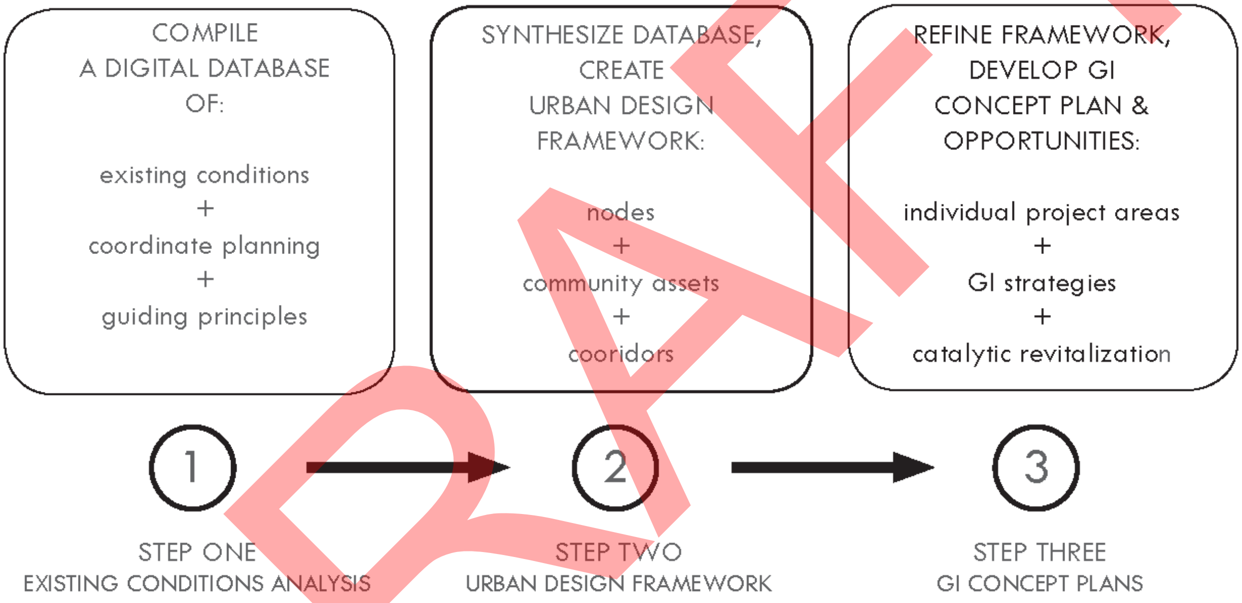


**Figure 6-11**

From the outset, a holistic approach grounded in sewershed-based design principles (established in the Framework plan) sets the stage for successful selection of individual projects and concept plans to emerge. The identification of individual projects and concepts was the third step in a complex, systems-based design approach that was preceded by the following:

- **STEP ONE: Digital Database of Existing Conditions** - Reviewed and analyzed existing plans and studies completed to date for proposed GI solutions throughout the six defined watersheds:
- **STEP TWO: Urban Design Framework Plan** - Facilitated a series of initial strategic stakeholder workshops and participated in bi-weekly stakeholder and/or community meetings. This provided technical support from early schematic design development through final stages of the GI Concept Plans

Ways to leverage these opportunities were woven into a larger vision that creates neighborhood nodes, corridors, and links community assets with interconnected GI strategies. This sewershed-based, systems approach uses urban planning and community revitalization to shape the Green Infrastructure Concept Plan. It serves as a catalyst for a broader vision that can be strategically implemented. These concept plans were refined with community and stakeholder input.

- **STEP THREE: Green Infrastructure Concept Plans** - to be integrated into the Preliminary Design Report and will lay the foundation for further development of a holistic sewershed-based design approach for Green Infrastructure concepts within the six watersheds.

A true collaboration will require City leadership, community, and stakeholder members to be an integral part of the process moving forward towards implementation opportunities. The process and approach with the proposed design outcomes are summarized in the following sections for each of the six areas:

- Four Mile Run (M-29)
- Washington Blvd + Negley Run (A-42)
- South Side (M-16)
- Woods Run (O-27)
- Heth's Run (A-41)
- Hill District/Uptown (M-19)

#### 6.1.10.1 Sewershed Approaches for Green Infrastructure Concepts: Upper, Middle, and Lower

The position of a potential green infrastructure site within the sewershed played an important role as the team identified opportunities and concepts for GI in the priority sewersheds. In general, sites and corridors located in upper portions of the sewershed are candidates for green infrastructure solutions that primarily collect runoff, sites and corridors in middle portions primarily convey runoff, and sites and corridors in lower portions of the sewershed capture runoff.

The **upper portions** of the sewershed, "Upland Neighborhoods," are often more developed with more impervious areas, making them suited for pervious pavement opportunities that can also convey runoff down the system. Upper portions are most effective at **collecting** runoff since they often contain numerous high yield areas and high amounts of impervious surface. When these areas are not in the public realm, public-private partnerships could be developed to expand opportunities.

In the **middle portions** of the sewershed, or "Tributary Gateways," **conveyance** becomes more of a priority. Runoff collected in the upper sewershed as well as high yield areas within the middle zone provide the stormwater flow carried by the conveyance system. Ideally this conveyance is accomplished with bioswales where street widths can be narrowed or within existing valleys through more natural settings like parks. Where steeper slopes exist, check dams are provided to slow the velocity and erosive power of water and provide storage volume as well. Many of the existing valleys would benefit from ecological restoration that reduce the amount of sediment washing into the system in addition to offering more resilient and diverse habitats. Where bioswales are not possible, pervious pavements can be utilized to convey runoff through highly porous gravels and supplemental underdrain pipes.

The **lower portions** “Greenway Boulevards” provide great opportunities to provide larger **capture** basins for the runoff that is collected and conveyed from the upper and middle portions. Many of these areas offer large, more gradually sloped areas in publicly owned parks or open space. These are ideal locations for storage. When practical, this should enhance the connection to the riverfront.

Within the three categories of **collect, convey, and capture,** a number of GI approaches collectively offer a **“kit of parts approach”.** The definition of these is provided in the Appendices F and G.

Figure 6-12

**"Kit of Parts approach"** to system-wide Green Infrastructure design solutions

Figure 6-13