
2013 Strategic Plan Technical Appendix



Open Space
March 2013

Overview of the Green Boulevard - Technical Appendices

Summary

In the 1800's, the Allegheny River became the birthplace of industry for Pittsburgh. The busy riverfronts housed steel mills, and accommodated transport—both via water and rail—of coal and steel. In the wake of industrial shifts and changing economies, Pittsburgh today seeks to transform its riverfronts, and the identity of the City. Pittsburgh's Allegheny Riverfront is transforming into a mixed use area of the City that provides unique business and development opportunities, riverfront living, recreation opportunities and connected trails, access to transportation choices, and a renewed riverfront environment and ecosystem.

The future Green Boulevard connects neighborhoods to the riverfront, unlocks the economic potential of the community, and re-imagines Pittsburgh as a river city. Imagine taking a ride on the Green Boulevard's new commuter rail or commuter bike path. The Green Boulevard connects from Downtown through a redeveloped Strip District with a significant new riverfront park and streets that are best practice demonstrations for stormwater management. It continues into bustling Lawrenceville where the neighborhood is integrated with its waterfront through infill housing, streetscapes, and new housing along the river's edge. It links further to Highland Park, where restored landscapes at Heth's Run and Negley Run provide access to the river. The future Green Boulevard makes all of this possible.

Elements of the Green Boulevard Plan

The Green Boulevard builds on the roadmap set out by the community in the 2011 Allegheny Riverfront Vision Plan, and furthers the technical details required to implement the project. As the Green Boulevard moves further toward implementation over the coming years, sustained support from the project partners and the community will be critical to its ultimate success.

The Allegheny Green Boulevard Plan focuses on a six mile stretch of corridor from downtown Pittsburgh to the eastern edge of the city. Four key tasks are addressed:

- Public outreach to engage the Pittsburgh community in realization of the Green Boulevard;
- Transportation improvements including a plan to transform an existing railroad ROW into a multi-modal green boulevard including integration of a commuter rail into the Allegheny Valley Railroad freight corridor, station area planning around the proposed station areas, station design and a shared multi-use path for pedestrians and cyclists;
- Creation of a new riverfront open space system with access points to the river, habitat and ecological enhancements, new community open space amenities, riverbank stabilization and stormwater technologies;
- A housing plan for mixed use and transit oriented development opportunities that create a live/work riverfront neighborhood for Lawrenceville's 43rd Street District.

Technical Appendices

The Green Boulevard Technical Appendices accompany the project Strategic Plan summary. The four technical appendices are organized to provide the detailed background information studied during the plan development process for the four project task areas: the Outreach Appendix, Open Space and Riverfront Access Appendix, Transportation Appendix, and 43rd Street District Development Appendix. Each technical appendix provides an introductory overview of the technical studies prepared during the plan process along with the full technical studies. The technical studies are organized to provide the background, conclusions, performance measures (where applicable), and potential future funding opportunities for implementation.

Open Space and Riverfront Access Appendix

While the landscape along the Allegheny River is predominantly urban, opportunities still abound to create a vibrant open space system and a renewed riverfront. What was once a decidedly industrial corridor is envisioned as a new urban ecological riverfront, with the potential for restored human connectivity, community, and productivity integrated with ecological function. The Allegheny Riverfront Green Boulevard and the associated redevelopment opportunities along the river will exemplify the coordination of environmental sustainability with economic development and community benefits.

A primary focus of the Green Boulevard is creating new open spaces, recreation opportunities, and connections to the river for the dozens of neighborhoods that will benefit from the plan. Key components of the open space plan are stabilization of the riverbank along the six-mile corridor where necessary and feasible, creation of riparian habitat, and stormwater treatment. As part of this last effort, three buried streams are reimagined as regenerative stormwater conveyances. Stormwater management, designed as part of the district's landscape and streetscapes, will handle runoff and improve water quality.

Based on ecological and community concerns, the planning study has identified three critical locations as priorities for development:

- The Strip District, 11th Street to 21st Street
- Lawrenceville, 43rd Street District
- Heth's Run/Washington Boulevard

New riverfront parks are planned for both the Strip District and the Lawrenceville neighborhood. These parks will provide active and passive recreation choices as well as unprecedented access to the Allegheny River for both of these growing neighborhoods. Improvements to existing infrastructure in Highland Park will simultaneously restore access to the river and improve the zoo entrance.

Open Space and Riverfront Access

Ecological Conditions and Observations [page 6]

The Ecological Observations section presents a description of existing ecological conditions, which incorporates a combination of desktop assessment of existing data and previous planning documents and studies, as well as onsite observations made during site visits conducted as part of this study. Recognizing that the site is part of a larger riparian and ecological system the historical and regional ecological context is introduced, followed by a summary of site conditions focused on the riverbank, shoreline, riparian vegetation and habitat potential.

Focal Species Memorandum [page 98]

Six focal species were selected to help identify urban habitat issues and to better understand the wildlife resources associated with the aquatic, riparian, and associated terrestrial upland habitats occurring along the Allegheny River system. The focal species are representative of the diversity of habitats and species groups found in the study area vicinity as well as assemblages, or guilds, of species. Consideration of the focal species habitat needs helped inform design decisions associated with buffer typologies and open space design along the riverfront.

Ecological Buffer Typologies [page 110]

In order to develop the ecological typologies for the Green Boulevard study, existing literature was reviewed associated with functioning riparian buffers for habitat and water quality, as well as ecological observations of existing conditions, historical development patterns and appropriate focal species needs. One-third of rivers and streams in Pennsylvania have degraded or altered riparian buffers. The wider the buffer, the more benefit it provides in terms of wildlife habitat, water temperature modulation, protection from nonpoint sources of pollution, flood mitigation, sediment removal, and bank stabilization. This section summarizes recommendations for varying buffer typologies along the Allegheny River Green Boulevard study area.

Riverfront Conceptual Open Space Plans and Cost Summaries [page 127]

With the goal of connecting Pittsburgh to the river, conceptual open space plans were created for three of the neighborhoods along the Allegheny River in the study area: the Strip District (11th-21st), Lawrenceville (40th-48th in the 43rd Street District Development), and Highland Park. The open space plans were developed by analyzing each of the project sites including the site history and content of the Ecological Conditions and Observations report, by organizing design principles, by assessing open space programming from the community obtained through the public meetings and MyGreenBoulevard online tools, and by reviewing draft concept plans at the public meetings to inform creation of the preferred plans. This section describes and illustrates the plan and provides concept level cost estimates for each of the three open space sites.

Open Space and Riverfront Access

Green Infrastructure Toolkit [page 176]

The Green Infrastructure Toolkit provides a suggested list of stormwater treatment practices that can be used in implementing a living infrastructure framework as part of the Green Boulevard design. Living infrastructure can be integrated into many positions within the landscape, from the roofs and plazas of buildings to the streetscapes and rights-of-way along the rail lines. Practices described in the toolkit are envisioned as integral design techniques in the 43rd Street District Redevelopment. The toolkit can be shared with city agencies as consideration for future stormwater practices within the Green Boulevard and beyond. The toolkit may be helpful in applying for funding associated with sustainable development and stormwater treatment in the corridor.

Zoning Recommendations [page 191]

This section summarizes zoning options to help implement the riverfront stabilization goals; zoning recommendations for development goals are included in the 43rd Street District Appendix. The 2011 Vision Plan recommended a general 200-foot wide buffer zone along the river that includes setbacks and development with green infrastructure. The Green Boulevard plan builds on this recommendation and encourages three different buffer zones tailored to the existing river's edge and development conditions. To support the proposed buffer, recommended changes to the Riverfront Overlay District are included within this section.

Stormwater Management Along the Riverfront

Stormwater management recommendations and analysis were prepared by Riverlife and are available under separate cover.

Performance Measures [page 194]

Benchmarks for performance are provided for stormwater management and creation of open space.

Ecological Conditions and Observations

Ecological Conditions and Observations

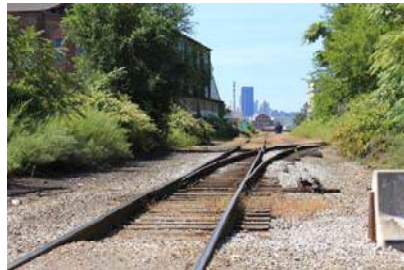
The study of existing ecological conditions incorporates a combination of desktop assessment of existing data and previous planning documents and studies, as well as onsite observations made during site visits conducted as part of this study. Recognizing that the site is part of a larger riparian and ecological system, the description of the historical and regional ecological context is followed by a summary of site conditions focused on the riverbank, shoreline, riparian vegetation, and habitat potential. Other important components of ecosystem function that were considered include geology, morphology, hydrology, and land cover. To provide a foundation for development of the Green Boulevard, a living infrastructure framework was developed to highlight opportunities for integrated regenerative design, stormwater management, habitat restoration, public access, stewardship, and redevelopment. As the framework progressed, themes of ecological potential were developed and vetted with stakeholders, including the concept of a riparian buffer that would be responsive to ecological and habitat function, as well as development patterns.

What was once a decidedly industrial corridor along the Allegheny is envisioned as a new urban ecological riverfront, with the potential for vibrant restored human connectivity, community, and productivity, with integrated ecological function. The proposed Allegheny Green Boulevard and the associated redevelopment opportunities within the study area will be the first examples of restored connectivity through a resilient corridor and restored patches in the urban landscape matrix. The design of the Green Boulevard will similarly promote community resilience and regenerative development along the riverfront and create new opportunities for access and movement. This multimodal corridor provides an opportunity to reconnect the urban fabric along the Allegheny Riverfront, strengthening connections by regenerating community and urban ecosystems through seamless integration with transportation infrastructure. The overarching themes of this living infrastructure network are corridors and connections along laterals and in parallel to the Allegheny River, and interstitial spaces in both temporary and permanent landscape forms that provide habitat and nutrient cycling.

These observations served to inform the buffer typologies created for the Green Boulevard. The material collected and summarized in this report was shared in public meetings and with the client as the Green Boulevard study progressed. It informed the open space studies for the Strip District, Lawrenceville, Highland Park/Heth's Run, and Washington Boulevard/Negley Run, as well as the riverfront landscape prototypes. Numerous foundations and grant programs could potentially fund planning and implementation of ecological restoration, urban ecology, and stormwater management projects. An implementation memorandum provided in the Performance Measures section of the Appendix provides further consideration of funding opportunities and potential project partners.

JANUARY 2013

ALLEGHENY RIVERFRONT GREEN BOULEVARD STUDY ECOLOGICAL CONDITIONS AND OBSERVATIONS



Prepared by:



2081 Clipper Park Road
Baltimore, MD 21211

Table of Contents

1. SITE CONTEXT	1
1.1. Natural Resource History	1
1.2. Regional Context	3
1.2.1. Migratory Flyway	3
1.2.2. Fish Habitat and Migration	4
1.2.3. Mussels	7
1.2.4. Rare, Threatened and Endangered (RTE) Species.....	8
1.2.5. Regional Geology	9
1.2.6. Regional Morphology.....	10
1.2.7. Regional Hydrology	11
1.2.8. Regional Land Cover.....	12
1.3. Concurrent and Complementary Ecologically Related Efforts.....	12
1.3.1. Publications and Studies	12
1.3.2. Key Environmental Stakeholders	17
1.4. Environmental and Natural Resource Related Regulations and Permitting.....	18
1.5. Regional Landscape Ecology Connections	19
2. STUDY AREA ANALYSIS.....	21
2.1. Study Area Description	21
2.2. Study Area Observations.....	22
2.2.1. Allegheny Riverbank and Shoreline	22
2.2.2. Allegheny River Riparian Vegetation	30
2.2.3. Vegetation and Habitats Needs	33
2.3. Study Area Conditions.....	34
2.3.1. Study Area Geology.....	34
2.3.2. Study Area Soils.....	34
2.3.3. Study Area Morphology	34
2.3.4. Study Area Hydrology	35
3. STUDY AREA POTENTIAL	36
3.1. An Ecological Narrative of Place	36
3.2. A Green Boulevard as Functional Open Space.....	38
3.3. Living Infrastructure Network.....	39
4. BIBLIOGRAPHY	53
4.1. References	53
4.2. Maps/Graphics.....	56

Appendix A – GIS Maps

Appendix B – Site Analysis and Assessment Graphics

1. SITE CONTEXT

1.1. Natural Resource History

An important element in planning for future development and ecological restoration within the Allegheny Riverfront Green Boulevard study area is to understand the ecological patterns that have defined this area over time. Pittsburgh sits at the confluence of the Allegheny and Monongahela Rivers, which form the Ohio River, serving as an important trade and cultural center. Natural systems and processes helped create the conditions that led to this important settlement and will continue to define the City.

In early accounts of the land at the confluence of the Allegheny and Monongahela Rivers, prior to the establishment of Pittsburgh, a number of Native American settlements are described, most notably the settlement of “Shannopin’s Town” – a Seneca tribe village – near the current location of Lawrenceville. The settlement, located between Penn Avenue and Two-Mile Run, contained twenty residential structures and approximately 80 individuals. As it was situated along a commonly used trail that ran east to west it was frequently used by traders. By the late 1760’s though, the earliest boundaries of the City of Pittsburgh and Fort Pitt were being delineated for Thomas and Richard Penn and accounts of Native American presence at that time are harder to find. In the late 1700’s mapping of Fort Pitt shows woody vegetation along the Allegheny and several large ponds, as well as a number of large coal pits upland from the shores of the Allegheny. Settlement grew out from the confluence and land was subdivided.

Mapping from the late 1700’s and early 1800’s describes and delineates a number of streams in the project study area, including Two-Mile Run, outfalling near the present day 33rd Street area of Lawrenceville, Heth’s Run, Negley Run, and a couple unnamed streams including those that begin in the cemetery and empty into the Allegheny near the present day 47th Street. Mapping also shows the present-day Washington’s Landing (formerly known as Herr’s Island), as well as a couple islands that no longer exist including Wainright Island and Guyosula Island. Fertile bottoms are identified near Negley Run east of Highland Park. All of these streams were eventually buried and connected to the sewer system as development continued to increase in the City (Figures 1 and 2). (Sources: <http://usgwarchives.net/pa/1pa/1picts/gist/gj4b.html>; Plate no. 1 – Pittsburgh and Mt Washington. 14warp01. Historic Pittsburgh Collection: <http://images.library.pitt.edu/pittsburgh/>; Plan of Pittsburgh and adjacent county: DARMAP0198. 1815. by William Darby; Plate no. 9 – City of Pittsburgh. 14warp09. 1914. By Pennsylvania of Internal Affairs, Harrisburg, PA. Warranty atlas of Allegheny County)

Anthropogenic changes as Pittsburgh was settled and grew to a burgeoning city made significant alterations to the natural environment as manifested over the last couple of centuries. By the late 1800s, Pittsburgh became a booming industrial city and through the mid to late 20th century Pittsburgh was a hub of heavy industry namely iron and steel mills, coal processing and various manufacturing. This industrial growth demanded shipping access along the waterways, rail line service and yards and the advent of roadway networks that resulted in the characteristics bridge system across the Three Rivers. The industrial growth also spawned the development of residential neighborhood housing and commercial enterprise expansion.

With this growth came the challenges of developing and maintaining infrastructure while facing natural forces such as flooding, sediment deposition, and stormwater runoff. The effects of intensive development on natural resources were further influenced by wastewater discharge, freshwater

withdrawal and waste disposal, including industrial slag. The culmination of growth and urbanization had profound effects on natural systems and ecological processes including alteration on the Allegheny River ecosystem. The U.S. Army Corps of Engineers (USACE) established the lock and dam system for river navigation that resulted in a lake-like environment when not under high flow discharge. The City established a stormwater and wastewater combined sewer system resulting in the creation of combined sewer overflow (CSO) discharge points. There was also extensive alteration and filling along floodplains, valleys and slopes including with industrial waste byproducts such as slag. Additionally, through much of the City, development and urbanization resulted in the conversion of vast reaches of natural stream channels to enclosed pipe drainages. These broad scale urbanization influences altered river hydrology, land-based runoff, nutrient cycling, habitat availability, water quality, air quality and soil health – dramatically altering ecosystem functions and services delivery (Figure 3).



Figure 1. A warranty atlas map of property ownership and surveys from the mid 1700's and early 1800's, which shows historic stream patterns along the Allegheny River. Map used for this overlay was the Plate no. 9 – City of Pittsburgh. 14warp09. 1914. By Pennsylvania of Internal Affairs, Harrisburg, PA. Warranty atlas of Allegheny County.



Figure 2. Historic streams overlaid on an aerial of existing conditions gives a sense of where the streams had run prior to development along the Allegheny. Already one can see that Two Mile Run (the western-most stream) is already showing evidence of an engineered form. Source map for overlay: Map of cities of Pittsburgh, Allegheny and adjoining boroughs. DARMAP0085. 1872. G.M. Hopkins & Co. Philadelphia.



Figure 3. Existing development patterns along the Allegheny River, view from downtown eastward across project site. The landscape is predominantly urban.

1.2. Regional Context

1.2.1. Migratory Flyway

Birds migrate along four main routes, or flyways, through the continental US, including the Atlantic, Central, Mississippi and the Pacific. The Atlantic flyway (Figure 4) extends along the Atlantic Coast from the shores of Greenland south to the Gulf of Mexico, extending west to the Allegheny Mountains, and northwest through northern West Virginia and Northeast Ohio and then across the provinces of Canada to the Northwest Territories. The flyway serves as important migratory route for shorebirds, raptors, waterfowl and pelagic birds, as well as butterflies, certain bats and dragonflies. (Sources: <http://www.fws.gov/migratorybirds/>, <http://www.birdnature.com/flyways.html>)



Figure 4. The Atlantic flyway with major, merging and principal routes.

Although one of the primary Atlantic flyway routes crosses western Pennsylvania just north of Pittsburgh, this area does see its share of migratory birds, mostly waterfowl. In addition, the Ohio Hills physiographic area is considered by the Partners in Flight Program to be one of the highest priorities for conservation attention among Northeastern physiographic areas because of a high numbers of declining and priority bird species. Three habitat types and 11 species have been identified and targeted with the Louisiana Waterthrush the most applicable as it is sensitive to loss of riparian forest buffers and declining stream quality. (Source: http://www.partnersinflight.org/bcps/pl_22sum.htm)

Table 1. Bird species of the Ohio Hills Physiographic Area.

Common Name	Habitat
Bewick's wren	Early succession shrub
Golden-winged warbler	Early succession shrub
Prairie warbler	Early succession shrub
Field sparrow	Early succession shrub
Cerulean warbler	Mature deciduous forest
Louisiana waterthrush	Mature deciduous forest
Worm-eating warbler	Mature deciduous forest
Acadian flycatcher	Mature deciduous forest
Kentucky warbler	Mature deciduous forest
Wood thrush	Mature deciduous forest
Henslow's sparrow	Grasslands

Source: http://www.partnersinflight.org/bcps/pl_22sum.htm

The Allegheny River itself does not concentrate waterfowl as do other large western Pennsylvania waterways and few birds are present during summer months. Migratory birds, such as pied-billed grebes and ruddy ducks, typically arrive by late-September with additional waterfowl and gulls appearing by late-October. Northward waterfowl migration begins in March with late waterfowl and gull migration through April. One unique bird species of note in the Pittsburgh area is the peregrine falcon. Extirpated east of the Mississippi River by 1965, the only two known nesting pairs in the western half of Pennsylvania can be found in Pittsburgh, on the Gulf Tower in downtown and on the University of Pittsburgh Cathedral of Learning. Although recently removed from the federal endangered species list, the peregrine is on the Pennsylvania endangered species list.

1.2.2. Fish Habitat and Migration

Fish species in the Allegheny River have rebounded significantly over the past 40 years as water quality has continued to improve. These warmwater fish communities are representative of a relatively diverse and large river of the upper Ohio River basin. Although the Allegheny River supports a number of migratory species, several have been extirpated, evidence of how the multitude of dams on the river have altered its fish communities. In an effort to assist fish migrations, the Pennsylvania Fish and Boat Commission (PFBC) began coordinating annual fish lockages with the USACE to facilitate fish migration up the Allegheny River through locks. These lockages are generally conducted from March through May and are triggered by water temperature parameters. In addition to inhibiting fish migration, the river's dams have altered the in-river habitat as pools created by dams are much deeper and have less complexity than areas of the free-flowing river, thus creating a more lake-like habitat. Allegheny River substrate is dominated by firmly-packed silt and USACE maintenance dredging continually disturbs the

river bottom. The majority of riverbanks have also been modified through the use of bulkheads and riprap (PFBC, 2011).

A total of 99 fish species and three hybrids have been identified in the Allegheny River and of those, 25 are considered migratory such as sauger, walleye, channel catfish, and redhorses. Of the river's 99 species, 15 are protected species with a total of seven listed as endangered (bluebreast darter, spotted darter, Tippecanoe darter, and gilt darter). When looking at the stretch of the Allegheny from Emsworth Pool to Pool 4, which includes the project reach, fish species numbers remain fairly robust at 84 total species, 23 migratory species, and seven protected species (PFBC, 2011).

Table 2. Fish species collected from the Allegheny River since 1970 from Emsworth Pool to Pool 4.

Common Name	Migratory	Pennsylvania Protected Status	Introduced (including hybrids)
Ohio Lamprey		Candidate	
Paddlefish	x		
Longnose gar	X		
Bowfin		Candidate	
Mooneye	X		
American eel	X		
Skipjack herring	X		
Gizzard Shad			
Goldfish			Introduced
Central stoneroller			
Spotfin shiner			
Common carp			Introduced
Streamline chub			
Bigeye chub			
Common shiner			
Silver chub			
River chub			
Golden shiner			
Emerald shiner			
River shiner		Endangered	
Bigeye shiner			
Spottail shiner			Introduced
Rosyface shiner			
Sand shiner			
Mimic shiner			
Channel shiner			
Bluntnose minnow			
Fathead minnow			
Blacknose dace			
Creek chub			
River carpsucker			
Quillback	X		
White sucker	X		
Northern hog sucker	X		

Table 2. Fish species collected from the Allegheny River since 1970 from Emsworth Pool to Pool 4.

Common Name	Migratory	Pennsylvania Protected Status	Introduced (including hybrids)
Smallmouth buffalo	X		
Black buffalo			
Silver redhorse	X		
Smallmouth redhorse	X		
River redhorse			
Black redhorse	X		
Golden redhorse	X		
White catfish			Introduced
Yellow bullhead			
Brown bullhead			
Channel catfish	X		
Stonecat			
Flathead catfish	X		
Northern pike	X		
Tiger muskellunge			Introduced
Muskellunge			
Trout-perch			
Brook silverside			
Banded killifish			
White perch	X		Introduced
White bass	X		
Hybrid striped bass			Introduced
Rock bass			
Green sunfish			
Pumpkinseed			
Bluegill			
Smallmouth bass	X		
Spotted bass			
Largemouth bass	X		
White crappie			
Black crappie			
Greenside darter			
Rainbow darter			
Bluebreast darter		Threatened	
Fantail darter			
Spotted darter		Threatened	
Johnny darter			
Tippecanoe darter		Threatened	
Variagate darter			
Banded darter			
Logperch			
Channel darter			
Gilt darter		Threatened	

Table 2. Fish species collected from the Allegheny River since 1970 from Emsworth Pool to Pool 4.

Common Name	Migratory	Pennsylvania Protected Status	Introduced (including hybrids)
Yellow perch			
Longhead darter			
Backside darter			
Sauger	X		
Saugeye			
Walleye	X		
Freshwater drum	X		

Adapted from Three River Management Plan: A Strategy for Managing Fisheries Resources of the Allegheny, Monongahela and Ohio Rivers, 2011.

1.2.3. Mussels

Historically the Allegheny River was the richest river in Pennsylvania for freshwater mussels, as over 50 species were known to inhabit the river. Similar to fish migration, lock and dam structures, as well as, navigational dredging started the decline and loss of mussels communities in the Allegheny. However, even with this decline, the Allegheny still boasts populations of 30 mussel species in the lower 72-mile impounded reach. Three federally endangered mussel species (clubshell, northern riffleshell, salamander mussel) and one federal candidate species (rayed bean mussel) have been found in the lower impounded Allegheny.

Table 3. Mussel species collected from the Impounded Allegheny River (RM 0-72).

Common Name	Federal Protected Status	Pennsylvania Protected Status
Black sandshell		
Clubshell	Endangered	Endangered
Creek heelsplitter		
Creeper		
Elktoe		
Fatmucket		
Fawnsfoot		
Fluted-shell		
Fragile papershell		
Giant floater		
Kidneyshell		
Long-solid		
Mapleleaf		
Mucket		
Northern Riffleshell	Endangered	Endangered
Paper pondshell		
Pink heelsplitter		
Pink papershell		
Pistolgrip mussel		
Plain pocketbook		
Pocketbook		
Rainbow mussel		

Table 3. Mussel species collected from the Impounded Allegheny River (RM 0-72).

Common Name	Federal Protected Status	Pennsylvania Protected Status
Rayed bean mussel	Candidate	
Round pigtoe		
Salamander mussel	Endangered	
Spike		
Three-ridge		
Wabash pigtoe		
Wavy-rayed lampmussel		
White heelsplitter		

Sources: <http://www.paconserve.org/rc/nw-ap.html>; *Three River Management Plan: A Strategy for Managing Fisheries Resources of the Allegheny, Monongahela and Ohio Rivers, 2011.*

It should also be noted that the Threehorn wartyback was identified in the Allegheny River during the development of the Sycamore Island Management Report (Applied Ecological Sciences, No Date).

1.2.4. Rare, Threatened and Endangered (RTE) Species

The Pennsylvania Natural Heritage Program inventories and maintains a list of ecologically significant species and communities for each county in Pennsylvania and is the basis for Environmental Review for the Pennsylvania Natural Diversity Inventory (PNDI). Allegheny County boasts a total of 164 plant and animal species and one community which have been listed based on either federal and/or state protected or rarity status. In conjunction with the county lists, County Natural Heritage Inventories have been developed for each Pennsylvania county providing a snapshot of the known biological information available at the time of the study. The Western Pennsylvania Conservancy developed the Allegheny County Natural Heritage Inventory and indicates that the project reach falls within the East and West Pittsburgh quadrangles. These quadrangles contain both the Allegheny Biological Diversity Area (BDA) and the Peregrine Falcon BDA. The Allegheny BDA currently provides habitat for a number of fish species of special concern while the Peregrine Falcon BDA provides two active nest boxes for the state-listed endangered peregrine falcon. To correlate the fish species, the PFBC's Three River Management Plan lists seven protected fish species in the Allegheny River from the Emsworth Pool to Pool 4, including the candidate species Ohio lamprey and bowfin; the endangered rivershiner; and four threatened darter species (bluebreast, spotted, Tippecanoe, and gilt). Three federally endangered mussel species (clubshell, northern riffleshell, salamander mussel) and one federal candidate species (rayed bean mussel) have also been found in the lower impounded Allegheny. RTE species reference sites include:

- Ohio Lamprey (*Ichthyomyzon bdellium*) Habitat Requirements:
<http://www.naturalheritage.state.pa.us/factsheets/11246.pdf>
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Ichthyomyzon+bdellium>
- Bowfin (*Amia calva*) Habitat Requirements:
<http://www.naturalheritage.state.pa.us/factsheets/11269.pdf>
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Amia+calva>
- River shiner (*Notropis blennioides*) Habitat Requirements:
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Lythrurus+umbratilis>
- Bluebreast Darter (*Etheostoma camurum*) Habitat Requirements:
<http://www.naturalheritage.state.pa.us/factsheets/11411.pdf>
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Etheostoma+camurum>

- Spotted Darter (*Etheostoma maculatum*) Habitat Requirements:
<http://www.naturalheritage.state.pa.us/factsheets/11415.pdf>
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Etheostoma+maculatum>
- Tippecanoe Darter (*Etheostoma tippecanoe*) Habitat Requirements:
<http://www.naturalheritage.state.pa.us/factsheets/11418.pdf>
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Etheostoma+tippecanoe>
- Gilt Darter (*Percina evides*) Habitat Requirements:
<http://www.naturalheritage.state.pa.us/factsheets/11424.pdf>
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Percina+evides>
- Clubshell (*Pleuroblema clava*) Habitat Requirements:
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Pleurobema+clava>
<http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=F01D>
- Northern Riffleshell (*Epioblasma torulosa rangiana*) Habitat Requirements:
<http://www.naturalheritage.state.pa.us/factsheets/12209.pdf>
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Epioblasma+rangiana>
- Salamander Mussel (*Simpsonaias ambigua*) Habitat Requirements:
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Simpsonaias+ambigua>
Rayed Bean Mussel (*Villosa fabalis*) Habitat Requirements:
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Villosa+fabalis>
<http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=F01A>
- Peregrine Falcon (*Falco peregrines*) Habitat Requirements:
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Falco+peregrinus>
- Paddlefish (*Polyodon spathula*) Habitat Requirements:
<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Polyodon+spathula>
<http://www.fish.state.pa.us/pafish/fishhtms/chap6.htm>
<http://www.fish.state.pa.us/anglerboater/1999/jf99/padlfish.htm>

Twelve endangered, threatened, and candidate species have been identified for the project reach. However, in order to obtain the most current and accurate study specific species lists, if this level of information and direct agency coordination is desired, a request would need to be submitted to both the U.S. Fish and Wildlife Service, for federally listed species, and the Pennsylvania Natural Heritage Program's PNDI for state listed species. The U.S. Fish and Wildlife Service requires a written request while the PNDI format is an extensive, project detailed on-line submittal. (Sources: <http://www.paconserve.org/rc/nw-ap.html>; <http://www.paconserve.org/rc/pdfs/allegheny-co-final-cd.pdf>; <http://www.naturalheritage.state.pa.us/Species.aspx>; PFBC, 2011)

1.2.5. Regional Geology

There are five main types of geology found in the region, including the Allegheny Formation, the Casselman Formation, the Glenshaw Formation, the Monongahela Formation, and the Waynesburg Formation (Figure 5 and Appendix A). In the Allegheny Formation the primary rock type sandstone and the secondary rock type is siltstone. Other rock types include shale, limestone and coal. This formation includes coal that is of major economic significance. It contains six major coal zones, which, in stratigraphic order, are: Upper Freeport Coal, Lower Freeport Coal, Upper Kittanning Coal, Middle Kittanning Coal, Lower Kittanning Coal, and Brooksville Coal. The Casselman Formation and Glenshaw Formation are part of the Conemaugh Group, which consists of cyclic sequences of shale, siltstone, sandstone, red beds, thin impure limestone, and thin nonpersistent coal. Siltstone is the primary rock

type, and shale is secondary. Red beds in this group are associated with landslides, as is shown on the mapping. In the Monongahela Group the primary rock type is shale and the secondary rock type is sandstone. There is coal as thick as 8 feet in some locations and the Upper Pennsylvania Pittsburgh coal bed is part of the Monongahela group, a coal seam named for its outcrop high on the sheer north face of Mount Washington in Pittsburgh. The Waynesburg Formation has a primary rock type of sandstone and a secondary rock type of shale. Other rock types include limestone and coal. (Sources: http://www.geology2.pitt.edu/GeoSites/allegheny_group.htm, <http://mrdata.usgs.gov/sqmc/pa.html>, <http://en.wikipedia.org/wiki/>)

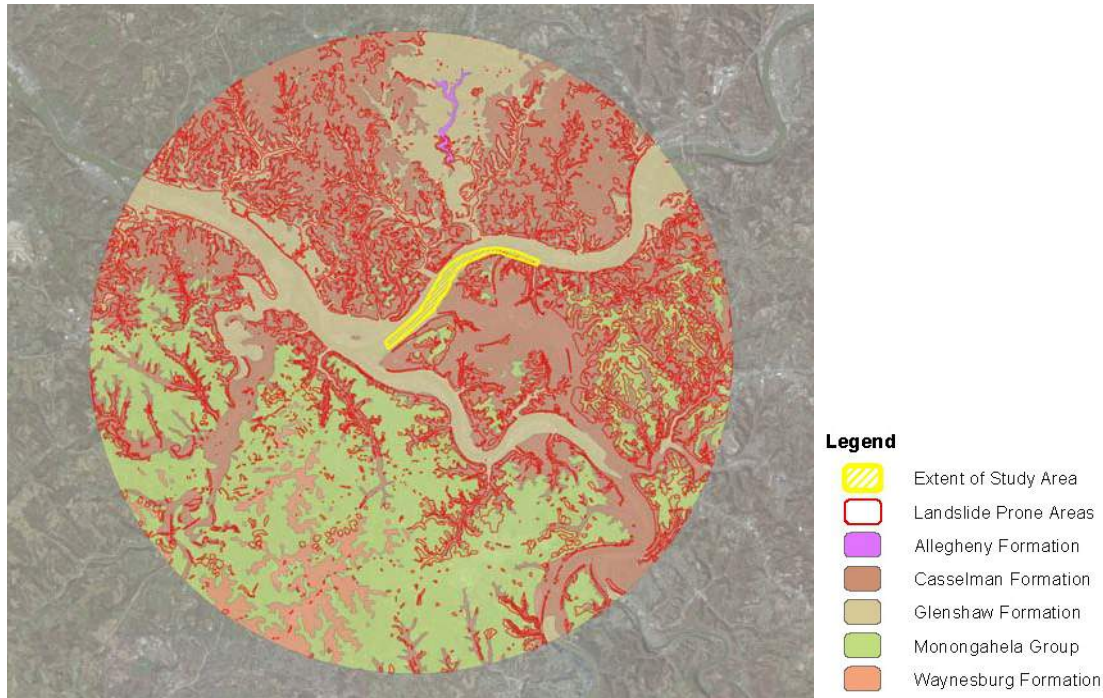


Figure 5. Regional Geology

1.2.6. Regional Morphology

The City of Pittsburgh is built upon a portion of the Appalachian Plateau, which extends westward and north and south from the Allegheny Front, which is a major southeast-facing escarpment of the Allegheny Mountains. Elevations in this region range from a high of 1359 feet and a low of 696 feet (Figure 6 and Appendix A). Three major topographical conditions found in the region are floodplains and bottomlands in the river valleys, upland areas found between rivers and hilltops, and higher upland areas along the plateau. (Source: <http://www.post-gazette.com/pg/06339/743531-44.stm#ixzz1Xq9Bfekl>)

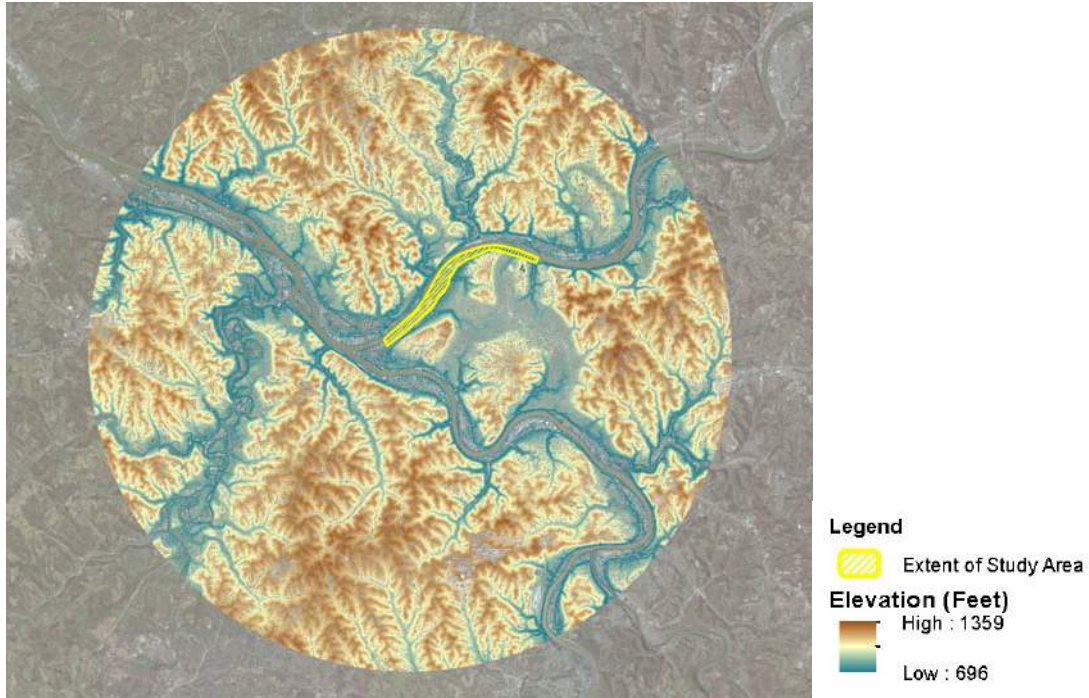


Figure 6. Regional Morphology

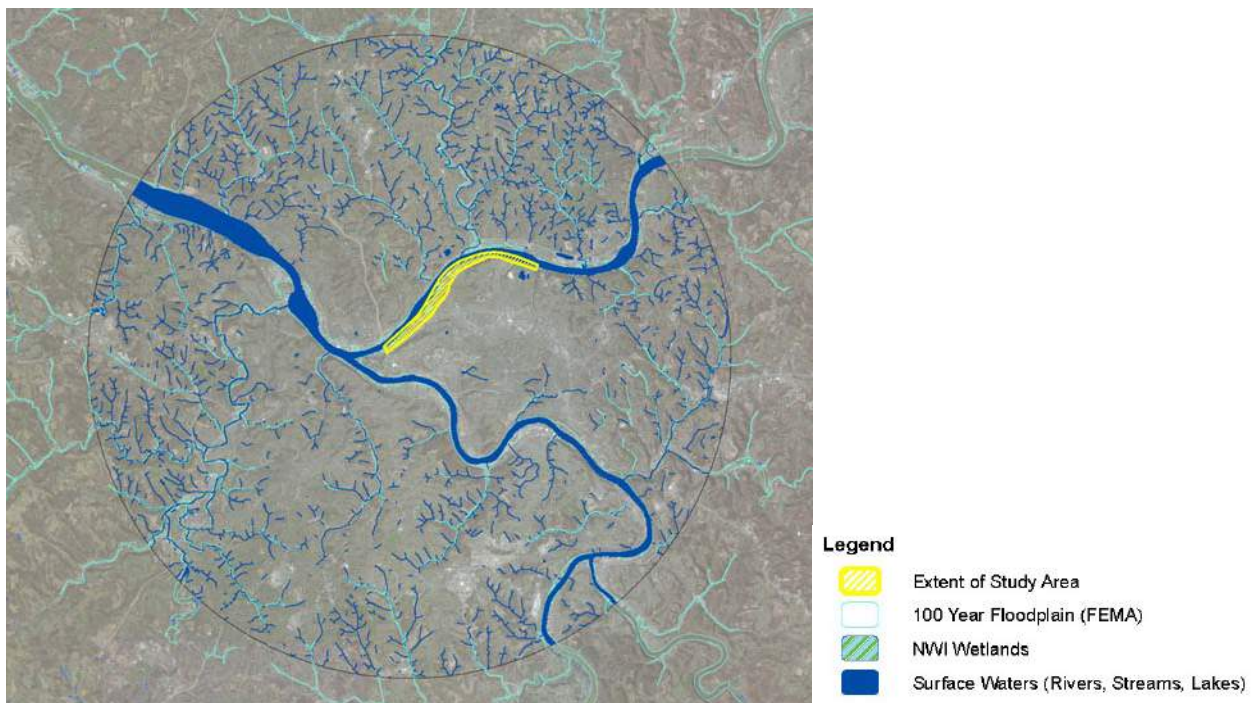


Figure 7. Regional Hydrology

1.2.7. Regional Hydrology

Pittsburgh is defined by its three rivers. The Allegheny, flowing from the north and east, and the Monongahela, flowing from the south and east, joint to form the Ohio, which flows north from Pittsburgh before making its way west and south to join the Mississippi. The Ohio is the largest tributary

– by volume – of the Mississippi. A number of small wetlands, defined by the National Wetlands Inventory, are found throughout the region and are shown in Figure 7 and Appendix A.

1.2.8. Regional Land Cover

Pittsburgh is mainly characterized by developed lands with some relief shown by areas of deciduous forest, most of which are parks found in the region. As one moves from the center of the urban core there are some areas of pasture and cultivated crops (Figure 8 and Appendix A).

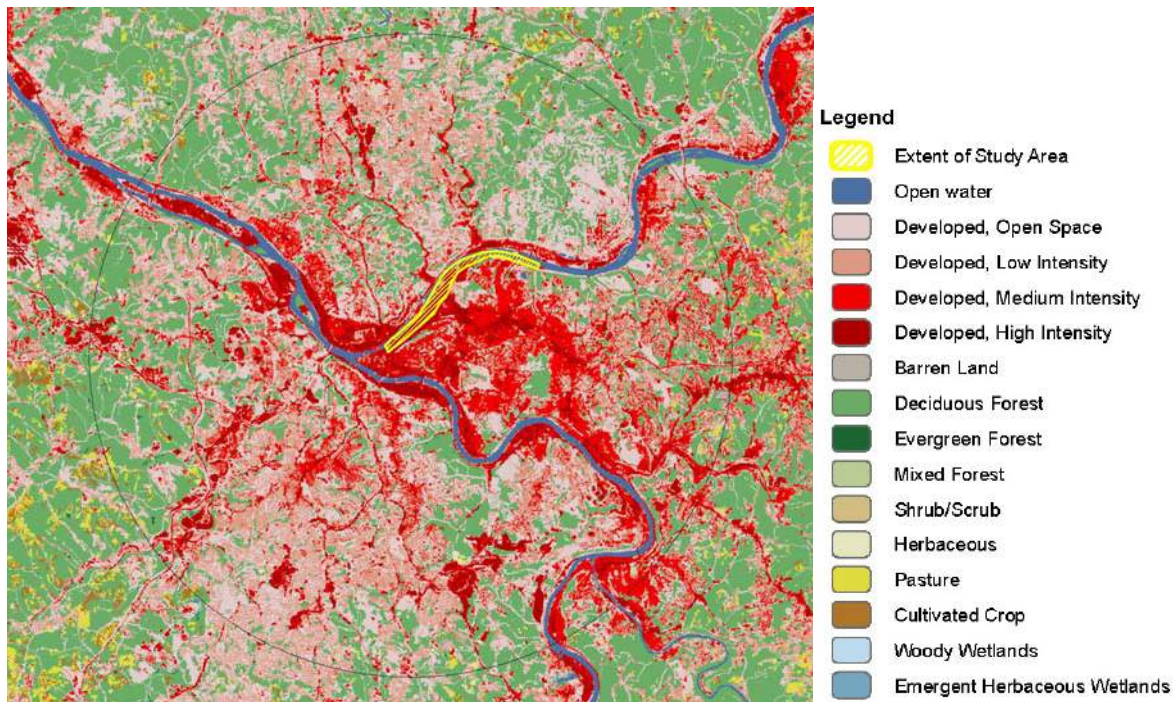


Figure 8. Regional Land Cover

1.3. Concurrent and Complementary Ecologically Related Efforts

1.3.1. Publications and Studies

Allegheny Riverfront Vision Plan

(Urban Redevelopment Authority, City of Pittsburgh Department of Planning, and Riverlife. Allegheny Riverfront Vision Plan. 2010. Prepared by Perkins Eastman.)

This Vision Plan, completed in 2010 is the basis for the current Green Boulevard planning project. The Vision Plan provides recommendations for 6 miles of the Allegheny Riverfront including the Strip District, Morningside, Highland Park, and Lawrenceville communities. A major goal was reconnecting the community with the river. Other goals include increasing economic vitality, restoring and enhancing ecological character and quality, development of complementary uses and amenities, creating beautiful and memorable places built upon natural, historical, and present resources, and planning for sustainable development. A key element that aligns with ecological health, green infrastructure, and open space planning is the Vision Plan's focus on *regenerative development*. This approach informed all components of the vision plan, from the ecology to the connections, market and urban form. This approach is much more holistic than a conventional piecemeal development approach, not just looking at isolated

problems but examining the full hydrologic and nutrient cycle, examining how it isn't working and finding new and innovative ways to restore it – to build resilience, connections, and new functional urban systems that integrate ecology with economy and community. This project falls within the regenerative and transition zones of the Vision Plan focusing on the riparian buffer as well as the upland green corridor along the AVRR. In terms of ecological infrastructure the Plan outlines guidelines including the following:

- In the Regenerative Zone: green corridor in the riparian buffer that captures clean runoff, green corridor in the rail ROW
- In the Transition Zone: High priority for green streets, vegetated curb extensions, and green roofs
- Green alleys, urban gardens, and residential rain gardens
- Tree canopy target of 80% for the first 100' of riparian buffer and the entire AVR right of way green corridor and 60% elsewhere in the Regenerative Zone. Transition Zone target of 40% canopy cover.
- A 200' buffer along the river's edge – using a combination of native meadow and woodland plantings – which is considered an essential component for both stormwater management and habitat rehabilitation.

Rivers in Synergy – A Waterfront Vision for Pittsburgh's Ohio Basin

(Riverlife Task Force. Rivers In Synergy : A waterfront vision for Pittsburgh's Ohio Basin. Prepared by Atelier Dreiseitl. June 2009.)

This 2009 study identifies opportunities for improved stormwater management along Pittsburgh's waterfront. Eight distinct area types, representing different land uses along the waterfront, were identified. For each, specific recommendations for retrofitting the landscape with practices to intercept and filter stormwater runoff are presented. Recommended practices include:

- Open canals
- Vegetated swales
- Sedimentation basins
- Bioretention swales
- Green roofs
- Filter manholes
- Underground substrate filters
- Cisterns
- Bioengineering

Changes in stormwater runoff and pollution as a result of development were also evaluated.

3 Rivers 2nd Nature Ecology and Recovery – Allegheny County

(3 Rivers 2nd Nature. Ecology and Recovery – Allegheny County. Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2006.)

In this 2006 report researchers examined the landscape ecology of the Rivers and the potential for recovery and restoration. After a brief summary description of the landscape of the County, and the demographic context, the study focused in on a woodland watershed analysis, examining impervious surface, invertebrate health, biotic integrity, ecological watershed rating, and then an examination of

the river corridor with a look at the ideal conditions and then the existing conditions found in this urban river corridor. Taking a restoration ecology approach the study argues for the measurement of remnant value, looking for areas of opportunity for preservation, conservation and potential restoration. The study also identifies areas of opportunity, mainly outside of this project's study area. Some of the data of relevance within the project area shown in this report:

- There are 0 – 0.015 acres of open space per person by watershed
- There is no woodland over 250 acres in patch size
- Negley Run is the only riparian woodland associated with a stream of note in the study area.
- The watershed woodland and ecological watershed rating of the study area is bad (1 on a scale of 5 to 1)
- Elements of the urbanized floodplain most common within the study area: fragment patches of native riverbank vegetation bank, fragment patches of native floodplain vegetation, partially culverted streams, lock and dam system controlling river elevation and flow, patches of dense urban settlement and patches of contaminated industrial brownfield.

3 Rivers 2nd Nature Terrestrial Report: Allegheny River Phase 3 – 2002 Vegetation Assessment
(3 Rivers 2nd Nature. Terrestrial Report: Allegheny River Phase 3 – 2002 Vegetation Assessment. Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2002.)

A vegetative assessment, completed in 2002, had several goals, including expanding the existing vegetation database for the region, comparing the vegetative conditions of the Allegheny and Monongahela, quantifying the vegetative status of the islands in the river, and evaluating the extent of exotic species along the river corridor. The Assessment concluded that the banks of the Allegheny accommodate diverse plant communities, including four native woody plant communities and 1 native herbaceous community. The five major plant communities are: Sycamore (River Birch) Box-Elder Floodplain Forest, Silver Maple Floodplain Forest, Black Willow Scrub/Shrub Wetland, Alder-Ninebark Wetland, and Water Willow (*Justica americana*) smartweed riverbed community (Figure 9). Tree of Heaven (*Ailanthus altissima*) and Japanese knotweed (*Polygonum cuspidatum*) are the most common invasive species noted during this assessment.



Figure 9. Regional parks and Vegetative communities found within the vicinity of the project area in the 3 Rivers 2nd Nature Vegetation Assessment completed in 2002.

3 Rivers 2nd Nature Terrestrial Report: Allegheny River Phase 3 – 2002 Riverbank Geology
(3 Rivers 2nd Nature. Terrestrial Report: Allegheny River Phase 3 – 2002 Riverbank Geology. Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2002.)

Completed in 2002, the riverbank geology assessment examined a number of riverbank characteristics along the Allegheny River in Pools 1-4, which included restoration potential, preservation, accessibility,

and geology. Preservation and accessibility data were graded into three categories and mapped, then analyzed to identify potential riverbank restoration sites. In addition, at each pool riverbank materials origin, distribution, and grain sizes were plotted and analyzed in conjunction with a previous study on the Monongahela River. A series of 24 separate figures is included, showing examples of different types of riverbank access.

3 Rivers 2nd Nature Aquatic Report: Allegheny River Phase 3 – 2002 Water Quality

(3 Rivers 2nd Nature. Aquatic Report: Allegheny River Phase 3 – 2002 Water Quality. Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2002.)

This three year program focused on identifying patterns and relationships between functioning ecosystems, water quality, and public use of the Allegheny River. Water quality data was mixed as tributaries showed high fecal contamination levels in dry weather however, on the Allegheny River itself levels were within acceptable ranges used in the study. Only one wet weather event was sampled and indicated that downriver pools are more affected by fecal contamination than upriver pools. Overall more sampling was recommended in both the Allegheny River and its tributaries to help identify sources of fecal contamination.

3 Rivers 2nd Nature Aquatic Report: Allegheny River Phase 3 – 2002 Fishes of Small Tributaries

(3 Rivers 2nd Nature. Aquatic Report: Allegheny River Phase 3 – 2002 Fishes of Small Tributaries. Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2002.)

This report summarizes an electro-fishing effort in 2002 in 35 small tributaries of the Allegheny and Monongahela Rivers in Allegheny County. Within the Allegheny River watershed, fish were present in 14 of the 18 sampled tributaries with a total of 29 different species collected. Index of Biotic Integrity (IBI) scores were developed for 16 of the Allegheny River tributaries with five receiving good scores, four fair scores, two poor scores, and five very poor scores. Results indicate that even though many of the tributaries are degraded and in spite of their urban and industrial environment, close to a third of the tributaries supported fair to good fish communities.

A Vision Plan for Pittsburgh's Riverfronts

(Riverlife Task Force. A Vision Plan for Pittsburgh's Riverfronts. Consultant team led by Chan Krieger & Associates. October 2001.)

This plan provides the foundation proposal for an urban river park in Pittsburgh, stretching along the rivers from the West End Bridge on the Ohio to the Sixteenth Street Bridge on the Allegheny and to the Tenth Street Bridge on the Monongahela¹. It will encompass the rivers themselves, the bridges, and at least the first 50 feet of all shoreline within this area. Three Rivers Park will connect the parks that now punctuate the shoreline including Point State Park, Allegheny Riverfront Park, and Northshore Riverfront Park – in a continuous flow of trails, bridges, green space, and waterfront amenities. It is envisioned as a riverfront park that is made up of a variety of distinct spaces, which also provide connections to, across, and along the rivers.

Three Rivers Park Design Handbook

(Riverlife Task Force. Three Rivers Park Design Handbook. October 31, 2002.)

¹ The boundaries of Three Rivers Park expanded subsequent to the development of the original Vision Plan. The Park is currently defined by the boundaries of the West End Bridge on the Ohio River, the 31st Street Bridge on the Allegheny River, and the Hot Metal Bridge on the Monongahela River.

This handbook is intended to complement the *Vision Plan for Pittsburgh's Riverfronts* and provides guidelines for the development of the rivers and land extending from the West End Bridge on the Ohio River to the Sixteenth Street Bridge on the Allegheny River to the Tenth Street Bridge on the Monongahela River. The intent is to establish optimal planning goals and to enhance and coordinate existing land-use requirements. Five elements are explained in great detail in relationship to shaping the overall character of an urban river park, and include waterscape, landscape, districts, connections, and landings.

Three Rivers Park Landscape Management Guidelines

(Riverlife Task Force. Three Rivers Park Landscape Management Guidelines. Prepared by Andropogon Associates Ltd. With CEC. December 2006.)

he guidelines in this handbook address the use, restoration, and management of the Pittsburgh riverbanks in correlation to public and private stewardship and are based on sustainable design strategies. Overarching and site specific recommendations and practices are presented through a multitude of photos, maps, and graphics. River edge zones are also examined with focuses on native plant material, bank stabilization, invasive species management, and monitoring.

Three Rivers Heritage Trail

http://www.friendsoftheriverfront.org/files/heritage_trail.html

This multimodal trail (accommodating a combination of cyclists, runners, walkers and in some places rollerbladers) includes 21 miles of trails along the Allegheny, Monongahela, and Ohio Rivers in the Pittsburgh area. The trail includes signage that describes the landscape heritage and the City's development history. The goal is to make it completely contiguous and to connect to the much larger Great Allegheny Trail Passage system that runs all the way to Cumberland, Maryland. The Friends of the Riverfront continues to push for the development of the few remaining 'missing links' along the trail system in the City and the surrounding municipalities in order to establish regional connections and economic opportunities. A number of disconnected portions of the trail run through the project boundaries including the Lawrenceville Trail and another portion that starts near the Cork Factory and goes toward downtown Pittsburgh. There are opportunities to connect these trails through the whole of the project boundary with both lateral and parallel trail linkages.

Three Rivers Conservation Plan

(Pennsylvania Environmental Council. Three Rivers Conservation Plan. 2004 March.
<http://www.dcnr.state.pa.us/brc/rivers/riversconservation/registry/62execsum.pdf>)

The Three Rivers Conservation Plan examines the existing data and resources to date (completed in March 2004) on the natural, recreational, and cultural resources of the three rivers in Pittsburgh and its surrounding communities while providing protection, restoration, and enhancement recommendations. General and specific recommendations are provided identifying key partners, potential funding sources, and implementation priorities.

TreeVitalize Pittsburgh

http://www.paconserve.org/assets/TreeVitalize_covinc.pdf

TreeVitalize Pittsburgh is a joint project of Allegheny County, the City of Pittsburgh, the Pennsylvania Department of Conservation and Natural Resources and the Western Pennsylvania Conservancy. The

aim is to plant 20,000 trees by 2012 throughout the Pittsburgh region, with an initial focus on planting street trees, enhancing canopy in City and County parks and along the riverfront. Preference for street tree plantings will be given to neighborhoods with a low number of trees per person, a predominance of residents at or below the median income, and neighborhoods where other stormwater management or community improvements are planned. Particularly relevant to this project is the focus on riverfronts and parks, especially those areas that are in need of intensive restoration, those that have historic or cultural significance, and those areas that are undergoing additional environmental improvements. According to mapping done by TreeVitalize Lower Lawrenceville and parks of Central Lawrenceville and Upper Lawrenceville show need based on income level and existing tree cover.

Heth's Run Ecological and Recreational Restoration Project

(http://www.senatorferlo.com/images/pdf/heths_run.pdf)

This plan focuses on replacing the Heth's Run bridge, removing fill, and restoring the stream valley, while creating a stronger open space connection to Highland Park and the surrounding residential communities. An extension of open space will create a new connection to the Allegheny River, restoring the ecology of the stream and creating new spaces for recreation and respite. The plan includes stepped stormwater wetlands, trails, a river overlook, and a new playing field. The plan was completed by a consultant team including Mackin Engineering Company, LaQuatra Bonci Associates landscape architects, Pashek Associates, Buchart Horn Inc., and Bergmann Associates. The plan re-establishes Heth's Run as an integral part of Highland Park, providing river access to its visitors and nearby residents, connecting the communities to the river and to the planned greenway trail along the river (AVRR Green Boulevard). Mackin Engineering has recently completed preliminary design work for all aspects of the project excluding replacement of the bridge.

1.3.2. Key Environmental Stakeholders

The following organizations and groups may be key environmental stakeholders as the Allegheny Riverfront Green Boulevard Study progresses:

- 3 Rivers Wet Weather – <http://www.3riverswetweather.org/>
- Allegheny Clean Ways – <http://www.alleghenycleanways.org/>
- Allegheny Land Trust – <http://www.alleghenylandtrust.org/>
- Audubon Society of Western Pennsylvania – <http://www.aswp.org/>
- Cal U (paddlefish) – <http://www.calu.edu/academics/faculty/David-Argent.aspx>
- Carnegie Mellon's Green Design Institute – <http://www.ce.cmu.edu/GreenDesign/>
- Explorers Club of Pittsburgh – <http://www.pittecpc.org/>
- Friends of the Riverfront – <http://www.friendsoftheriverfront.org/>
- Friends of Pittsburgh Urban Forest (Tree Pittsburgh) – <http://www.treepittsburgh.org/>
- Green Pittsburgh – <http://www.greenpittsburgh.net/>
- Green Building Alliance – <http://www.gbapgh.org/>
- Grow Pittsburgh – <http://www.growpittsburgh.org/growpittsburgh/>
- Pennsylvania Biodiversity Project – <http://www.pabiodiversity.org/>
- Penn Future – <http://www.pennfuture.org/>
- Pennsylvania Environmental Council – <http://www.pecpa.org/>
- Pennsylvania Fish and Boat Commission – <http://www.fish.state.pa.us/>
- Pittsburgh National Aviary – <http://www.aviary.org/>

- Pittsburgh Parks Conservancy – <http://www.pittsburghparks.org/>
- Pittsburgh Permaculture – <http://pittsburghpermaculture.org/>
- Pittsburgh Region Clean Cities – <http://www.pgh-cleancities.org/wordpress/>
- Pittsburgh Zoo and PPG Aquarium – <http://www.pittsburghzoo.org/>
- Powdermill Avian Research Center – <http://www.powdermillarc.org/research/default.aspx>
- Rachel Carson Homestead – http://rachel_carson_homestead.myupsite.com/
- Sierra Club Allegheny Group – <http://alleghenysc.org/>
- Slow Food Pittsburgh – <http://www.slowfoodpgh.com/>
- Sustainable Pittsburgh – <http://www.sustainablepittsburgh.org/>
- Steinbrenner Institute of Environmental Education and Research – <http://www.cmu.edu/steinbrenner/>
- University of Pittsburgh – Center for Healthy Environment and Communities <http://www.chec.pitt.edu/>
- Western Pennsylvania Conservancy – <http://www.paconserve.org/2/about>

1.4. Environmental and Natural Resource Related Regulations and Permitting

A number of federal, state and local environmental and natural resources laws and regulations apply to public and private activities in the Commonwealth of Pennsylvania. Although a planning level study does not require actual application and acquisition of permits or authorizations, understanding the requirements and ramifications of environmental permits is important for informing recommendations of the proposed plan. For example, recommended opportunities, elements and actions related to redevelopment, new development, stormwater treatment and green infrastructure, wastewater management strategies, and ecological restoration recommendations for river shoreline, streams, floodplains and wetlands all require an understanding of regulatory implications. A listing of laws, regulations and permitting requirements is provided in Table 4.

Table 4. Environmental and natural resource related laws, regulations and permitting requirements.

Water Obstruction and Encroachment and Wetlands
US Army Corps of Engineers Section 404 Joint Permit Application
Environmental Assessment (EA Form)
General Permits
Transfer of Permit and Submerged Lands License
National Pollutant Discharge Elimination System
General Permits
Individual Permits
Municipal Separate Storm Sewer Systems (MS4s)
Stormwater Construction Activities
Erosion and Sediment Control
Erosion and Sediment Control Permit Application
Stormwater Construction Activities
Rare Threatened and Endangered Species
Pennsylvania Lists of Endangered, Threatened and Candidate Species
Pennsylvania Natural Diversity Inventory – Project Planning & Environmental Review Form
The Wild Resource Conservation Act, the Pennsylvania Fish and Boat code and the Pennsylvania Game and Wildlife Code

Table 4. Environmental and natural resource related laws, regulations and permitting requirements.

U.S. Endangered Species Act (ESA)
Other Related Regulated Resources
Section 106 of the National Historic Preservation Act
Pennsylvania Historical & Archaeological Resource Protection – PA Historical & Museum Commission – Bureau of Historic Preservation (National Register of Historic Places)
Water Quality and Other Water Management*
Pennsylvania Storm Water Management Act (Act 167)
Water Quality Management Permit
Water Quality Management General Permit for Small Flow Treatment Facilities
General Permit for Sewer Extensions and Pump Stations
Water Quality Management Post Construction Certification
Water Allocation
Safe Drinking Water
Act 537 – Municipal Sewage
Hazardous Waste and Brownfields*
Pennsylvania Act 2 Land Recycling Program – Voluntary Cleanup Program
Brownfield Redevelopment Program
Pennsylvania Act 68 – The Uniform Environmental Covenants Act (UECA)
Federal (EPA) – Resource Conservation and Recovery Act (RCRA)
*Other permits that aren't purely natural resources/ecological but relate to redevelopment, existing infrastructure/systems and water use and discharge allocations (e.g., wastewater).

1.5. Regional Landscape Ecology Connections

The project study area lies along the Allegheny River corridor intersecting with the Monongahela River to form the Ohio River, creating a regionally significant riparian corridor, which runs northeast from Pittsburgh before starting its journey south and eastward to the Mississippi. There are many natural areas in the vicinity of Pittsburgh with forest cover of 25 acres or larger (significant for its woodland habitat potential for neotropical migratory and forest dwelling birds). To the east and west of the project area there are a number of wooded areas including state game lands, state parks and a number of county parks, which provide interior forest cover for wildlife and potential stepping stones for migration between larger forest patches (Figure 10). There are a number of reservoirs associated with woodland patches that would provide potential stopover habitat for birds including Beaver Run Reservoir, Conemaugh Lake National Recreation Area, Latrobe Reservoir, Quemahong Reservoir, and Keystone Lake.

The other significant corridor of note, in the regional vicinity, is the Allegheny Front, which is the southeast facing escarpment of the Allegheny Mountains. Along the Front and just to the east of the project area are large woodland patches including Gallitzen State Forest, Powder Mill Nature Preserve (which conducts avian research for the region), Laurel Mountain State Park, Yellow Creek State Park, as well as a number of State Game Lands.

Within 100 miles of the project area larger habitat patches of significance include: Wayne National Forest in the foothills of the Appalachians in Ohio; Canaan Valley National Wildlife Refuge—which is

home to the highest elevation valley and wetland system east of the Rocky Mountains which host rare species including: the bobolink, the clay-colored sparrow, cerulean warbler, saw-whet owl and the Henslow’s sparrow; and Allegheny National Forest on the Allegheny Plateau to the north.



Figure 10. Regional Connections to the site include river connections, area reservoirs, large parks and recreation areas, state games lands and forest along the Allegheny Front escarpment of the Appalachians (also found in Appendix A),

2. STUDY AREA ANALYSIS

2.1. Study Area Description

The Allegheny River defines the northern edge of Pittsburgh and as such is characterized as a highly modified urban riverfront. Although historical mapping found to date provides little insight into the direct modifications of the river and its floodplain, conversations with USACE confirm that the river has experienced decades of dredging. Meanwhile, as the river was deepened to support shipping, the floodplain was filled to expand developable land and reduce flooding.

The form of the riverbanks prior to both bulkheading and construction of the locks and dams is largely unknown. However, 3 Rivers 2nd Nature, 2004 presents graphics from circa 1925 associated with the recommended construction of a Barge Terminal at the Duquesne Freight Depot, which is immediately downriver of the study area. Figure 11 illustrates an existing riverbank slope of 1:5 (horizontal:vertical). Without further information it is assumed that this condition extended into the study area.

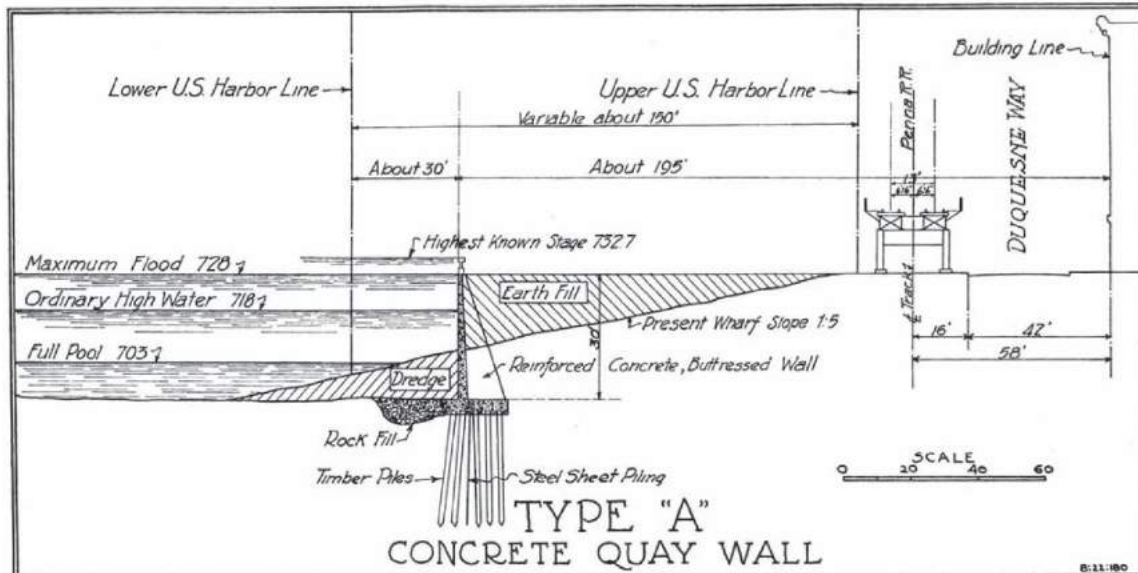


Figure 11. Illustration of recommendation to construct a Barge Terminal at the Duquesne Freight Depot, immediately downriver of the study area, circa 1925. (Source: 3 Rivers 2nd Nature. Pittsburgh Urban Waterfront : 172-1926. Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2004.)

The river itself is a highly regulated waterway. Due to the presence of dams, the river can be described as a novel ecosystem that functions more as a lake than a river during dry weather. However, during flooding events, debris and ice flows are more reflective of a river's processes than a lake. The dams are actively managed to control discharges and limit flooding to the extent practicable.

2.2. Study Area Observations

2.2.1. Allegheny Riverbank and Shoreline

Washington Boulevard to Dam and Lock 2

At the upriver extent of the project area, between Washington Boulevard and Dam and Lock 2, modification of the floodplain is less evident than the downriver areas. This in part is because Highland Park thrusts upwards from the river as a natural geologic feature that resists the erosive forces of the Allegheny and limits the opportunity for alluvial deposition. The most evident modification of the floodplain in this location is associated with blasting of the bedrock to create space for the Allegheny Valley Railroad (AVR) (Figure 12). Traffic through this area is limited to the railroad and by a gravel drive providing access to the lock, park and a few residences. The riverbank alternates between vegetated and bulkheaded. The vegetated slopes from the normal water level to the first terrace are between 2:1 and 3:1 (horizontal:vertical) with no apparent erosion. At the toe of the natural riverbank, there exists a small bench comprised of finer sediment and sand that are vegetated with herbaceous plant material (Figure 13 and 14). It is not known whether the stability of this natural riverbank is the product of armored protection of the armored bulkhead immediately upriver of the observation area. Since the bulkhead protrudes into the river, it may shadow the natural riverbank from high velocities with the potential to scour. No CSO outfalls were observed through this area. Vegetation is described in the following section.



Figure 12. The AVR ROW and visible bedrock along the floodplain.



Figure 13 and 14. A small bench of finer sediment and sand is vegetated with herbaceous plant material, including this blue vervain plant.

Lock 2 to 62nd Street Bridge

This section of the riverfront is characterized by the steep geography of Highland Park. Inaccessible by land, aside from the AVR right of way, the riparian forest is at its widest within the entire project area, extending over 200 feet from the river's edge to Butler Street (the forest is bisected by the AVR). This section of the project area holds the outfall from Heth's Run, a historic stream currently buried beneath parking lots for the Pittsburgh Zoo. From Highland Park, observations into this forest reveal a mix of mature canopy interspersed with pockets of newer growth (Figures 15 and 16).

Approximately 2000 linear feet upriver of the 62nd Street Bridge, a scrap metal recycling facility marks the transition to a more urban and industrial waterfront. The riparian forest is reduced to less than 75 feet. Several CSO outfalls are located between the scrap metal recycling facility and the bridge. A characteristic observed at each of the outfalls is the presence of vegetated bench or terrace. This may be the product of sediment deposition associated with the outfalls.



Figures 15 and 16. A view down into the Heth's Run Stream Valley, and the bridge crossing at the edge of Highland Park and Butler Street.

62nd Street Bridge to 57th Street

The riverbank through this section is vegetated over the entire length and is approximately 75 feet wide with side slopes that are 2:1 or 3:1. The Allegheny Marina is located at the top of this riverfront section, but appeared to be vacant. A boat ramp is located just downriver of the marina. Between the river and the AVR and downriver of the boat ramp, there are no remaining buildings for 2000 linear feet. Only concrete pads and a small rail yard dot the top of the riverbank until the Allegheny Cold Storage building. A CSO that runs beneath 57th Street discharges at the downriver extent of this section. Upriver and downriver of the outfall, a low vegetated bench sits 1-2 feet above the dry weather river level (Figures 17 to 19). The land use in this section is under transition, as old industrial buildings, now owned by the Urban Redevelopment Authority of Pittsburgh (URA), have recently been cleared in preparation for redevelopment. Fuel tanks where methanol is mixed with gasoline are in active use.



Figure 17. Access to one of the CSO outfalls in the vicinity.



Figure 18. The vegetated bank at the CSO access point directly to the north of the 62nd bridge crossing.



Figure 19. The abandoned marina to the south of the 62nd street bridge crossing.

57th Street to 51st Street

The riverbank through this section is vegetated over the entire length but appears to be generally less than 50 feet wide with side slopes that are 2:1 or steeper. A large parking lot at the upriver end characterizes the upriver extent of this section. Downriver, buildings are situated between 50 and 100 feet from the river edge and are mostly characterized with parking lots or pavement between the building and what's left of the riparian corridor. CSOs run beneath 57th Street, McCandless, and upriver of 51st Street. A small vegetated bench sits one to two feet above the dry weather river level near these outfalls (Figures 20 and 21).



Figure 20. The CSO outfall at 57th Street.



Figure 21. The low bench along this stretch of the river.

51st Street to 43rd Street

The riverbank is bulkheaded immediately downriver of 51st Street with a timber wall. However, downriver of this wall, the bank is largely vegetated with a few locations where rubble or rock are employed as armoring. The riparian forest comprising this riverbank is less than 50 feet through much of this section as industrial buildings were constructed at the top of bank (Figure 22). An existing rail spur is located along the top of the riverbank from 47th to 45th Street and connects into the AVR right of way at 43rd Street. Just upriver of 43rd Street, the riverbank is nearly vertical and unvegetated as the existing concrete plant requires barges importing aggregate to be within reach of the plant's crane. Several acres of land at this location are currently in turf.



Figure 22. View of bulkhead and riparian edge north and east of 43rd Street.

43rd Street to 33th Street

43rd Street represents the upper extent of the existing Lawrenceville Trail. The trail presently extends to 37th Street although the AVR right of way may be used by some pedestrians. Near the National Robotics Engineering Center, the riparian corridor is approximately 75 feet wide, but the building is almost 150 feet from the river. The trail itself is allayed with fruit trees while there appears to be fairly substantial open space that is in turf or being used for storage (Figures 23 and 24). At the 40th Street Bridge, a trail head parking lot is adjacent to a kayak storage area. Downriver of the 40th Street Bridge, although vegetation is as limited as 50 feet in parts while there is more than 100 feet between the river and the AVRR right of way until 37th Street, where it begins to narrow as the railroad spurs. There is a approximately one hundred feet of riverbank that is unvegetated near 35th Street as the railroad spurs with one section elevating. Between 35th and 33rd Street, the riparian corridor is barely 50 feet wide.

CSO outfalls are located at 43rd Street and 36th Street. More infrastructure along the river is observable, with a tower supporting power lines located at 35th Street. Barge infrastructure supports are located just upriver of 33rd Street. A ramp providing access to the river is located underneath the rail bridge here as well.



Figure 23. View of riparian edge southwest of 43rd Street.



Figure 24. The trail provides views to the river near the Robotics Center, north of the Washington Crossing Bridge.

33th Street to 27th Street

The vegetated riverbank narrows to less than 50 feet through most of the section. The railroad runs along the top of bank. A large CSO outfall is located at 32nd Street and probably conveys most of the flows from what once was Two Mile Run (Figure 25). Immediately downriver of this outfall is an old water intake which may no longer be operational. Through this section, there is a greater frequency of timber or concrete walls and steel pilings in various states of degradation once employed to stabilize the riverbank. Since Herr's Island is immediately across river, the Allegheny River is at its narrowest through this section. Combined with development near the top of bank, it is likely the riverbanks have experienced a greater degree of erosive forces than other areas within the project reach. Just upriver of 27th Street, unused railroad has been converted into a walking path for a new office building (Figure 26).



Figure 25. The outfall near 32nd street which may convey flows of the historic Two Mile Run.



Figure 26. A portion of the old rail spur along the river in front of the Pitt Ohio offices that serves as trail and landscape amenity.

27th Street to 16th Street

The vegetated riverbank remains less than 50 feet through this section with several blocks almost entirely free of vegetation. At 25th Street, the Three Rivers Heritage Trail is complete to Three Rivers Park. At the Cork Factory, a new bulkhead has recently been constructed. A marina and its associated parking lot comprise a river access point between 23rd and 21st Street. What appears to be water intakes, perhaps representing the water supply for the Heinz Factory are just downstream. These wells were referred to during a meeting with Buncher, as it was noted that they will need a replacement water supply. From this point down to 16th Street, the river bank is vegetated while at the top of the bank, on the inland side of the trail is parking lots.

2.2.2. Allegheny River Riparian Vegetation

Vegetative communities vary over the course of the Green Boulevard study area, ranging from riverside forest stands to herbaceous fields and edges near Highland Park and Lawrenceville, to sparsely vegetated and weedy areas dominated by impervious surfaces closer to downtown Pittsburgh. The Three Rivers watershed, including the Allegheny River segment of the green boulevard study area, belongs to the River Bed-Bank-Floodplain Plant Community Complex (RBBFC) (3R2N 2002). This complex is a mosaic of forest, shrub woodland, grassland, and partially vegetated gravel or sand bar communities found in association with major rivers (Fike 1999). Due to the heterogeneous nature of the river habitat and factors such as flooding and substrate variability, this complex is composed of several distinct plant communities that can intergrade without clear boundaries (3R2N 2002).

Initial observations of the study area support this point by revealing a varied and integrated distribution of native plant assemblages and non-native invasive species-dominated areas. The distribution and condition of vegetation types is highly variable, showing the effects of a long history of industry and other development in the study area, as well as current transportation patterns, maintenance regimes associated with site landscaping and utilities, stormwater runoff and flood regimes, and development activities including demolition and new construction.

There are five distinct riverine communities found by the 3R2N study along the Allegheny and Monongahela Rivers. These communities, including four native woody and one native herbaceous community, are Silver Maple Floodplain Forest, Sycamore-Box elder Floodplain Forest, Black Willow Scrub/Shrub Wetland, Alder Ninebark Wetland and Water-willow-smartweed riverbed community. Biohabitats' initial observations during rapid field assessment in August 2011 revealed a predominance of Sycamore-Box Elder floodplain forest species and Silver Maple Floodplain Forest species. Wetland woody and herbaceous communities dominated by willow or water willow and smartweed were observed as fringes along the shoreline, associated with elevated substrate benches or bars, near Washington's Landing, and across to the north shore of the Allegheny. The wetland herbaceous fringes include primarily open substrate with native plants including smartweeds (including *Polygonum pennsylvanica*), water willow (*Justicia americana*). The invasive species Japanese knotweed (*Falopia japonica*) commonly occurs along sections of the shoreline. There were also infrequent occurrences of purple loosestrife (*Lythrum salicaria*) in some locations along the shoreline (Figure 27).



Figure 27. Purple loosestrife found near a CSO outfall.

Trees observed along the woodland stands of the riverbank slopes include sycamore (*Platanus occidentalis*), box elder (*Acer negundo*), slippery elm (*Ulmus rubra*), silver maple (*Acer saccharinum*) cottonwood (*Populus deltoides*) and black willow (*Salix nigra*) along with other willow species. Invasive trees species observed include tree of heaven (*Ailanthus altissima*), catalpa (*Catalpa speciosa*), and Norway maple (*Acer platanoides*). The understory layer of shrubs and saplings variably includes staghorn sumac (*Rhus typhina*), slippery elm, box elder, poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and riverbank grape (*Vitis riparius*). The understory and groundcover layer is extensively invaded with non-native plant species including Japanese knotweed. This includes extensive slope areas throughout the middle of the project reach that are entirely composed of stands of Japanese knotweed, oriental bittersweet (*Celastrus orbiculatus*) and porcelain berry (*Ampelopsis brevipedunculata*), along with grape vines (*Vitis spp*).

Herbaceous patches and fields primarily observed in open areas and vacant lands along the alignment include plants such as ragweed (*Ambrosia artemisifolia*), Queen Anne's lace (*Daucus carota*), primrose (*Oenothera sp.*), false nettle (*Boehmeria cylindrica*), jewelweed (*Impatiens capensis*), Joe pye weed (*Eupatorium dubium*), blue vervain (*Verbena hastata*), and boneset (*Eupatorium perfoliatum*), among others (Figures 28 and 14).



Figure 28. Joe-pye weed and other native herbaceous material found along the river shoreline.



Figure 29. Native woody vegetation near Heth's Run includes Sumac and Sycamore, as well as some invasive species including oriental bittersweet and knotweed.

Because of diverse land uses along the riverfront the riparian vegetative buffer is variable. Generally, the upriver section of the project study area exhibits somewhat larger buffer widths with more contiguous tree cover. The uppermost reach near Highland Park has vegetated riparian buffers approximately 100 or more feet wide (with proximity to larger woodlands) (Figure 29), the middle reach buffer is about 50 to 75 feet wide (with fewer lateral connections), and the lower reach buffer is typically only 25 feet wide (an isolated linear strip) or essentially absent along some intensively developed properties.

The more inland, upland portions of the project alignment are much more urban in Lawrenceville and the Strip District, which have a large amount of impervious building, street, parking lot and sidewalk. Vegetated areas are small and randomly distributed and include small lawn and meadow areas, weedy

patches, ornamental plantings and flower gardens, and small pocket-parks, with some sections of street trees (Figure 30).



Figure 30. A vegetated open space near the 40th Street Bridge (Washington Crossing)

Biohabitats generally observed more natural native assemblages and a greater occurrence and diversity of native indigenous plant species along the upriver portion of the study area near Highland Park. The visual qualitative observations included seeing more native species at all layers including trees, shrub, vines and herbaceous with lesser occurrence of the number and extent of non-native invasive species. According to the 3R2N Riverbank Vegetation Phase 3 (2002), the frequency of invasive species decreases with distance from Point State Park on the Allegheny, suggesting that human disturbance may be facilitating invasion or maintenance of these species once established. Our anecdotal observations of the upriver portion also noted the occurrence of wildlife including birds, as well as signs of mammal presence and insect use of wildflowers and forbs including Lepidoptera species (butterflies, skippers and moths).

2.2.3. Vegetation and Habitats Needs

The review of existing plans, studies, and mapping along with initial onsite observations leads to the identification of a set of basic needs regarding the ecological character of the study area's vegetative communities, habitat considerations and overall riparian zone functionality. Some of the specific observed needs to be addressed include the following:

- Control strategies for non-native invasive plant species along the riparian zone, particularly for Japanese Knotweed
- Enhancement of native plant biodiversity particularly from the mid-reaches of the project area downriver to the urban end.
- Enhancement of associated vegetative habitat for resident and migratory birds, pollinating insects, and herptiles (reptiles and amphibians) in targeted areas
- Augmentation of the existing urban tree canopy to address heat island effects and fragmented green connections

- Exploration of soil health parameters and related needs for nutrient cycling, water retention, bank stability and supporting native plant communities
- Enhancing and restoring riparian buffers to address the functional needs and opportunities along the various natural, transitional and developed river segments
- Addressing community health, access & connections, degraded conditions abatement and ecological improvements at CSO outfall locations.

2.3. Study Area Conditions

(The complete GIS mapping described in this section is located in Appendix A of this report.)

2.3.1. Study Area Geology

The project boundary area includes mainly the Glenshaw formation with a small sliver of the Casselman Formation at the eastern end of the site, where there are some landslide-prone areas. According to the 3R2N Geology Assessment of the Rivers, the Allegheny Valley, which is the location of the project site, experienced less industrial site placement because a majority of the Pittsburgh Seam is present in the Monongahela Valley, as opposed to the Allegheny Valley. Except for the Upper Freeport Coal, which is much thinner than the Pittsburgh Coal, there are comparatively fewer coal resources available in the Allegheny Valley.

2.3.2. Study Area Soils

Soils in the study area include UB, UCD, UWD, URB, URC, RaB, and GQF. UB, UCD, UWD, URB and URC are all urban land soils that consist mainly of fill that was hauled in and placed over natural soils. For the most part the soils are obscured by buildings or other structures and in many places the original soils cannot be identified. Slopes vary from gentle to steep escarpments. Urban soils are often compacted and nutrient deficient. Contamination potential is unknown without further site-specific studies. Gilpin Upshur complex (GQF) with steep slopes is generally found on valley sides that parallel streams. Runoff can be rapid and springs and groundwater seepage are common. These soils show susceptibility to landslides. GQF is found mainly in small patches near Highland Park along the steep slopes. Rainsboro silt loam (RaB) with moderate slopes, is found along stream terraces, characterized by well drained soils. These soils are on old terraces that are as much as 300 feet above the present floodplain, where permeability is slow and available water capacity is moderate. RaB is found near Lawrenceville on the edge of the project site boundary.

(Source for soil definitions: USDA's Allegheny County Soil Survey: <http://soildatamart.nrcs.usda.gov/manuscripts/PA003/0/allegheny.pdf>)

2.3.3. Study Area Morphology

Elevations range from 715' along the river shoreline to 915' near Highland Park. The project area is relatively flat along the floodplain with slopes that start to become increasingly steep as one approaches Highland Park and the surrounding neighborhoods. If one follows the rail corridor the steep slopes appear as rocky outcroppings and rockfaces in this area. The riverbank also has a relatively steep drop between the floodplain and the top of bank, depending on flows. Access to the river is therefore limited stairs and trails that have been created for ALCOSAN and other utility access.

2.3.4. Study Area Hydrology

Only small areas in the western portion of the study area are within the FEMA 100-year floodplain. There are no large-scale mapped wetlands within the site. The Highland Park reservoir and the Lampher Reservoir can be found at the eastern end of the study area.

3. STUDY AREA POTENTIAL

3.1. An Ecological Narrative of Place

The Allegheny Riverfront Vision Plan provides a striking image for the future of the City: to restore a riverine landscape transformed by industry into a matrix of communities capable of generating the needs of its population over time. This vision recognizes that developing a truly sustainable community requires more than improving efficiency and reducing waste. Instead, it requires integrating the community into nature's regenerative cyclical processes.

The fundamental characteristic of regenerative ecosystems is that they sustain themselves through continuous cyclical regenerative processes—processes that restore and renew their own sources of energy and matter, thus promoting resiliency. Similarly the conversion of the AVR right of way into a Green Boulevard can be approached as an urban landscape ecology design challenge which promotes resiliency. This multimodal boulevard provides an opportunity to reconnect the urban fabric along the Allegheny Riverfront, strengthening connections, by regenerating community and urban ecosystems through the seamless integration with transport infrastructure.

Habitat corridors and patches provide two important elements of functional and regenerative ecosystems. Vegetative corridors provide protection for biodiversity along riparian habitats as well as dispersal routes for recolonization of species that may be displaced through disturbance. Riparian corridors also provide resource management, including flood control, sediment control, clean water, and habitat for fish and other migratory populations. Tree canopy along a corridor can provide windbreaks and microclimate controls, as well as recreation and respite areas. Habitat patches provide key habitat areas and stepping stones utilized for species survival and dispersal.

Prior to settlement one can imagine that this portion of the Allegheny River had a robust forest cover, providing ample habitat for birds, mammals and amphibians. Rocky outcroppings of the Appalachian Plateau would have provided other small niche habitat and nesting opportunities for birds. When one reviews the historic patterns of development in some of the earliest mapping of Pittsburgh one sees a robust stream network, as well as notes from the early land owners of "fertile bottoms" and "green meadows" (Figure 31). One sees a meandering river that was most likely well-stocked with a diverse array of fish, amphibians, reptiles and other creatures. As noted in previous sections of this report both the river shoreline and the upland landscape have been altered radically over the long history of industry thriving upon the shores of the Allegheny. Disturbance of the natural ecology occurred starting with the earliest settlers of Native Americans and became more dramatic as populations increased and technologies allowed for more and more control of the natural systems. (Sources: <http://usgwarchives.net/pa/1pa/1picts/gist/qj4b.html>; Plate no. 1 – Pittsburgh and Mt Washington. 14warp01. Historic Pittsburgh Collection: <http://images.library.pitt.edu/pittsburgh/>; Plan of Pittsburgh and adjacent county: DARMAP0198. 1815. by William Darby; Plate no. 9 – City of Pittsburgh. 14warp09. 1914. By Pennsylvania of Internal Affairs, Harrisburg, PA. warranty atlas of Allegheny County)



Figure 31. Notes associated with early survey from a map published in 1914, show areas of fertile bottom, as well as the historic stream network. Map used for this overlay was the *Plate no. 9 – City of Pittsburgh. 14warp09. 1914. By Pennsylvania of Internal Affairs, Harrisburg, PA. warranty atlas of Allegheny County.*

Today, the Allegheny is a highly engineered river, which shows characteristics of both a river and a lake, exhibiting flows and currents controlled by an extensive lock and dam system. It is a novel ecosystem that still has the potential for functional habitat, providing food, shelter, and territory for both aquatic and terrestrial life. Many of the streams in Pittsburgh have been buried, piped, and connected to a massive storm and sanitary sewer system. These pipes collect the waters that fall during rain and storm events and direct them to a wastewater treatment plant or flush them out into the river, bypassing all opportunities for infiltration and filtration in the landscape. Tree canopy along the river shoreline and in the upland area has diminished, providing uneven corridors of woody vegetation fragmented by industry (Figure 32).



Figure 32. This overlay of ALCOSAN outfalls and pipe network shows the historic stream patterns from earlier historic maps (purple) and the potential stream pipes (blue) inferred from the stormwater network. (Source: http://www.alcosan.org/Portals/0/Wet%20Weather%20Docs/CTSwithOutfalls_36x24_June2011.pdf; accessed online August 16, 2011)

The existing habitat patches within and near the project area are small vacant lots, parks, and wooded locations, the largest of which include Highland Park, Allegheny Cemetery, and the small vegetated islands in the river. A fragmented corridor along the Allegheny River shows diminishing canopy cover and vegetated shorelines as one moves from east to west, Highland Park to 16th Street. The river is not only an important part of the economy of the City, it is also a defining factor in the ecology of the City and the surrounding region.

3.2. A Green Boulevard as Functional Open Space

Like wildlife within a functional landscape mosaic, which is made up of a combination of movement corridors and habitat patches, humans rely upon the strength of healthy and safe corridors as we inhabit and move across the urban landscape. Our corridors are our streets, roads, rail lines, sidewalks and trails, all of which connect us to our homes, workplaces, schools, places of worship, and our food—whether at markets or in our gardens and farms. What was once a decidedly industrial corridor along the Allegheny is envisioned as a new urban ecological riverfront, with the potential for vibrant, restored human connectivity, community, and productivity with integrated ecological function. The proposed Allegheny Green Boulevard and the associated redevelopment opportunities within the study area will be the first examples of restored connectivity through a resilient corridor and restored patches in the urban landscape matrix. The design of the Green Boulevard would similarly promote community resilience and regenerative development along the riverfront and create new opportunities for access and movement.

This open space plan provides an opportunity for connecting and enhancing a novel urban ecological system that promotes functional natural systems while providing a location for redevelopment and economic prosperity. As we travel the length of the project area and review the data, new patterns began to emerge. Taking into consideration the native vegetation found along the river near Highland Park and along the river to the north and east of the project area, the existing open space, vacant lands, river access points, CSO locations (where water could be handled differently before entering the Allegheny system) and historic streams that once traversed the landscape, we start to see many opportunities. Through the landscape ecological lens one can envision how natural patterns once common in the landscape, as well as existing development patterns, can help inform a new living/green infrastructure network that reconnects and restores ecological function. The overarching themes of this living infrastructure network are corridors and connections along laterals and in parallel to the Allegheny

River and the use of interstitial spaces in both temporary and permanent landscape forms that provide habitat and nutrient cycling.

3.3. Living Infrastructure Network

Unlike the conventional grey infrastructure (pipes/utilities, structures, facilities, etc.) of the past, which would need replacement and repair over time, the design of this regenerative multimodal corridor would provide opportunities to create a new living infrastructure framework as the foundation for redevelopment and community sustainability. This would occur through the creation of new open spaces, strengthened connections between residential and mixed use development, transport of both community members and their goods, the source of new products created through processing of renewable resources on site, the treatment of stormwater and wastewater to be reused on site.

A stable natural system is often characterized as having the following elements: relatively complete internal cycling, varied pathways of flow, filled niches, high volumes of life per unit of energy, and a high content of information (Odum in Lyle, 1999). Nutrient cycling is a key component that this living infrastructure approach would hope to return to the system. Within the current system, water and nutrients are flushed from the landscape in a conventional engineered piping approach. A renewal of nutrient cycling would allow for more nutrients, water, and organic matter to be taken up again within the project area, continuing to cycle these important elements in a way that allows the landscape to continue to utilize these natural resources rather than release them (Figure 33). This will be done through practices including wastewater treatment, stormwater filtration and evaporation, organic matter cycling within a restored riparian buffer, remediation of contaminated soil, creation of new biotic soil (e.g., through biochar and composting), reuse of stormwater runoff in cooling, greywater systems throughout the new structures, and other living ecological systems that will be enhanced or restored.

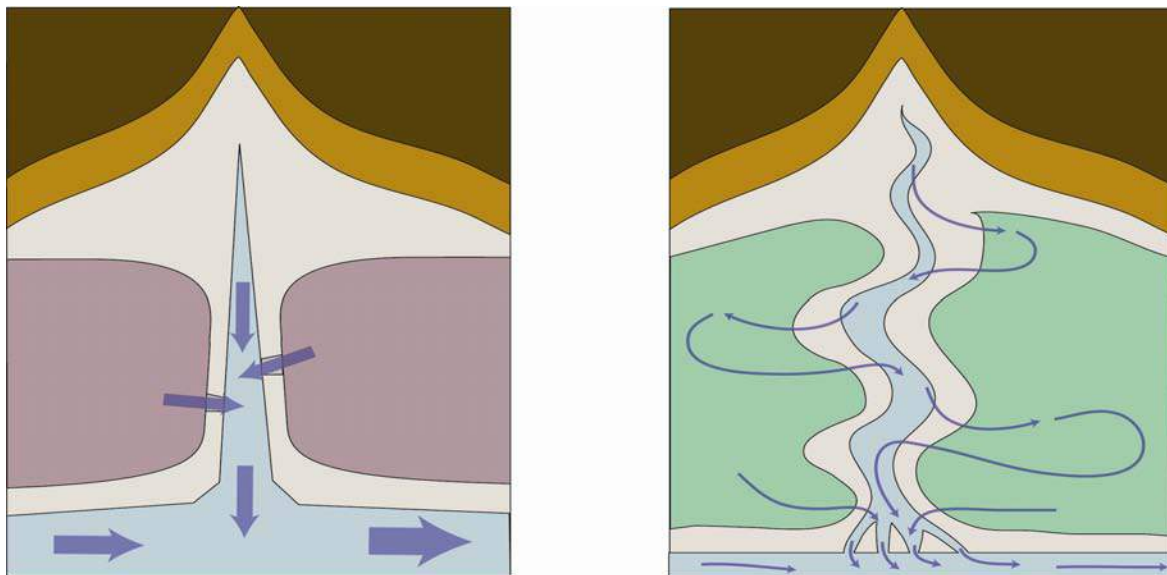


Figure 33. A nutrient cycling diagram, interpreted from cycle and flow graphics shown in John Lyle's *Design for Human Ecosystems* (1999). On the left is the conventional nutrient and water piped system, where nutrients, water, and energy are flushed from the system and concentrated downstream. On the right is a more functional cycling system where nutrients, water, and energy are retained, reused and recycled within the landscape. Water is infiltrated or treated and reused. Sediment and organic materials are spread out, filtered, broken down and taken up again. Runoff is minimized to more natural conditions and the character of the water forms is responsive to landscape forms.

Moving along the project area from east to west, there are a series of important green corridors and potential habitat patches within the urban network of streets, rails and industrial spaces, which are identified and described below, as the foundation for a living infrastructure network (Figures 34 & 35).



Figure 34. An overlay of the historic streams, the Vision Plan's Green Extensions, County Parks, and the Green Connections as highlighted extensions through the project area to the river (in turquoise) begins to highlight important elements of the Living Infrastructure Network.



Figure 35. The Living Infrastructure Network, with various points of importance for ecological enhancement, stormwater management, restoration, integrated treatment of water and soils, and opportunities for education and recreation.

1. North of Highland Park Bridge

At the northern edge of the study area is a small pocket-park along the river just north of the Highland Park Bridge (Figures 36 and 37). It provides a good reference point for native vegetation but could be improved to provide an enhanced native riparian shoreline, with increased tree canopy and improved access for pedestrians that could link to the green boulevard along the AVR right of way. Stormwater management could be integrated into parking and trail design changes (Figure 38).



Figures 36 and 37. The existing park and parking area conditions.



Figure 38. Opportunities include potential vegetated swales along a permeable parking lot. © Biohabitats, Inc.

2. Heth's Run and Historic Bridge Crossing

This first green extension is the location of the historic Heth's Run stream corridor and outfall point at the Allegheny River. There is exciting potential at this location to restore the riparian buffer to a more functional width of 300' or more, bring the stream back to the surface and create new pedestrian access to the river. As suggested in the Heth's Run ecological restoration and historic bridge restoration plans submitted to the City (described in an earlier section) (Figures 39 and 40) this offers an opportunity not only for enhanced habitat with increased vegetative cover, but also for integrated regenerative stormwater conveyance, vegetated pools of stormwater treatment and filtration. This also provides for a physical connection to the river and the historic stream valley from Highland Park and the surrounding neighborhoods. This also acts as a key educational node, with the location of schools in the neighborhoods surrounding Highland Park and the Zoo. Between this node and the 62nd Street Bridge there is an important opportunity to enhance the river habitat with living shoreline restoration by widening the riparian buffer through extended aquatic vegetation along a vegetated bench terrace.



Figure 41. The abandoned marina to the south of the 62nd street bridge crossing provides a unique opportunity for integration of floating wetlands as a public park space.



Figure 42. Floating wetlands create habitat in an otherwise challenging ecological environment in the urban context. © Biohabitats, Inc.



Figure 43. A shoreline treatment where native plantings are integrated into a strengthened bulkhead along a trail amenity. © Biohabitats, Inc.



Figure 44. An example of integrated stormwater treatment and native plantings along a streetscape. © Biohabitats, Inc.



Figure 45. A greenroof provides another layer of habitat and stormwater management, extending the vegetated buffer, even as structures are included on a redevelopment site. © Biohabitats, Inc.

4. 51st Street

As one moves downriver, the existing riparian buffer narrows with an increase in industrial activity along the riverfront. 51st Street provides a green extension opportunity to the river from one corner of Allegheny Cemetery and the associated upland woodland. The green lateral extension to the river would include stormwater management integrated with an enhanced tree canopy in the streetscape. The existing Cavacini Landscaping property provides an interesting opportunity for integrating regenerative industry through the introduction of composting, soil creation and conditioning, and nutrient cycling (Figure 46). Perhaps the expansion of the landscaping business could also incorporate an increased presence of native nursery vegetation, providing enhanced vegetative cover and tree canopy as well. This could become an eco-industrial redevelopment that could act as a nursery and nutrient energy center for the Allegheny riverfront. The schools located along McCandless, just a few streets away, would have access to this green infrastructure extension for educational and stewardship activities that could be woven into curriculum.



Figure 46. The existing landscaping and garden center on 51st Street provides an interesting opportunity for expansion into soil conditioning and composting.

5. 47th Street

The other prominent green extension from the cemetery and associated woodland occurs along 47th Street, which is also one of the key drainage points for the historic streams that begin in the Cemetery. With the integration of stormwater management in the form of bioretention, native vegetation, and planted swales designed along the streetscape one can highlight, and in a sense recreate, the feeling of this stream corridor. Several streets that intersect with 47th Street have vacant lots, which along with the vacant property owned by the Regional Industrial Development Corporation (RIDC), provide open space that is already evolving into a temporary meadow attracting birds, pollinators and other small wildlife. This space could provide an interesting opportunity for a wastewater treatment wetland and meadow system, or an algal turf scrubber water treatment system. These innovative systems treat wastewater diverted from the sanitary sewer system while also providing an intriguing open space and potential habitat amenity in the neighborhood. The expansive parking lots near the intersection of 47th and Plummer Street and the existing urban garden at the corner also provide interesting opportunities for increased urban agriculture and the integrated stormwater capture and reuse (Figures 47 to 51).



Figures 47 and 48. The RIDC property and vacant city properties.



Figures 49 and 50. An integrated wastewater treatment wetland and stormwater amenity integrated into a building's surrounding landscape creates a functional landscape that acts as an amenity, learning space, and treatment zone. Images © Natural Systems International – NSI



Figure 51. Raised beds in an urban zone provide an opportunity for gardening and productive landscapes. © Biohabitats, Inc.

6. 43rd Street

Another key green extension to the river occurs at 43rd Street. Enhanced tree canopy and stormwater management along the streetscape could be integrated with research opportunities at the National Robotics Engineering Center (Figure 52). The Center could look to expand its studies to include enhanced ecological function in urban systems: invasive species management and adaptive habitat management, biochar research for soil conditioning, or bioremediation on vacant lots. All of these research opportunities would allow for increased vegetative expanses in neighboring vacant lands or on existing City properties in the vicinity of the 40th Street Bridge (Washington Crossing Bridge).



Figure 52. The Robotics Engineering Center provides some interesting opportunities for expanded research in living infrastructure, organics manipulation, and bioremediation.

7. 43rd to 36th Street Corridor

The existing Lawrenceville Trail portion of the Three Rivers Heritage trail that runs between 43rd and 36th Street, parallel to the AVR corridor, could be enhanced with native vegetation in both canopy, understory and ground cover. This is an ideal location for a widened reach of riparian buffer (expanding

to 200 feet or greater) where native vegetation which would provide an important habitat patch along the Allegheny in an otherwise industrial portion of the river shoreline. At 36th Street the rails rise above the surface, and as rail use along the riverfront is re-envisioned an alternative landscape treatment of historic rails acting as raised trails could include integrated plantings, which provide pollinator habitat and stormwater management, as well as an expanded amenity for trail users (Figures 53 to 57). The 40th Street corridor provides another educational connection to secondary schools who could partner with research coming out of the National Robotics Engineering Center or other similar entities who could be attracted to an urban ecological research location on the riverfront.



Figure 53. A portion of the existing Lawrenceville Trail.



Figure 54. A view west from under the Washington Crossing bridge in an area that could provide for habitat enhancement and recreational amenity.



Figure 55. The existing rail spur that rises above the riparian edge (view west toward downtown).



Figures 56 and 57. The Highline in New York City has as its foundation an abandoned rail line. It is lauded as an exceptional reuse of industrial infrastructure as public park and amenity, employing native plantings, public art, and open space in an otherwise entirely impervious area of the city. © Biohabitats, Inc.

8. 33rd Street

Between 36th and 33rd Streets raised rails align with the river shoreline. 33rd Street sits below the raised rails which cross the river at this point. This sheltered street corridor provides an interesting opportunity for enhanced understory and ground cover integrated stormwater management, speaking to the Two-Mile Stream corridor that historically flowed in the vicinity.

9. 28th Street

The green extension at 28th Street connects to woodland patches that occur up-gradient of the project area in the Hill District. This green extension to the river, originally identified in the Vision Plan has the beginnings of a great river overlook with the small trail treatment along the frontage of the Pitt Ohio

riverfront offices. Enhancing the vegetation along this trail with natives and woodland buffer plantings, and carrying the associated aesthetic and woodland palette further along the riverfront trail system would continue to strengthen this connection to the river and provide increased ecological functionality along the riparian corridor. Small vegetation could be used in enhancing the rail corridor. Streetscape treatment of stormwater would include new tree canopy to help provide a better connection to the upland woodland (Figures 58-62).



Figures 58 and 59. Planted active rails. © Biohabitats, Inc.



Figures 60 and 61. Streetscape plantings for stormwater management, and vertical plantings for habitat enhancement and stormwater management. © Biohabitats, Inc.



Figure 62. Cisterns and native plantings integrated into structural design. © Biohabitats, Inc.

10. 17th Street

This green extension connects the Strip District to the river, providing an opportunity for integrated green infrastructure design to present itself in a very public location at the entry to the Green Boulevard corridor. This extension offers the first opportunity to become aware of the living infrastructure framework that underpins this redevelopment effort with a stormwater and ecological amenity in an integrated urban form. Along with opportunities to integrate bioretention, cisterns, wastewater treatment, and green roofs into the redevelopment of this space there is an opportunity for an ecological landscape feature that promotes functional landscapes with multiple benefits and provides open space amenity for users. A stormwater or wastewater treatment wetland and ecopark, with native meadow, riparian buffer plantings and sections of living shoreline treatment, would provide a very exciting amenity that shines light on the innovative approach to urban space design interfacing with natural systems. (Figures 63-67)



Figures 63. A green roof provides visual amenity integrated into building architecture, stormwater management, and multilayer habitat opportunities. © Biohabitats, Inc.



Figures 64 and 65. An urban park redevelopment reusing onsite industrial materials, integrating stormwater management and habitat enhancement plantings as an amenity along the Delaware River in Philadelphia. © Biohabitats, Inc.



Figures 66 and 67. An urban stormwater wetland park on an urban infill site provides an attractive open space amenity and stormwater treatment. © Biohabitats, Inc.

4. BIBLIOGRAPHY

4.1. References

3 Rivers 2nd Nature. ***Aquatic Report: Allegheny River Phase 3 – 2002 Fishes of Small Tributaries.*** Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2002.

3 Rivers 2nd Nature. ***Aquatic Report: Allegheny River Phase 3 – 2002 Water Quality.*** Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2002.

3 Rivers 2nd Nature. ***Ecology and Recovery – Allegheny County.*** Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2006.

3 Rivers 2nd Nature. ***Terrestrial Report: Allegheny River Phase 3 – 2002 Riverbank Geology.*** Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2002.

3 Rivers 2nd Nature. ***Terrestrial Report: Allegheny River Phase 3 – 2002 Vegetation Assessment.*** Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2002.

3 Rivers 2nd Nature. ***Pittsburgh Urban Waterfront : 1872-1926.*** Prepared by STUDIO for Creative Inquiry at Carnegie Mellon University. 2004.

Adams, Michele. **Green Infrastructure, Reconnecting Water, Soils, and Vegetation in the Urban Environment.** . Restoring Panther Hollow presentation. September 15, 2010.
<http://www.pittsburghparks.org/lecturearchive>

Andrews, Lena. ***Pittsburgh's Hillsides: Using GIS to Investigate the Post-Industrial Landscape.*** (with Tim Collins, Priya Lakshmi Krishna, Susan Kalisz, Henry Prellwitz, Kostula Vallianos, and Jessica Dunn) STUDIO for Creative Inquiry at Carnegie Mellon University. Presentation at 2005 ESRI International Conference.

Applied Ecological Sciences. ***Sycamore Island Management Report.*** Prepared for Allegheny Land Trust, Sewickley, PA. No Date.

Bachman, Clover. ***Images and Anxieties in the 19th Century Landscape Painting: Pittsburgh and Allegheny County.*** 3 Rivers 2nd Nature: STUDIO for Creative Inquiry, Carnegie Mellon University, Pittsburgh, PA. 2002.

Coeffe, Lisa. TreeVitalize Pittsburgh. PPC speaker series presentation “Preserving Pittsburgh’s Trees: Action and Recovery” on February 17, 2011.
<http://pittsburghparks.wordpress.com/2011/03/01/presentation-treevitalize-pittsburgh/> Accessed on August 3, 2011.

City of Pittsburgh Department of City Planning, with Pennsylvania Department of Conservation and Natural Resources, Heinz Endowments. **Pittsburgh Regional Parks Natural Areas Study: Natural Areas Program Phase 1 Report Assessment Results and Management Plan Framework.** June 2010. Consultant team led by Biohabitats.

City of Pittsburgh. **Urban Design Guidelines**. 1998. <http://www.city.pittsburgh.pa.us/dt/UDGuide.pdf>
Accessed August 3, 2011.

Collins, Timothy, Jonathan Kline, Kostula Vallianos, and Cyril Fox. **Ecology and Recovery: Allegheny County**. 3 Rivers 2nd Nature: STUDIO for Creative Inquiry, Carnegie Mellon University, Pittsburgh, PA 2006.

Collins, Timothy, Priya Lakshmi Krishna, Susan Kalisz, Henry Prellwitz, Kostoula Vallianos, with Lena Andrews and Jessica Dunn. **An Ecological and Physical Investigation of Pittsburgh's Hillsides** – Prepared in cooperation with Allegheny Land Trust and City of Pittsburgh Hillsides Committee. 3 Rivers 2nd Nature: STUDIO for Creative Inquiry, Carnegie Mellon University, Pittsburgh, PA 2004.

Gruszka, Phil. **Urban Parks Woodlands**. PPC speaker series presentation “Preserving Pittsburgh’s Trees: Action and Recovery” on February 17, 2011.
<http://pittsburghparks.wordpress.com/2011/02/22/presentation-urban-parks-woodlands/> accessed on August 3, 2011.

Heth's Run Ecological and Recreational Restoration Project, (Butler Street and Heth's Run Bridge)
http://www.senatorferlo.com/images/pdf/heths_run.pdf. Accessed September 9, 2010.

Hoskin, Robert, Michael Koryak and Linda Stafford. **3R2N Aquatic Report: Allegheny River: Phase 3 – 2002 - Fishes of Small Tributaries**. 3 Rivers 2nd Nature: STUDIO for Creative Inquiry, Carnegie Mellon University, Pittsburgh, PA 2003.

Jahn, David . **Responding to Threats in Pittsburgh's Urban Forest**. PPC speaker series presentation “Preserving Pittsburgh’s Trees: Action and Recovery” on February 17, 2011.
<http://pittsburghparks.wordpress.com/2011/02/28/presentation-responding-to-threats-in-pittsburghs-urban-forest/> . Accessed on August 3, 2011.

Kalisz, Susan, and Jessica Dunn. **3R2N Terrestrial Report: Allegheny River: Phase 3 – 2002 - Vegetative Assessment**. 3 Rivers 2nd Nature: STUDIO for Creative Inquiry, Carnegie Mellon University, Pittsburgh, PA 2002.

Knauer, Kathy, and Timothy Collins. **3R2N Aquatic Report: Allegheny River: Phase 3 – 2002 – Water Quality**. 3 Rivers 2nd Nature: STUDIO for Creative Inquiry, Carnegie Mellon University, Pittsburgh, PA. 2002.

Krishna, Priya, Tim Collins and Reiko Goto. **Pittsburgh Urban Waterfront: 1872 – 1926. History Report: Phase 5 – 2004**. 3 Rivers 2nd Nature: STUDIO for Creative Inquiry, Carnegie Mellon University, Pittsburgh, PA. 2004.

Kyshakevych, Roman, and Henry Prellwitz. **3R2N Terrestrial Report: Allegheny River: Phase 3 – 2002 – Riverbank Geology**. 3 Rivers 2nd Nature: STUDIO for Creative Inquiry, Carnegie Mellon University, Pittsburgh, PA. 2002.

Lyle, John Tillman. 1999. Design for Human Ecosystems: Landscape, Land Use, and Natural Resources. Island Press, Washington, DC.

Moxley, Shera. ***From Rivers to Lakes: Engineering Pittsburgh's Three Rivers***. 3 Rivers 2nd Nature: STUDIO for Creative Inquiry, Carnegie Mellon University, Pittsburgh, PA. 2001.

Paytas, Jerry, Robert Gradeck and Lena Andrews. ***Universities and Development of Industry Clusters***. Carnegie Mellon University Center for Economic Development. With the assistance of Alexis Haakensen, Anjani Datla, Timothy Collins, and David Anderson. Prepared for the Economic Development Administration, US Department of Commerce. 2004.

Pennsylvania Environmental Council. **Three Rivers Conservation Plan**. 2004 March.
<http://www.dcnr.state.pa.us/brc/rivers/riversconservation/registry/62execsum.pdf>. Accessed August 3, 2011

Pennsylvania Fish and Boat Commission. **Three Rivers Management Plan – A Strategy for Managing Fisheries Resources of the Allegheny, Monongahela and Ohio Rivers**. 2011.
http://fishandboat.com/water/rivers/threerivers/three_rivers_plan_draft.pdf. Accessed Sept. 8, 2011.

Riverlife Task Force. **A Vision Plan for Pittsburgh's Riverfronts**. Consultant team led by Chan Krieger & Associates. October 2001. <http://www.riverlifepgh.org/news/guidelines/>. Accessed on August 3, 2011.

Riverlife Task Force. **Three Rivers Park Design Handbook**. October 31, 2002.

Riverlife Task Force. **Three Rivers Park – Defining Strategies for Implementation**. Prepared by Burt Hill Kosar Rittelman Associates. Pittsburgh 2003.
[http://www.riverlifepgh.org//images/uploads/Three Rivers Park Connecting the Loop Defining Strategies for Implementation.pdf](http://www.riverlifepgh.org//images/uploads/Three_Rivers_Park_Connecting_the_Loop_Defining_Strategies_for_Implementation.pdf) Accessed August 3, 2011.

Riverlife Task Force. **Three Rivers Park Landscape Management Guidelines**. Prepared by Andropogon Associates Ltd. With CEC. December 2006.

Riverlife Task Force. **Rivers In Synergy : A waterfront vision for Pittsburgh's Ohio Basin**. Prepared by Atelier Dreiseitl. June 2009.
[http://www.riverlifepgh.org//images/uploads/Atelier Dreiseitl for Riverlife Stormwater Communicator.pdf](http://www.riverlifepgh.org//images/uploads/Atelier_Dreiseitl_for_Riverlife_Stormwater_Communicator.pdf) . Accessed August 3, 2011.

TreeVitalize Pittsburgh, Western Pennsylvania Conservancy.
<http://www.paconserve.org/216/treevitalize> ;
http://www.paconserve.org/assets/TreeVitalize_covinc.pdf

Urban Redevelopment Authority, City of Pittsburgh Department of Planning, and Riverlife. **Allegheny Riverfront Vision Plan**. 2010. Prepared by Perkins Eastman.

Wells, Godrun. **Invasive Plants of Pittsburgh: Building Sustainable Urban Ecosystems Through Citizen Stewardship**. A joint project of the Pittsburgh Parks Conservancy, Nine Mile Run Watershed Association, Frick Environmental Center and the City of Pittsburgh. June 2008.
<http://www.pittsburghparks.org/invasiveplants>, Accessed on August 3, 2011.

4.2. Maps/Graphics

Darlington Digital Library : <http://digital.library.pitt.edu/d/darlington/maps.html>

Map of cities of Pittsburgh, Allegheny and adjoining boroughs. DARMAP0085. 1872. G.M. Hopkins & Co. Philadelphia.

Cities of Pittsburgh and Allegheny with parts of adjacent boroughs . DARMAP0089. 1855. J.H. Holton & Co. New York.

Map of County of Allegheny, PA . DARMAP0090. 1850. E.H. Hastings. Deputy Surveyor General. Lith of William Schuchman Pittsburgh, PA.

Plan of Pittsburgh and adjacent county: DARMAP0197. 1815 – relief shown by hatch, by William Darby

Plan of Pittsburgh and adjacent county: DARMAP0198. 1815 – relief shown by hatch, by William Darby – *hand drawn copy of original map.*

Fort Pitt in 1795. DARMAP0202. 1865. A.G. Haumann. Shows vegetation along Allegheny between Marbury Street and St. Clair Street.

Map of Pittsburgh and its environs. DARMAP0577. 1835. Relief shown by hatch, by Lewis Keyon. Streets, property owners, insert of Lawrenceville.

Inland waterways of the Pittsburgh District: DARMAP0800. 1928. By Pittsburgh Coal Company. Locations of industries.

Historic Pittsburgh Collection: <http://images.library.pitt.edu/pittsburgh/>

Plate no. 1 – Pittsburgh and Mt Washington. 14warp01. with surveys of City shown by trees .. scale varies – note on map itself indicates this survey was completed “27th day of March 1769, for the honorable Thomas Penn and Richard Penn Esq., true and absolute properties of the province of Pennsylvania, in pursuance of a warrant bearing date of the 5th day of January 1769.” (1914 by Pennsylvania Department of Internal Affairs, Harrisburg PA. warranty atlas of Allegheny County)

Plate no. 9 – City of Pittsburgh. 14warp09. 1914. By Pennsylvania of Internal Affairs, Harrisburg, PA. warranty atlas of Allegheny County – real property.

Plate no 72, Part of Pittsburgh. 76v01p72. By G. M. Hopkins & Co. Philadelphia: G. M. Hopkins & Co. Real estate plat-book of the City of Pittsburgh : from official records, private plans and actual surveys.

Plate no. 51 – Riverbeds and Islands. 14warp51. 1914. By Pennsylvania of Internal Affairs, Harrisburg, PA. warranty atlas of Allegheny County – real property.

Historic Pittsburgh – flood commission mapping 1912: <http://images.library.pitt.edu/f/flood/>

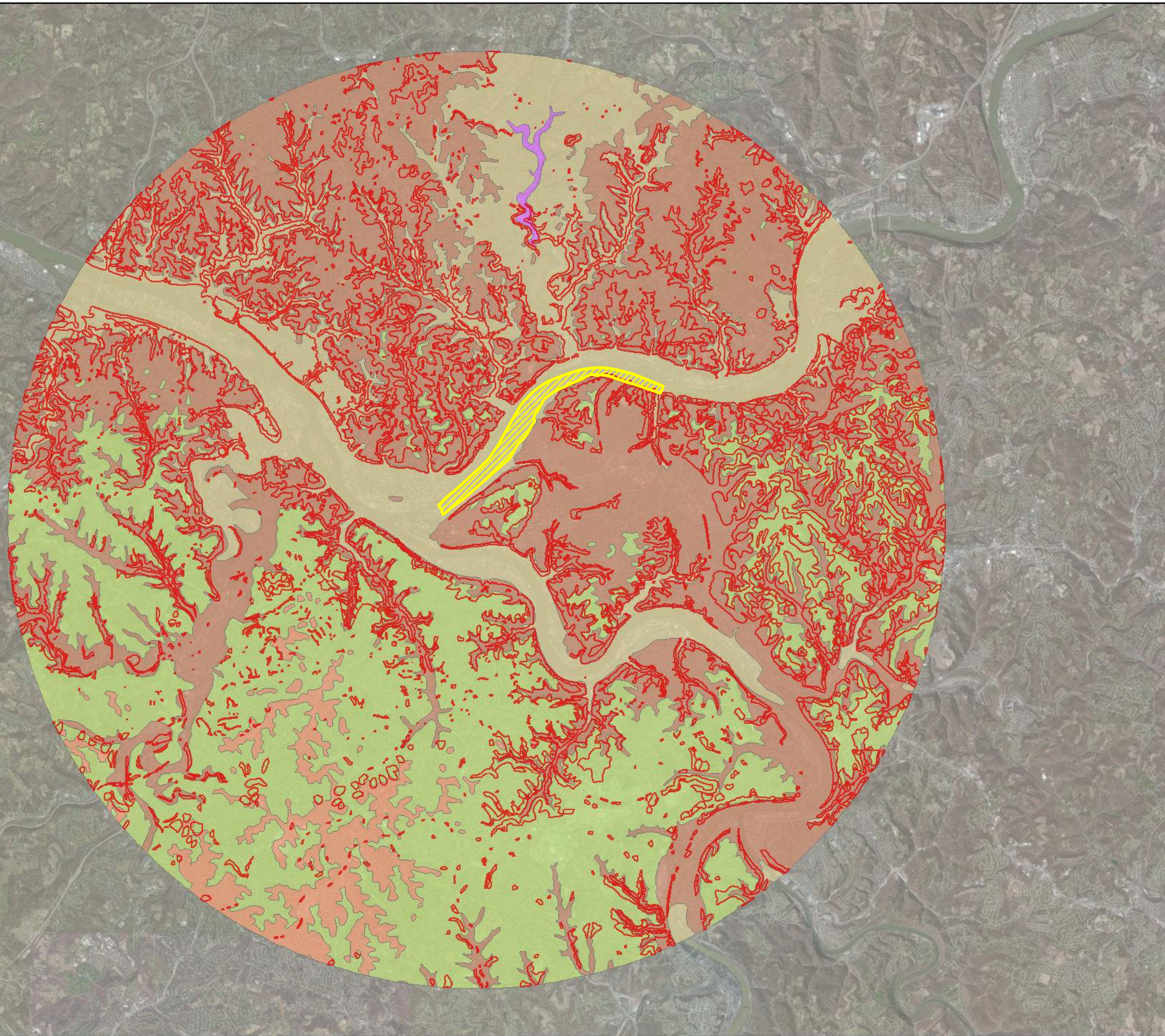
Pittsburgh geodetic and topographic survey maps - 1923-1961:
<http://images.library.pitt.edu/g/geotopo/>

Appendix A – GIS Maps








Regional Geology

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania



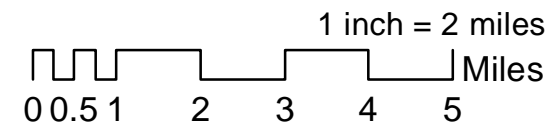
Legend

-  Extent of Study Area
-  Landslide Prone Areas
-  Allegheny Formation
-  Casselman Formation
-  Glenshaw Formation
-  Monongahela Group
-  Waynesburg Formation

Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



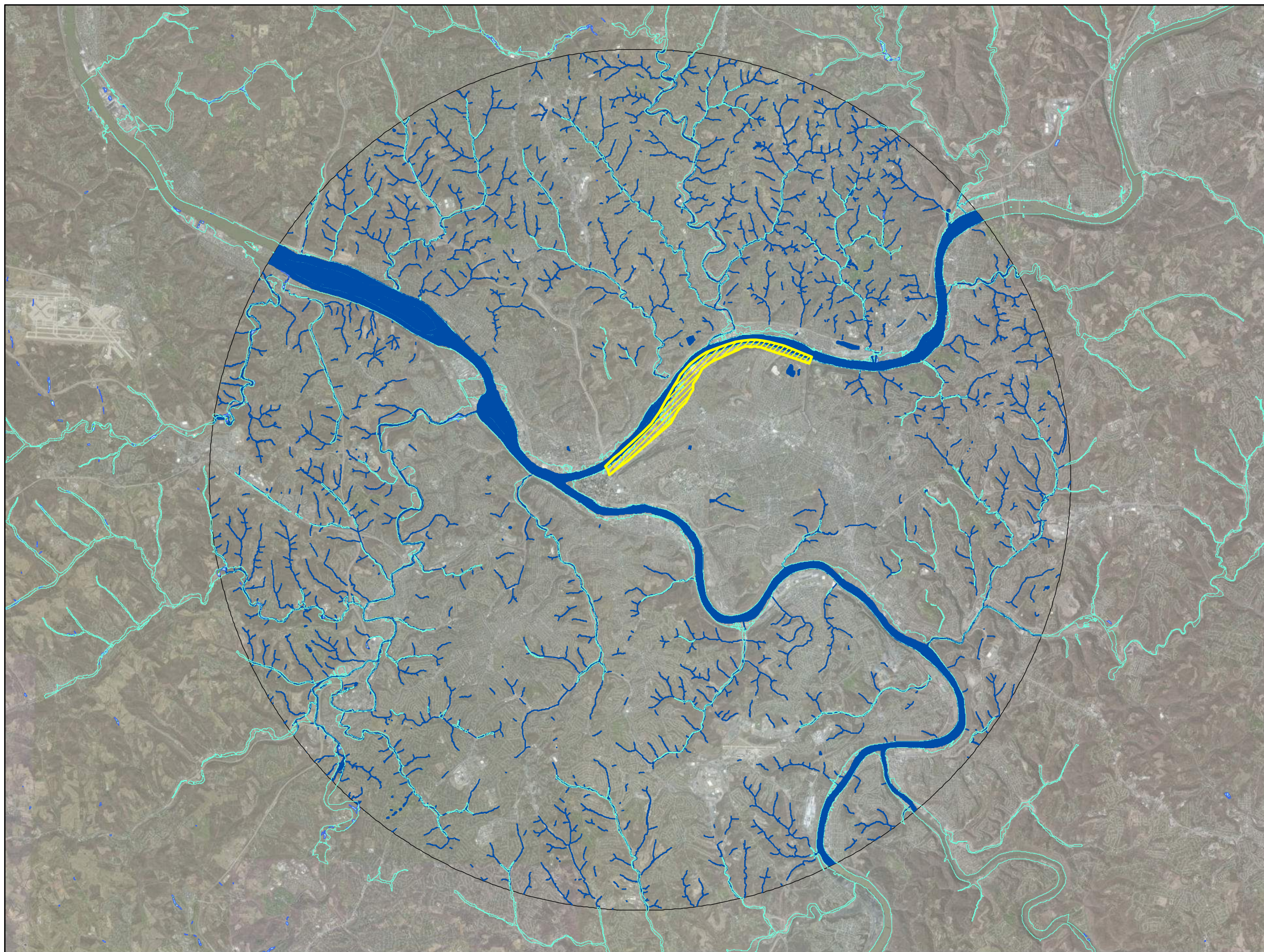
Date: 1/21/2013



Regional Hydrology

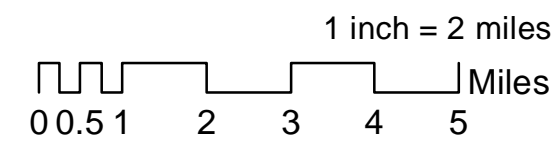
Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania



Legend

-  Extent of Study Area
-  100 Year Floodplain (FEMA)
-  NWI Wetlands
-  Surface Waters (Rivers, Streams, Lakes)



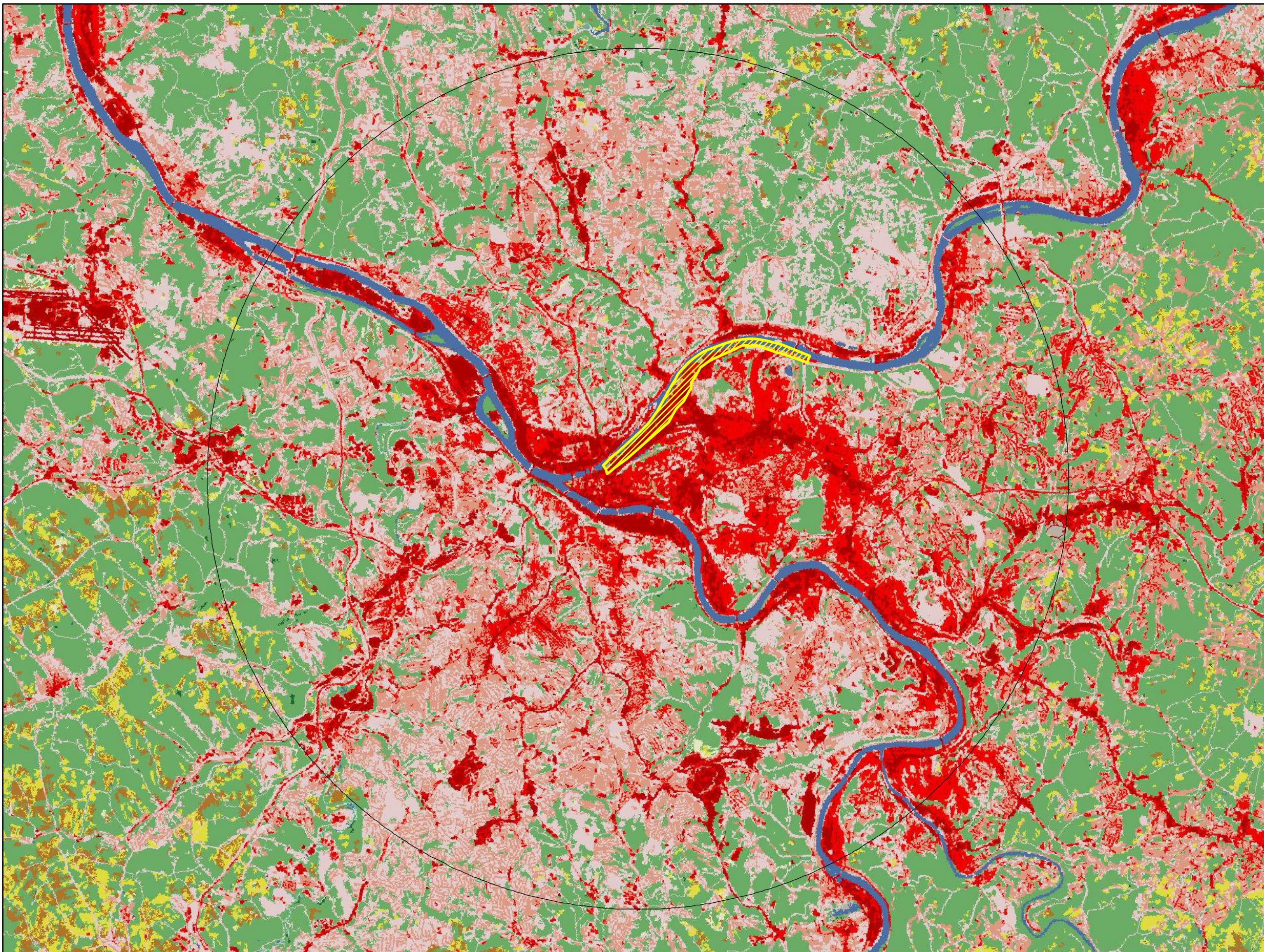
Regional Land Cover

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania

Legend

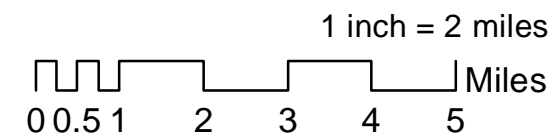
-  Extent of Study Area
-  Open water
-  Developed, Open Space
-  Developed, Low Intensity
-  Developed, Medium Intensity
-  Developed, High Intensity
-  Barren Land
-  Deciduous Forest
-  Evergreen Forest
-  Mixed Forest
-  Shrub/Scrub
-  Herbaceous
-  Pasture
-  Cultivated Crop
-  Woody Wetlands
-  Emergent Herbaceous Wetlands



Map and data made available by the
 Pennsylvania Spatial Data Clearinghouse (PASDA).
 Visit the PASDA Website for more information.
<http://www.pasda.psu.edu>



Date: 1/21/2013




Regional Morphology

Allegheny Riverfront Green Boulevard


Pittsburgh, Pennsylvania




Legend

 Extent of Study Area

Elevation (Feet)

 High : 1359

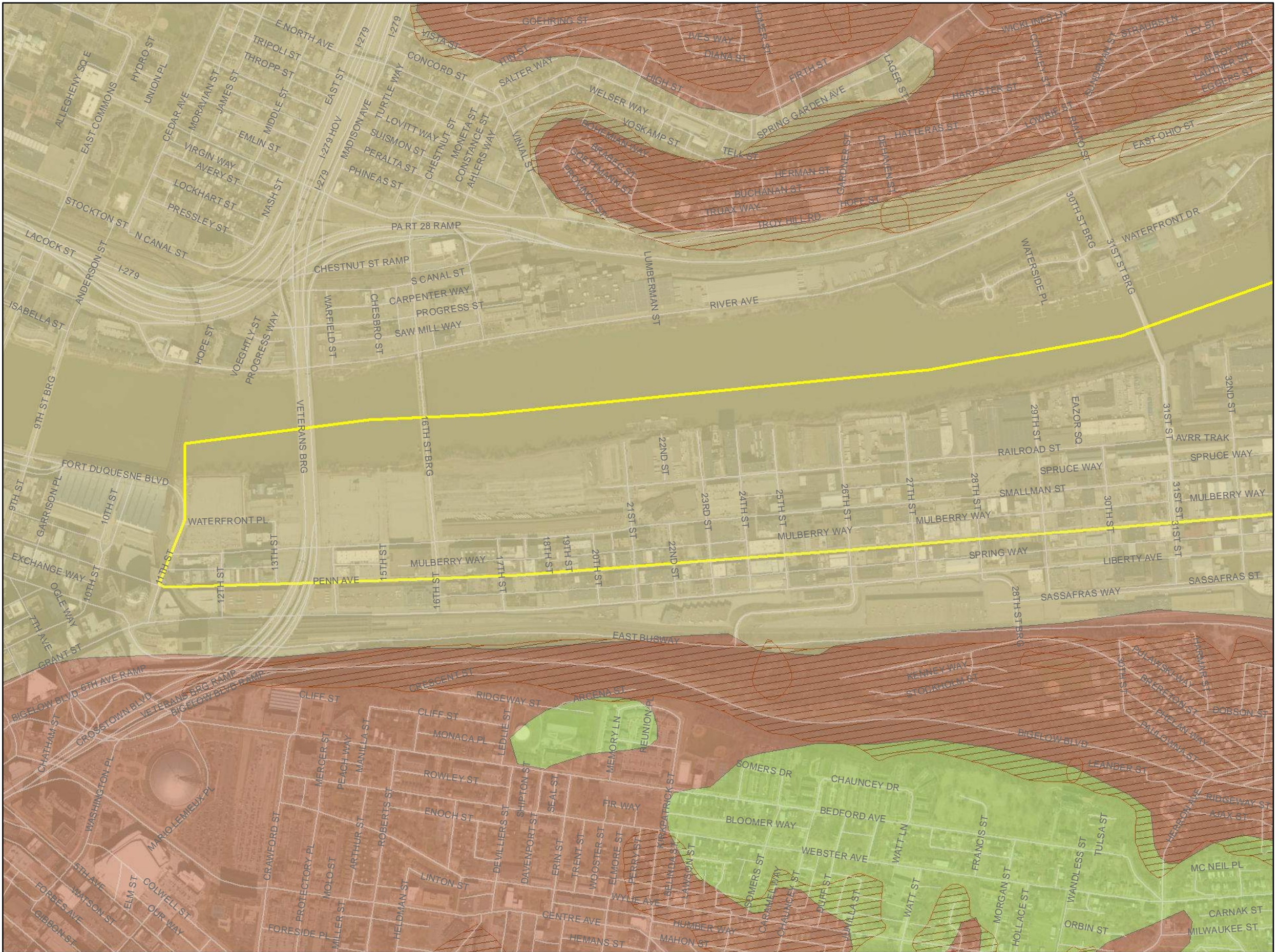
 Low : 696










Site Geology

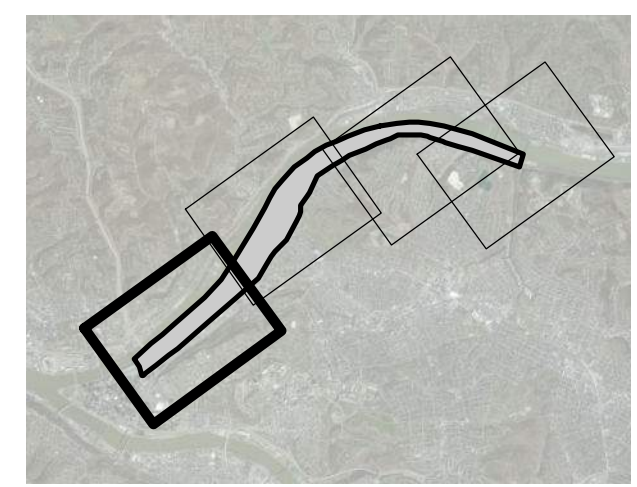
Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania



Legend

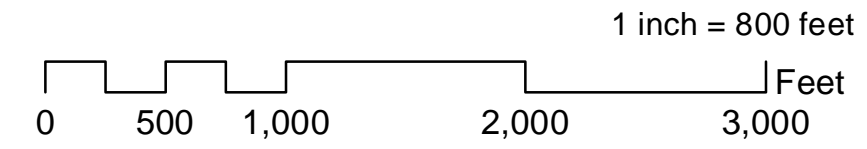
-  Extent of Study Area
-  Landslide Prone Areas
-  Allegheny Formation
-  Casselman Formation
-  Glenshaw Formation
-  Monongahela Group
-  Waynesburg Formation



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



Date: 1/22/2013










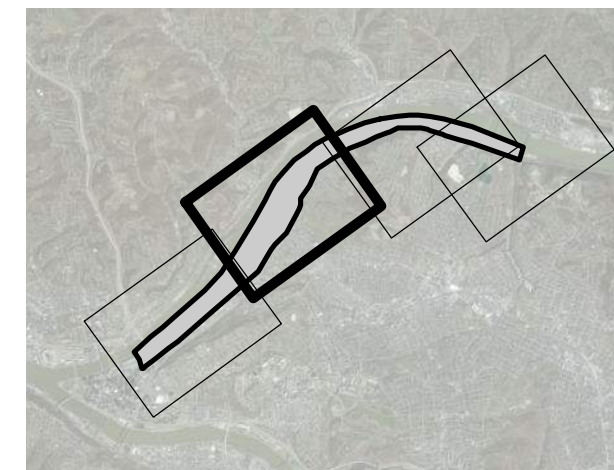
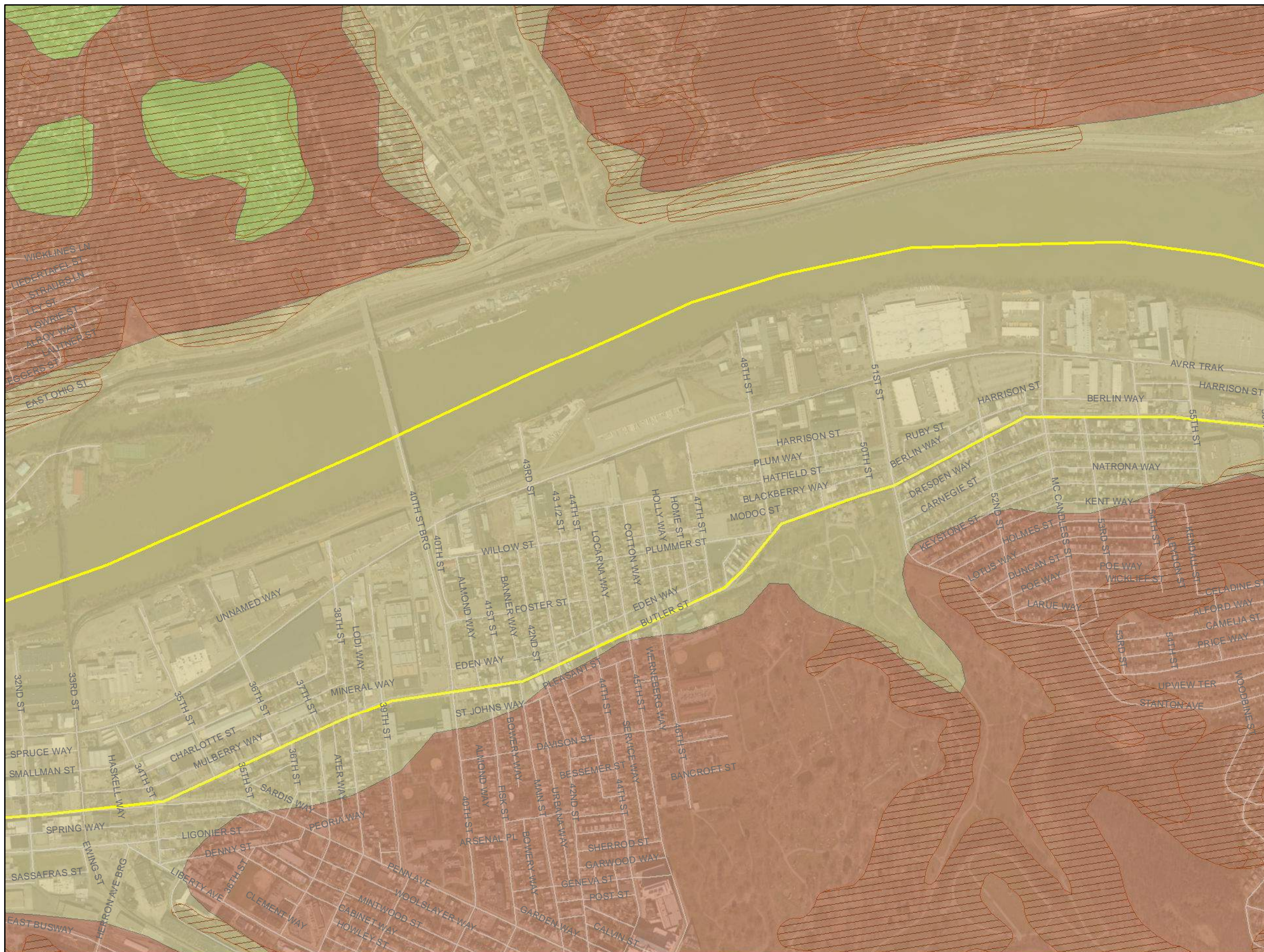
Site Geology

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania

Legend

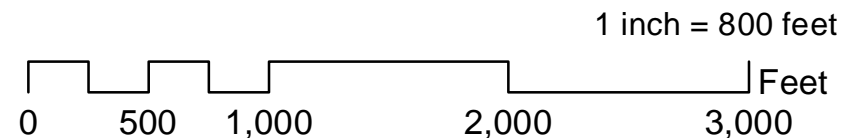
-  Extent of Study Area
-  Landslide Prone Areas
-  Allegheny Formation
-  Casselman Formation
-  Glenshaw Formation
-  Monongahela Group
-  Waynesburg Formation



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>

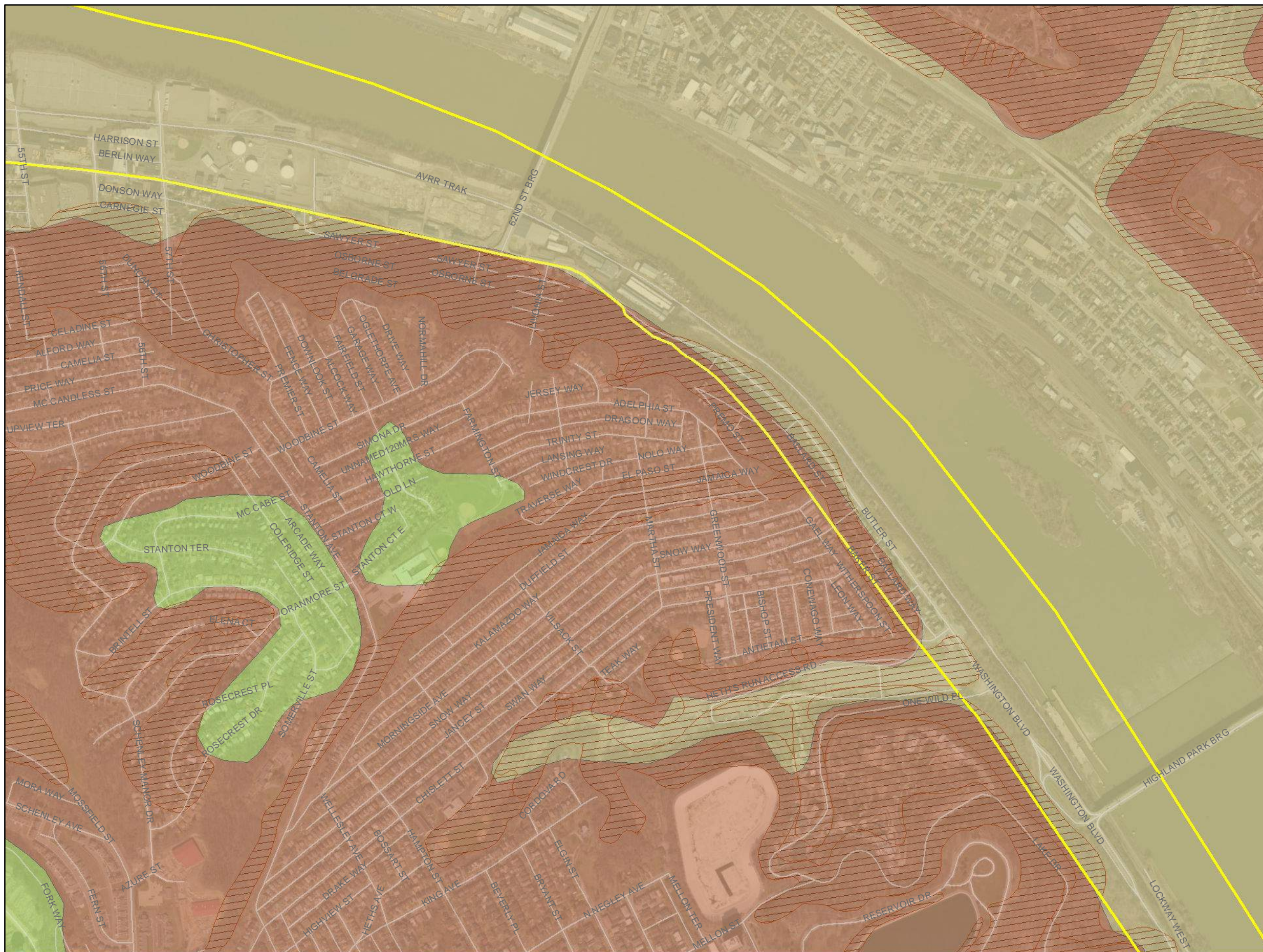


Date: 1/22/2013

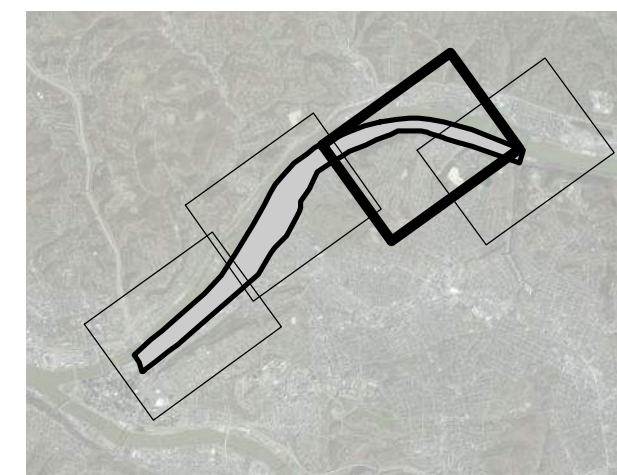


Site Geology

Allegheny Riverfront Green Boulevard Pittsburgh, Pennsylvania



- Legend**
- Extent of Study Area
 - Landslide Prone Areas
 - Allegheny Formation
 - Casselman Formation
 - Glenshaw Formation
 - Monongahela Group
 - Waynesburg Formation



Map and data made available by the
 Pennsylvania Spatial Data Clearinghouse (PASDA).
 Visit the PASDA Website for more information.
<http://www.pasda.psu.edu>



Date: 1/22/2013










1 inch = 800 feet

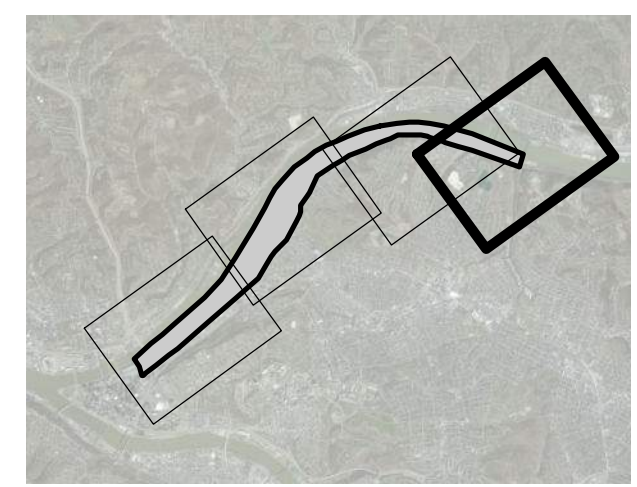
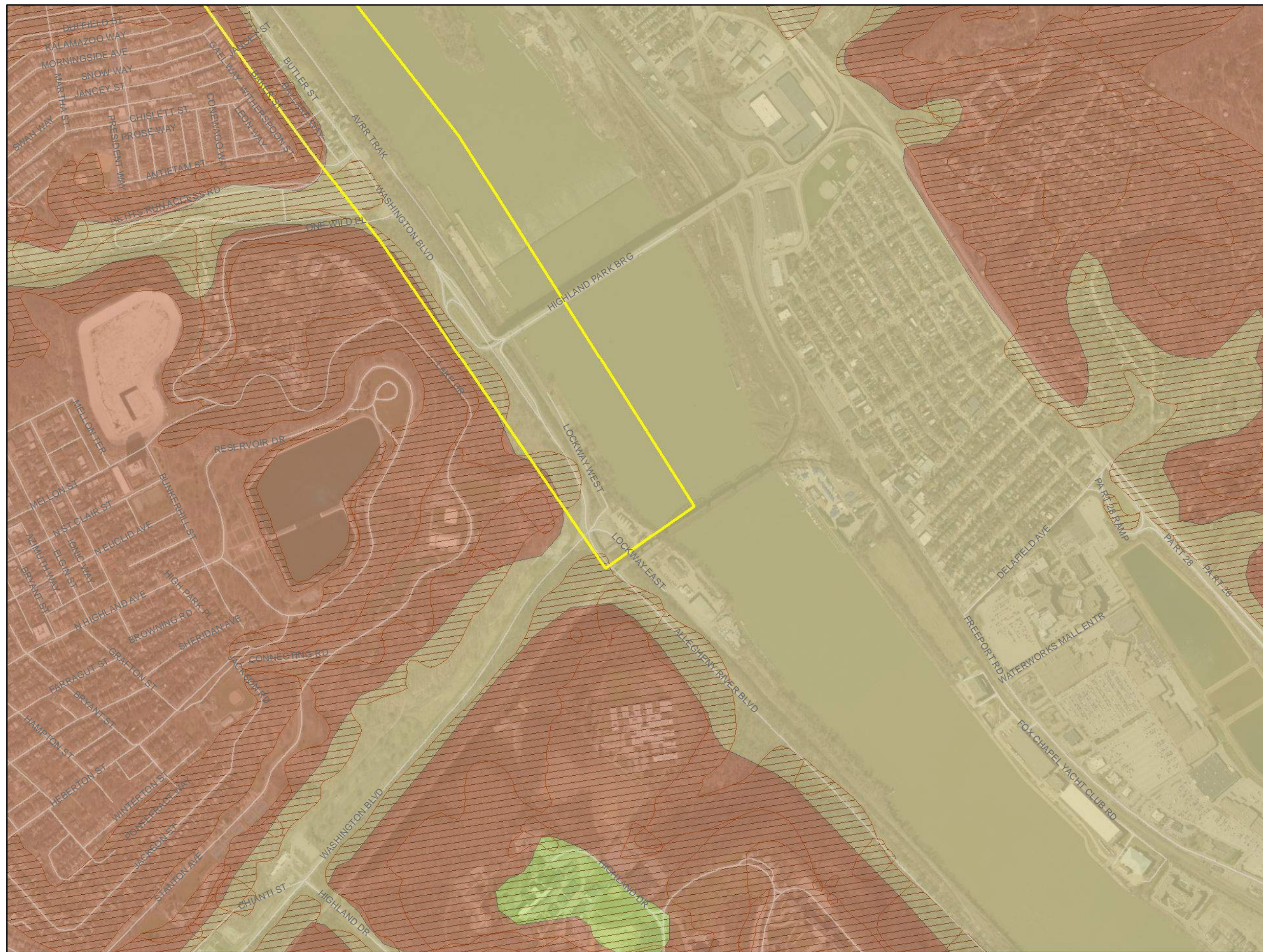
Site Geology

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania

Legend

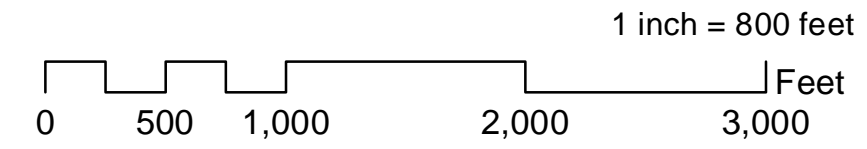
-  Extent of Study Area
-  Landslide Prone Areas
-  Allegheny Formation
-  Casselman Formation
-  Glenshaw Formation
-  Monongahela Group
-  Waynesburg Formation



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



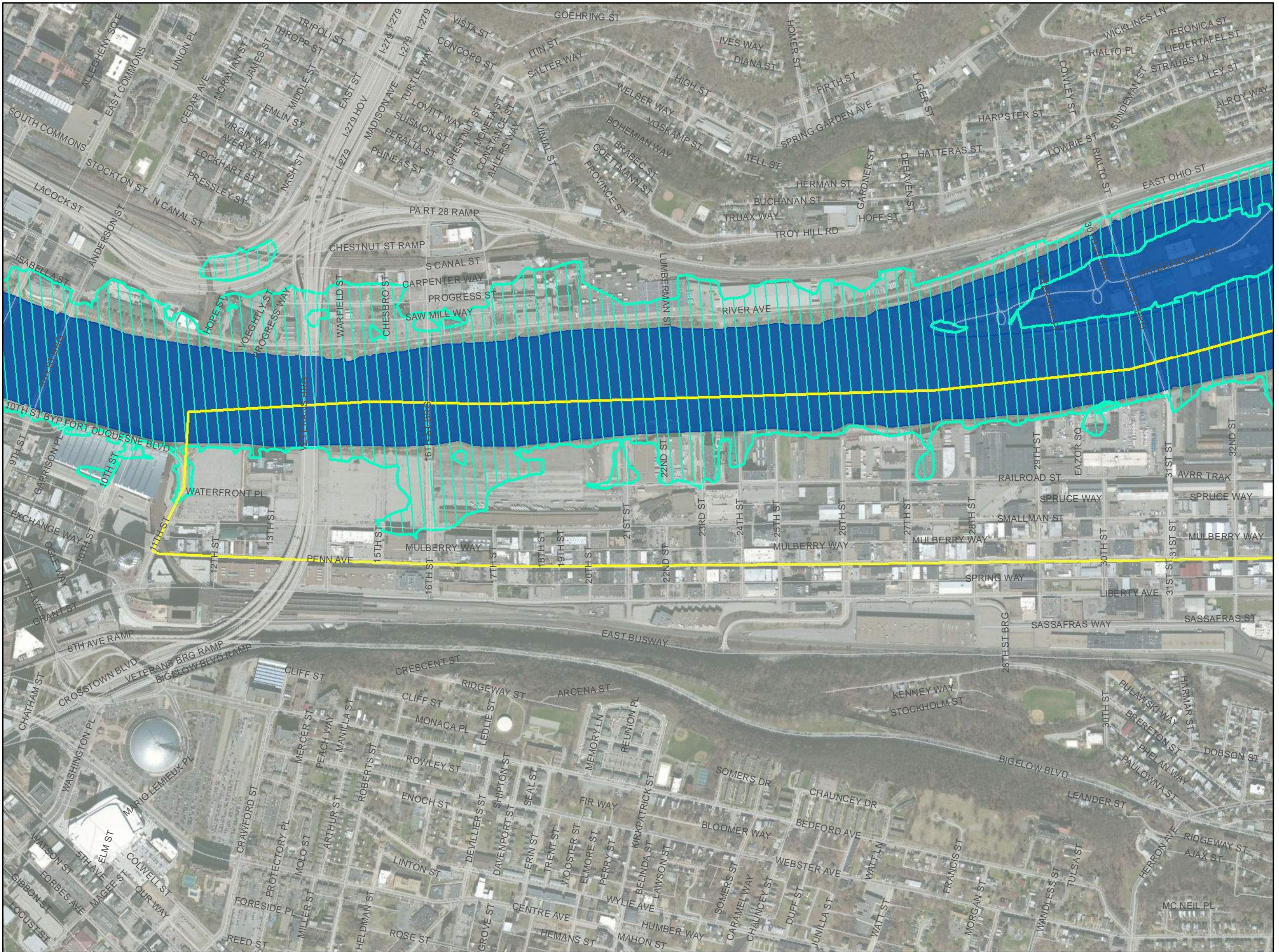
Date: 1/22/2013






Site Hydrology

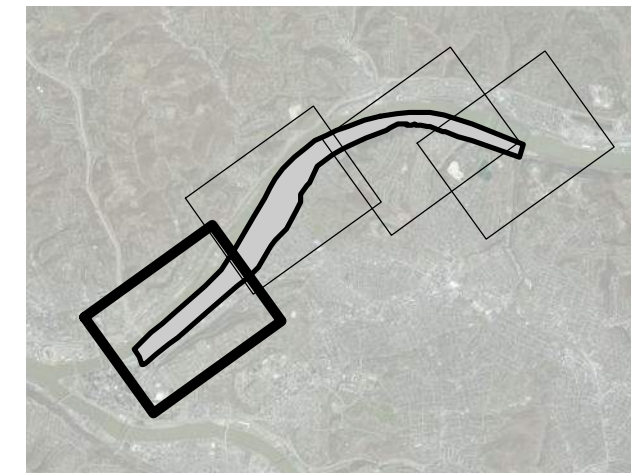
Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania



Legend

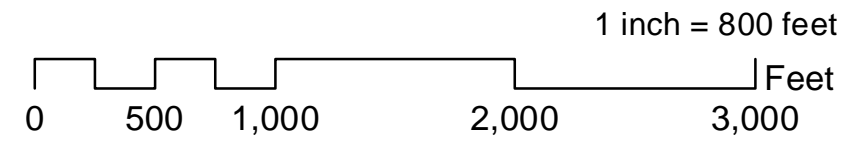
-  Extent of Study Area
-  100 Year Floodplain (FEMA)
-  Surface Waters



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



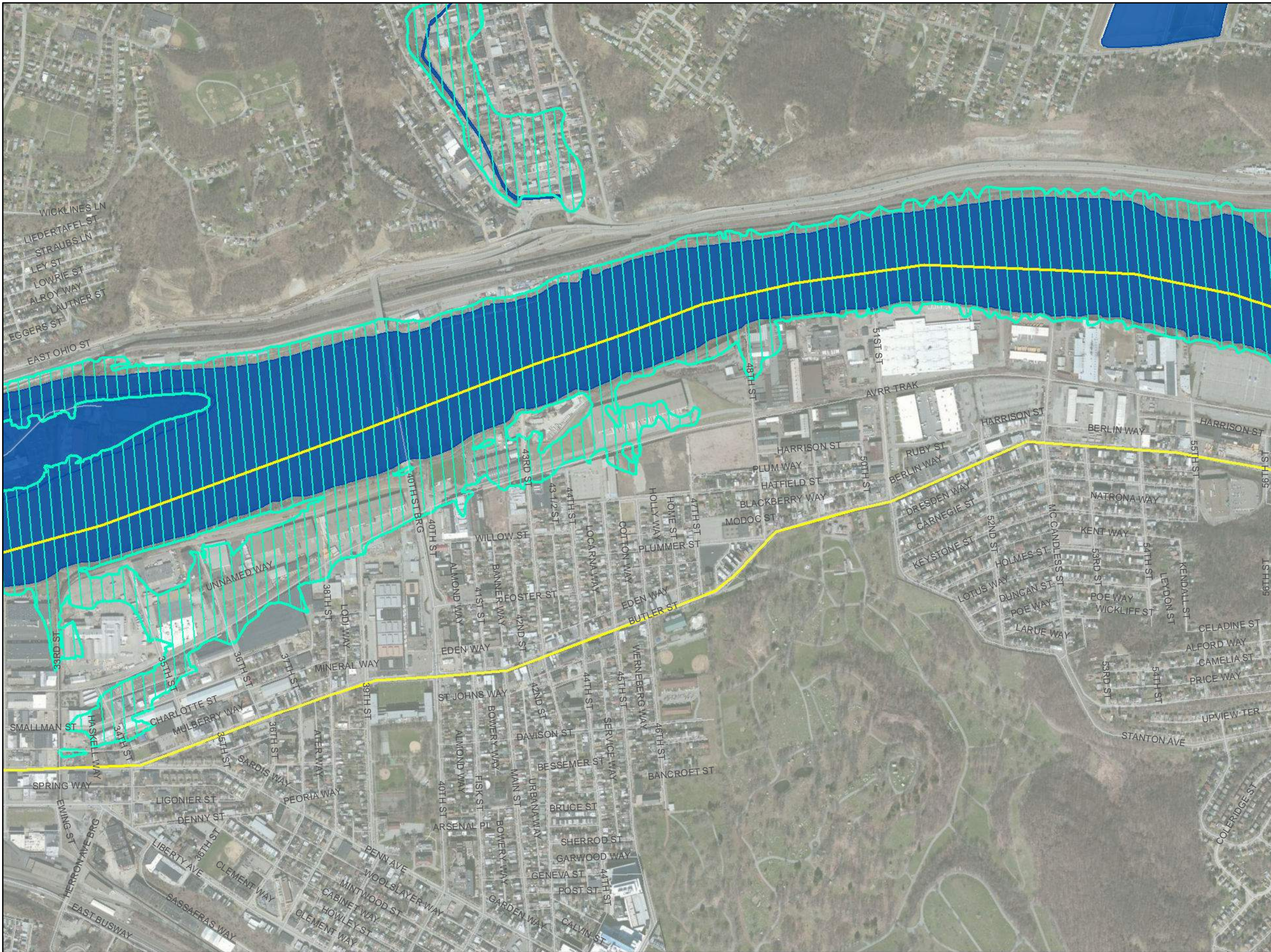
Date: 1/24/2013






Site Hydrology

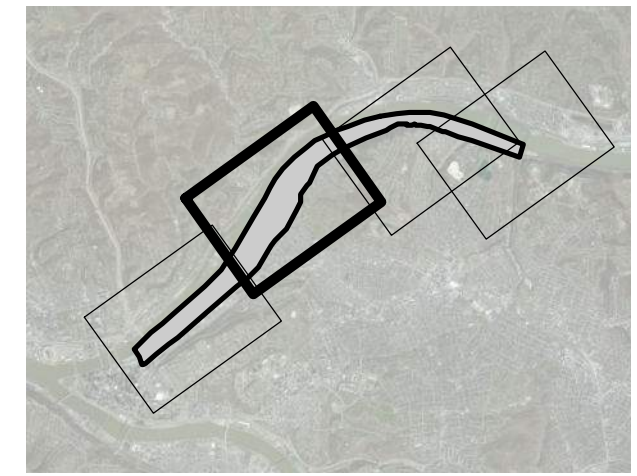
Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania



Legend

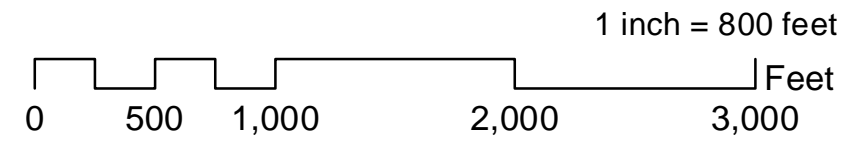
-  Extent of Study Area
-  100 Year Floodplain (FEMA)
-  Surface Waters



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



Date: 1/24/2013






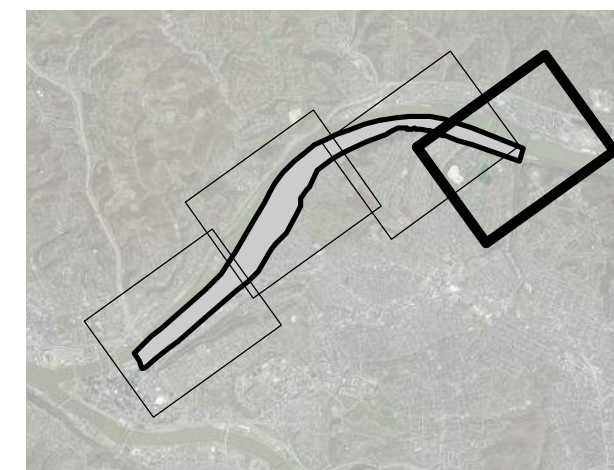
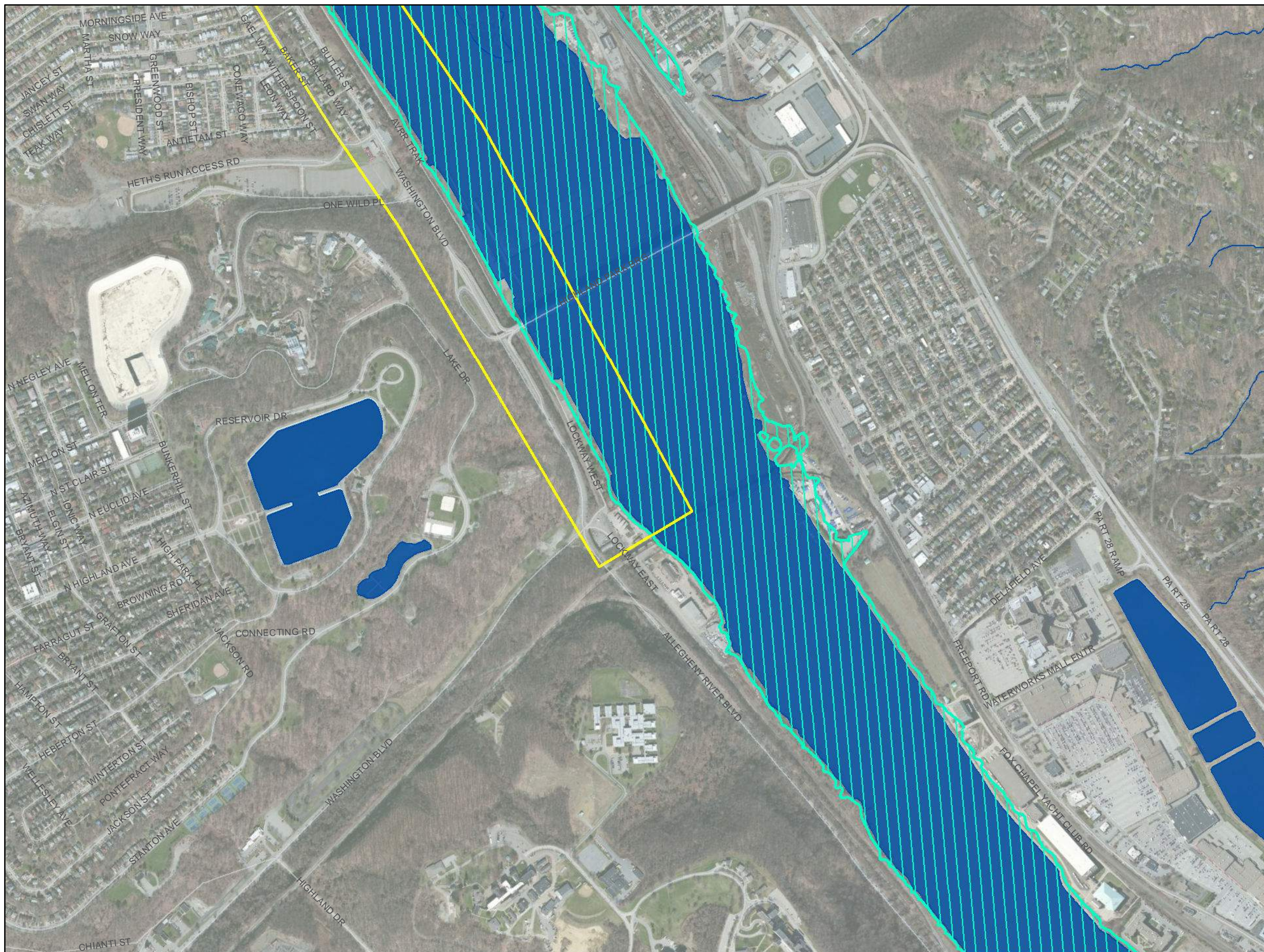
Site Hydrology

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania

Legend

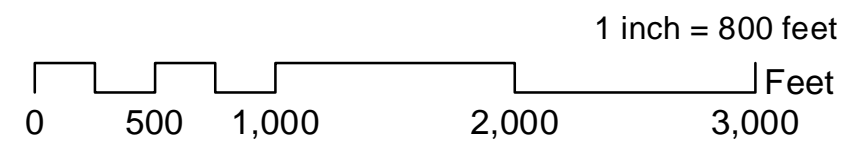
-  Extent of Study Area
-  100 Year Floodplain (FEMA)
-  Surface Waters



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>















Date: 1/24/2013

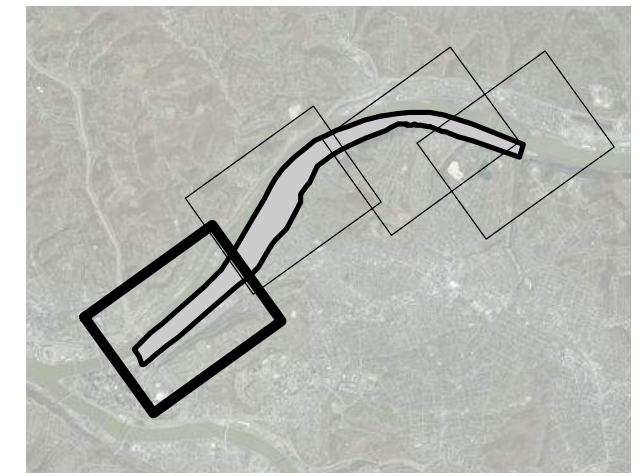
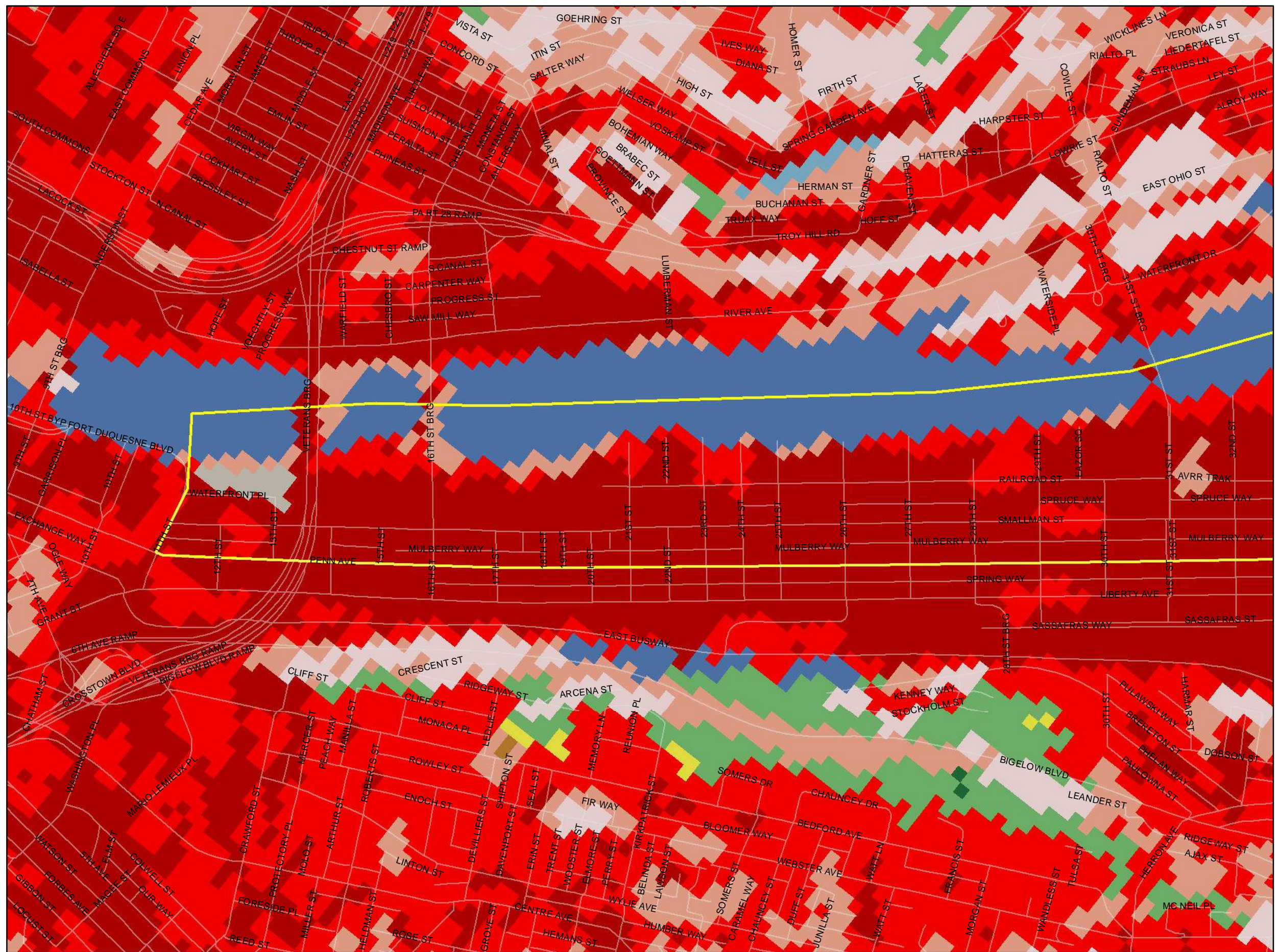


Site Land Cover

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania

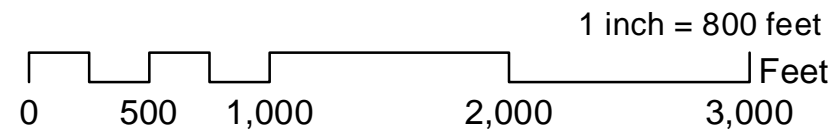
- Legend**
-  Extent of Study Area
 -  Open water
 -  Developed, Open Space
 -  Developed, Low Intensity
 -  Developed, Medium Intensity
 -  Developed, High Intensity
 -  Barren Land
 -  Deciduous Forest
 -  Evergreen Forest
 -  Mixed Forest
 -  Shrub/Scrub
 -  Herbaceous
 -  Pasture
 -  Cultivated Crop
 -  Woody Wetlands
 -  Emergent Herbaceous Wetlands



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



Date: 1/22/2013



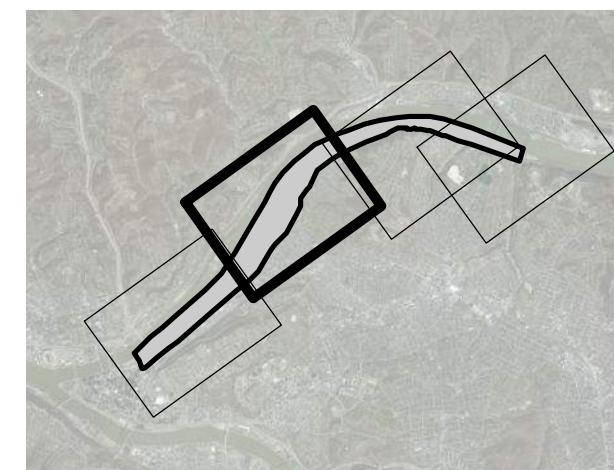
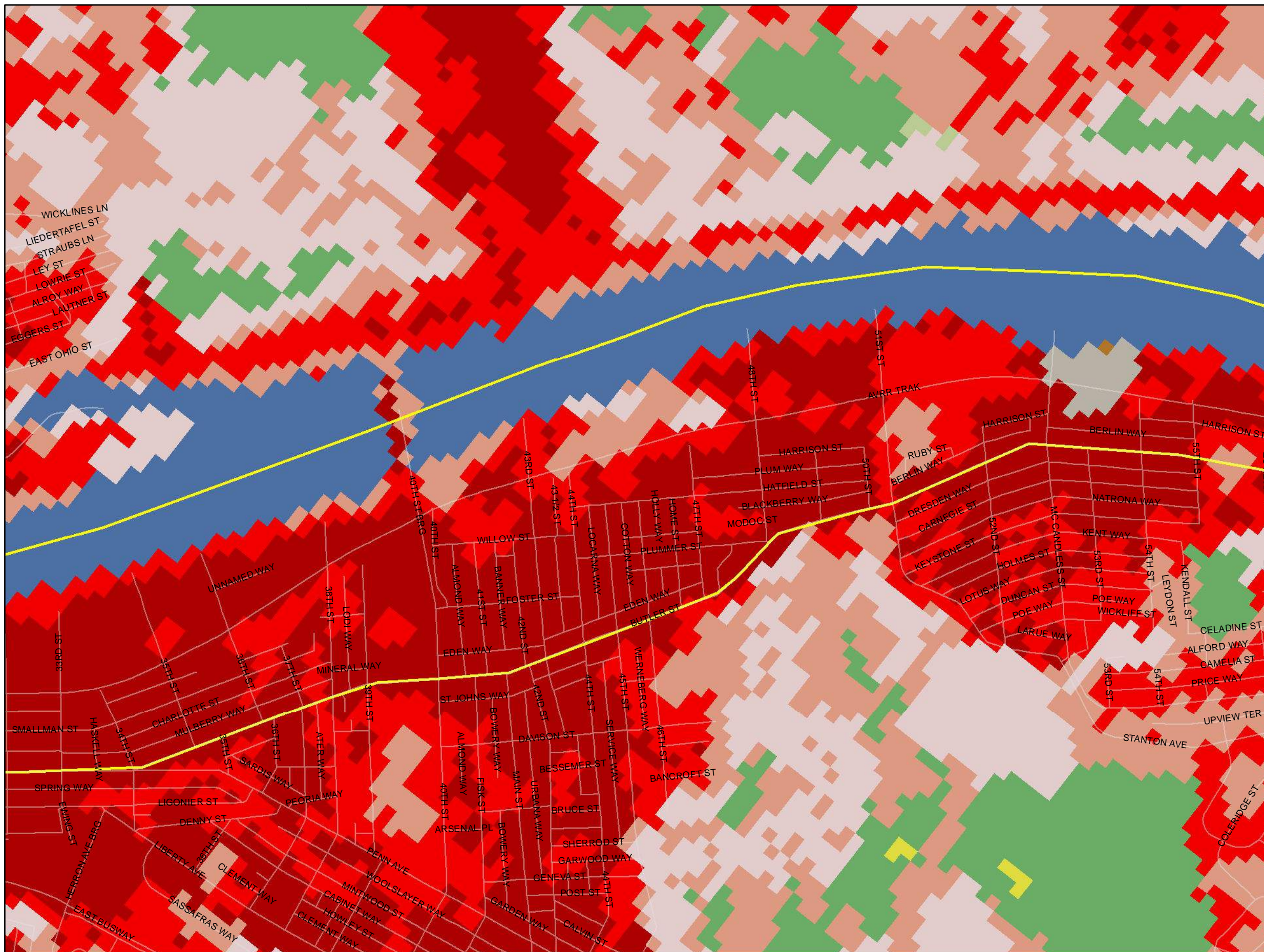
Site Land Cover

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania

Legend

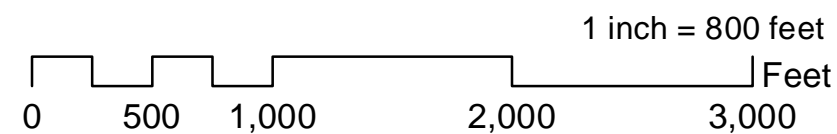
-  Extent of Study Area
-  Open water
-  Developed, Open Space
-  Developed, Low Intensity
-  Developed, Medium Intensity
-  Developed, High Intensity
-  Barren Land
-  Deciduous Forest
-  Evergreen Forest
-  Mixed Forest
-  Shrub/Scrub
-  Herbaceous
-  Pasture
-  Cultivated Crop
-  Woody Wetlands
-  Emergent Herbaceous Wetlands



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



Date: 1/22/2013



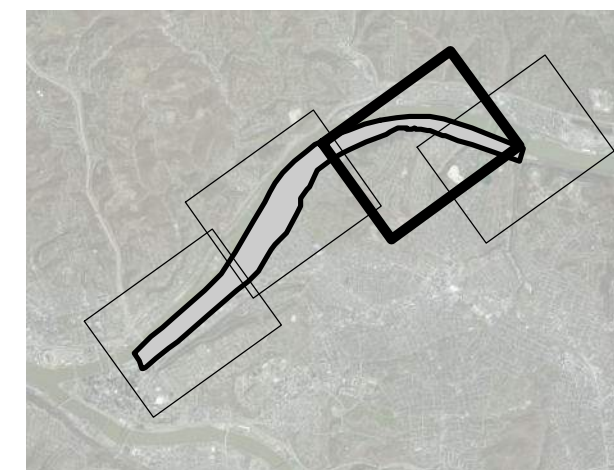
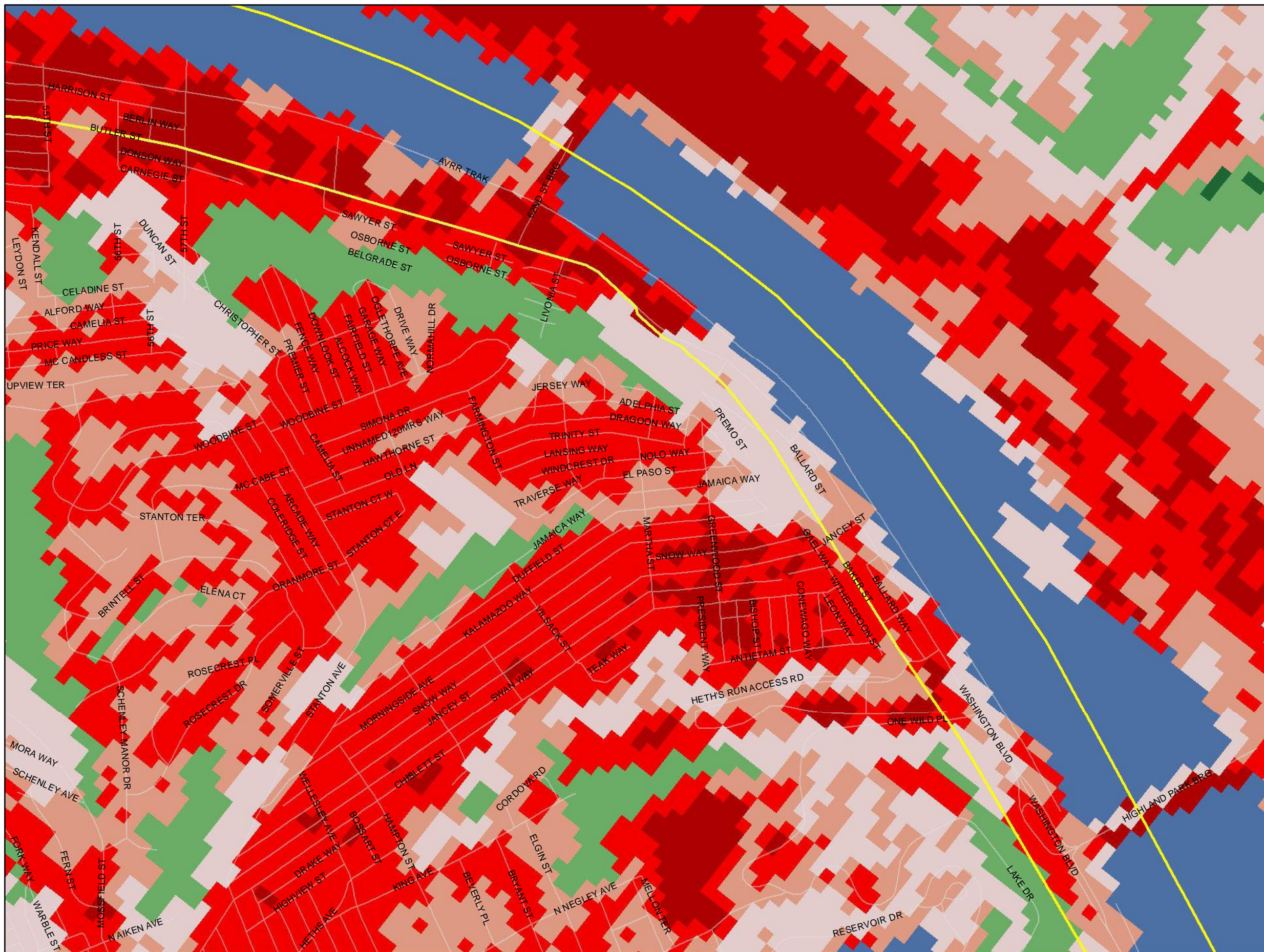
Site Land Cover

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania

Legend

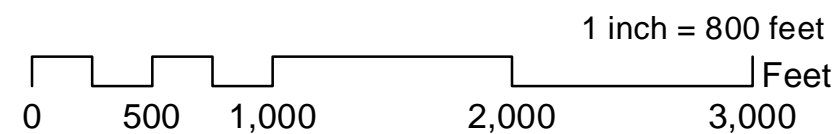
-  Extent of Study Area
-  Open water
-  Developed, Open Space
-  Developed, Low Intensity
-  Developed, Medium Intensity
-  Developed, High Intensity
-  Barren Land
-  Deciduous Forest
-  Evergreen Forest
-  Mixed Forest
-  Shrub/Scrub
-  Herbaceous
-  Pasture
-  Cultivated Crop
-  Woody Wetlands
-  Emergent Herbaceous Wetlands



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



Date: 1/22/2013



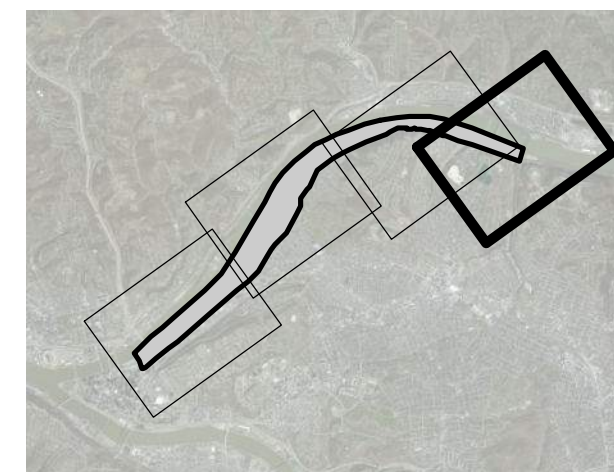
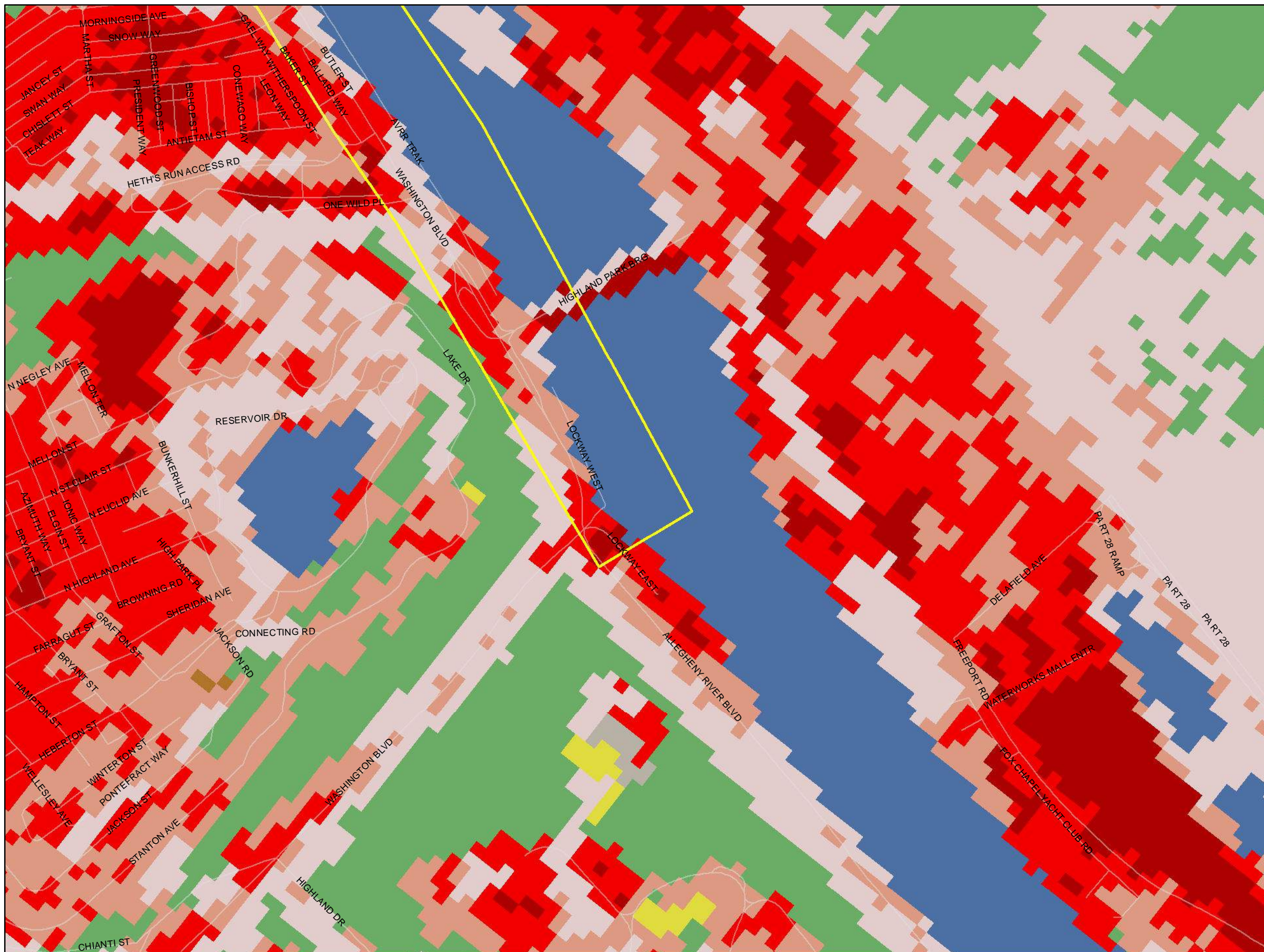
Site Land Cover

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania

Legend

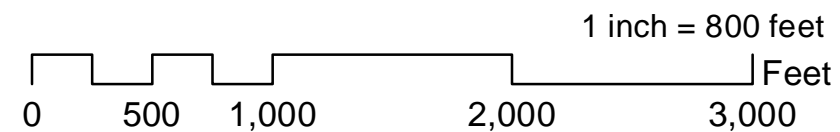
-  Extent of Study Area
-  Open water
-  Developed, Open Space
-  Developed, Low Intensity
-  Developed, Medium Intensity
-  Developed, High Intensity
-  Barren Land
-  Deciduous Forest
-  Evergreen Forest
-  Mixed Forest
-  Shrub/Scrub
-  Herbaceous
-  Pasture
-  Cultivated Crop
-  Woody Wetlands
-  Emergent Herbaceous Wetlands



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



Date: 1/22/2013













Site Morphology

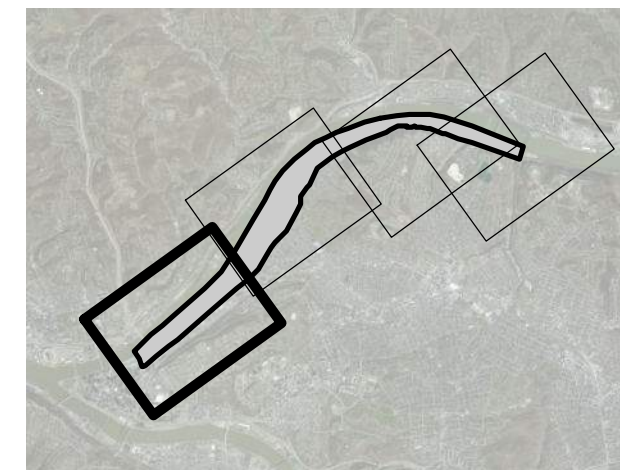
Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania



Legend

-  Extent of Study Area
- Elevation (Feet)**
-  678 - 753
-  753 - 829
-  829 - 905
-  905 - 980
-  980 - 1,056
-  1,056 - 1,132
-  1,132 - 1,208
-  1,208 - 1,283
-  1,283 - 1,359



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



Date: 1/22/2013

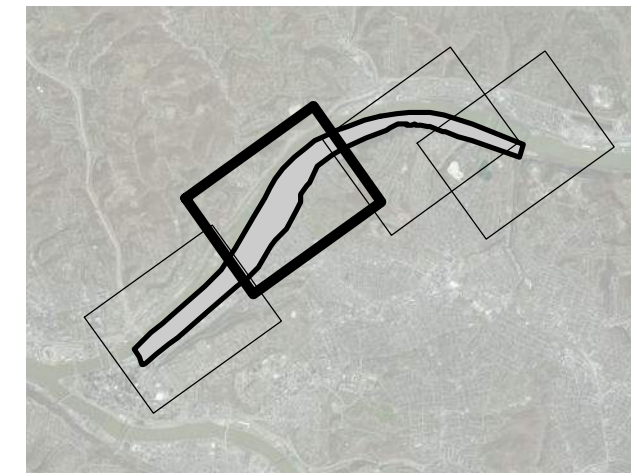
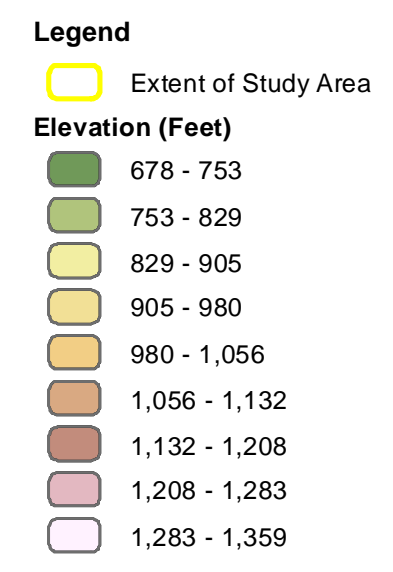


1 inch = 800 feet

Site Morphology

Allegheny Riverfront Green Boulevard

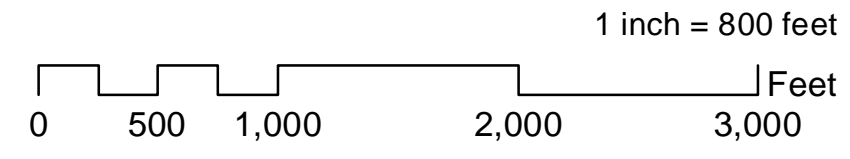
Pittsburgh, Pennsylvania



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



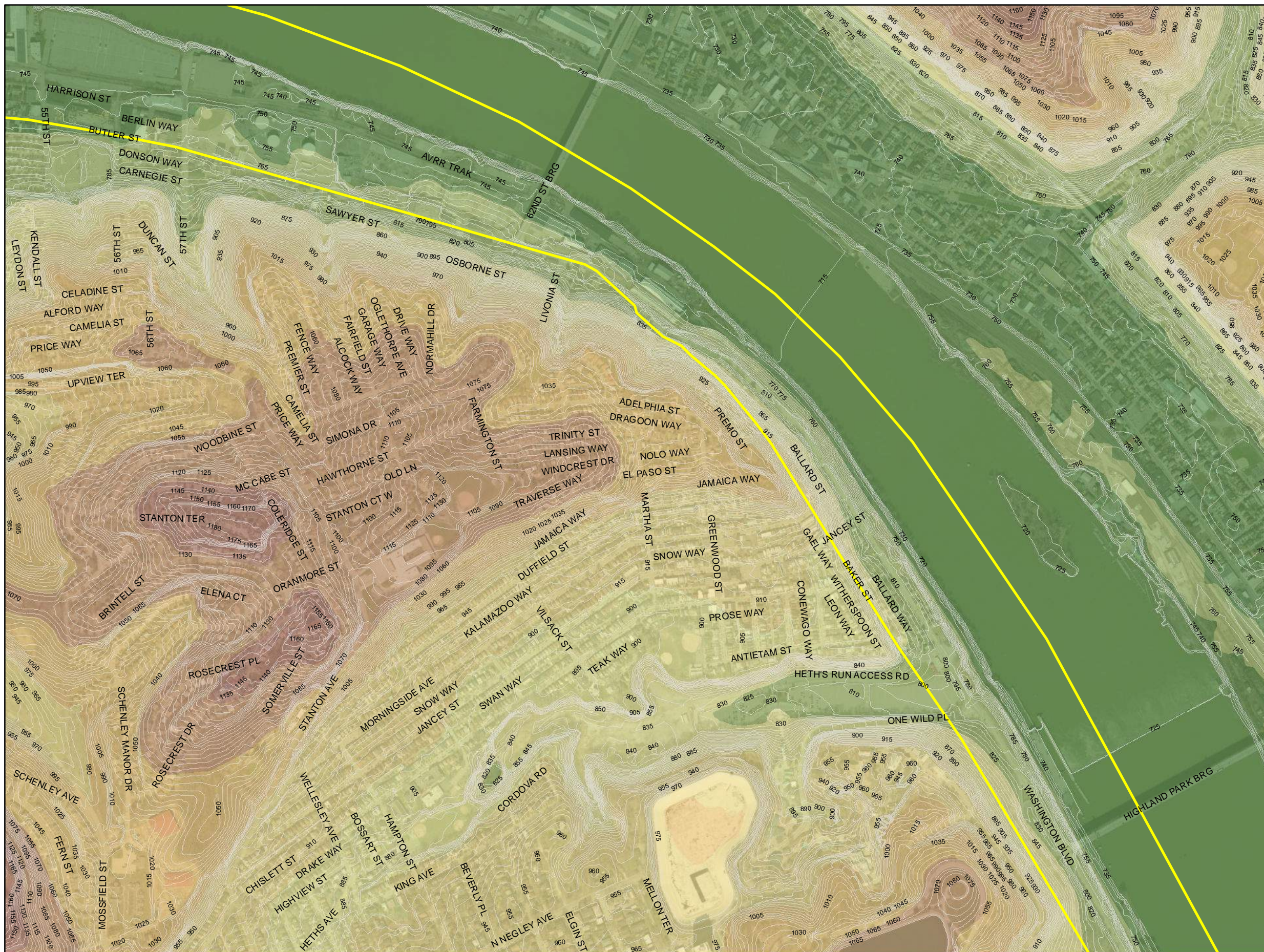
Date: 1/22/2013



Site Morphology

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania



Legend

Extent of Study Area

Elevation (Feet)

678 - 753

753 - 829

829 - 905

905 - 980

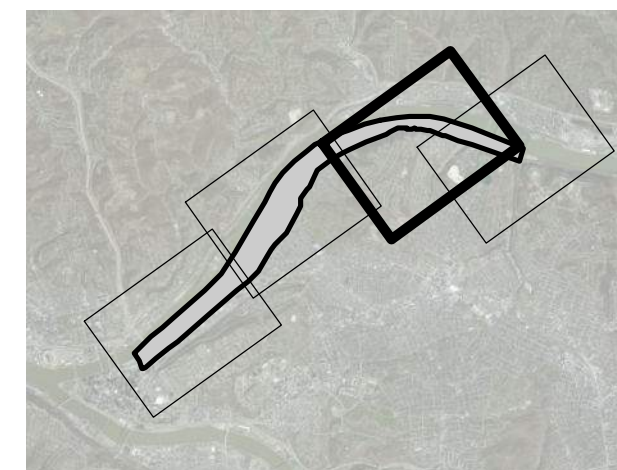
980 - 1,056

1,056 - 1,132

1,132 - 1,208

1,208 - 1,283

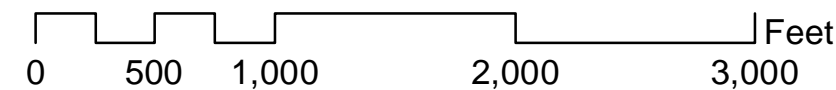
1,283 - 1,359



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



Date: 1/22/2013



Site Morphology

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania



Legend

Extent of Study Area

Elevation (Feet)

678 - 753

753 - 829

829 - 905

905 - 980

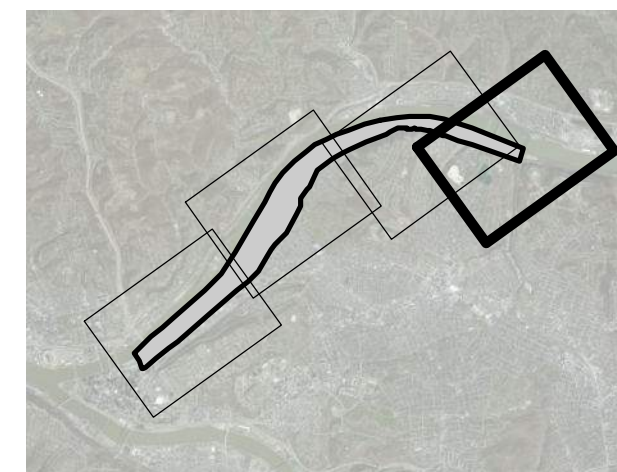
980 - 1,056

1,056 - 1,132

1,132 - 1,208

1,208 - 1,283

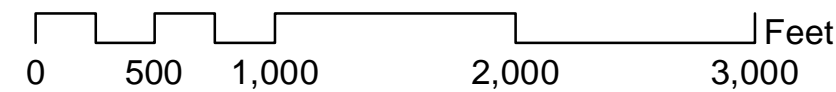
1,283 - 1,359



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



Date: 1/22/2013

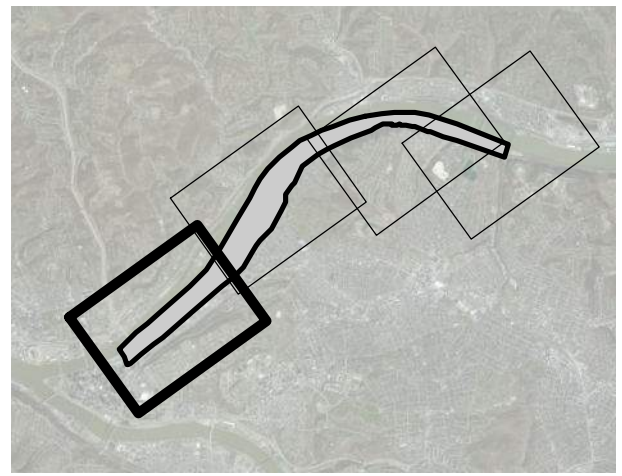
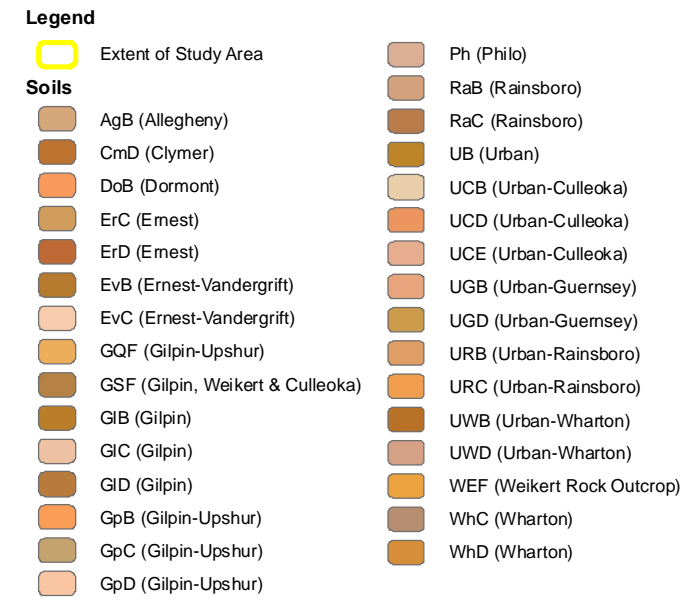
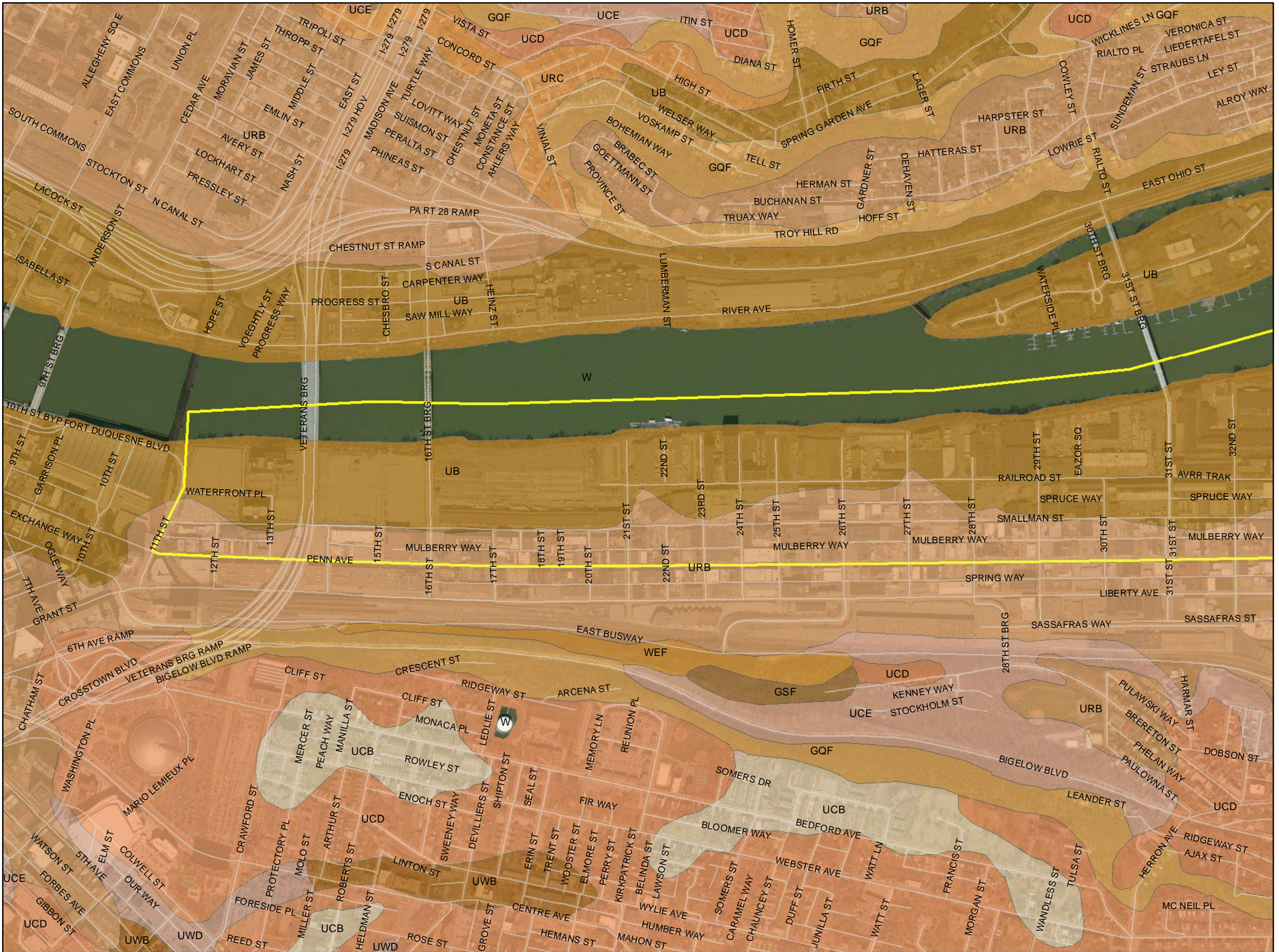


1 inch = 800 feet

Site Soils

Allegheny Riverfront Green Boulevard

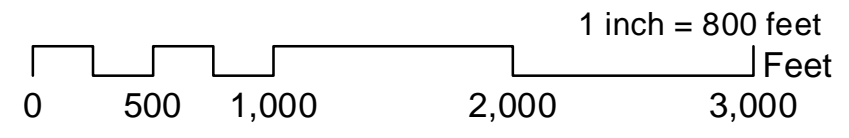
Pittsburgh, Pennsylvania



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



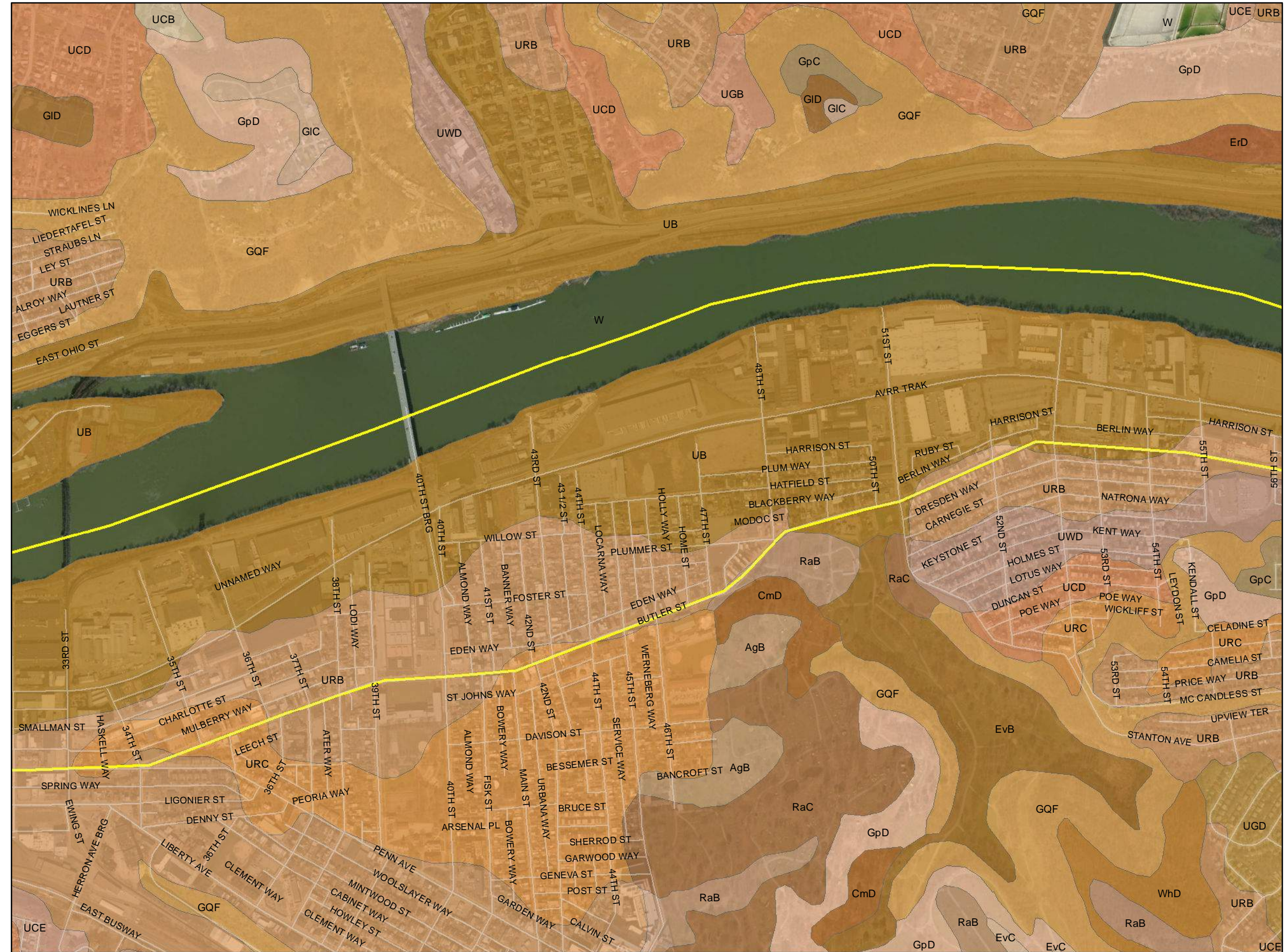
Date: 1/23/2013



Site Soils

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania

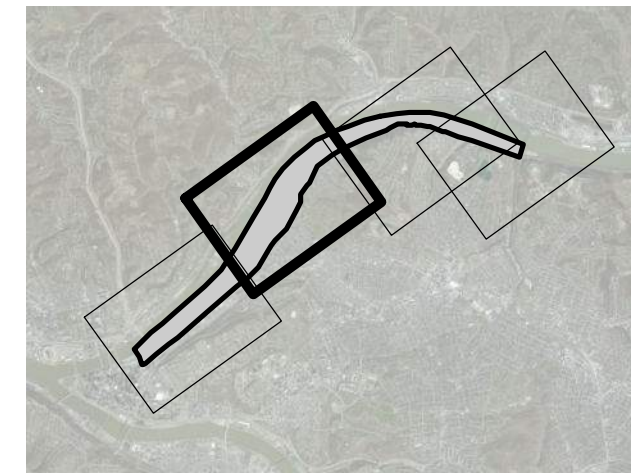


Legend

- Extent of Study Area

Soils

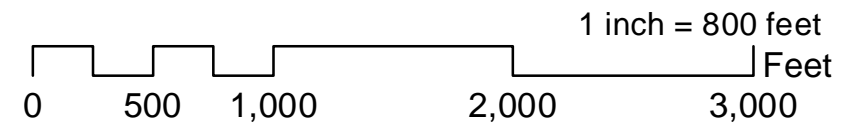
AgB (Allegheny)	Ph (Philo)
CmD (Clymer)	RaB (Rainsboro)
DoB (Dormont)	RaC (Rainsboro)
ErC (Emest)	UB (Urban)
ErD (Emest)	UCB (Urban-Culleoka)
EvB (Ernest-Vandergrift)	UCD (Urban-Culleoka)
EvC (Ernest-Vandergrift)	UCE (Urban-Culleoka)
GQF (Gilpin-Upshur)	UGB (Urban-Guernsey)
GSF (Gilpin, Weikert & Culleoka)	UGD (Urban-Guernsey)
GIB (Gilpin)	URB (Urban-Rainsboro)
GIC (Gilpin)	URC (Urban-Rainsboro)
GID (Gilpin)	UWB (Urban-Wharton)
GpB (Gilpin-Upshur)	UWD (Urban-Wharton)
GpC (Gilpin-Upshur)	WEF (Weikert Rock Outcrop)
GpD (Gilpin-Upshur)	WhC (Wharton)
	WhD (Wharton)



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



Date: 1/23/2013



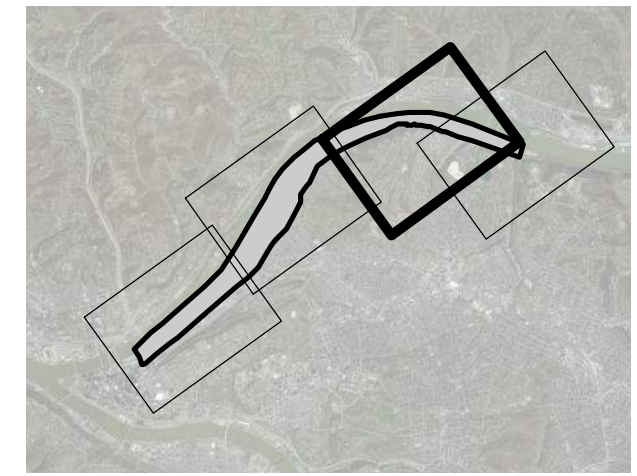
Site Soils

Allegheny Riverfront Green Boulevard Pittsburgh, Pennsylvania



Legend

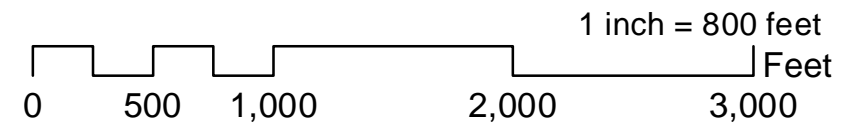
- Extent of Study Area
- Soils**
- AgB (Allegheny)
- CmD (Clymer)
- DoB (Dormont)
- ErC (Emest)
- ErD (Emest)
- EvB (Ernest-Vandergrift)
- EvC (Ernest-Vandergrift)
- GQF (Gilpin-Upshur)
- GSF (Gilpin, Weikert & Culleoka)
- GIB (Gilpin)
- GIC (Gilpin)
- GID (Gilpin)
- GpB (Gilpin-Upshur)
- GpC (Gilpin-Upshur)
- GpD (Gilpin-Upshur)
- Ph (Philo)
- RaB (Rainsboro)
- RaC (Rainsboro)
- UB (Urban)
- UCB (Urban-Culleoka)
- UCD (Urban-Culleoka)
- UCE (Urban-Culleoka)
- UGB (Urban-Guernsey)
- UGD (Urban-Guernsey)
- URB (Urban-Rainsboro)
- URC (Urban-Rainsboro)
- UWB (Urban-Wharton)
- UWD (Urban-Wharton)
- WhC (Wharton)
- WhD (Wharton)



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



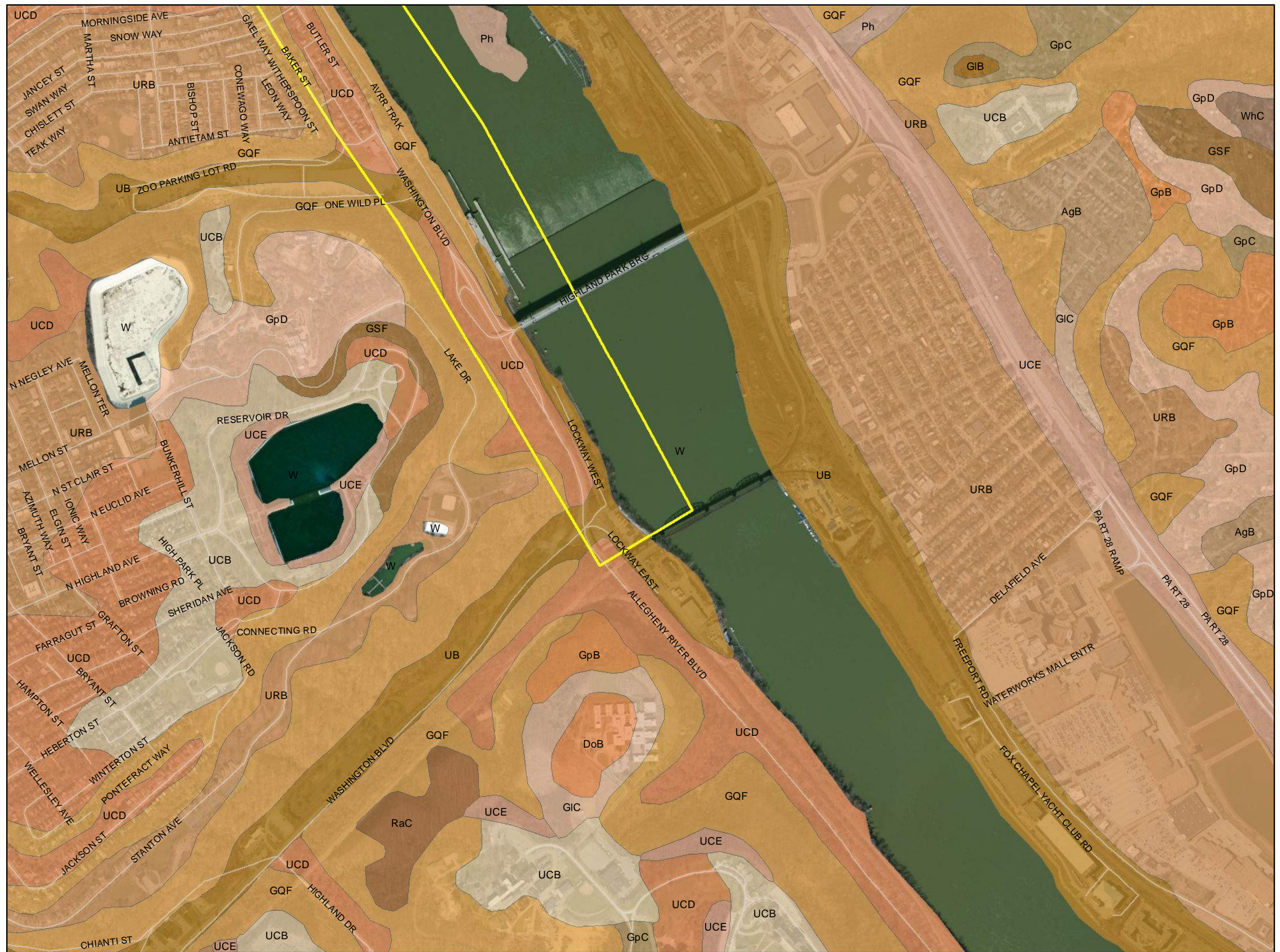
Date: 1/23/2013



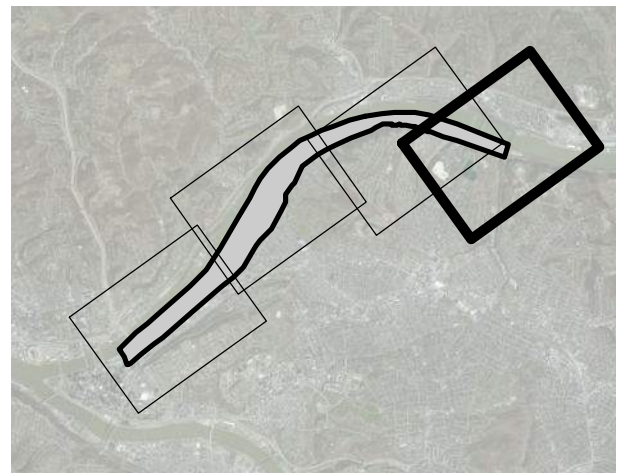
Site Soils

Allegheny Riverfront Green Boulevard

Pittsburgh, Pennsylvania



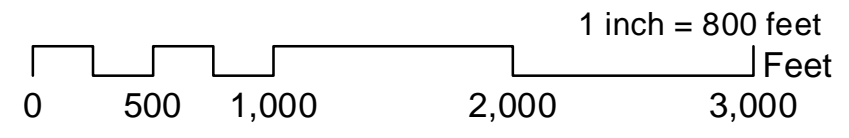
- Legend**
- Extent of Study Area
 - Soils**
 - AgB (Allegheny)
 - CmD (Clymer)
 - DoB (Dormont)
 - ErC (Erest)
 - ErD (Erest)
 - EvB (Ernest-Vandergrift)
 - EvC (Ernest-Vandergrift)
 - GQF (Gilpin-Upshur)
 - GSF (Gilpin, Weikert & Culleoka)
 - GIB (Gilpin)
 - GIC (Gilpin)
 - GID (Gilpin)
 - GpB (Gilpin-Upshur)
 - GpC (Gilpin-Upshur)
 - GpD (Gilpin-Upshur)
 - Ph (Philo)
 - RaB (Rainsboro)
 - RaC (Rainsboro)
 - UB (Urban)
 - UCB (Urban-Culleoka)
 - UCD (Urban-Culleoka)
 - UCE (Urban-Culleoka)
 - UGB (Urban-Guernsey)
 - UGD (Urban-Guernsey)
 - URB (Urban-Rainsboro)
 - URC (Urban-Rainsboro)
 - UWB (Urban-Wharton)
 - UWD (Urban-Wharton)
 - WhC (Wharton)
 - WhD (Wharton)



Map and data made available by the Pennsylvania Spatial Data Clearinghouse (PASDA). Visit the PASDA Website for more information. <http://www.pasda.psu.edu>



Date: 1/23/2013



Appendix B – Site Analysis and Assessment Graphics

EXISTING ECOLOGICAL CONDITIONS

Heth's Run



51st Street



43rd Street



36th to 33rd Street Rails



North of Highland Park Bridge



62nd Street Marina



47th Street



28th Street



Heth's Run Restoration



51st Street Soil Conditioning and Nursery



43rd Street Riparian Corridor Enhancement and Eco-Industrial Research Complex



36th to 33rd Street Rails to Trails



62nd Street Marina Floating Wetland Park



47th Street Wastewater Wetland Treatment Amenity



28th Street Riparian Corridor and Trail Enhancement



17th Street Wetland and Stormwater Treatment Amenity



Focal Species Memorandum

Focal Species Memorandum

Six focal species were selected to help identify urban habitat issues and to better understand the wildlife resources associated with the aquatic, riparian, and related terrestrial upland habitats occurring along the Allegheny River system. The focal species are representative of the diversity of habitats and species groups found in the study area vicinity as well as representative of assemblages, or guilds, of species. Focal species that are representative of guilds or wildlife assemblages provide a broader habitat context for future conservation and enhancement needs. The six chosen focal species include a few fairly common species whose habitat can be protected, restored, established, and managed in conjunction with ecological connections to broader regional systems (the bank swallow and the least weasel). The list also includes scarce or declining species in the region that need help in order to survive and flourish as a part of a functioning native Allegheny River ecosystem (the paddlefish and the Louisiana waterthrush).

Integrating the needs of the focal species into the planning process provides important environmental education, stewardship, amenity, and quality of life benefits for the greater community. This approach emphasizes community variability and a diversity of habitat needs, acknowledging that other individual species in these ecological zones may have specific, varying, or conflicting needs. Consideration of the focal species habitat needs helped inform design decisions associated with buffer typologies and open space design along the riverfront. Specific grants may be available based on species habitat restoration needs. The Performance Measures section of the Open Space Appendix provides further consideration of implementation and funding opportunities.



2081 Clipper Park Road
 Baltimore, MD 21211
 tel 410.554.0156
 fax 410.554.0168
 www.biohabitats.com

Date: December 15, 2011

To: Jason Hellendrung, Sasaki

From: Edward Morgereth and Jennifer Dowdell

Re: **Ecological and Open Space Planning – Focal Wildlife Species**

Native ecological communities, including indigenous plant and animal species, provide essential benefits and services wildland, rural, suburban and urban areas. However, as development occurs, suburban and urban areas experience habitat loss and ecosystem impacts including diminished ecosystem function and decreased native species diversity. The resilience of a species is tested in highly altered or manipulated landscapes, like those found in former industrial areas, and as species diversity decreases the system becomes less robust. As an example, pollinator species (bees, butterflies, and birds) rely on a wide array of plant species for food and those plants in return rely on the pollinators for reproductive support, promoting the growth and health of our vegetable and flower gardens, as well as our street trees and public park lands. Pollinators are known to promote the survival of 75% of the world's pollinator plants, and responsible for one-third of every bite of food humans consume, affecting food supplies within and outside the city limits (witf.org). In this context, native communities and the wildlife they support can play an important role in the health, well-being, functionality, and productivity of an urban area. Identifying certain representative species for a project area is one way of integrating wildlife and habitat needs into urban area planning and management.

For this project six focal species were selected to help identify urban habitat issues and to better understand the wildlife resources associated with the aquatic, riparian, and associated terrestrial upland habitats occurring along the Allegheny River system (Table 1). The focal species selected are representative of the diversity of habitats and species groups found in the study area vicinity as well as assemblages, or guilds, of species. This approach emphasizes community variability and a diversity of habitat needs, acknowledging other individual species in these ecological zones may have specific, varying or conflicting needs.

The focal species chosen include some fairly common species whose habitat can be protected, restored, established and managed in conjunction with ecological connections to broader regional systems (i.e., the bank swallow and the least weasel). The list also includes some scarce or declining species that need help in the region, in order to survive and flourish as a part of a functioning ecosystem (i.e., the paddlefish and the Louisiana waterthrush). Integrating focal species needs into the planning process

December 15, 2011

Re: **Ecological and Open Space Planning – Focal Wildlife Species**

Page 2 of 10

provides important environmental education, stewardship, amenity and quality of life benefits for the greater community.

Table 1: Allegheny River Green Boulevard Study Focal Species

Type-Habitat	Focal Species Common Name	Focal Species Latin name (Genus species)	Allegheny Riverfront Buffer Zone or Open Area Locations
Fish-Aquatic River	Paddlefish	<i>Polyodon spathula</i>	River and shoreline
Bird-Riparian Edge	Bank swallow	<i>Riparia riparia</i>	Buffer Zones 2 and 3, Heth's Run, Negley Run
Butterfly-Terrestrial	Eastern tiger swallowtail	<i>Papilio glaucus</i>	Buffer Zones 1, 2 and 3, Highland Park, Hill District Neighborhoods
Mammal-Terrestrial	Least weasel	<i>Mustela nivalis</i>	Buffer Zones 2 and 3, Highland Park, Heth's Run, Negley Run
Amphibian-Woodlands/Wetlands	Wood frog	<i>Rana sylvatica</i>	Buffer Zones 2 and 3, Heth's Run, Negley Run, Highland Park wetlands
Bird-Forest/Stream	Louisiana waterthrush	<i>Parkesia motacilla</i>	Buffer Zone 3, Highland Park, connections to the Allegheny Front

December 15, 2011

Re: **Ecological and Open Space Planning – Focal Wildlife Species**

Page 3 of 10

FOCAL SPECIES – AQUATIC

Paddlefish (*Polyodon spathula*)

Zone: River and shoreline

Taxonomy: Vertebrate animal – Bony fish

Species Status: Extirpated (local extinction)

Length: 150 cm (~ 5 feet)

Age: Maturity males – 6-9 years
Maturity females – 8-10 years
Lifespan – 15-30 years

Reproduction: Spawning – Spring high water
Temperature – 10-15° C
Larvae – April to June

Habitat Type: Freshwater – Riverine
Big River – Low gradient
Medium River – Moderate gradient
Prefers deep water, slower currents

Migration: Local Migrant

Foraging: Invertivore (consumes invertebrates)

Background

The paddlefish is a riverine fish species that is in decline. Throughout portions of its range in the United States it is identified as a species of conservation concern. Habitat destruction and river modifications have significantly impacted this species which has resulted in extinction in some areas. The known breeding population in Pennsylvania is thought to be extinct. The construction and operation of dams on mainstem streams and rivers has had severe impacts. Dams have eliminated traditional spawning sites, interrupted spawning migrations and altered flow regimes as well as hampering long-range movements that help to maintain populations. As a part of recovery efforts for this species, some states have hatchery release programs to supplement or help restore populations.

Threats to Species

Threats to the species occur throughout its range; specific threats include:

Habitat alteration; pollution; harvesting; destruction/unavailability of spawning habitat; loss of genetic integrity; and impoundments.

Local Population

Once found in the Ohio River system and up the Allegheny River, the last documented naturally-reproducing paddlefish in Pennsylvania waters was in 1919. The Pennsylvania Fish and Boat Commission's Paddlefish Restoration Program has released hatchery-raised, tagged fingerling paddlefish into the Ohio and Allegheny Rivers. Although released fish are present, no evidence of natural reproduction has been found yet.

Project Related Opportunities

There are some habitat improvement opportunities that may be undertaken in the context of this project to help support this species, including localized aquatic habitat restoration:

Clean gravel bar creation; other habitat structures; pollution run-off control; species education and interpretation. Some locations that may provide habitat enhancement potential include areas of reduced current including bridge pilings and sand bars.

December 15, 2011

Re: **Ecological and Open Space Planning – Focal Wildlife Species**

Page 4 of 10

FOCAL SPECIES – RIPARIAN

Bank Swallow (*Riparia riparia*)

Zone: Buffer zones 2 and 3, Heth's Run, Negley Run

Taxonomy: Vertebrate animal – Bird

Species Status: Stable

Length: 12-14 cm (~5-5.5 inches)

Age: Lifespan – up to 9 years

Reproduction: Bank nester – Burrowing
Clutch size – 2-6 eggs
Broods – 1 to 2

Habitat Type: Riparian Lowlands – Rivers, Streams
Coastal Bluffs – Soft Banks

Migration: Neotropical

Foraging: Primarily flying or jumping insects

Background

The bank swallow is a small bird that breeds throughout Alaska, Canada and much of the continental United States. This species is highly associated with riparian areas along the coasts, rivers, streams and lakes. The swallow nests in colonies on soft banks or bluffs, primarily along rivers and streams. Important foraging habitats include wetlands, large water bodies, grasslands, open woodlands and agricultural areas. Males of the species excavate perpendicular burrows into soft, stable banks. Bank swallows have more recently been found to utilize human-made sites and habitats such as road cuts, quarries and gravel pits. This species is considered widespread, stable and abundant. However, some local populations have been impacted by the loss of nesting habitat and therefore some states have listed conservation status for the swallow.

Threats to Species

Threats to the species occur throughout its range; specific threats include:

Habitat loss for nesting; fluctuating water levels/rapid erosion; nest predation; and sometimes lack of enough erosion/too gently sloped banks.

Local Population

The bank swallow is one of five swallow species found in Pennsylvania. The species travels to Pennsylvania to breed in summer and winters in Central and South America. The local population numbers and current use of study area are unknown.

Project Related Opportunities

There are some habitat protection and improvement opportunities that may be undertaken in the context of this project to help support this species, including:

Plan for unarmored/non-bulkhead shoreline areas; protect nesting sites (signs, leashed pets, limited access); manage natural exposed bank/bluffs; species education and monitoring inventory.

December 15, 2011

Re: **Ecological and Open Space Planning – Focal Wildlife Species**

Page 5 of 10

FOCAL SPECIES – MAMMALIAN PREDATOR

Least Weasel (*Mustela nivalis*)

Zone: Buffer zones 2 and 3, Highland Park, Heth's Run, Negley Run

Taxonomy: Vertebrate animal – Mammal

Species Status: Globally Secure , State Vulnerable

Length: 15-22 cm (~ 6-8 ½ inches)

Age: Maturity males – 8 months
Maturity females – 4 months
Lifespan – Unknown in wild

Reproduction: Breeding – Nearly year-round
Litters – 2 or more per year
Young – 1 to 6

Habitat Type: Varied – Meadows, Fields, Brushy areas, Woodlands

Migration: Resident

Foraging: Carnivore (preys on mice, voles, insects, small birds, worms and amphibians)

Background

The least weasel is in the family Mustelidae which includes other weasels, skunks, fisher, mink and otter. The least weasel lives in North America, Europe and northern Asia. There are two other weasel species in Pennsylvania: the long-tailed weasel and the ermine. As mustelids, weasels have a strong musk odor and they have long slim bodies. Weasels are primarily nocturnal and difficult to observe. They are active year-round and are known as ravenous predators killing more than they can consume and cache the remainder. Least weasels are aggressive predators and can kill prey larger than they are. In Pennsylvania some least weasels turn white in pelt color during the winter.

Threats to Species

Threats to the species occur throughout its range; specific threats include:

High mortality; short lifespan; habitat Loss; data gaps/difficult to study; many predators; and climate change.

Local Population

In Pennsylvania the least weasel is most common in the Allegheny plateau area and in the south-central part of the state.

Project Related Opportunities

There are some habitat improvement opportunities that may be undertaken in the context of this project to help support this species, including localized habitat improvement and management:

Conserve natural area; restore riparian and upland habitat; find a survey collaborator; and habitat for prey base; education/stewardship (Weasel cam).

December 15, 2011

Re: **Ecological and Open Space Planning – Focal Wildlife Species**

Page 6 of 10

FOCAL SPECIES – UPLAND WOODS AND MEADOW

Eastern Tiger Swallowtail (*Papilio glaucus*)

Zone: Buffer zones 1, 2 and 3, Highland Park, Hill District neighborhoods

Taxonomy: Invertebrate animal – Lepidoptera

Species Status: Stable

Length: 9-16.5cm (~ 3.5-6.5 inches)

Development: Egg to pupa to adult – ~ 1 month
Lifespan – unknown

Reproduction: Egg – On tree leaf, Larva – Caterpillar
Pupa (chrysalis) – Resting stage
Broods - 2-3 per adult female

Habitat Type: Forest – Deciduous
Grasslands – meadows
Other – Including urban

Migration: Non-migratory

Foraging: Herbivore
Caterpillar – tree leaves
Butterfly – sweet flower nectar

Background

The eastern tiger swallowtail is a species of butterfly that is native to North America, and is found in the United States and Canada. It is a member of the order Lepidoptera which includes moths, skippers and butterflies. It is a familiar and common species that is found in many different habitats including woodlands, fields and open space urban areas. This species flies from spring to fall. This butterfly goes through four life stages: first the egg is deposited by females, then the caterpillar larva molts several times, and then transformation to a pupa (or chrysalis) which is a resting stage before the emergence of the flying adult. This species is intended to represent a group of pollinators that are important to a wide variety of plants and are integral to their pollination and reproduction.

Threats to Species

Threats to butterflies as a group occur throughout North America; specific threats include: *Habitat alteration and loss; interstate shipment and release of butterflies; spread of diseases to native populations; introduced genes/decreased fitness; and climate change impact.*

Local Population

The eastern tiger swallowtail is an abundant species in the United States, including western Pennsylvania. It is considered common and secure throughout most of the eastern United States.

Project Related Opportunities

There are some habitat improvement opportunities that may be undertaken in the context of this project to help support this species and the group it represents:

Conserve and protect native woodlands and meadows; plant pollinator gardens with nectar flowers; butterfly and pollinator guild education and interpretation/signage; community plantings and monitoring.

December 15, 2011

Re: **Ecological and Open Space Planning – Focal Wildlife Species**

Page 7 of 10

FOCAL SPECIES – LOWLAND FOREST/WETLAND

Wood Frog (*Lithobates sylvaticus*) / (*Rana sylvatica*)

Zone: Buffer zones 2 and 3, Heth's Run, Negley Run, Highland Park wetlands

Taxonomy: Vertebrate animal – Amphibian

Species Status: Abundant

Length: 5-7.5 cm (~2-3 inches)

Age: Unknown – estimated 2-3 years

Reproduction: Water – Temporary (vernal) or permanent water body
One egg mass per female (2000-3000 eggs)

Habitat Type: Forest
Deciduous – Moist or Lowland
Standing water during mating

Migration: Non-migratory – moves from woodlands to breeding pools

Foraging: Adults – Primarily consume insects

Background

The wood frog is a moderately sized frog common to the eastern United States including Pennsylvania. This species is a true frog of the family Ranidae. The wood frog has a wide variation in coloration from light to dark extremes and this species is characterized by a dark patch extending back from the eye. The wood frog is selected to represent amphibians, including frogs, toads, newts and salamanders, which as a group are sensitive to environmental disturbance and pollution, while being recognized as indicators of overall ecosystem health.

Threats to Species

Threats to amphibians are widespread. Specific threats include:

Habitat loss of wetlands; acidifying streams and lakes; herbicide pollution; parasites and disease; immune suppression; and climate change.

Local Population

The wood frog occurs throughout much of Pennsylvania including Allegheny County, in the western part of the state. It has been verified by the Pennsylvania Herp Identification program as occurring in the region recently (i.e., since 2000).

Project Related Opportunities

There are some habitat protection and improvement opportunities that may be undertaken in the context of this project to help support this species, including:

Protect and restore vernal pools and lowland forests; provide corridors and buffers; encourage toxic herbicide reduction; enhance dissolved organic carbon and protect from low acidity; education and monitoring.

December 15, 2011

Re: **Ecological and Open Space Planning – Focal Wildlife Species**

Page 8 of 10

FOCAL SPECIES – RIPARIAN FOREST / STREAMS

Louisiana Waterthrush (*Parkesia motacilla*) / (*Seiurus motacilla*)

Zone: Buffer zone 3, Highland Park, connections to the Allegheny Front

Taxonomy: Vertebrate animal – Bird

Species Status: Secure

Length: 13-16 cm (~5.25-6 inches)

Age: Up to 8 years

Reproduction: Ground – Low nesting
Clutch size – 4-6 eggs
Broods – 1 per year

Habitat Type: Riparian
Woodlands – Mature Deciduous
Ravines – Floodplains -- Swamps

Migration: Neotropical

Foraging: Primarily aquatic invertebrates

Background

The Louisiana waterthrush is a small neotropical migratory bird that breeds and nests throughout the eastern half of the United States and Canada. It winters in Mexico, Central and South America and parts of the Caribbean. It is a species that is secure in Pennsylvania, but is considered to be a 'Maintenance Concern' species under the State Wildlife Action Plan. The waterthrush inhabits mature forested watersheds with medium to high gradient 1st to 3rd order streams and prefers areas with moderate to sparse undergrowth. It is sensitive to declining stream quality and loss of riparian forest buffers.

Threats to Species

Threats to the species occur throughout its range. Specific threats include:

Habitat loss for nesting; forest fragmentation; loss of riparian buffers; acid precipitation and discharge, low stream pH; and declining stream quality and aquatic insects.

Local Population

The Louisiana waterthrush is one of many important migratory bird species found in Pennsylvania. Although we have no information on the local population there are Pennsylvania eBird (Cornell Lab and Audubon project) range and point map occurrences nearby for observed locations and birding hotspots.

Project Related Opportunities

There are some habitat protection and improvement opportunities that may be undertaken in the context of this project to help support this species, including:

Protect core wooded habitats; conserve and increase riparian forest buffers (100m [328 ft] wide optimal); restore streams and improve water quality; species education, monitoring, and birding group stewardship.

December 15, 2011

Re: **Ecological and Open Space Planning – Focal Wildlife Species**

Page 9 of 10

REFERENCES

Absolute Astronomy. Eastern tiger swallowtail: Facts, Discussion Forum, and Encyclopedia Article.

http://www.absoluteastronomy.com/topics/Eastern_tiger_swallowtail

Accessed November 2011

Bull, John. O., and Farrand, John, Jr., 1989. The Audubon Society Field Guide to North American Birds. Alfred A. Knopf, New York.

Conant, Roger. 1986. The Peterson Field Guide Series, A Field Guide to Reptiles and Amphibians – Eastern and Central North America. Houghton Mifflin Company.

Cornell Lab of Ornithology. All About Birds, Bank Swallow Life History.

http://www.allaboutbirds.org/guide/Bank_Swallow/lifehistory

Accessed November 2011

eBird Range Map. Species: Louisiana Waterthrush.

<http://ebird.org/ebird/pa/map/louwat?neg=true&env.minX=&env.minY=&env.maxX=&env.maxY=&zh=false&gp=false&mr=1-12&bmo=1&emo=12&yr=1900-2011&byr=1900&eyr=2011>

Accessed November 2011

Enchanted Learning. Tiger Swallowtail Butterfly.

<http://www.enchantedlearning.com/subjects/butterfly/species/Tigersw.shtml>

Accessed November 2011

Fergus, Chuck. Undated. Weasels, Wildlife Notes – 26 LDR0603 Pennsylvania Game Commission.

<http://www.cfdccd.com/Wildlife%20Notes/Wildlife%20Notes%20-%20weasels.pdf>

Accessed November 2011.

Gough, G.A., Sauer, J.R., Iloff, M. *Patuxent Bird Identification Infocenter*. 1998. Version 97.1. Patuxent Wildlife Research Center, Laurel, MD. <http://www.mbrpwrc.usgs.gov/id/framlst/infocenter.html>

Accessed November 2011

Hayden, Nancy. 2011. Swallows of Pennsylvania. http://www.ehow.com/info_8669185_swallows-pennsylvania.html

Accessed November 2011

NatureServe. An Online encyclopedia of life (Nature serve). 2000. Version 1.1 Comprehensive Report Species – *Parkesia motacilla*. <http://www.natureserve.org/explorer/servlet/NatureServe>

Accessed November 2011.

NatureServe. An Online encyclopedia of life (Nature serve). 2000. Version 1.1 Comprehensive Report Species – *Polyodon spathula*. <http://www.natureserve.org/explorer/servlet/NatureServe>

Accessed November 2011.

December 15, 2011

Re: **Ecological and Open Space Planning – Focal Wildlife Species**

Page 10 of 10

PA Herp Identification. Online Guide to Reptiles & Amphibians of PA. Wood Frog.

http://www.paherps.com/herps/frogs-toads/wood_frog

Accessed November 2011.

Pennsylvania Natural Heritage Program. Species of Special Concern Lists. Allegheny County, All Species.

<http://www.naturalheritage.state.pa.us/Species.aspx>

Accessed November 2011

The Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission. 2005 (Revised 2008). Pennsylvania's Wildlife Action Plan Version 1.0a.

<http://www.portal.state.pa.us/portal/server.pt?open=514&objID=622722&mode=2>

Accessed November 2011.

Whitaker, John. O., Jr., 1989. The Audubon Society Field Guide to North American Mammals. Alfred A. Knopf, New York.

Ecological Buffer Typologies

Ecological Buffer Typologies

Developing the ecological typologies for the Green Boulevard study involved reviewing existing literature related to functioning riparian buffers for information on habitat and water quality, as well as making ecological observations of existing conditions, reviewing historical development patterns, and appropriate focal species needs. One-third of rivers and streams in Pennsylvania have degraded or altered riparian buffers. The wider the buffer, the more benefit provided in terms of wildlife habitat, water temperature modulation, protection from nonpoint sources of pollution, flood mitigation, sediment removal, and bank stabilization. The most widely recognized buffer planning model notes that the ideal width of a functional buffer should be at least 95 feet wide. The suggested buffers try to meet and exceed that, aiming for higher functionality in a section of the riverfront that already includes some wider buffer areas alongside a mix of residential and urban development. The Allegheny Riverfront Vision Plan suggests the ideal riparian buffer along the whole of the riverfront be at least 200 feet of wooded riparian buffer. Therefore, as one moves east along the river the suggested buffer is 250 to 300 feet, providing further habitat potential and improved connectivity with city parks and forest. However, there are constraints posed by individual landholders along the riverfront and by economic considerations for feasible redevelopment. Further research was done to understand the feasibility of and suggested functionality for narrower buffer widths in the more urban sections of the riverfront closer to downtown.

Three buffer zones (setbacks) are recommended for the Allegheny Riverfront Green Boulevard: Buffer Typology 1 – Dense Urban Development Buffer Zone (95–125 feet) from 11th Street to 31st Street, Buffer Typology 2 – Mixed Industrial and Residential Buffer Zone (125–150 feet) from 31st Street to 65th Street, and Buffer Typology 3 – Ecological Conservation and Open Space Buffer Zone (150–300 feet) from 65th Street to Washington Boulevard. Specific grants may be available based on species habitat restoration needs within the buffer. The buffer widths are integrated into the plan through the design of the buffer along the riverfront. The Performance Measures section of the Open Space Appendix provides further consideration of implementation and funding opportunities.



2081 Clipper Park Road
 Baltimore, MD 21211
 tel 410.554.0156
 fax 410.554.0168
 www.biohabitats.com

Date: February 2, 2012

To: Jason Hellendrung, Sasaki

CC: Lisa Schroeder and Edward Patton, Riverlife

From: Jennifer Dowdell and Edward Morgereth

Re: **Ecological and Open Space Planning –
 Revised Ecological Buffer Typologies for Allegheny Riverfront and Green Boulevard**

This memorandum sets forth recommended buffer typologies for the Allegheny riverfront, extending from the convention center to the City's eastern boundary. Background is provided on buffer function and ecological services; design guidance and performance criteria for three recommended buffer zones is detailed, and the ecological benefits of the Allegheny Riverfront green boulevard planning approach is summarized.

Riparian Buffer Function and Ecological Services

A riparian buffer is a permanent naturally vegetated area located adjacent to a stream, river, lake, pond or wetland. The USDA Forest Service estimates that one-third of rivers and streams in Pennsylvania have degraded or altered riparian buffers. The wider the buffer, the more benefit it provides in terms of wildlife habitat, water temperature modulation, protection from nonpoint sources of pollution, flood mitigation, sediment removal, and bank stabilization.

According to the Allegheny Riverfront Vision Plan, 2010, the riparian buffer along the riverfront should be a minimum of 200 foot wide, with a combination of meadow and woodland cover for habitat enhancement. Within the first 100 feet of this suggested riparian buffer the target tree canopy is 80%. However, there are constraints posed by individual landholders along the riverfront and economic considerations for a feasible redevelopment, further research was done to understand the feasibility and suggested functionality for narrower buffer widths in the more urban sections of the riverfront closer to downtown. The Montgomery County, PA, Guide for Riparian Corridor Conservation suggests that a riparian buffer should be no less than 75 feet at its narrowest, with three zones of buffer from the stream edge inland. Per the guide, the first zone should be undisturbed forest to provide food, shade for the waterbody, and slope stability. The second zone should consist of managed woodland that allows for infiltration, filtration of sediment and nutrients, and nutrient uptake by plants. The buffer area on the upland side should include sheet flow of rainwater runoff to maximize vegetative and soil contact with the runoff. The riparian corridor should be uninterrupted, helping to reduce the concentrated flows

February 2, 2012

Re: Ecological and Open Space Planning – Revised Ecological Buffer Typologies for Allegheny Riverfront and Green Boulevard
Page 2 of 8

to the waterbody and providing continuous habitat for birds and other wildlife species that require undisturbed access to food, shelter and water. It is noted that trees are the most important element in a riparian corridor for removing nutrients, stabilizing the soil, modifying water temperature and providing food for aquatic organisms. Recreation in the buffer should be balanced with the effects this will have on existing features, especially in terms of excess nutrients, contaminants, and chemicals including pesticides, fertilizers and herbicides.

One of the most widely recognized buffer planning models developed by the USDA Forest Service notes that the ideal width of a functional buffer should be at least 95 feet wide. “Zone one of the model begins at the normal water level or at the edge of the active channel and extends a minimum of 15 feet along a line perpendicular to the watercourse. Dominant vegetation consists of existing or planted woody vegetation suitable for the site and intended purpose. This zone should remain undisturbed; therefore, tree removal is generally not permitted. Zone two begins at the edge of zone one and extends a minimum of 60 feet perpendicular to the watercourse. While vegetation in zone two should be similar to zone one, removal of tree and shrub products is permitted on a regular basis provided the tree and shrubs are replaced. The third zone begins at the outer edge of zone two and has a minimum width of 20 feet. Vegetation in this zone can be grazed or ungrazed grass or other plant communities as long as it facilitates sediment filtering, nutrient uptake, and the conversion of concentrated flow to uniform, shallow, sheet flow through the use of structural practices such as level spreaders (Lowrance et al., 1995).”

Resources

<http://www.epa.gov/nrmrl/pubs/600R05118/600R05118.pdf>

<http://www.soil.ncsu.edu/publications/BMPs/buffer.html>

<http://newsletters.wetlandstudies.com/docUpload/RiparianBufferIssuePaper2.pdf>

<http://planning.montcopa.org/planning/cwp/view,a,1462,q,41420,planningNav,|.asp>

http://www.stormwaterpa.org/assets/media/BMP_manual/chapter_6/Chapter_6-7-1.pdf

February 2, 2012

Re: Ecological and Open Space Planning – Revised Ecological Buffer Typologies for Allegheny Riverfront and Green Boulevard
Page 3 of 8

Recommended Buffer Zones

Three buffer zones are recommended for the Allegheny riverfront:

- Buffer Typology 1 – Dense Urban Development Buffer Zone
- Buffer Typology 2 – Mixed Industrial & Residential Buffer Zone
- Buffer Typology 3 – Ecological Conservation & Open Space Buffer Zone

The proposed extent of each buffer zone is displayed in Figure 1. More detail on the proposed buffer zones is provided below.



Figure 1. Proposed buffer zones and living infrastructure framework for the Allegheny Riverfront Green Boulevard Study.

Buffer Typology 1 – Dense Urban Development Buffer Zone

11th Street to 31st Street, including the Strip District (transition to Typology 2 from 25th to 31st street)



Context: This buffer zone occurs along a dramatically altered segment of the Allegheny Riverfront, just upstream from the Convention Center. Land use in this portion of the study area includes significant existing development including buildings, roadways, parking lots, and other paved zones. The existing shoreline includes several small vegetated areas and bulkheads that exhibit varying levels of stability (based on the study done by Riverlife). The existing buffer zone along the river's shoreline is predominantly impervious, with some narrow bands of native and invasive vegetation along bank slopes. The Three Rivers Heritage Trail (including the Strip District Trail) follows much of the shoreline, connecting 25th street to the trail in front of the Convention Center. Opportunities exist for improving

February 2, 2012

Re: Ecological and Open Space Planning – Revised Ecological Buffer Typologies for Allegheny Riverfront and Green Boulevard
Page 4 of 8

the extent, form, and function of the riparian buffer, particularly along areas where there is planned redevelopment along the Riverfront.

Existing Impacts & Constraints: Extensive existing infrastructure, site size/layout, failing bulkheads, varied public & private ownership, and soil contaminant potential.

Buffer Needs & Opportunities: Enhanced water quality, protection of river banks, added green space and improved trail connections, increased urban ecological function, and enhanced native biodiversity.

Buffer Vegetation Cover: Native species landscapes including canopy trees, small trees/shrubs, and native herbaceous ground cover. The Allegheny Riverfront Vision Plan suggests a minimum of 80% tree canopy in the riparian buffer.

Buffer Width Standard: Minimum 100 feet wide from shoreline with a continuous connection, and a desired 125 feet plus width when possible. This is based on environmental needs for enhancing water quality, protecting riverbanks, and increasing urban ecological functions by providing for habitat and biological diversity. Cultural uses in the buffer zone also help determine width needs to provide for public use green space, enhance the visitor experience and aesthetics, as well as to accommodate the greenway trail. Additionally, the buffer zone provides a functional setback from buildings and their shadowing, it provides a front 'yard' transition from residential housing to the river banks, it accommodates stormwater practice placement and it allows for some unobstructed floodplain function.

Buffer Composition: Maximum 25% Impervious Surface Cover* and a Minimum 75% Cover of Native Vegetated Plantings including vegetated stormwater management practices. (*The goal is to achieve additional maximum perviousness with porous surface practices that help filter and convey water to stormwater management practices.) Infiltration is not recommended in areas with potential soil contamination.

Primary Buffer Design and Redevelopment Techniques: Integrated green infrastructure, stormwater management practices, improved trail access, improved habitat corridor with increased tree canopy, open space amenity, integrated design of waterfront access and hardscape elements, marina access, and provision of ecosystem services.

February 2, 2012

Re: Ecological and Open Space Planning – Revised Ecological Buffer Typologies for Allegheny Riverfront and Green Boulevard
Page 5 of 8

Buffer Typology 2 – Mixed Industrial & Residential Buffer Zone

31st Street to 65th Street (transition from Typology 1 from 25th to 31st street, transition to Typology 3 upstream of 62nd Street Bridge)



Context: This buffer zone occurs along a moderately to highly developed segment in the central portion of the study area. Land use includes significant industrial and commercial operations, as well as residential dwellings. Impervious areas, in addition to the buildings, include roads, parking lots, and occasional vacant lands that range from nearly barren to primarily vegetated areas. The existing buffer zone along the river's shoreline includes both impervious areas as well as widening bands of vegetation, with both native and invasive plant species on relatively steep riverbank slopes. A portion of the Three Rivers Heritage Trail follows the shoreline, as the Lawrenceville Trail. Opportunities exist for improving the extent, form and function of the buffer zone, particularly along areas where there is planned redevelopment along the Riverfront. This segment has a couple of historic unnamed stream outfalls where ecological restoration at the outfalls could provide further ecological function.

Existing Impacts & Constraints: Extensive existing infrastructure, site size/layout, failing bulkheads, varied public & private ownership, and soil contaminant potential.

Buffer Needs & Opportunities: Enhanced water quality, protection of riverbanks, added green space and trail connections, increased urban ecology function, enhanced native biodiversity. There is potential to reconnect the Lawrenceville Neighborhood with the riverfront.

Buffer Vegetation Cover: Native species landscapes including a blend of more naturalized habitat sub-zones and managed native landscapes. Structure should include canopy trees, understory trees, shrubs, vines and native herbaceous ground cover varied from natural areas to maintained landscape beds.

Buffer Width Standard: Minimum 125 feet wide from the shoreline with a continuous connection, and desired 150 feet + width when possible. The most widely recognized buffer planning model developed by the USDA Forest Service notes that the ideal width of a functional buffer should be at least 95 feet wide and thus this zone 2 buffer tries to meet and exceed that, but aiming for higher functionality in a section of the riverfront that already includes some wider buffer areas, as well as a mix of residential and urban development.

Buffer Composition: Maximum 15% Impervious Surface Cover* and a Minimum 85% Cover of Native Vegetated Plantings. (*The goal is to achieve additional maximum perviousness with porous surface practices that help filter and convey water to stormwater management practices.) Infiltration is not recommended in areas with potential soil contamination.

February 2, 2012

Re: Ecological and Open Space Planning – Revised Ecological Buffer Typologies for Allegheny Riverfront and Green Boulevard
Page 6 of 8

Primary Buffer Design and Redevelopment Techniques: Provision of ecosystem services, integrated green Infrastructure, ecological restoration, stormwater management practices, improved public trail access, improved and widened habitat corridor, open space and recreational amenity including low impact water (kayak) access, environmental education opportunities integrated with neighborhood and schools, and permaculture and regenerative landscapes.

Buffer Typology 3 – Ecological Conservation & Open Space Buffer Zone

65th Street to Washington Boulevard (transition to Typology 3 upstream of 62nd Street Bridge)



Context: This buffer zone occurs along a less-densely developed segment of the study area, which includes existing open space, parkland and undeveloped riverfront paralleling the existing rail line. Land use in this portion of the study area includes former industrial lands, residential development, docks, parks and otherwise vacant areas. There is a range of imperviousness including roadways and parking areas and a few building footprints. The existing buffer zone along this stretch of the river includes densely vegetated areas with more intact woodland structure and groundcover. It is dominated by native species assemblages, with widening bands of native and invasive vegetation on relatively steep river bank slopes. Opportunities exist for improving the extent, form and function of the buffer, particularly as lands are redeveloped along the shoreline. This segment also has two historic stream outfalls, Negley and Heth's Run, which could provide opportunities for restoration.

Existing Impacts & Constraints: Failing bulkheads, some infrastructure interruptions including the existing rail line, varied public & private ownership, and less soil contaminant potential.

Buffer Needs & Opportunities: Ecological restoration and enhancement, enhanced water quality, river bank protection, increased green space connections, improved urban ecological function, enhanced native biodiversity, improved connections to the historic stream network at Heth's Run and Negley Run. The planned ecological and recreation restoration project at Heth's Run provides an important open space connection integrated with ecological restoration and regenerative stormwater conveyance.

Buffer Vegetation Cover: Native species landscapes including more naturalized habitat woodland stands, scrub-shrub, meadow and limited managed native landscapes. Structure should include canopy trees, understory trees, shrubs, vines and native herbaceous ground cover.

Buffer Width Standard: Minimum 250 feet wide from shoreline with a continuous connection, and desired 300 feet + width when possible. The Allegheny Riverfront Vision Plan suggests that the ideal

February 2, 2012

Re: Ecological and Open Space Planning – Revised Ecological Buffer Typologies for Allegheny Riverfront and Green Boulevard
Page 7 of 8

riparian buffer along the whole of the riverfront would be at least 200 feet of wooded riparian buffer. Within Zone 3 there is more flexibility for widening the buffer to at least 250' in many places and up to 300', in order to improve ecological function because of the steep slopes, and existing development patterns. It is also important to note that this zone already has existing native vegetation and wide buffers that could be enhanced to provide improved habitat and hydrologic function along the Allegheny River.

Buffer Composition: Maximum 5% Impervious Surface Cover* and a Minimum 95% Cover Native Vegetated Plantings. (*The goal is to achieve additional maximum perviousness with porous surface practices that help filter and convey water to stormwater management practices.) Infiltration is not recommended in areas with potential soil contamination.

Primary Buffer Design and Redevelopment Techniques: Provision of ecosystem services, ecological restoration, conservation and improvement of biodiversity, increased habitat corridor potential, improved public trail access, open space amenity, and environmental education.

February 2, 2012

Re: Ecological and Open Space Planning – Revised Ecological Buffer Typologies for Allegheny Riverfront and Green Boulevard

Page 8 of 8

Ecological Benefits of the Allegheny Green Boulevard Planning Approach

Increased and Enhanced Tree Canopy and Native Vegetation Cover

- Reducing effects of urban heat island through increased shade
- Enhanced and expanded habitat
- Air and water filtration
- Provision of pollinator food
- Aesthetic and recreation amenity
- Potential for natural treatment of both wastewater and stormwater

Functional Riparian Buffer

- Improvement and enhancement of ecological function
- A more continuous movement and migration corridor for wildlife
- Resources for food and shelter for wildlife
- Providing shade for waterway, cooling and allowing for adequate conditions for invertebrates and diatoms in the water

Improved Organic Shoreline Form

- Enhanced natural shoreline conditions improve likelihood of aquatic habitat for fish and other aquatic species
- Irregular forms provide novel approaches to improved aquatic habitat

Stormwater Treatment

- Filtering water, reducing nutrients and contaminants

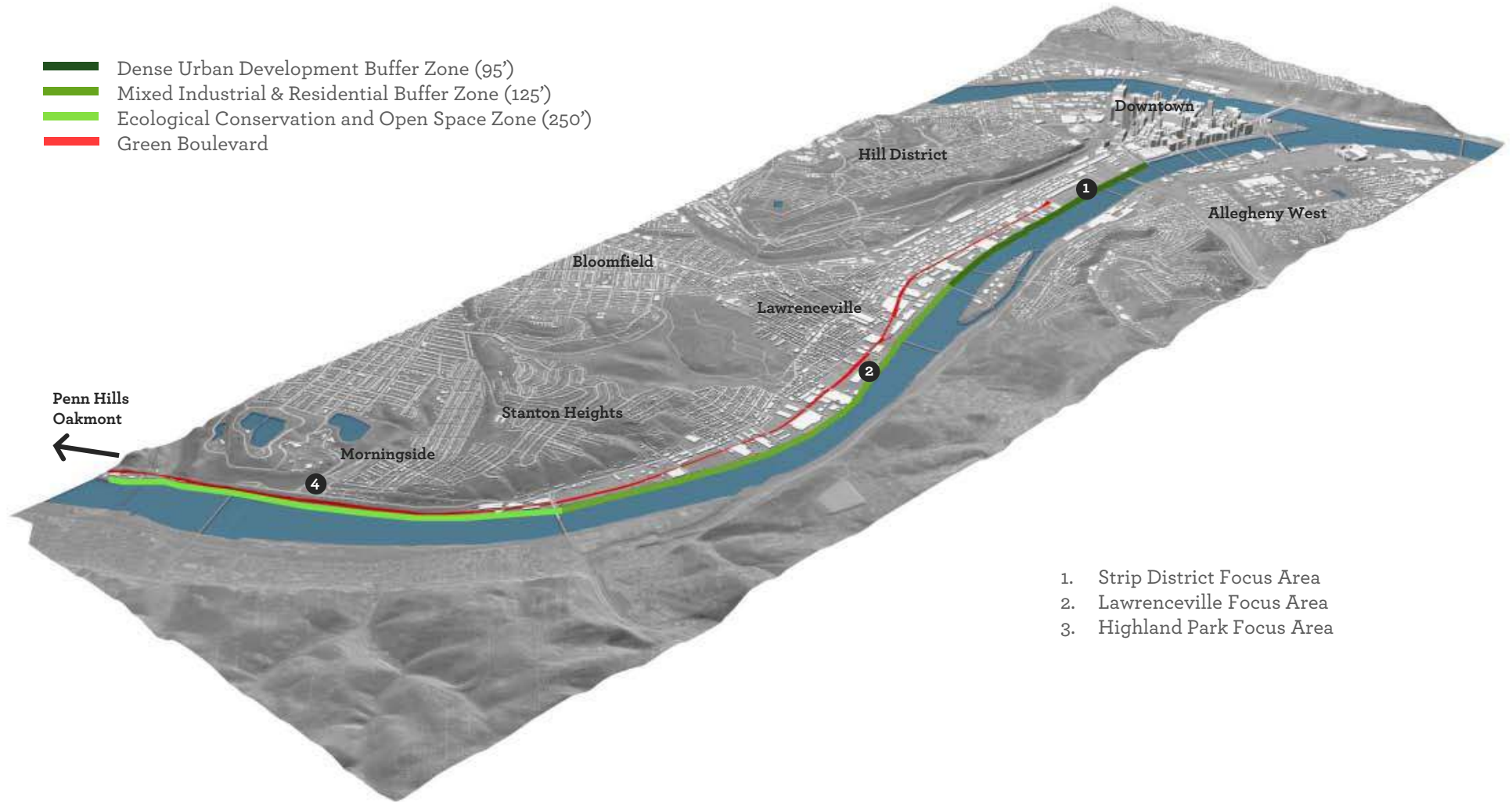
Shoreline Stability

- Established native vegetation, especially trees, help stabilize shoreline while providing multiple benefits

Allegheny Landscape Prototypes

Buffer Zones

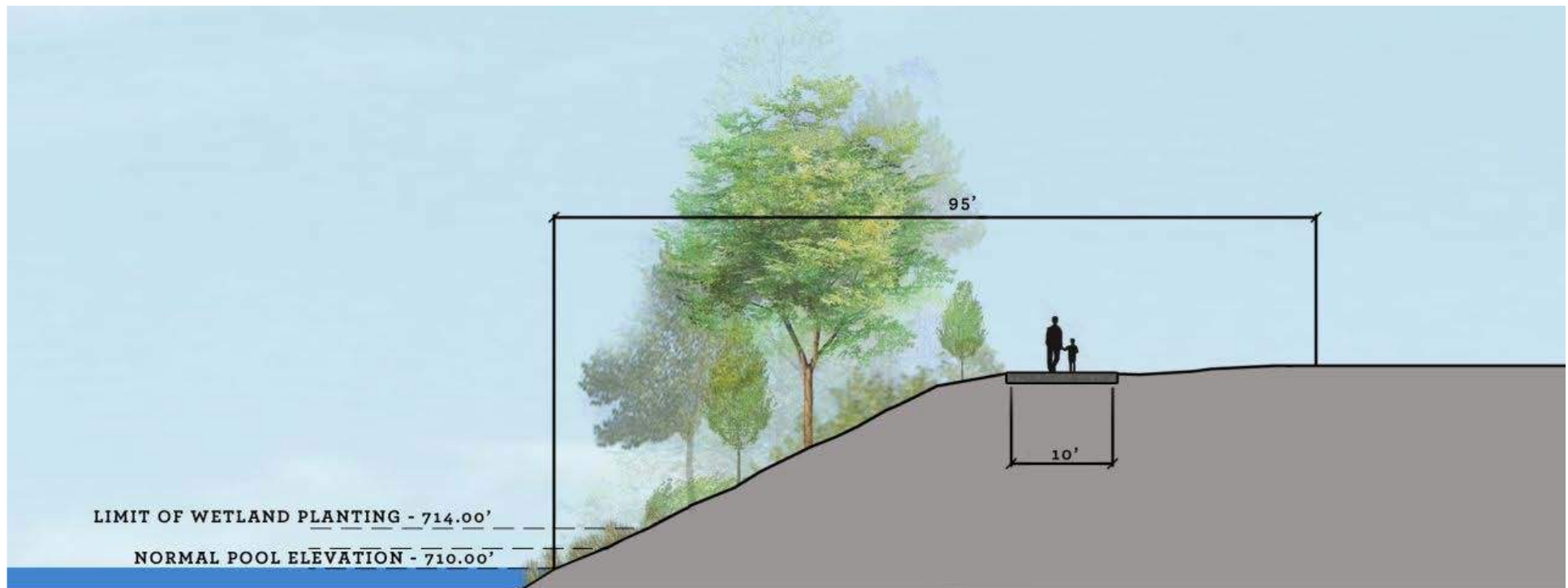
- Dense Urban Development Buffer Zone (95')
- Mixed Industrial & Residential Buffer Zone (125')
- Ecological Conservation and Open Space Zone (250')
- Green Boulevard



1. Strip District Focus Area
2. Lawrenceville Focus Area
3. Highland Park Focus Area

Open Space

17th Street River Edge Condition [Dense Urban Development Buffer Zone 95']



Note: Section depicts existing condition for river edge condition today.

Open Space

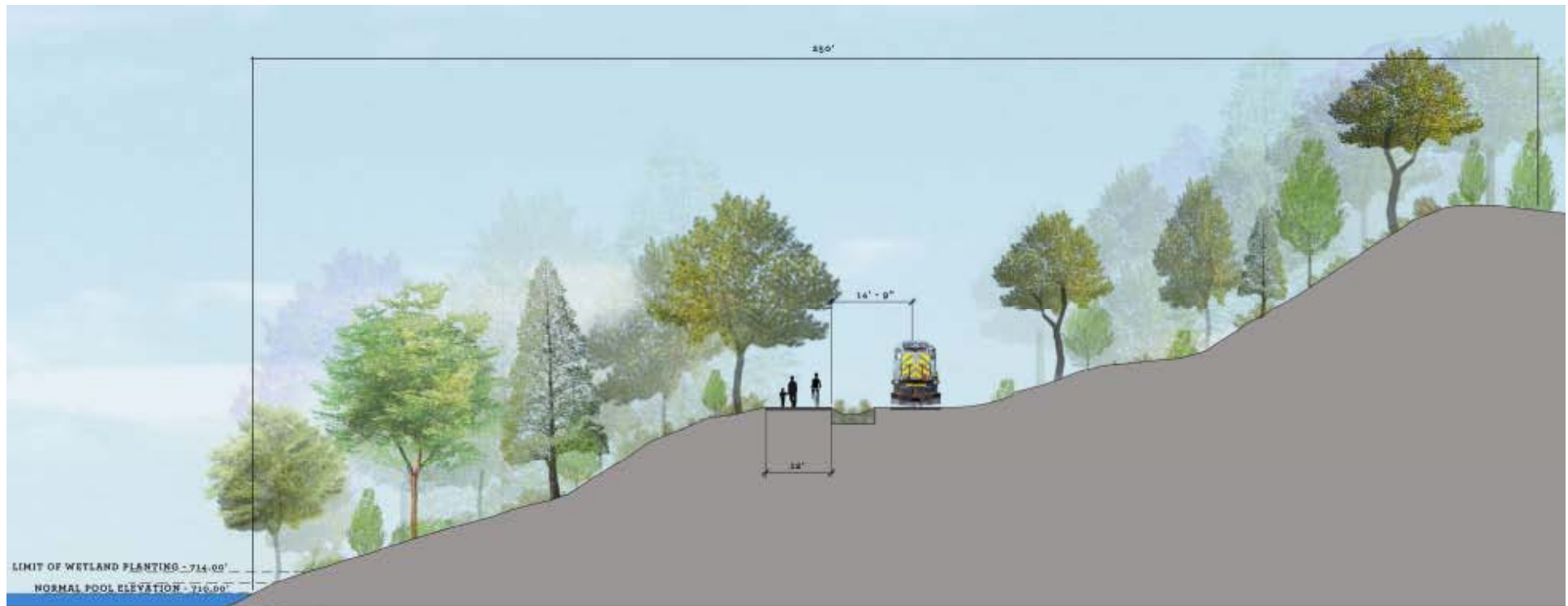
40th Street River Edge Condition [Mixed Industrial & Residential Buffer Zone (125')]



Note: Section depicts existing condition for river edge condition today.

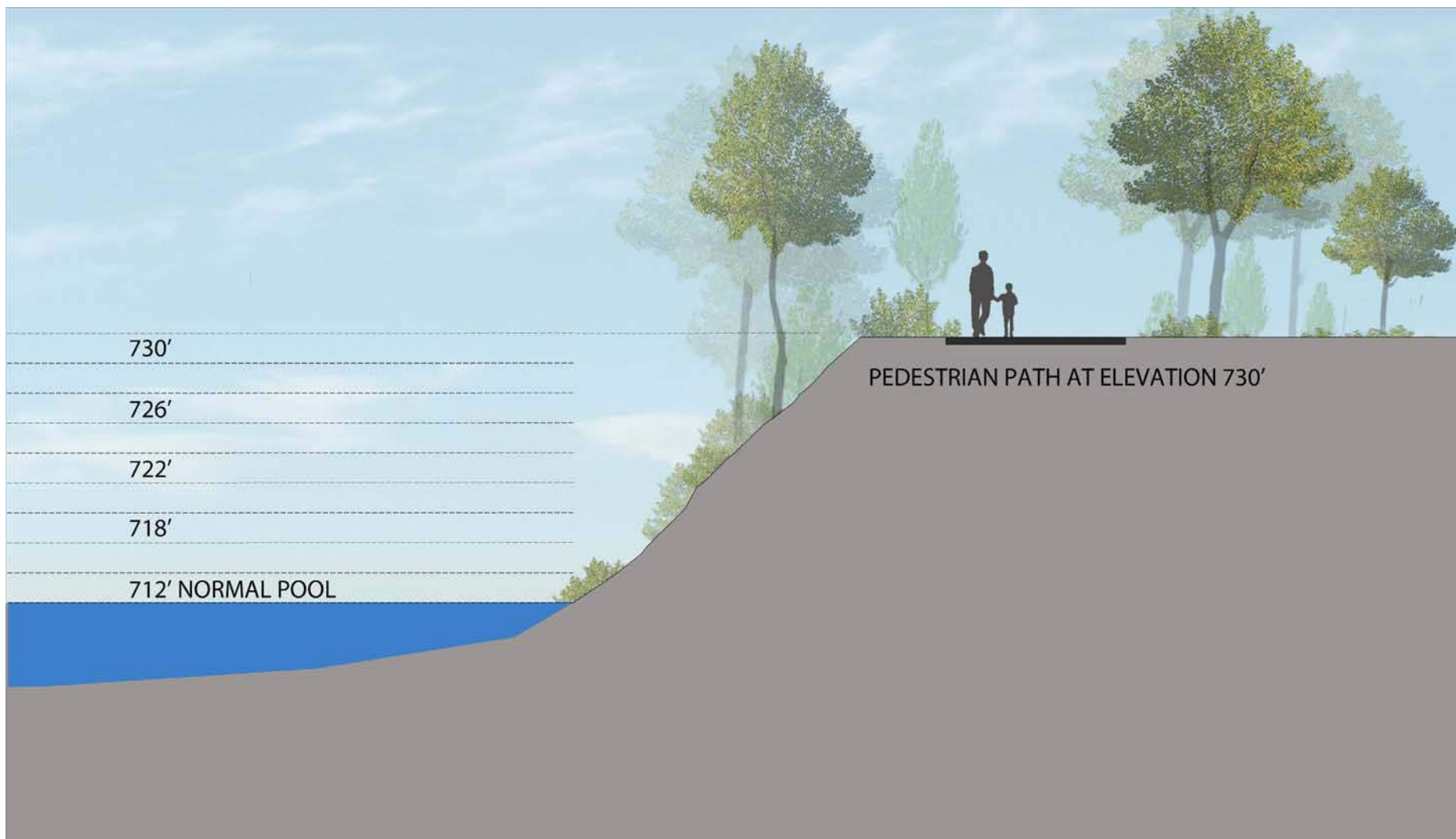
Open Space

Negley Run River Edge Condition [Ecological Conservation and Open Space Zone (250')]

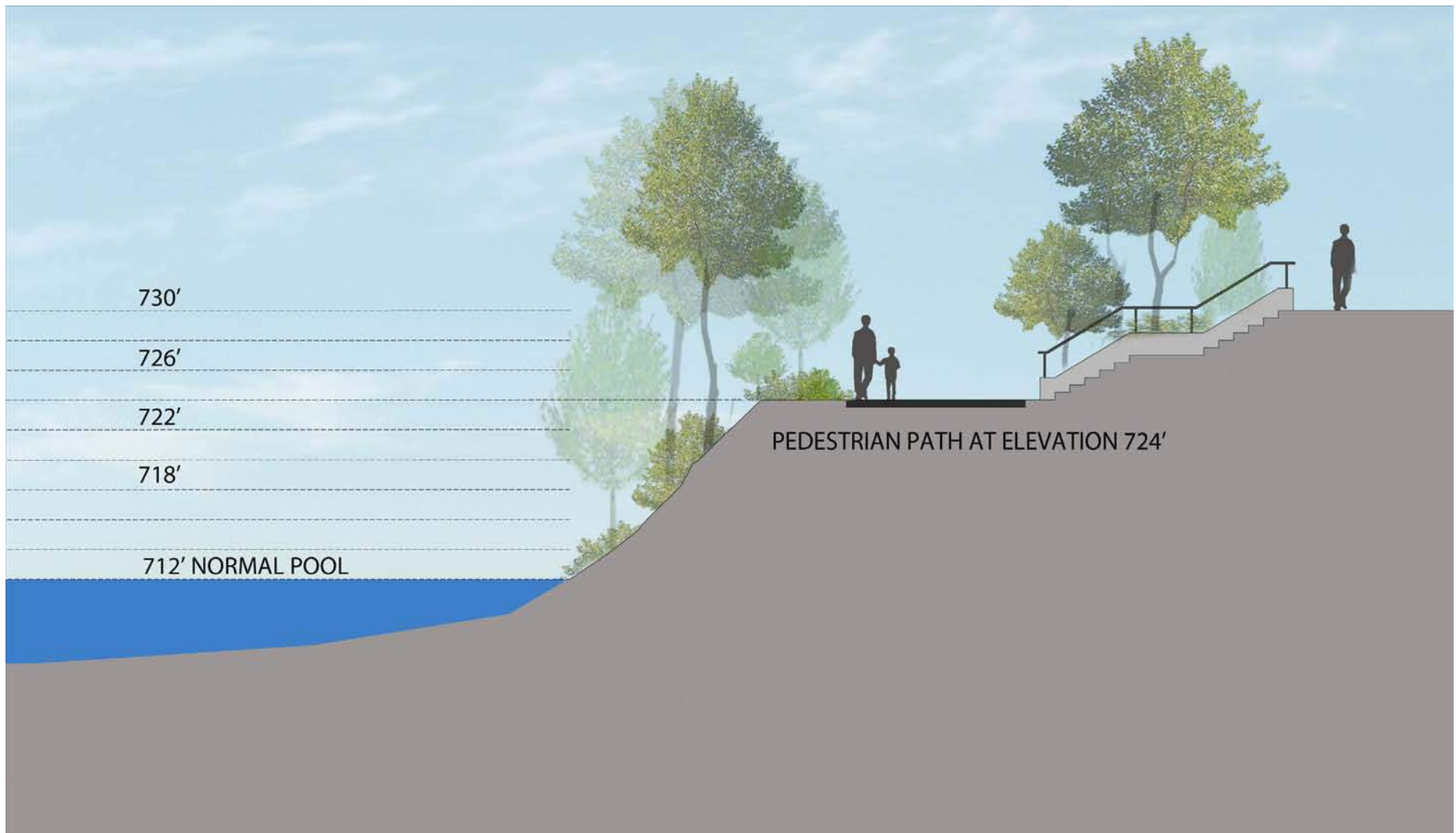


Note: Section depicts existing condition for river edge condition today.

Landscape Prototypes - High Elevation Path



Landscape Prototypes - Low Elevation Path



Landscape Prototypes - Stormwater Conveyance with Combined Sewer Overflow



**Riverfront Conceptual Open Space
Plans and Cost Summaries**

Riverfront Conceptual Open Space Plans

With the goal of connecting Pittsburgh to the river, conceptual open space plans were created for three of the neighborhoods along the Allegheny River in the study area: the Strip District (11th-21st), Lawrenceville (40th-48th in the 43rd Street District Development), and Highland Park. The open space plans were developed by analyzing each of the project sites including the site history and content of the Ecological Conditions and Observations report, by organizing design principles, by assessing open space programming from the community obtained through the public meetings and MyGreenBoulevard online tools, and by reviewing draft concept plans at the public meetings to inform creation of the preferred plans. Concept level cost estimates were generated for each of the open space plans.

Historical Background

The Allegheny Riverfront is best characterized as a river of commerce and industrial production, particularly in the Strip District and Lawrenceville neighborhoods. Neighborhoods further east, including Stanton Heights, Morningside, and Highland Park, share a different relationship with the river because of the steep, rocky slopes of the river valley adjacent to those neighborhoods. Both the Strip District and Lawrenceville were first laid out in 1814 based on proximity to downtown, access to river transportation, and access to iron ore production, making them both ideal locations for industrial development. The Strip District was home to iron mills, foundries, and glass factories. Lawrenceville was home to the Allegheny Arsenal, between 39th and 40th Streets, built in 1814. Throughout the 19th century, industrial development continued to grow east along the river as transportation expanded with the construction of the Allegheny Valley Railroad in 1852, providing service for freight and passengers.

The 20th century brought a change to the neighborhoods—most specifically to the Strip District. With the removal of railroads in downtown Pittsburgh in 1906 and construction of the Produce Terminal at the corner of 21st Street and Smallman, the Strip District transformed into a hub of wholesale produce business with food warehouses and auction houses. During the post-war years, the wholesale business forced other transformations on the Strip District, as trucking replaced rail traffic and large grocery store chains emerged. Similarly, shifts in industrial

manufacturing impacted Lawrenceville. By the latter part of the 20th century, many areas of the industrial riverfront were shifting to storage and distribution facilities.

The future Strip District open space is situated along the Allegheny River between 11th and 21st Streets. This land was originally industrial properties, then primarily rail yards. Today, much of this land between the river and Smallman Street is surface parking lots for commuters who work in Downtown and the Strip District, with the exceptions of the Produce Terminal between 16th and 21st along Smallman, a Hampton Inn at 12th and Smallman, and the Seagate Office Building along the river between approximately 12th Street and the Veteran's Memorial Bridge. The site is in the process of redevelopment by the Buncher Company; their Preliminary Development Plan was approved for the Strip District in December 2012.

The future Lawrenceville open space is situated along the river between 40th and 48th Streets. Much of this property was a rail yard for storage and switching from their junction at 40th Street. Today, much of the property inside the rail yard is a storage and distribution facility owned by the Buncher Company. South of the AVR mainline is the site of the former Heppenstall steel mill. 43rd Street is flanked by Carnegie-Mellon's National Robotics Engineering Center (NREC) and 43rd Street Concrete. A narrow riverside trail, maintained by NREC employees, runs from 36th to 43rd Street. A siding still runs between the river and the Buncher facility to serve the McConway-Torley foundry, which dates back to 1868. The district is the location of the 43rd Street station proposed on the commuter rail in the Green Boulevard, and the 43rd Street District development plan on the surrounding parcels of land.

At the eastern edge of the city, an open space concept plan was prepared for the Highland Park and Morningside neighborhoods between Baker Street and Washington Boulevard. The focus was on the opportunity to create connections from the neighborhoods to the Green Boulevard multi-use path, as well as to the proposed commuter rail station at the intersection of Washington and Allegheny River Boulevards. Because of the steep slopes in this area and little infrastructure to support development, the Highland Park area is characterized as the Ecological Conservation Buffer, based on the analysis of the Ecological

Conditions and Observations and Ecological Buffers Typologies memos of the Green Boulevard Open Space and Riverfront Access Appendix. Highland Park, the park, was founded in 1889 and opened in 1893. The Pittsburgh Zoo opened on June 14, 1898, after a private monetary donation was made for the construction of a zoological garden in Pittsburgh's Highland Park. The PPG Aquarium in the zoo opened in 1967.

The open space plan builds on recent efforts in the community. The zoo's parking lot was constructed decades ago by filling the Heth's Run valley. The Highland Park and Morningside neighborhoods, Pittsburgh Parks Conservancy, and Pittsburgh Zoo and PPG Aquarium have been collaborating for the past decade to replace the Butler Street Bridge at Baker Street, a major gateway to the neighborhoods and the zoo. This is an effort to reimagine the former Heth's Run, rebuild the bridge, and reorganize zoo parking to allow creation of a new multi-purpose field and provide access to a new Allegheny River overlook below the bridge. The city has been coordinating with the Pennsylvania Department of Transportation and the Butler Street bridge project that is scheduled to begin in the coming year.

Over the past few years, the Parks Conservancy has more broadly initiated a process of preparing a master plan for the restoration and management of Highland Park. The Heth's Run project is a priority of the plan, but another significant priority is Washington Boulevard and Negley Run. Similar to Heth's Run, Negley Run is another stream that was filled decades ago. The Parks Conservancy Plan prioritizes transforming Washington Boulevard in a manner that better resembles the parkway it was intended to be, with an emphasis in creating improved bike and pedestrian connections from the neighborhoods to Washington Boulevard and the bike oval.

Analysis, Outreach, and Programming

During the planning process, several efforts were made to engage the community in the Green Boulevard planning process. MyGreenBoulevard.com was launched as an interactive planning tool and game to allow community members to provide input. Through feedback provided by participants, the community identified that the river is minimally used for walking trails, dog walking, and boat/kayak launches, primarily because of the limited opportunities for public access and open space. The community priorities for the future included more trails along the river, more flexible open spaces, improved connections to the river from the neighborhood, and more garden spaces.

The community was similarly invited throughout the process to provide input by participating in the public meetings. Consistently, priorities from the community included the following key themes:

- Enable the next generation to “grow up” with the river
- Appreciate the natural feel of the riverfront: don't over-program it
- Take a balanced programming approach that also provides accessibility for sports
- The industrial feel is an opportunity
- Take advantage of community gardens as a great opportunity for community engagement
- Always incorporate green infrastructure
- Help reestablish the riverfront and remove invasive species
- Consider long-term maintenance and funding
- Ensure physical and visual access to the river
- Address concerns about flooding

Similarly, materials provided by the Parks Conservancy Pittsburgh Regional Parks Master Plan: Highland Park included feedback and priorities that struck similar themes:

- Extend and integrate the park, boulevard, and greenway system by extending the City of Pittsburgh's multi-modal transportation efforts to connect parks as part of a comprehensive citywide effort addressing streets, boulevards and repurposed vacant lands; and linking the regional parks to smaller parks, greenways, rivers, and new efforts such as the Allegheny Riverfront Green Boulevard initiative
- Reclaim Highland Park's landscape character while improving connectivity, safety, and zoo interfaces with the park
- Link improvement of existing park institutions, such as the zoo (and Phipps Conservatory), to a comprehensive strategy of improving and screening park edges and interfaces, reinforcing park settings and natural systems
- In rebuilding the park landscape and user amenities, incorporate state-of-the-art sustainable infrastructure technologies that reduce impacts and reinforce natural systems
- Seek green infrastructure solutions for stormwater wherever possible
- Leverage partnerships to advance park improvements, such as transportation improvements that can enhance accessibility and connectivity
- Renew the Heth's Run valley as a park gateway and greenway trail connection
- For Negley Run and Washington Boulevard, make Negley Run Boulevard into a complete street, adding stormwater management areas along its edges; complete the missing trail link along Washington Boulevard; improve ingress and egress points; create a gateway at Butler Street; buffer the police and fire facilities; add user amenities near the bicycle facility; continue to manage and enhance the meadow
- For Heth's Run, develop the play field, trails, and river connection as originally planned; complete the trail connection to the King Estate; permit zoo parking to expand but retain public access with a clear gateway to Highland Park and a park drive with a public trail on the west side; reestablish connections to neighborhood

Through the planning process, utilizing feedback from the outreach initiatives and working with the steering committee, design principles were organized to guide development of the open space plans:

- Maximize public access to the riverfront for recreation.
- Create open space for the programming of public spaces (on land and in water) to provide a variety of options to activate the Riverfront
- Promote environmental restoration of the Allegheny Riverfront, including water quality improvement, bank stabilization, ecological restoration, habitat creation, and productive landscapes
- Design and organize a system of riverfront access, both parallel and perpendicular to the river
- Create public spaces that incent and enable the highest and best use of adjacent lands
- Promote all transportation uses along the AVR Corridor/Green Boulevard

Through the background, analysis, programming, and community feedback, the design team organized an approach to the design of the conceptual open spaces. This approach builds on the character of the riverfront, restoring and enhancing the natural systems of the riverbanks and drainage ways by introducing green infrastructure to handle stormwater, while also taking a design approach that expresses the industrial character of the neighborhoods that grew up along the riverfront.

Strip District Conceptual Open Space Plan

In the Strip District, the future landscape design for the riverfront between 11th Street and 21st Street includes riverfront trails, a marina, fishing pier, kayak launch, ferry launch site, and riverfront overlook to draw visitors down to the water and provide new waterborne activities. The open space plan extends the urban riverfront promenade that starts at the Point and continues up to 17th Street, before the riverfront access becomes a more natural riverfront trail. A community park at 12th Street offers activities for the neighborhood with a flexible gathering space, small stage, and children's splash pad. Nearby a skate park takes

advantage of underutilized space beneath the Veteran's Bridge. While comfortable streetscaping is planned for all streets in the Strip District, broad rights-of-way at 15th Street and 17th Street provide critical opportunities to integrate regenerative stormwater conveyance strategies into the street design. Streets will be beautiful, functional, and express the sustainability goals of the project, while making strong connections to Smallman and Penn Avenue in the neighborhood. Designed to accommodate plans for a mixed-use development, improvement of the riverfront is anticipated to increase foot traffic through the series of active public spaces, thereby attracting investment and raising property values for the city. (Note: A Preliminary Development Plan was approved for the Strip District in December 2012.)

43rd Street District Conceptual Open Space Plan

A new vision for the riverfront in Lawrenceville addresses the community's wishes for a neighborhood park that balances active and passive uses. The riverfront park creates value for new housing along the river, with a lively riverfront promenade extending from approximately 41st Street to 47th Street, where it crosses the new stormwater landscape. Creating immediate access to and along the water's edge, a pedestrian overlook at 43rd Street extends into the river and connects to the riverfront trail system, which extends from 43rd down to 37th Street. The trail also connects to the kayak launch below the 40th Street Bridge and the new dog park constructed in 2012. A boardwalk at 44th Street connects to a generous stair that provides ample space for seating and gathering as visitors approach the river. A large open field is located at the eastern edge of the riverfront park, providing space for informal recreation, outdoor sports, and community events and festivals.

Highland Park Conceptual Open Space Plan

A key idea for Highland Park open space plan is to introduce new and enhanced stormwater conveyance systems where Heth's Run and Negley Run previously drained. The plan makes new connections from the Green Boulevard to the Morningside and Highland Park neighborhoods by building on the previous planning efforts by the Pittsburgh Parks Conservancy and the neighborhoods. New multiuse path connections link the Green Boulevard to the neighborhoods. The connection at Heth's Run will ramp and bridge over the railroad to the proposed overlook below the Butler Street Bridge. Connections through the

zoo parking lot are reorganized to improve proposed circulation routes to the neighborhoods while allowing greater opportunities to convey stormwater through the site and Heth's Run valley.

At Washington Boulevard, Negley Run will run again. Drainage through the Negley Run valley will reconnect to the Allegheny River through the construction of a new bridge/culvert below Washington Boulevard, the AVR rail line, and the tow path. A proposed multiuse path extension from the Green Boulevard will generally follow this new stormwater conveyance from a proposed commuter rail station at the intersection of Washington Boulevard and Allegheny River Boulevard (the former asphalt plant), through the neighborhoods and Highland Park, up to Negley Run Boulevard. This extension allows residents to walk or bike to downtown via the Green Boulevard multi-use path or to access the commuter rail. The landscape character along Washington Boulevard will be enhanced to expand the meadow and the landscape character of Highland Park, transforming Washington Boulevard into a parkway.

Concept Open Space Plan Cost Estimates

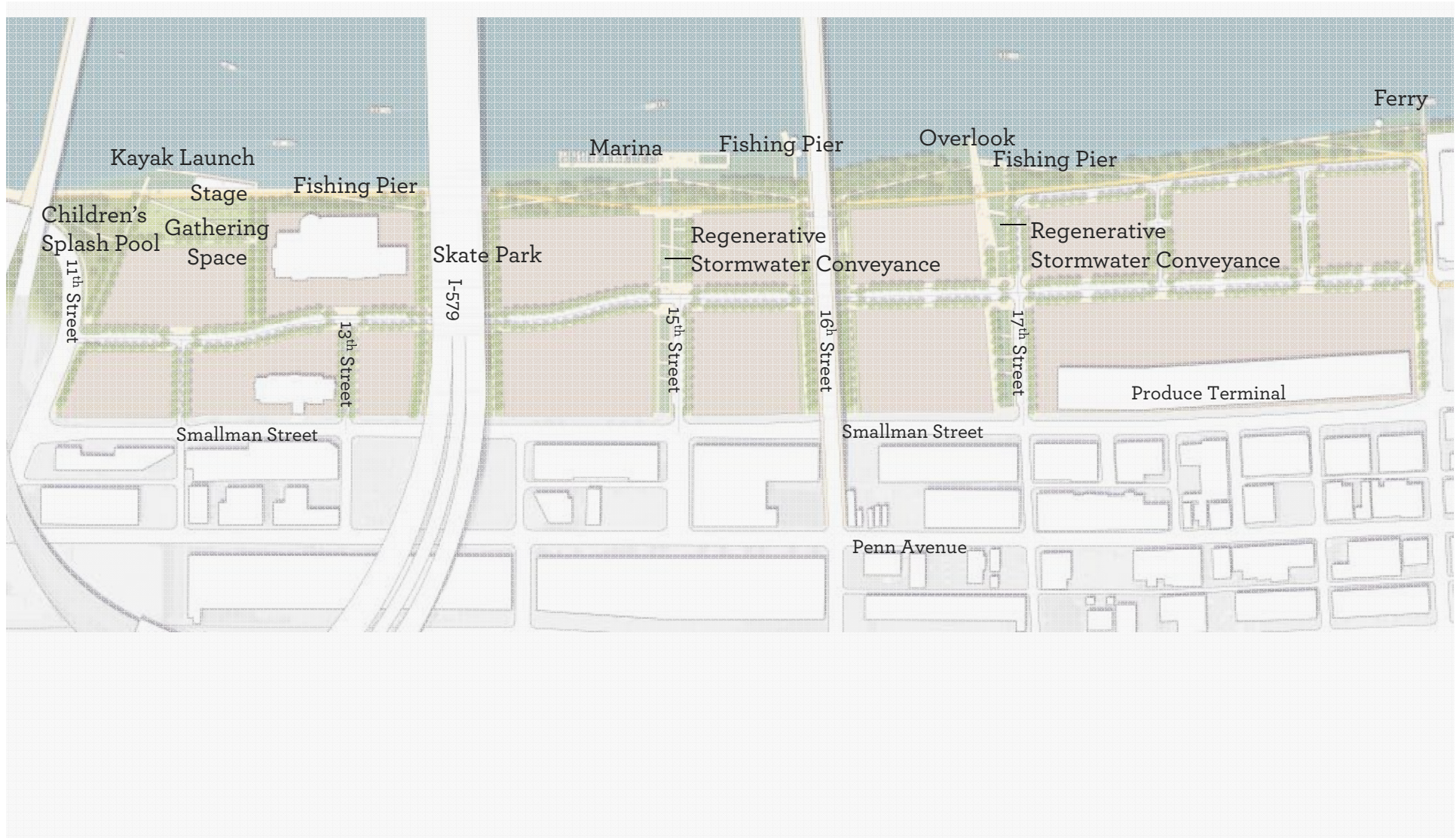
Cost estimates (budgets) were created for the concept designs. The estimates were generated by calculating site area takeoffs for the conceptual plans. Unit prices for improvements were developed utilizing bid tabulations from awarded projects provided by Riverlife, RIDC, and URA. Unit prices were compared to other Sasaki projects and RS Means cost estimating. Cost estimates were reviewed by team members, including Cosmos, to confirm unit prices. Overall contingencies were provided at 40%, which allows for a 15% design contingency and 10% construction contingency, as well as 10% for soft costs (survey, geotech, permitting, and owner administration) and 5% for inflation, not knowing when the projects will be bid but allowing for roughly two years of project development time. A 40% contingency is comparable to other estimates we have been developing at the concept level.

**Strip District Conceptual Open Space
Plan and Cost Summary**

Strip District - Open Space Plan



Strip District – Open Space Program



Statement of Estimated Probable Construction Cost
Allegheny Riverfront Project - Strip District
Concept Design
Summary of Costs

Sasaki Associates
December 19, 2012

Item No.	Item		Total
1	Open Space		
A.	CHILDREN'S SPLASH POOL	\$	2,027,930
B.	AMPHITHEATER	\$	2,478,567
C.	FISHING PIER	\$	2,014,321
D.	SKATE PARK	\$	1,410,550
E.	MARINA	\$	5,021,710
F.	PRIMANTI PARK	\$	3,002,771
G.	STORMWATER CONVEYANCE EAST	\$	3,332,093
H.	STORMWATER CONVEYANCE WEST	\$	3,162,660
	Sub-Total		\$22,450,602
	Contingencies	40.00%	\$8,980,241
	Total		\$31,430,843

Statement of Estimated Probable Construction Cost
 Allegheny Riverfront Project - Strip District
 Concept Design
 Open Space

Sasaki Associates
 December 5, 2012

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
CHILDREN'S SPLASH POOL		58,000	SF				\$38.41
A. Site Preparation							
1	Clearing & Grubbing	1.3	AC	\$ 4,000.00	\$ 5,326		
2	Site Demolition	58,000	SF	\$ 2.00	\$ 116,000		
						\$121,326	
B. Earthwork							
1	Fill / Grading	4,296	CY	\$ 15.00	\$ 64,444		Assume 2' depth of grading on average
2	River's Edge Stabilization		LF	\$ 500.00	\$ -		
3	Bulkhead	250	LF	\$ 2,000.00	\$ 500,000		
4	River Edge Naturalization	250	LF	\$ 250.00	\$ 62,500		Interplanted Rip Rap
						\$626,944	
Utilities & Infrastructure							
1	Site Electrical	1.3	AC	\$ 75,000.00	\$ 99,862		Allowance
2	Utility Improvements	1	LS	\$ 75,000.00	\$ 75,000		Allowance
3	Stormwater System	1	LS	\$ 100,000.00	\$ 100,000		Allowance
4	Drainage Outfall		LS	\$ -	\$ -		Allowance
						\$274,862	
E. Hardscape							
1	Pedestrian Walkway	12,240	SF	\$ 7.00	\$ 85,680		8' wide, gravel base
2	Concrete Pavers	3,188	SF	\$ 20.00	\$ 63,760		16" x 16" precast concrete unit pavers
3	Concrete Planting Curbs		LF	\$ 10.00	\$ -		
						\$149,440	
F. Lighting							
1	Pole Light	20	EA	\$ 5,300.00	\$ 106,000		
2	In-Ground LED Light	16	EA	\$ 1,850.00	\$ 29,600		
3	Step Light		LF	\$ 100.00	\$ -		
4	Tree Uplight	5	EA	\$ 1,100.00	\$ 5,500		
						\$141,100	
G. Special Elements							
1	Interpretive Signage	3	LF	\$ 4,000.00	\$ 12,000		
2	Blue Light	2	EA	\$ 300.00	\$ 600		
3	Stage		LS	\$ 700,000.00	\$ -		
4	Skate Park		EA	\$ 300,000.00	\$ -		
5	Fishing Pier		LS	\$ 100,000.00	\$ -		Floating pier
6	Marina		LS	\$ -	\$ -		Developer cost
7	Kayak Launch		EA	\$ 200,000.00	200,000		
8	Spash Pool	1	LS	\$ 350,000.00	\$ 350,000		Allowance
9	Water Taxi		LS	\$ 75,000.00	\$ -		
10	Overlook		LS	\$ 100,000.00	\$ -		
						\$562,600	
H. Site Furnishings							
1	Bench	10	EA	\$ 5,000.00	\$ 50,000		
2	Trash Receptacle- Solar	3	EA	\$ 3,500.00	\$ 10,500		
3	Bike Rack	2	EA	\$ 2,000.00	\$ 4,000		
4	Drinking Fountain		EA	\$ 3,700.00	\$ -		
						\$64,500	

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
I. Landscape							
2	Tree	40	EA	\$ 800.00	\$ 32,000		
5	Perennials/Groundcovers	1,100	SF	\$ 3.00	\$ 3,300		
7	Turf Grass	71,045	SF	\$ 1.50	\$ 106,568		
8	Turf Irrigation System	72,145	SF	\$ 2.00	\$ 144,290		
15	Double tree bubbler	20	EA	\$ 50.00	\$ 1,000		
						\$287,158	
CHILDREN'S SPLASH POOL TOTAL						\$2,227,930	

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
AMPHITHEATER		61,400	SF				\$40.37
A. Site Preparation							
1	Clearing & Grubbing	1.4	AC	\$ 4,000.00	\$ 5,638		
2	Site Demolition	61,400	SF	\$ 2.00	\$ 122,800		
						\$128,438	
B. Earthwork							
1	Fill / Grading	4,548	CY	\$ 15.00	\$ 68,222		Assume 2' depth of grading on average
2	River's Edge Stabilization		LF	\$ 500.00	\$ -		
3	Bulkhead	300	LF	\$ 2,000.00	\$ 600,000		
						\$668,222	
C. Utilities & Infrastructure							
1	Site Electrical	1.4	AC	\$ 75,000.00	\$ 105,716		Allowance
2	Utility Improvements	1	LS	\$ 75,000.00	\$ 75,000		Allowance
3	Stormwater System	1	LS	\$ 50,000.00	\$ 50,000		Allowance
4	Drainage Outfall	0	LS	\$ -	\$ -		Allowance
						\$230,716	
E. Hardscape							
1	Pedestrian Walkway	8,600	SF	\$ 7.00	\$ 60,200		8' wide, gravel base
2	Concrete Pavers	4,247	SF	\$ 20.00	\$ 84,940		16" x 16" precast concrete unit pavers
3	Concrete Planting Curbs	0	LF	\$ 10.00	\$ -		
4	Seatwall	730	LF	\$ 250.00	\$ 182,500		
5	Stairs	120	LFN	\$ 55.00	\$ 6,600		
						\$334,240	
F. Lighting							
1	Pole Light	32	EA	\$ 5,300.00	\$ 169,600		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light	15	LF	\$ 100.00	\$ 1,500		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$171,100	
G. Special Elements							
1	Interpretive Signage	2	LF	\$ 4,000.00	\$ 8,000		
2	Blue Light	1	EA	\$ 300.00	\$ 300		
3	Stage	1	LS	\$ 700,000.00	\$ 700,000		
4	Skate Park		EA	\$ 300,000.00	\$ -		
5	Fishing Pier		LS	\$ 100,000.00	\$ -		Floating pier
6	Marina		LS	\$ -	\$ -		Developer cost
7	Kayak Launch		EA	\$ 200,000.00	\$ -		
8	Splash Pool		LS	\$ 350,000.00	\$ -		Allowance
9	Water Taxi		LS	\$ 75,000.00	\$ -		
10	Overlook		LS	\$ 100,000.00	\$ -		
						\$708,300	
H. Site Furnishings							
1	Bench	5	EA	\$ 5,000.00	\$ 25,000		
2	Trash Receptacle- Solar	3	EA	\$ 3,500.00	\$ 10,500		
3	Bike Rack	2	EA	\$ 2,000.00	\$ 4,000		
4	Drinking Fountain	2	EA	\$ 3,700.00	\$ 7,400		
						\$46,900	
I. Landscape							
1	Tree	19	EA	\$ 800.00	\$ 15,200		

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
2	Perennials/Groundcovers	1,000	SF	\$ 3.00	\$ 3,000		
3	Reinforced Turf Lawn	34,000	SF	\$ 3.00	\$ 102,000		
4	Turf Grass	0	SF	\$ 1.50	\$ -		
5	Turf Irrigation System	35,000	SF	\$ 2.00	\$ 70,000		
6	Double tree bubbler	9	EA	\$ 50.00	\$ 450		
						\$190,650	
AMPHITHEATER TOTAL						\$2,478,567	

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
FISHING PIER		46,200	SF				\$43.60
A. Site Preparation							
1	Clearing & Grubbing	1.1	AC	\$ 4,000.00	\$ 4,242		
2	Site Demolition	46,200	SF	\$ 2.00	\$ 92,400		
						\$96,642	
B. Earthwork							
1	Fill / Grading	3,422	CY	\$ 15.00	\$ 51,333		Assume 2' depth of grading on average
2	River's Edge Stabilization	500	LF	\$ 500.00	\$ 250,000		
3	Bulkhead	460	LF	\$ 2,000.00	\$ 920,000		
4	River Edge Naturalization	130	LF	\$ 250.00	\$ 32,500		Interplanted Rip Rap
						\$1,253,833	
C. Utilities & Infrastructure							
1	Site Electrical	1.1	AC	\$ 75,000.00	\$ 79,545		Allowance
2	Utility Improvements	0	LS	\$ 75,000.00	\$ -		Allowance
3	Stormwater System	1	LS	\$ 50,000.00	\$ 50,000		Allowance
4	Drainage Outfall		LS	\$ -	\$ -		Allowance
						\$129,545	
E. Hardscape							
1	Pedestrian Walkway	8,000	SF	\$ 7.00	\$ 56,000		8' wide, gravel base
2	Concrete Pavers	6,400	SF	\$ 20.00	\$ 128,000		16" x 16" precast concrete unit pavers
3	Concrete Planting Curbs	0	LF	\$ 10.00	\$ -		
4	Seatwall	0	LF	\$ 250.00	\$ -		
5	Stairs	80	LFN	\$ 55.00	\$ 4,400		
						\$188,400	
F. Lighting							
1	Pole Light	12	EA	\$ 5,300.00	\$ 63,600		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light	26	LF	\$ 100.00	\$ 2,600		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$66,200	
G. Special Elements							
1	Interpretive Signage	2	LF	\$ 4,000.00	\$ 8,000		
2	Blue Light	1	EA	\$ 300.00	\$ 300		
3	Stage		LS	\$ 700,000.00	\$ -		
4	Skate Park		EA	\$ 300,000.00	\$ -		
5	Fishing Pier	1	LS	\$ 100,000.00	\$ 100,000		Floating pier
6	Marina		LS	\$ -	\$ -		Developer cost
7	Kayak Launch		EA	\$ 200,000.00	\$ -		
8	Splash Pool		LS	\$ 350,000.00	\$ -		Allowance
9	Water Taxi		LS	\$ 75,000.00	\$ -		
10	Overlook		LS	\$ 100,000.00	\$ -		
						\$108,300	
H. Site Furnishings							
1	Bench	8	EA	\$ 5,000.00	\$ 40,000		
2	Trash Receptacle- Solar	2	EA	\$ 3,500.00	\$ 7,000		
3	Bike Rack	0	EA	\$ 2,000.00	\$ -		
4	Drinking Fountain	0	EA	\$ 3,700.00	\$ -		

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
----------	------	----------	------	-----------	----------	-------	---------

\$47,000

I. Landscape

1	Tree	32	EA	\$ 800.00	\$ 25,600		
2	Perennials/Groundcovers	0	SF	\$ 3.00	\$ -		
3	Reinforced Turf Lawn	0	SF	\$ 3.00	\$ -		
4	Turf Grass	28,000	SF	\$ 1.50	\$ 42,000		
5	Turf Irrigation System	28,000	SF	\$ 2.00	\$ 56,000		
6	Double tree bubbler	16	EA	\$ 50.00	\$ 800		

\$124,400

FISHING PIER TOTAL

\$2,014,321

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
SKATE PARK		85,600	SF				\$16.48
A. Site Preparation							
1	Clearing & Grubbing	2.0	AC	\$ 4,000.00	\$ 7,860		
2	Site Demolition	85,600	SF	\$ 2.00	\$ 171,200		
						\$179,060	
B. Earthwork							
1	Fill / Grading	6,341	CY	\$ 15.00	\$ 95,111		Assume 2' depth of grading on average
2	River's Edge Stabilization		LF	\$ 500.00	\$ -		
3	Bulkhead	180	LF	\$ 2,000.00	\$ 360,000		
4	River's Edge Naturalization	180	LF	\$ 250.00	\$ 45,000		
						\$500,111	
C. Utilities & Infrastructure							
1	Site Electrical	2.0	AC	\$ 35,000.00	\$ 68,779		Allowance
2	Utility Improvements	0	LS	\$ 30,000.00	\$ -		Allowance
3	Stormwater System	1	LS	\$ 20,000.00	\$ 20,000		Allowance
4	Drainage Outfall		LS	\$ -	\$ -		Allowance
						\$88,779	
E. Hardscape							
1	Pedestrian Walkway	8,000	SF	\$ 7.00	\$ 56,000		8' wide, gravel base
2	Concrete Pavers	0	SF	\$ 20.00	\$ -		16" x 16" precast concrete unit pavers
3	Concrete Planting Curbs	0	LF	\$ 10.00	\$ -		
4	Seatwall	0	LF	\$ 250.00	\$ -		
5	Stairs	0	LFN	\$ 55.00	\$ -		
						\$56,000	
F. Lighting							
1	Pole Light	35	EA	\$ 5,300.00	\$ 185,500		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light	24	LF	\$ 100.00	\$ 2,400		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$187,900	
G. Special Elements							
1	Interpretive Signage	4	LF	\$ 4,000.00	\$ 16,000		
2	Blue Light	2	EA	\$ 300.00	\$ 600		
3	Stage		LS	\$ 700,000.00	\$ -		
4	Skate Park	1	EA	\$ 300,000.00	\$ 300,000		
5	Fishing Pier		LS	\$ 100,000.00	\$ -		
6	Marina		LS	\$ -	\$ -		Developer cost
7	Kayak Launch		EA	\$ 200,000.00	\$ -		
8	Splash Pool		LS	\$ 350,000.00	\$ -		Allowance
9	Water Taxi		LS	\$ 75,000.00	\$ -		
10	Overlook		LS	\$ 100,000.00	\$ -		
						\$316,600	
H. Site Furnishings							
1	Bench	8	EA	\$ 5,000.00	\$ 40,000		
2	Trash Receptacle- Solar	3	EA	\$ 3,500.00	\$ 10,500		
3	Bike Rack	2	EA	\$ 2,000.00	\$ 4,000		
4	Drinking Fountain	3	EA	\$ 3,700.00	\$ 11,100		

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
----------	------	----------	------	-----------	----------	-------	---------

\$65,600

I. Landscape

1	Tree	20	EA	\$ 800.00	\$ 16,000		
2	Perennials/Groundcovers	0	SF	\$ 3.00	\$ -		
3	Reinforced Turf Lawn	0	SF	\$ 3.00	\$ -		
4	Turf Grass	0	SF	\$ 1.50	\$ -		
5	Turf Irrigation System	0	SF	\$ 2.00	\$ -		
6	Double tree bubbler	10	EA	\$ 50.00	\$ 500		

\$16,500

SKATE PARK TOTAL

\$1,410,550

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
MARINA		219,000	SF				\$22.93
A. Site Preparation							
1	Clearing & Grubbing	5.0	AC	\$ 4,000.00	\$ 20,110		
2	Site Demolition	219,000	SF	\$ 2.00	\$ 438,000		
						\$458,110	
B. Earthwork							
1	Fill / Grading	16,222	CY	\$ 15.00	\$ 243,333		Assume 2' depth of grading on average
2	River's Edge Stabilization		LF	\$ 500.00	\$ -		
3	Bulkhead	200	LF	\$ 2,000.00	\$ 400,000		
4	River's Edge Naturalization	330	LF	\$ 250.00	\$ 82,500		
						\$725,833	
C. Utilities & Infrastructure							
1	Site Electrical	5.0	AC	\$ 75,000.00	\$ 377,066		Allowance
2	Utility Improvements	1	LS	\$ 75,000.00	\$ 75,000		Allowance
3	Stormwater System	1	LS	\$ 150,000.00	\$ 150,000		Allowance
4	Drainage Outfall	1	LS	\$ 200,000.00	\$ 200,000		Allowance
						\$802,066	
E. Hardscape							
1	Pedestrian Walkway	20,800	SF	\$ 7.00	\$ 145,600		8' wide, gravel base
2	Concrete Pavers	10,700	SF	\$ 20.00	\$ 214,000		16" x 16" precast concrete unit pavers
3	Concrete Planting Curbs	1,000	LF	\$ 10.00	\$ 10,000		
4	Seatwall	0	LF	\$ 250.00	\$ -		
5	Stairs	350	LFN	\$ 55.00	\$ 19,250		
						\$388,850	
F. Lighting							
1	Pole Light	50	EA	\$ 5,300.00	\$ 265,000		
2	In-Ground LED Light	6	EA	\$ 1,850.00	\$ 11,100		
3	Step Light	24	LF	\$ 100.00	\$ 2,400		
4	Tree Uplight	12	EA	\$ 1,100.00	\$ 13,200		
						\$291,700	
G. Special Elements							
1	Interpretive Signage	4	LF	\$ 4,000.00	\$ 16,000		
2	Blue Light	4	EA	\$ 300.00	\$ 1,200		
3	Stage		LS	\$ 700,000.00	\$ -		
4	Skate Park		EA	\$ 300,000.00	\$ -		
5	Fishing Pier	1	LS	\$ 350,000.00	\$ 350,000		Floating pier
6	Marina	1	LS	\$ -	\$ -		Developer cost
7	Kayak Launch		EA	\$ 200,000.00	\$ -		
8	Spash Pool		LS	\$ 350,000.00	\$ -		Allowance
9	Water Taxi		LS	\$ 75,000.00	\$ -		
10	Overlook		LS	\$ 100,000.00	\$ -		
11	Pedestrian Ramps to Bridge	1	LS	\$ 1,500,000.00	\$ 1,500,000		Includes design, foundation, arch elements
						\$1,867,200	
H. Site Furnishings							
1	Bench	30	EA	\$ 5,000.00	\$ 150,000		
2	Trash Receptacle- Solar	4	EA	\$ 3,500.00	\$ 14,000		
3	Bike Rack	0	EA	\$ 2,000.00	\$ -		
4	Drinking Fountain	0	EA	\$ 3,700.00	\$ -		

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
----------	------	----------	------	-----------	----------	-------	---------

\$164,000

I. Landscape

1	Tree	86	EA	\$ 800.00	\$ 68,800		
2	Perennials/Groundcovers	7,200	SF	\$ 3.00	\$ 21,600		
3	Reinforced Turf Lawn		SF	\$ 3.00	\$ -		
4	Turf Grass	62,000	SF	\$ 1.50	\$ 93,000		
5	Turf Irrigation System	69,200	SF	\$ 2.00	\$ 138,400		
6	Double tree bubbler	43	EA	\$ 50.00	\$ 2,150		

\$323,950

MARINA TOTAL

\$5,021,710

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
PRIMANTI PARK		207,700	SF				\$14.46
A. Site Preparation							
1	Clearing & Grubbing	4.8	AC	\$ 4,000.00	\$ 19,073		
2	Site Demolition	207,700	SF	\$ 2.00	\$ 415,400		
						\$434,473	
B. Earthwork							
1	Fill / Grading	15,385	CY	\$ 15.00	\$ 230,778		Assume 2' depth of grading on average
2	River's Edge Stabilization		LF	\$ 500.00	\$ -		
3	Bulkhead	100	LF	\$ 2,000.00	\$ 200,000		Includes sheet pile shore stabilization
4	River's Edge Naturalization	1,500	LF	\$ 250.00			
						\$430,778	
C. Utilities & Infrastructure							
1	Site Electrical	4.8	AC	\$ 75,000.00	\$ 357,610		Allowance
2	Utility Improvements	1	LS	\$ 75,000.00	\$ 75,000		Allowance
3	Stormwater System	1	LS	\$ 150,000.00	\$ 150,000		Allowance
4	Drainage Outfall	1	LS	\$ 200,000.00	\$ 200,000		Allowance
						\$782,610	
E. Hardscape							
1	Pedestrian Walkway	16,000	SF	\$ 7.00	\$ 112,000		8' wide, gravel base
2	Concrete Pavers	15,000	SF	\$ 20.00	\$ 300,000		16" x 16" precast concrete unit pavers
3	Concrete Planting Curbs	500	LF	\$ 10.00	\$ 5,000		
4	Seatwall	0	LF	\$ 250.00	\$ -		
5	Stairs	192	LFN	\$ 55.00	\$ 10,560		
						\$427,560	
F. Lighting							
1	Pole Light	48	EA	\$ 5,300.00	\$ 254,400		
2	In-Ground LED Light	16	EA	\$ 1,850.00	\$ 29,600		
3	Step Light	24	LF	\$ 100.00	\$ 2,400		
4	Tree Uplight	6	EA	\$ 1,100.00	\$ 6,600		
						\$293,000	
G. Special Elements							
1	Interpretive Signage	6	LF	\$ 4,000.00	\$ 24,000		
2	Blue Light	4	EA	\$ 300.00	\$ 1,200		
3	Stage		LS	\$ 700,000.00	\$ -		
4	Skate Park		EA	\$ 300,000.00	\$ -		
5	Fishing Pier	1	LS	\$ 100,000.00	\$ 100,000		Floating pier
6	Marina		LS	\$ -	\$ -		Developer cost
7	Kayak Launch		EA	\$ 200,000.00	\$ -		
8	Splash Pool		LS	\$ 350,000.00	\$ -		Allowance
9	Water Taxi	1	LS	\$ 75,000.00	\$ 75,000		
10	Overlook	1	LS	\$ 100,000.00	\$ 100,000		
						\$200,200	
H. Site Furnishings							
1	Bench	20	EA	\$ 5,000.00	\$ 100,000		
2	Trash Receptacle- Solar	5	EA	\$ 3,500.00	\$ 17,500		
3	Bike Rack	3	EA	\$ 2,000.00	\$ 6,000		
4	Drinking Fountain	1	EA	\$ 3,700.00	\$ 3,700		

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
						\$127,200	
I. Landscape							
1	Tree	66	EA	\$ 800.00	\$ 52,800		
2	Perennials/Groundcovers	5,000	SF	\$ 3.00	\$ 15,000		
3	Reinforced Turf Lawn		SF	\$ 3.00	\$ -		
4	Turf Grass	65,000	SF	\$ 1.50	\$ 97,500		
5	Turf Irrigation System	70,000	SF	\$ 2.00	\$ 140,000		
6	Double tree bubbler	33	EA	\$ 50.00	\$ 1,650		
						\$306,950	
PRIMANTI PARK TOTAL						\$3,002,771	
STORMWATER CONVEYANCE EAST		40,000	SF			\$83.30	
A. Site Preparation							
1	Clearing & Grubbing	0.9	AC	\$ 4,000.00	\$ 3,673		
2	Site Demolition	40,000	SF	\$ 2.00	\$ 80,000		
						\$83,673	
B. Earthwork							
1	Fill / Grading	3,000	CY	\$ 15.00	\$ 45,000		Assume 2' depth of grading on average
2	River's Edge Stabilization		LF	\$ 500.00	\$ -		
3	Retaining Wall A	230	LF	\$ 800.00	\$ 184,000		Major wall 10'-14' height
4	Retaining Wall B	775	LF	\$ 600.00	\$ 465,000		Major wall 8'-10' height
5	Retaining Wall C	560	LF	\$ 400.00	\$ 224,000		Minor wall 4'-8' height
6	Wall Stone Clading	13,095	SF	\$ 25.00	\$ 327,375		
						\$1,245,375	
C. Utilities & Infrastructure							
1	Site Electrical	0.9	AC	\$ 75,000.00	\$ 67,500		Allowance
2	Utility Improvements	1	LS	\$ 75,000.00	\$ 75,000		Allowance
4	Drainage Outfall	1	LS	\$ 200,000.00	\$ 200,000		River's Edge Forebay
5	Conveyance System	1	LS	\$ 250,000.00	\$ 250,000		Wiers, Check Dams, Level Spreaders, Filer Fabric
6	Culvert	100	LF	\$ 300.00	\$ 30,000		Assume 30" RCP
						\$622,500	
E. Hardscape							
1	Pedestrian Walkway	13,700	SF	\$ 7.00	\$ 95,900		8' wide, gravel base
2	Concrete Pavers		SF	\$ 20.00	\$ -		16" x 16" precast concrete unit pavers
3	Concrete Planting Curbs		LF	\$ 10.00	\$ -		
4	Seatwall	100	LF	\$ 250.00	\$ 25,000		
5	Stairs	120	LFN	\$ 55.00	\$ 6,600		
						\$127,500	
F. Lighting							
1	Pole Light	10	EA	\$ 5,300.00	\$ 53,000		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light	12	LF	\$ 100.00	\$ 1,200		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$54,200	
G. Special Elements							
1	Interpretive Signage	2	LF	\$ 4,000.00	\$ 8,000		
2	Blue Light	1	EA	\$ 300.00	\$ 300		

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
3	Pedestrian Bridge		SF	\$ 325.00	\$ -		
4	Pedestrian Crossings	3,750	SF	\$ 250.00	\$ 937,500		
5	Fishing Pier		LS	\$ 100,000.00	\$ -		Floating pier
6	Marina		LS	\$ -	\$ -		Developer cost
7	Kayak Launch		EA	\$ 200,000.00	\$ -		
8	Spash Pool		LS	\$ 350,000.00	\$ -		Allowance
9	Water Taxi		LS	\$ 75,000.00	\$ -		
10	Overlook		LS	\$ 100,000.00	\$ -		
						\$945,800	
H. Site Furnishings							
1	Bench	10	EA	\$ 5,000.00	\$ 50,000		
2	Trash Receptacle- Solar	1	EA	\$ 3,500.00	\$ 3,500		
3	Bike Rack		EA	\$ 2,000.00	\$ -		
4	Drinking Fountain		EA	\$ 3,700.00	\$ -		
						\$53,500	
I. Landscape							
1	Tree	6	EA	\$ 800.00	\$ 4,800		
2	Perennials/Groundcovers	1,665	SF	\$ 3.00	\$ 4,995		
3	Wetland Planting	15,800	SF	\$ 12.00	\$ 189,600		Includes Soils and plant materials
4	Double tree bubbler	3	EA	\$ 50.00	\$ 150		
						\$199,545	
STORMWATER CONVEYANCE EAST TOTAL						\$3,332,093	
STORMWATER CONVEYANCE WES'		45,350	SF			\$69.74	
A. Site Preparation							
1	Clearing & Grubbing	1.0	AC	\$ 4,000.00	\$ 4,164		
2	Site Demolition	45,350	SF	\$ 2.00	\$ 90,700		
						\$94,864	
B. Earthwork							
1	Fill / Grading	3,000	CY	\$ 15.00	\$ 45,000		Assume 2' depth of grading on average
2	River's Edge Stabilization		LF	\$ 500.00	\$ -		
3	Retaining Wall A	200	LF	\$ 1,000.00	\$ 200,000		Major wall 14'-18' height
4	Retaining Wall B	500	LF	\$ 750.00	\$ 375,000		Major wall 10'-14' height
5	Retaining Wall C	600	LF	\$ 450.00	\$ 270,000		Minor wall 4'-10' height
6	Wall Stone Clading	13,400	SF	\$ 25.00	\$ 335,000		
						\$1,225,000	
C. Utilities & Infrastructure							
1	Site Electrical	1.0	AC	\$ 75,000.00	\$ 75,000		Allowance
2	Utility Improvements	1	LS	\$ 75,000.00	\$ 75,000		Allowance
3	Drainage Outfall	1	LS	\$ 200,000.00	\$ 200,000		
4	Conveyance System	1	LS	\$ 250,000.00	\$ 250,000		Wiers, Check Dams, Level Spreaders, Filer Fabric
5	Culvert	185	LF	\$ 300.00	\$ 55,500		Assume 30" RCP
						\$350,000	
E. Hardscape							
1	Pedestrian Walkway	20,200	SF	\$ 7.00	\$ 141,400		8' wide, gravel base
2	Concrete Pavers		SF	\$ 20.00	\$ -		16" x 16" precast concrete unit pavers
3	Concrete Planting Curbs		LF	\$ 10.00	\$ -		
4	Seatwall	100	LF	\$ 250.00	\$ 25,000		

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
5	Stairs	150	LFN	\$ 55.00	\$ 8,250		
						\$174,650	
F. Lighting							
1	Pole Light	15	EA	\$ 5,300.00	\$ 79,500		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light	12	LF	\$ 100.00	\$ 1,200		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$80,700	
G. Special Elements							
1	Interpretive Signage	2	LF	\$ 4,000.00	\$ 8,000		
2	Blue Light	1	EA	\$ 300.00	\$ 300		
3	Pedestrian Bridge	1,000	SF	\$ 350.00	\$ 350,000		
4	Pedestrian Crossings	2,600	SF	\$ 250.00	\$ 650,000		
5	Fishing Pier		LS	\$ 100,000.00	\$ -		Floating pier
6	Marina		LS	\$ -	\$ -		Developer cost
7	Kayak Launch		EA	\$ 200,000.00	\$ -		
8	Spash Pool		LS	\$ 350,000.00	\$ -		Allowance
9	Water Taxi		LS	\$ 75,000.00	\$ -		
10	Overlook		LS	\$ 100,000.00	\$ -		See Primanti Park for Overlook
						\$1,008,300	
H. Site Furnishings							
1	Bench	10	EA	\$ 5,000.00	\$ 50,000		
2	Trash Receptacle- Solar	1	EA	\$ 3,500.00	\$ 3,500		
3	Bike Rack		EA	\$ 2,000.00	\$ -		
4	Drinking Fountain		EA	\$ 3,700.00	\$ -		
						\$53,500	
I. Landscape							
1	Tree	15	EA	\$ 800.00	\$ 12,000		
2	Perennials/Groundcovers	3,000	SF	\$ 3.00	\$ 9,000		
3	Wetland Planting	12,858	SF	\$ 12.00	\$ 154,296		Includes Soils and plant materials
4	Double tree bubbler	7	EA	\$ 50.00	\$ 350		
						\$175,646	
STORMWATER CONVEYANCE WEST TOTAL						\$3,162,660	
SUBTOTAL						\$22,650,602	
Contingency				40%		\$9,060,241	
TOTAL						\$31,710,843	

**43rd Street District Conceptual Open Space Plan and
Cost Summary**

43rd Street District - Open Space Plan

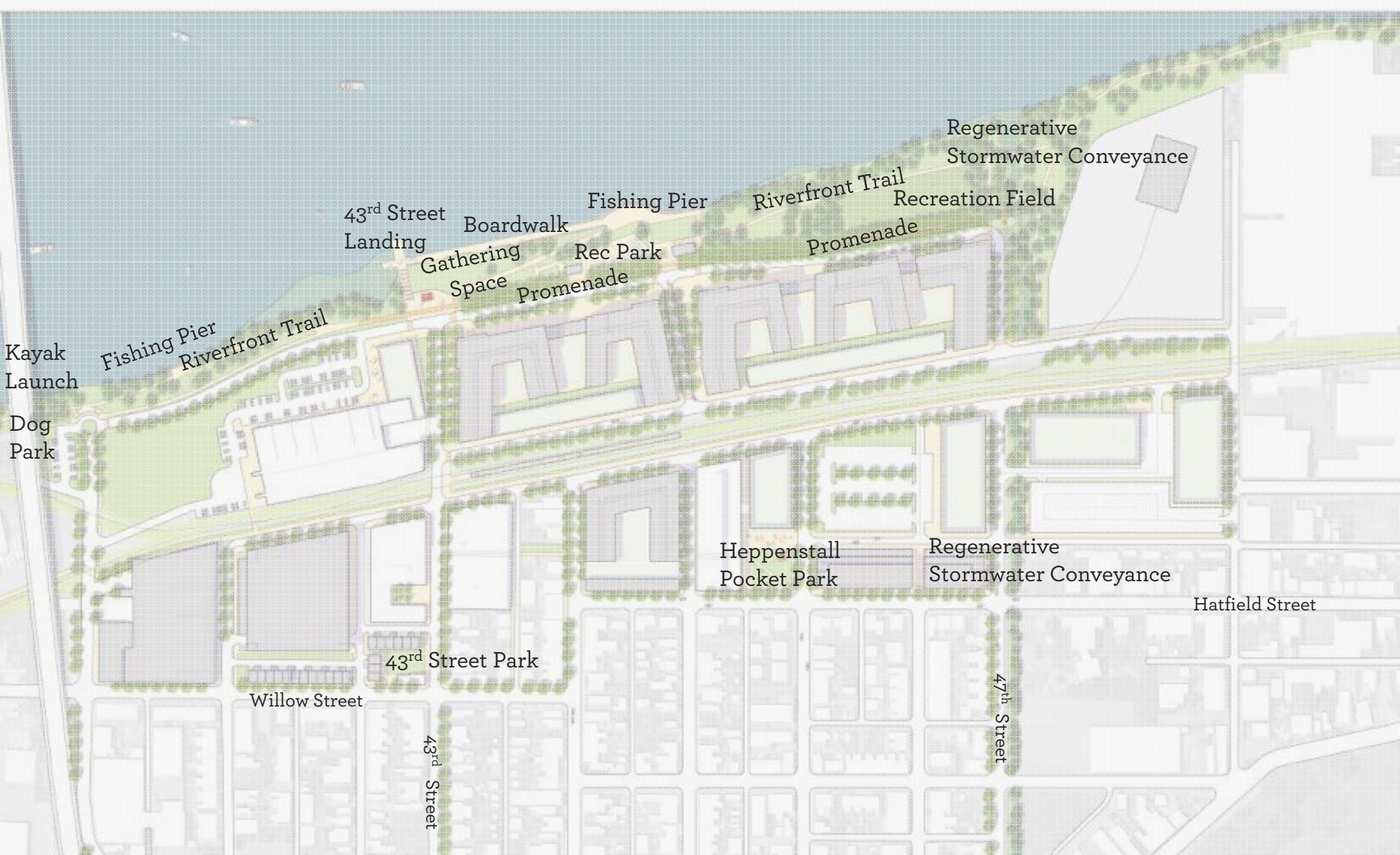
Existing Conditions



43rd Street District Redevelopment - Open Space



43rd Street District Redevelopment – Program



**Statement of Estimated Probable Construction Cost
 Allegheny Riverfront Park - 43rd St. Redevelopment
 Concept Design
 Summary of Costs**

**Sasaki Associates
 December 19, 2012**

Item No.	Item		Total
1	Open Space		
A.	RIVERFRONT TRAIL	\$	1,017,780
B.	43rd STREET LANDING	\$	8,335,898
C.	REC PARK	\$	1,433,312
D.	RECREATION FIELD	\$	4,329,281
E.	47th STREET REGENERATIVE STORMWATER CONVEYANCE	\$	3,531,088
F.	HEPPENSTALL POCKET PARK	\$	517,334
G.	43rd STREET PARK	\$	279,815
	Sub-Total		\$19,444,508
	Contingencies	40.00%	\$7,777,803
	Total		\$27,222,312
2	Roadways		
A.	40th Street (Willow to AVR)	\$	562,875
B.	40th Street (AVR to Terminus)	\$	739,150
C.	41st Street (Willow to Green Blvd)	\$	549,375
D.	42nd Street (Willow to Green Blvd)	\$	640,250
E.	43.5 Street (Willow to Green Blvd)	\$	842,000
F.	Willow Street (40th to 43rd)	\$	1,311,525
G.	Willow Street (43rd to 44th)	\$	512,125
H.	Hatfield Street (44th to 46th)	\$	865,900
I.	Hatfield Street (46th to 47th)	\$	735,050
J.	Plum Way (47th to 48th)	\$	772,850
K.	43rd Street (Willow to AVR)	\$	997,780
L.	43rd Street (AVR to Terminus)	\$	708,700
M.	44th Street (Willow to AVR)	\$	910,550
N.	45th Street (Hatfield to AVR)	\$	666,700
O.	45th Street (AVR to Riverfront)	\$	832,800
P.	47th Street (Hatfield to AVR)		Included in open space costs
Q.	48th Street (Plum Way to AVR)	\$	764,975
R.	48th Street (AVR to Terminus)	\$	907,350
S.	Riverfront Drive (41st to 43rd)	\$	2,268,450
T.	Riverfront Drive (43rd to 45th)	\$	1,079,600
U.	Riverfront Drive (45th to 47th)	\$	1,854,370
	Sub-Total		\$18,522,375
	Design Contingency	40.00%	\$7,408,950
	Total		\$25,931,325

Item No.	Item		Total
3 Green Boulevard			
A.	Green Boulevard (39th to 40th)		
B.	Green Boulevard (40th to 43rd)		\$1,157,475
C.	Green Boulevard (43rd to 47th)		\$3,512,100
D.	Green Boulevard (47th to 48th)		\$449,950
	Sub-Total		\$5,119,525
	Design Contingency	40.00%	\$2,047,810
	Total		\$7,167,335
	Project Total		\$60,320,972

Statement of Estimated Probable Construction Cost
 Allegheny Riverfront Park - Green Boulevard Improvements
 Concept Design
 Summary of Costs

Sasaki Associates
 December 19, 2012

Item No.	Item	Length (Mi.)	Total
3	Green Boulevard		
A.	Green Boulevard (20th to 31st)	0.90	\$9,512,990
B.	Green Boulevard (30st to 40th)	0.82	\$3,588,770
C.	Green Boulevard (48th to 62nd)	1.48	\$4,902,748
D.	Green Boulevard (62nd to Wash. Blvd.)	1.65	\$4,197,375
	Sub-Total		\$12,688,893
	Design Contingency	40.00%	\$5,075,557
	Total		\$17,764,451

Statement of Estimated Probable Construction Cost
 Allegheny Riverfront Park - 43rd St. Redevelopment
 Concept Design
 Open Space

Sasaki Associates
 December 19, 2012

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
RIVERFRONT TRAIL		89,500	SF				
A. Site Preparation							
1	Clearing & Grubbing	1.0	AC	\$ 4,000.00	\$ 4,000		
2	Site Demolition	89,500	SF	\$ 2.00	\$ 179,000		
3	Soils Remediation	5,000	SF	\$ 21.00	\$ 105,000		Assume minimal excavation, cap contaminated sc
						\$288,000	
B. Earthwork							
1	Fill / Grading	3,315	CY	\$ 15.00	\$ 49,722		Assume 1' of earthwork depth on average
3	River's Edge Stabilization		LF	\$ 500.00	\$ -		
4	Bulkhead		LF	\$ 2,000.00	\$ -		
5	River Edge Naturalization	800	LF	\$ 250.00	\$ 200,000		Interplanted Rip Rap
						\$249,722	
C. Utilities & Infrastructure							
1	Site Electrical		AC	\$ 75,000.00	\$ -		Allowance
2	Utility Improvements		LS	\$ 75,000.00	\$ -		Allowance
3	Stormwater System		LS	\$ 75,000.00	\$ -		Allowance
4	Drainage Outfall		LS	\$ -	\$ -		
						\$0	
E. Hardscape							
1	Concrete Paving	2,000	SF	\$ 20.00	\$ 40,000		
2	Concrete Planting curb		LF	\$ 10.00	\$ -		
3	Pedestrian Walkway	8,800	SF	\$ 7.00	\$ 61,600		
						\$101,600	
F. Lighting							
1	Pole Light		EA	\$ 5,300.00	\$ -		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light		LF	\$ 100.00	\$ -		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$0	
G. Special Elements							
1	Interpretive Signage		LF	\$ 4,000.00	\$ -		
2	Blue Light		EA	\$ 300.00	\$ -		
3	Stage		LS	\$ -	\$ -		
4	Kiosk		EA	\$ -	\$ -		
5	Restrooms		LS	\$ -	\$ -		
6	Pavilion Structure		LS	\$ -	\$ -		
7	Bridge		EA	\$ -	\$ -		
8	Jetty		LS	\$ -	\$ -		
9	Public Art	1	EA	\$ -	\$ -		
						\$0	
H. Site Furnishings							
1	Bench	10	EA	\$ 5,000.00	\$ 50,000		
2	Trash Receptacle- Solar	3	EA	\$ 3,500.00	\$ 10,500		
3	Bike Rack	2	EA	\$ 2,000.00	\$ 4,000		
4	Drinking Fountain		EA	\$ 3,700.00	\$ -		
						\$64,500	
I. Landscape							
2	Tree	40	EA	\$ 1,500.00	\$ 60,000		
5	Perennials/Groundcovers	1,100	SF	\$ 3.00	\$ 3,300		
7	Turf Grass	71,045	SF	\$ 1.50	\$ 106,568		
8	Turf Irrigation System	71,045	SF	\$ 2.00	\$ 142,090		
15	Double tree bubbler	40	EA	\$ 50.00	\$ 2,000		
						\$313,958	
RIVERFRONT TRAIL SUBTOTAL						\$1,017,780	

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
43rd STREET LANDING		90,500	SF				
A. Site Preparation							
1	Clearing & Grubbing	2.1	AC	\$ 4,000.00	\$ 8,310		
2	Site Demolition	90,500	SF	\$ 2.00	\$ 181,000		
3	Soils Remediation	90,500	SF	\$ 21.00	\$ 1,900,500		
						\$2,089,810	
B. Earthwork							
1	Fill / Grading	6,704	CY	\$ 15.00	\$ 100,556		Assume 2' of earthwork depth on average
3	River's Edge Stabilization		LF	\$ 500.00	\$ -		
4	Bulkhead	1,300	LF	\$ 2,000.00	\$ 2,600,000		
5	Retaining Wall	330	LF	\$ 1,000.00	\$ 330,000		
						\$3,030,556	
C. Utilities & Infrastructure							
1	Site Electrical	2.1	AC	\$ 75,000.00	\$ 157,500		Allowance
2	Utility Improvements	1	LS	\$ 75,000.00	\$ 75,000		Allowance
3	Stormwater System	1	LS	\$ 75,000.00	\$ 75,000		Allowance
4	Drainage Outfall		LS	\$ -	\$ -		Allowance
						\$307,500	
E. Hardscape							
1	Concrete Paving	6,300	SF	\$ 20.00	\$ 126,000		
2	Concrete Planting curb		LF	\$ 10.00	\$ -		
3	Pedestrian Walkway	32,000	SF	\$ 7.00	\$ 224,000		
4	Stairs	675	LFN	\$ 55.00	\$ 37,125		
5	Riverwalk	129,600	SF	\$ 15.00	\$ 1,944,000		
						\$2,331,125	
F. Lighting							
1	Pole Light	26	EA	\$ 5,300.00	\$ 137,800		
2	In-Ground LED Light	12	EA	\$ 1,850.00	\$ 22,200		
3	Step Light		LF	\$ 100.00	\$ -		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$160,000	
G. Special Elements							
1	Interpretive Signage	2	LF	\$ 4,000.00	\$ 8,000		
2	Blue Light	1	EA	\$ 300.00	\$ 300		
3	Stage		LS	\$ -	\$ -		
4	Kiosk		EA	\$ -	\$ -		
5	Restrooms		LS	\$ -	\$ -		
6	Pavilion Structure	1	LS	\$ -	\$ -		
7	Bridge		EA	\$ -	\$ -		
8	Jetty	1	LS	\$ -	\$ -		
9	Public Art	1	LS	\$ -	\$ -		
						\$8,300	
H. Site Furnishings							
1	Bench	12	EA	\$ 5,000.00	\$ 60,000		
2	Trash Receptacle- Solar	7	EA	\$ 3,500.00	\$ 24,500		
3	Bike Rack	4	EA	\$ 2,000.00	\$ 8,000		
4	Drinking Fountain	1	EA	\$ 3,700.00	\$ 3,700		
						\$96,200	
I. Landscape							
1	Tree	51	EA	\$ 1,500.00	\$ 76,500		
2	Perennials/Groundcovers	3,600	SF	\$ 3.00	\$ 10,800		
3	Reinforced Turf Lawn	26,210	SF	\$ 3.00	\$ 78,630		
4	Turf Grass	26,145	SF	\$ 1.50	\$ 39,218		
5	Turf Irrigation System	52,355	SF	\$ 2.00	\$ 104,710		
6	Double tree bubbler	51	EA	\$ 50.00	\$ 2,550		
						\$312,408	
43rd STREET LANDING SUBTOTAL						\$8,335,898	

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
REC PARK		17,700	SF				
A. Site Preparation							
1	Clearing & Grubbing	0.4	AC	\$ 4,000.00	\$ 1,625		
2	Site Demolition	17,700	SF	\$ 2.00	\$ 35,400		
3	Soils Remediation	17,700	SF	\$ 21.00	\$ 371,700		
						\$408,725	
B. Earthwork							
1	Fill / Grading	1,311	CY	\$ 15.00	\$ 19,667		Assume 2' of earthwork depth on average
3	River's Edge Stabilization		LF	\$ 500.00	\$ -		
4	Bulkhead	100	LF	\$ 2,000.00	\$ 200,000		
						\$219,667	
C. Utilities & Infrastructure							
1	Site Electrical	0.4	AC	\$ 75,000.00	\$ 30,750		Allowance
2	Utility Improvements	1	LS	\$ 75,000.00	\$ 75,000		Allowance
3	Stormwater System	1	LS	\$ 75,000.00	\$ 75,000		Allowance
4	Drainage Outfall		LS	\$ -	\$ -		Allowance
						\$180,750	
E. Hardscape							
1	Concrete Paving	8,800	SF	\$ 20.00	\$ 176,000		
2	Concrete Planting curb		LF	\$ 10.00	\$ -		
3	Seatwall	1,075	LF	\$ 250.00	\$ 268,750		
4	Pedestrian Walkway	7,360	SF	\$ 7.00	\$ 51,520		
5	Stairs	240	LFN	\$ 55.00	\$ 13,200		
						\$509,470	
F. Lighting							
1	Pole Light	6	EA	\$ 5,300.00	\$ 31,800		
2	In-Ground LED Light	0	EA	\$ 1,850.00	\$ -		
3	Step Light	18	LF	\$ 100.00	\$ 1,800		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$33,600	
G. Special Elements							
1	Interpretive Signage		LF	\$ 4,000.00	\$ -		
2	Blue Light		EA	\$ 300.00	\$ -		
3	Stage	1	LS	\$ -	\$ -		
4	Kiosk	1	EA	\$ -	\$ -		
5	Restrooms		LS	\$ -	\$ -		
6	Pavilion Structure		LS	\$ -	\$ -		
7	Bridge		EA	\$ -	\$ -		
8	Jetty		LS	\$ -	\$ -		
9	Tennis Courts		EA	\$ -	\$ -		
10	Basketball Courts		EA	\$ -	\$ -		
11	Adventure Playground	1	LS	\$ 10,000.00	\$ 10,000		
						\$10,000	
H. Site Furnishings							
1	Bench	8	EA	\$ 5,000.00	\$ 40,000		
2	Trash Receptacle- Solar	2	EA	\$ 3,500.00	\$ 7,000		
3	Bike Rack	2	EA	\$ 2,000.00	\$ 4,000		
4	Drinking Fountain		EA	\$ 3,700.00	\$ -		
						\$51,000	
I. Landscape							
1	Tree	12	EA	\$ 1,500.00	\$ 18,000		
2	Perennials/Groundcovers	500	SF	\$ 3.00	\$ 1,500		
3	Reinforced Turf Lawn		SF	\$ 3.00	\$ -		
4	Turf Grass		SF	\$ 1.50	\$ -		
5	Turf Irrigation System		SF	\$ 2.00	\$ -		
6	Double tree bubbler	12	EA	\$ 50.00	\$ 600		
						\$20,100	
REC PARK SUBTOTAL						\$1,433,312	

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
RECREATION FIELD		133,200	SF				
A. Site Preparation							
1	Clearing & Grubbing	3.1	AC	\$ 4,000.00	\$ 12,231		
2	Site Demolition	133,200	SF	\$ 2.00	\$ 266,400		
3	Soils Remediation	133,200	SF	\$ 21.00	\$ 2,797,200		
						\$3,075,831	
B. Earthwork							
1	Fill / Grading	9,867	CY	\$ 15.00	\$ 148,000		Assume 2' of earthwork depth on average
3	River's Edge Stabilization		LF	\$ 500.00	\$ -		
4	Bulkhead		LF	\$ 2,000.00	\$ -		
						\$148,000	
C. Utilities & Infrastructure							
1	Site Electrical	3.0	AC	\$ 75,000.00	\$ 221,250		Allowance
2	Utility Improvements	1	LS	\$ 75,000.00	\$ 75,000		Allowance
3	Stormwater System	1	LS	\$ 75,000.00	\$ 75,000		Allowance
4	Drainage Outfall		LS	\$ -	\$ -		Allowance
						\$371,250	
E. Hardscape							
1	Concrete Paving		SF	\$ 20.00	\$ -		
2	Concrete Planting curb		LF	\$ 10.00	\$ -		
3	Seatwall		LF	\$ 250.00	\$ -		
4	Pedestrian Walkway	5,600	SF	\$ 7.00	\$ 39,200		
5	Stairs		LF	\$ 55.00	\$ -		
6	Riverwalk	750	LF	\$ -	\$ -		
						\$39,200	
F. Lighting							
1	Pole Light	20	EA	\$ 5,300.00	\$ 106,000		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light		LF	\$ 100.00	\$ -		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$106,000	
G. Special Elements							
1	Interpretive Signage	3	LF	\$ 4,000.00	\$ 12,000		
2	Blue Light	2	EA	\$ 300.00	\$ 600		
3	Stage		LS	\$ -	\$ -		
4	Kiosk		EA	\$ -	\$ -		
5	Restrooms	1	LS	\$ -	\$ -		
6	Pavilion Structure		LS	\$ -	\$ -		
7	Bridge		EA	\$ -	\$ -		
8	Jetty		LS	\$ -	\$ -		
						\$12,600	
H. Site Furnishings							
1	Bench	6	EA	\$ 5,000.00	\$ 30,000		
2	Trash Receptacle- Solar	3	EA	\$ 3,500.00	\$ 10,500		
3	Bike Rack	2	EA	\$ 2,000.00	\$ 4,000		
4	Drinking Fountain	2	EA	\$ 3,700.00	\$ 7,400		
						\$51,900	
I. Landscape							
1	Tree	30	EA	\$ 1,500.00	\$ 45,000		
2	Perennials/Groundcovers	1,000	SF	\$ 3.00	\$ 3,000		
3	Reinforced Turf Lawn	60,000	SF	\$ 3.00	\$ 180,000		
4	Turf Grass	50,000	SF	\$ 1.50	\$ 75,000		
5	Turf Irrigation System	110,000	SF	\$ 2.00	\$ 220,000		
6	Double tree bubbler	30	EA	\$ 50.00	\$ 1,500		
						\$524,500	
RECREATION FIELD SUBTOTAL						\$4,329,281	

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
47th STREET REGENERATIVE STORMWATER CONVEYANCE		70,900	SF				
A. Site Preparation							
1	Clearing & Grubbing	1.6	AC	\$ 4,000.00	\$ 6,511		
2	Site Demolition	70,900	SF	\$ 2.00	\$ 141,800		
3	Soils Remediation		SF	\$ 21.00	\$ -		See Earthwork
						\$148,311	
B. Earthwork							
1	Fill / Grading	5,252	CY	\$ 15.00	\$ 78,778		Assume 2' of earthwork depth on average
3	River's Edge Stabilization		LF	\$ 500.00	\$ -		
4	Bulkhead		LF	\$ 2,000.00	\$ -		
5	Cut Soils Remediation	11,000	CY	\$ 250.00	\$ 2,750,000		Assume 5ft cut from approx 21,000sf conveyance
						\$2,828,778	
C. Utilities & Infrastructure							
1	Site Electrical	0.8	AC	\$ 75,000.00	\$ 60,000		Allowance
2	Utility Improvements	1	LS	\$ 75,000.00	\$ 75,000		Allowance
3	Stormwater System		LS	\$ 75,000.00	\$ -		Allowance
4	Drainage Outfall	1	LS	\$ 150,000.00	\$ 150,000		Allowance
						\$285,000	
E. Hardscape							
1	Concrete Paving		SF	\$ 20.00	\$ -		
2	Concrete Planting curb		LF	\$ 10.00	\$ -		
3	Seatwall		LF	\$ 250.00	\$ -		
4	Pedestrian Walkway	4,800	SF	\$ 7.00	\$ 33,600		
5	Stairs		LFN	\$ 55.00	\$ -		
6	Riverwalk		LF	\$ -	\$ -		
						\$33,600	
F. Lighting							
1	Pole Light	20	EA	\$ 5,300.00	\$ 106,000		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light		LF	\$ 100.00	\$ -		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$106,000	
G. Special Elements							
1	Interpretive Signage		LF	\$ 4,000.00	\$ -		
2	Blue Light		EA	\$ 300.00	\$ -		
3	Stage		LS	\$ -	\$ -		
4	Kiosk		EA	\$ -	\$ -		
5	Restrooms		LS	\$ -	\$ -		
6	Pavilion Structure		LS	\$ -	\$ -		
7	Bridge	2	EA	\$ -	\$ -		
8	Jetty		LS	\$ -	\$ -		
						\$0	
H. Site Furnishings							
1	Bench	6	EA	\$ 5,000.00	\$ 30,000		
2	Trash Receptacle- Solar	3	EA	\$ 3,500.00	\$ 10,500		
3	Bike Rack	2	EA	\$ 2,000.00	\$ 4,000		
4	Drinking Fountain	2	EA	\$ 3,700.00	\$ 7,400		
						\$51,900	
I. Landscape							
1	Tree	50	EA	\$ 1,500.00	\$ 75,000		
2	Perennials/Groundcovers		SF	\$ 3.00	\$ -		
3	Reinforced Turf Lawn		SF	\$ 3.00	\$ -		
4	Turf Grass		SF	\$ 1.50	\$ -		
5	Turf Irrigation System	0	SF	\$ 2.00	\$ -		
6	Double tree bubbler	50	EA	\$ 50.00	\$ 2,500		
						\$77,500	
47th STREET STORMWATER CONVEYANCE SUBTOTAL						\$3,531,088	

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
HEPPENSTALL POCKET PARK		11,500	SF				
A. Site Preparation							
1	Clearing & Grubbing	0.3	AC	\$ 4,000.00	\$ 1,056		
2	Site Demolition	11,500	SF	\$ 2.00	\$ 23,000		
3	Soils Remediation	11,500	SF	\$ 21.00	\$ 241,500		
						\$265,556	
B. Earthwork							
1	Fill / Grading	852	CY	\$ 15.00	\$ 12,778		Assume 2' of earthwork depth on average
3	River's Edge Stabilization		LF	\$ 500.00	\$ -		
4	Bulkhead		LF	\$ 2,000.00	\$ -		Includes sheet pile shore stabilization
						\$12,778	
C. Utilities & Infrastructure							
1	Site Electrical		AC	\$ 75,000.00	\$ -		Allowance
2	Utility Improvements	1	LS	\$ 75,000.00	\$ 75,000		Allowance
3	Stormwater System		LS	\$ 75,000.00	\$ -		Allowance
4	Drainage Outfall		LS	\$ -	\$ -		Allowance
						\$75,000	
E. Hardscape							
1	Concrete Paving		SF	\$ 20.00	\$ -		
2	Concrete Planting curb		LF	\$ 10.00	\$ -		
3	Seatwall		LF	\$ 250.00	\$ -		
4	Pedestrian Walkway	1,200	SF	\$ 7.00	\$ 8,400		
5	Stairs		LFN	\$ 55.00	\$ -		
6	Riverwalk		LF	\$ -	\$ -		
						\$8,400	
F. Lighting							
1	Pole Light	8	EA	\$ 5,300.00	\$ 42,400		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light		LF	\$ 100.00	\$ -		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$42,400	
G. Special Elements							
1	Interpretive Signage	1	LF	\$ 4,000.00	\$ 4,000		
2	Blue Light		EA	\$ 300.00	\$ -		
3	Stage		LS	\$ -	\$ -		
4	Kiosk		EA	\$ -	\$ -		
5	Restrooms		LS	\$ -	\$ -		
6	Pavilion Structure		LS	\$ -	\$ -		
7	Bridge		EA	\$ -	\$ -		
8	Jetty		LS	\$ -	\$ -		
9	Public Art	1	EA	\$ 10,000.00	\$ 10,000		
						\$14,000	
H. Site Furnishings							
1	Bench	8	EA	\$ 5,000.00	\$ 40,000		
2	Trash Receptacle- Solar	2	EA	\$ 3,500.00	\$ 7,000		
3	Bike Rack	2	EA	\$ 2,000.00	\$ 4,000		
4	Drinking Fountain		EA	\$ 3,700.00	\$ -		
						\$51,000	
I. Landscape							
1	Tree	4	EA	\$ 1,500.00	\$ 6,000		
2	Perennials/Groundcovers		SF	\$ 3.00	\$ -		
3	Reinforced Turf Lawn		SF	\$ 3.00	\$ -		
4	Turf Grass	12,000	SF	\$ 1.50	\$ 18,000		
5	Turf Irrigation System	12,000	SF	\$ 2.00	\$ 24,000		
6	Double tree bubbler	4	EA	\$ 50.00	\$ 200		
						\$48,200	
HATFIELD PARK SUBTOTAL						\$517,334	

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
43rd STREET PARK		5,000	SF				
A. Site Preparation							
1	Clearing & Grubbing	0.1	AC	\$ 4,000.00	\$ 459		
2	Site Demolition	5,000	SF	\$ 2.00	\$ 10,000		
3	Soils Remediation	5,000	SF	\$ 21.00	\$ 105,000		
						\$115,459	
B. Earthwork							
1	Fill / Grading	370	CY	\$ 15.00	\$ 5,556		Assume 2' of earthwork depth on average
2	River's Edge Stabilization		LF	\$ 500.00	\$ -		
3	Bulkhead		LF	\$ 2,000.00	\$ -		Includes sheet pile shore stabilization
						\$5,556	
C. Utilities & Infrastructure							
1	Site Electrical		AC	\$ 75,000.00	\$ -		Allowance
2	Utility Improvements		LS	\$ 75,000.00	\$ -		Allowance
3	Stormwater System		LS	\$ 75,000.00	\$ -		Allowance
4	Drainage Outfall		LS	\$ -	\$ -		Allowance
						\$0	
E. Hardscape							
1	Concrete Paving		SF	\$ 20.00	\$ -		
2	Concrete Planting curb		LF	\$ 10.00	\$ -		
3	Seatwall		LF	\$ 250.00	\$ -		
4	Pedestrian Walkway		SF	\$ 7.00	\$ -		
5	Stairs		LFN	\$ 55.00	\$ -		
6	Riverwalk		LF	\$ -	\$ -		
						\$0	
F. Lighting							
1	Pole Light	4	EA	\$ 5,300.00	\$ 21,200		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light		LF	\$ 100.00	\$ -		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$21,200	
G. Special Elements							
1	Interpretive Signage		LF	\$ 4,000.00	\$ -		
2	Blue Light		EA	\$ 300.00	\$ -		
3	Stage		LS	\$ -	\$ -		
4	Kiosk		EA	\$ -	\$ -		
5	Restrooms		LS	\$ -	\$ -		
6	Pavilion Structure		LS	\$ -	\$ -		
7	Bridge		EA	\$ -	\$ -		
8	Jetty		LS	\$ -	\$ -		
9	Adventure Play Structure	1	LS	\$ 100,000.00	\$ 100,000		
						\$100,000	
H. Site Furnishings							
1	Bench	2	EA	\$ 5,000.00	\$ 10,000		
2	Trash Receptacle- Solar	1	EA	\$ 3,500.00	\$ 3,500		
3	Bike Rack	1	EA	\$ 2,000.00	\$ 2,000		
4	Drinking Fountain		EA	\$ 3,700.00	\$ -		
						\$15,500	
I. Landscape							
1	Tree	3	EA	\$ 1,500.00	\$ 4,500		
2	Perennials/Groundcovers		SF	\$ 3.00	\$ -		
3	Reinforced Turf Lawn		SF	\$ 3.00	\$ -		
4	Turf Grass	5,000	SF	\$ 1.50	\$ 7,500		
5	Turf Irrigation System	5,000	SF	\$ 2.00	\$ 10,000		
6	Double tree bubbler	2	EA	\$ 50.00	\$ 100		
						\$22,100	
43rd STREET PARK SUBTOTAL						\$279,815	

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks	
SUBTOTAL							\$19,444,508	
Contingency				40%		\$7,777,803		
TOTAL						\$27,222,312		

43rd Street District Redevelopment - 47th Street View



43rd Street District Redevelopment – 43rd Street View



43rd Street District Redevelopment – Bird’s Eye View



Highland Park Conceptual Open Space Plan and Cost Summary

Highland Park + Heth's Run

Open Space and Stormwater Conveyance



Washington Boulevard / Negley Run

River Accessibility , Connectivity, and Stormwater Management

Open Space and Stormwater Conveyance Conceptual Plan



Washington Boulevard / Negley Run

River Accessibility , Connectivity, and Stormwater Management

Open Space and Stormwater Conveyance Conceptual Plan



Statement of Estimated Probable Construction Cost
Allegheny Riverfront Park - Highland Park
Concept Design
Summary of Costs

Sasaki Associates
December 19, 2012

Item		Total
Open Space		
HETH'S RUN		\$ 4,361,050
NEGLEY RUN		\$ 7,079,600
Sub-Total		\$11,440,650
Contingencies	40.00%	\$4,576,260
Total		\$16,016,910

Statement of Estimated Probable Construction Cost
Allegheny Riverfront Park - Highland Park
Concept Design

Sasaki Associates
 July 18, 2012

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
HETH'S RUN		343,000	SF				
A. Site Preparation							
1	Clearing & Grubbing	3.0	AC	\$ 4,000.00	\$ 12,000		
2	Site Demolition	150,000	SF	\$ 2.00	\$ 300,000		
3	Parking Lot Demolition	55,000	SF	\$ 3.00	\$ 165,000		
						\$477,000	
B. Earthwork							
1	Fill / Grading	35,000	CY	\$ 15.00	\$ 525,000		
2	Drainage Excavation	13,000	CY	\$ 5.00	\$ 65,000		
3	Drainage Ditch	3,000	LF	\$ 8.00	\$ 24,000		18' wide stormwater ditch
4	River Edge Naturalization	1,000	LF	\$ 250.00	\$ 250,000		Interplanted Rip Rap
						\$864,000	
Utilities & Infrastructure							
1	Site Electrical	2.5	AC	\$ 75,000.00	\$ 187,500		Parking lot, Bus & Train electrical
2	Utility Improvements	1	LS	\$ 100,000.00	\$ 100,000		
3	Stormwater System	1	LS	\$ 150,000.00	\$ 150,000		
4	Drainage Outfall	1	LS	\$ 250,000.00	\$ 250,000		Include culvert, not excavation
5	Pedestrian Bridge	1,155	SF	\$ 250.00	\$ 288,750		
6	Bus Station	1	EA	\$ 200,000.00	\$ 200,000		
7	Train Station	1	EA	\$ 750,000.00	\$ 750,000		
8	Rail Line Configuration		LF	\$ 1,350.00	\$ -		
9	Road Crossings	2	EA	\$ 150,000.00	\$ 300,000		
						\$2,226,250	
E. Hardscape							
1	Pedestrian Walkway	52,000	SF	\$ 7.00	\$ 364,000		8' wide, gravel base
2	Concrete Pavers		SF	\$ 20.00	\$ -		16" x 16" precast concrete unit pavers
3	Concrete Planting Curbs		LF	\$ 10.00	\$ -		
4	Parking Spots		EA	\$ 1,700.00	\$ -		
5	Roadway		LF	\$ 135.00	\$ -		
						\$364,000	
F. Lighting							
1	Pole Light	15	EA	\$ 5,000.00	\$ 75,000		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light	13	LF	\$ 100.00	\$ 1,300		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$76,300	
G. Special Elements							
1	Interpretive Signage	2	EA	\$ 4,000.00	\$ 8,000		
2	Blue Light	1	EA	\$ 300.00	\$ 300		
3	Overlook		LS	\$ 250,000.00	\$ -		
						\$8,300	

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
H. Site Furnishings							
1	Bench	6	EA	\$ 1,500.00	\$ 9,000		
2	Trash Receptacle- Solar	3	EA	\$ 3,500.00	\$ 10,500		
3	Bike Rack	2	EA	\$ 2,000.00	\$ 4,000		
4	Drinking Fountain	2	EA	\$ 3,700.00	\$ 7,400		
						\$30,900	
I. Landscape							
1	Tree	21	EA	\$ 800.00	\$ 16,800		
2	Perennials/Groundcovers	1,500	SF	\$ 3.00	\$ 4,500		
3	Turf Grass	195,000	SF	\$ 1.50	\$ 292,500		
4	Turf Irrigation System		SF	\$ 2.00	\$ -		
5	Double tree bubbler	10	EA	\$ 50.00	\$ 500		
						\$314,300	
HETH'S RUN TOTAL						\$4,361,050	
SUBTOTAL						\$4,361,050	

Statement of Estimated Probable Construction Cost
 Allegheny Riverfront Park - Highland Park
 Concept Design

Sasaki Associates
 December 5, 2012

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
NEGLEY RUN		900,000	SF				
A. Site Preparation							
1	Clearing & Grubbing	4.0	AC	\$ 4,000.00	\$ 16,000		
2	Site Demolition	200,000	SF	\$ 2.00	\$ 400,000		
						\$416,000	
B. Earthwork							
1	Fill / Grading	1,480	CY	\$ 15.00	\$ 22,200		Assume 2' depth on average
2	River's Edge Stabilization	130	LF	\$ 500.00	\$ 65,000		
3	Drainage Ditch	2,300	LF	\$ 8.00	\$ 18,400		
4	River Edge Naturalization	600	LF	\$ 250.00	\$ 150,000		Interplanted Rip Rap
						\$255,600	
Utilities & Infrastructure							
1	Site Electrical	2.5	AC	\$ 75,000.00	\$ 187,500		
2	Utility Improvements	1	LS	\$ 100,000.00	\$ 100,000		
3	Stormwater System	1	LS	\$ 150,000.00	\$ 150,000		
4	Drainage Outfall	1	LS	\$ 250,000.00	\$ 250,000		
3	Retaining Wall - Drainage Crossing	400	LF	\$ 550.00	\$ 220,000		
4	Culvert	250	LF	\$ 140.00	\$ 35,000		
5	Pedestrian Bridge	4,600	SF	\$ 300.00	\$1,380,000		
6	Bus Station	1	EA	\$ 200,000.00	\$ 200,000		
7	Train Station	1	EA	\$ 750,000.00	\$ 750,000		
8	Rail Line Configuration	1,000	LF	\$ 1,350.00	\$1,350,000		
9	Road Crossings	2	EA	\$ 150,000.00	\$ 300,000		
						\$4,922,500	
E. Hardscape							
1	Pedestrian Walkway	40,000	SF	\$ 7.00	\$ 280,000		
2	Concrete Pavers		SF	\$ 20.00	\$ -		
3	Concrete Planting Curbs		LF	\$ 10.00	\$ -		
4	Parking Spots	175	EA	\$ 1,700.00	\$ 297,500		
5	Roadway	1,500	LF	\$ 135.00	\$ 202,500		
						\$780,000	
F. Lighting							
1	Pole Light	15	EA	\$ 5,000.00	\$ 75,000		
2	In-Ground LED Light		EA	\$ 1,850.00	\$ -		
3	Step Light	12	LF	\$ 100.00	\$ 1,200		
4	Tree Uplight		EA	\$ 1,100.00	\$ -		
						\$76,200	
G. Special Elements							
1	Interpretive Signage	2	EA	\$ 4,000.00	\$ 8,000		
2	Blue Light	1	EA	\$ 300.00	\$ 300		
3	Overlook	1	LS	\$ 250,000.00	\$ 250,000		
						\$258,300	
H. Site Furnishings							
1	Bench	6	EA	\$ 1,500.00	\$ 9,000		
2	Trash Receptacle- Solar	6	EA	\$ 3,500.00	\$ 21,000		
3	Bike Rack	4	EA	\$ 2,000.00	\$ 8,000		
4	Drinking Fountain		EA	\$ 3,700.00	\$ -		
						\$38,000	
I. Landscape							
1	Tree	40	EA	\$ 800.00	\$ 32,000		
2	Perennials/Groundcovers	50,000	SF	\$ 3.00	\$ 150,000		
3	Turf Grass	100,000	SF	\$ 1.50	\$ 150,000		
4	Turf Irrigation System		SF	\$ 2.00	\$ -		
5	Double tree bubbler	20	EA	\$ 50.00	\$ 1,000		
						\$333,000	
TOTAL						\$7,079,600	
SUBTOTAL						\$7,079,600	

Green Infrastructure Toolkit

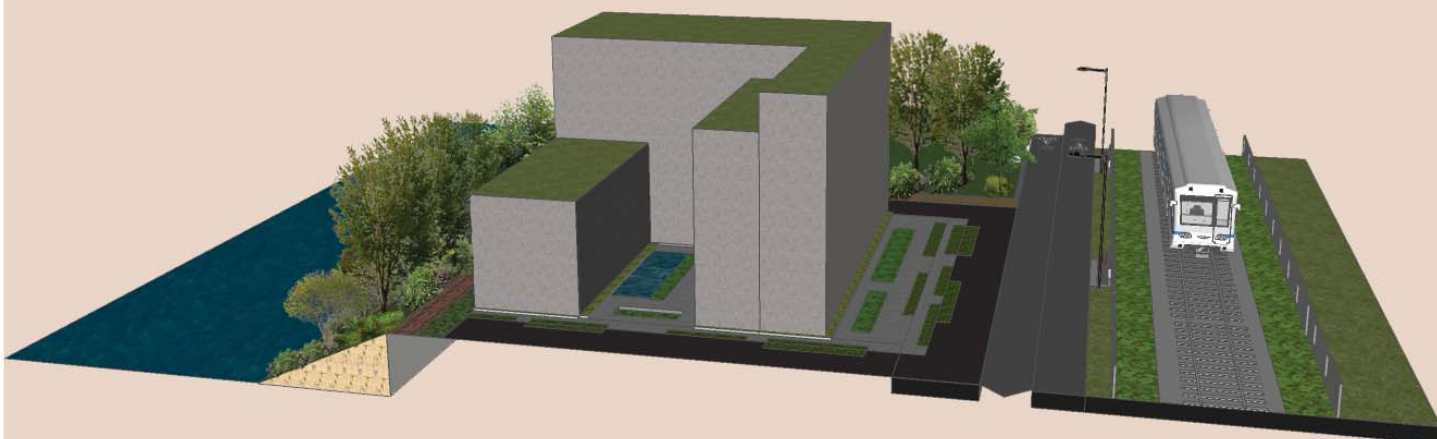
Green Infrastructure Toolkit

The Green Infrastructure Toolkit provides a suggested list of stormwater treatment practices that can be used in implementing a living infrastructure framework as part of the Green Boulevard design. Living infrastructure can be integrated into many positions within the landscape, from the roofs and plazas of buildings to the streetscapes and rights-of-way along the rail lines. Along the Allegheny River, the shoreline and open space provide further opportunities for integrating practices that improve ecological function and provide aesthetically pleasing opportunities for sustainable stormwater treatment. The design of this regenerative, multimodal corridor will provide opportunities to create a new living infrastructure network as the foundation for redevelopment and community sustainability. This will occur through the creation of new open spaces, strengthened connections between residential and mixed-use development, transport of community members and their goods, creation of new products by processing renewable resources on site, and treatment of stormwater and wastewater for reuse on site.

Practices described in the toolkit are envisioned as integral design techniques in the 43rd Street District Redevelopment. The toolkit can be shared with city agencies as consideration for future stormwater practices within the Green Boulevard and beyond. Local nonprofits, development groups, and neighborhood organizations may also find it useful as educational material associated with environmental stewardship and sustainability. The toolkit may be helpful in applying for funding associated with sustainable development and stormwater treatment in the corridor.

Green Tool Kit

ALLEGHENY RIVERFRONT GREEN BOULEVARD



Prepared by
Biohabitats, Inc.



January 25, 2013

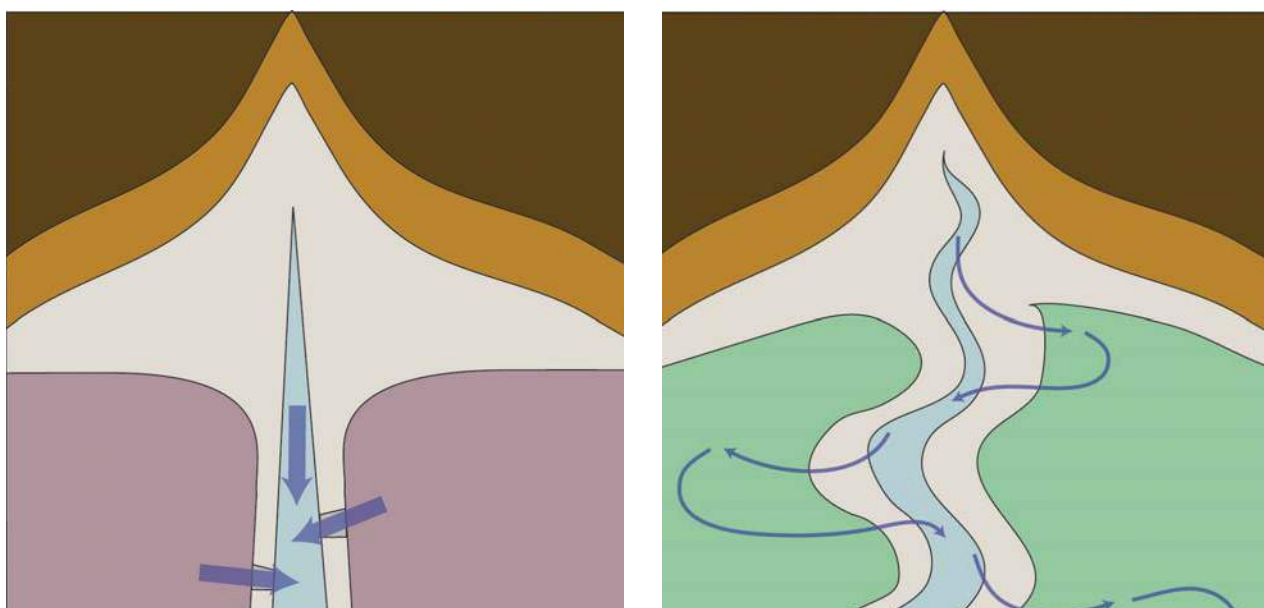
STORMWATER TREATMENT APPROACH

Living Infrastructure

Unlike the conventional grey infrastructure (pipes/utilities, structures, facilities, etc.) of the past, which would need replacement and repair over time, the design of this regenerative multimodal corridor would provide opportunities to create a new living infrastructure network as the foundation for redevelopment and community sustainability. This would occur through the creation of new open spaces, strengthened connections between residential and mixed use development, transport of both community members and their goods, the source of new products created through processing of renewable resources on site, the treatment of stormwater and wastewater to be reused on site.

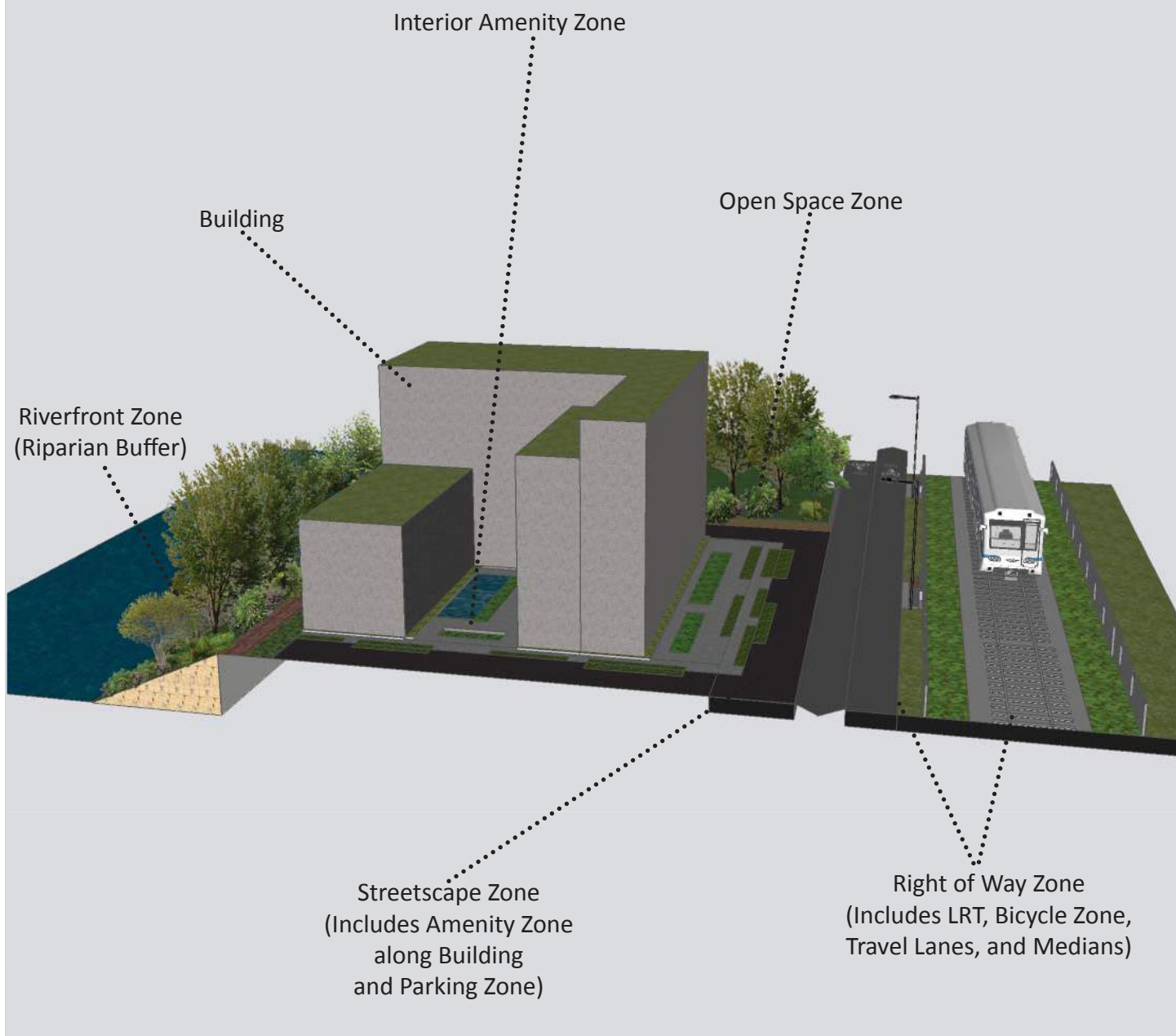
A stable natural system is often characterized as having the following elements: relatively complete internal cycling, varied pathways of flow, filled niches, high volumes of life per unit of energy, and a high content of information (Odum in Lyle, 1999). Nutrient cycling is a key component that this living infrastructure approach would hope to return to the system. Within the current system, water and nutrients are flushed from the landscape in a conventional engineered piping approach. A renewal of nutrient cycling would allow for more nutrients, water, and organic matter to be taken up again within the project area, continuing to cycle these important elements in a way that allows the landscape to continue to utilize these natural resources rather than release them. This will be done through practices including wastewater treatment, stormwater filtration and evaporation, organic matter cycling within a restored riparian buffer, remediation of contaminated soil, creation of new biotic soil (e.g., through biochar and composting), reuse of stormwater runoff in cooling, greywater systems throughout the new structures, and other living ecological systems that will be enhanced or restored.

Living infrastructure can be integrated into many positions within the landscape. From the roofs and the plazas of buildings, to the streetscapes and rights-of-way along the rail lines. Along the Allegheny the river shoreline and open space provide further opportunities for integration of practices that improve ecological function, and new provide aesthetically pleasing opportunity for sustainable stormwater treatment.



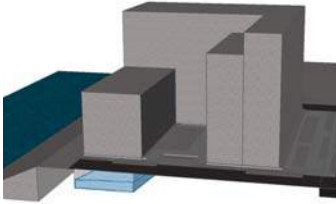
A nutrient cycling diagram, interpreted from cycle and flow graphics shown in John Lyle's *Design for Human Ecosystems* (1999). On the left is the conventional nutrient and water piped system, where nutrients, water, and energy are flushed from the system and concentrated downstream. On the right is a more functional cycling system where nutrients, water, and energy are retained, reused and recycled within the landscape. Water is infiltrated or treated and reused. Sediment and organic materials are spread out, filtered, broken down and taken up again. Runoff is minimized to more natural conditions and the character of the water forms is responsive to landscape forms.

LANDSCAPE POSITIONS FOR LIVING INFRASTRUCTURE



PRACTICES

Rainwater Harvesting



Landscape Position Treated:

- Building
- Interior Amenity Zone

Highlights:

- Irrigation water
- Source for nonpotable interior uses (toilet flushing, etc.)

Rather than treating stormwater as a nuisance to be disposed of, rainwater harvesting is a technique used to capture and reuse this valuable resource. Harvested rainwater may be collected from most impervious areas such as rooftops or plazas. Rooftop harvesting tends to be the most common, since it is a relatively clean source of water. Cisterns are typically plastic or metal, and can be either above ground and integrated into the architecture of the building or buried. Stormwater can be collected and reused for non-potable water uses within a building like flushing toilets, for landscape irrigation purposes, or for other uses like HVAC system make up water to support cooling systems. All toilets and hose bibs must have permanent signage that notifies users of non-potable water. Gravity flow or pumps can be used to distribute the water. Harvested rainwater can also be used for onsite irrigation within amenity spaces and streetscape plantings.



photo by Biohabitats



photo by Biohabitats

top: Chesapeake Bay Foundation's Merrill Center, Annapolis, Maryland;
above: Children's Zoo, Birmingham, Alabama

PRACTICES

Green Roof

Green roofs are made of a lightweight vegetated roof system consisting of waterproofing material, growing medium, and specially selected plants. They can be used in place of a traditional roof as a way to limit impervious site area and manage stormwater runoff. Green roofs can help mitigate runoff temperatures by keeping roofs cool and retaining most of the runoff in dry seasons. In a highly urbanized setting, green roofs can potentially provide small habitat islands for certain species like insects, butterflies, and even some bird species. Green roofs can be designed as aesthetic amenities when added to roofs with views from higher stories or on angled surfaces.

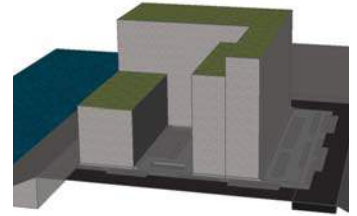


photo by Jennifer Dowdell, Biohabitats



photo by Jennifer Dowdell, Biohabitats

Landscape Position Treated:

- Building (including parking structures)

Highlights:

- Visible from upper floors on tiered buildings
- Creates additional urban habitats

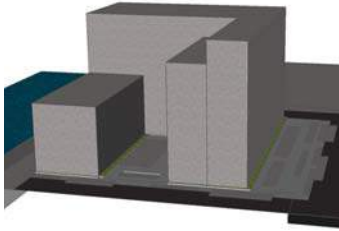


photo by Jennifer Dowdell, Biohabitats

top left: *Living Classrooms, Baltimore, Maryland*; top right: *Chesapeake Bay Foundation's Merrill Center, Annapolis, Maryland*; above: *Portland City Hall, Portland, Oregon*

PRACTICES

Stormwater Planter



Stormwater planters are structural reservoirs that can be built into the façade of a building and used to collect and filter stormwater, allowing pollutants to settle and filter out as the water percolates through the vegetation, growing medium, and gravel. They can be designed as lined, flow-through facilities where stormwater is temporarily stored but can also allow for some infiltration if site conditions allow. Excess stormwater collects in a perforated pipe at the bottom of the planter and drains to an approved discharge point. Planters can be used to help fulfill a site’s required landscaping area requirement. Numerous design variations of shape, wall treatment, and planting scheme can be used to fit the character of a site. Because planters can be constructed immediately next to buildings, they are ideal for sites with setback requirements, poorly draining soils, steep slopes, or other constraints.

Landscape Position Treated:

- Building
- Interior Amenity Zone
- Streetscape (Amenity Zone)

Highlights:

- Architectural extension of structural design



photo by Phil Jones, Biohabitats



Ken Brown, Center for Watershed Protection

*above: Stormwater planter, Portland, Oregon;
right: Stormwater planter and detail of sculptural element*



photo by Jennifer Dowdell, Biohabitats

Microbioretention, Enhanced Filters, & Bioretention

Biofiltration uses a combination of plants and soil media in the removal of pollutants such as bacteria, nitrogen, phosphorus, heavy metals, oil and grease from stormwater runoff via adsorption, filtration, sedimentation, volatilization, ion exchange and biological decomposition. Treated stormwater is then infiltrated into the ground or, where infiltration is not appropriate or possible, collected via an underdrain system and discharged into a traditional stormwater drainage system. In addition, biofiltration practices provide habitat enhancement benefits and landscape amenity in more formalized areas on campus.

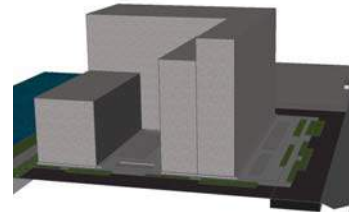


photo by Biohabitats



photo by Biohabitats

Landscape Position Treated:

- Building
- Interior Amenity Zone
- Streetscape Zone
- Right of Way Zone
- Streetscape Zone
- Riverfront Zone

Highlights:

- Garden and landscape amenity
- Visual interest
- Riparian buffer enhancement

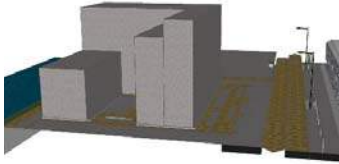


photo by Jennifer Dowdell, Biohabitats

top left and right: Bioretention, Lynchburg, Virginia; above: Bioretention, Portland, Oregon

PRACTICES

Permeable Pavement



Permeable pavement is an alternative to conventional concrete and asphalt paving which allows for infiltration of stormwater into a storage area, with void spaces that provide temporary storage as well as some infiltration. In parking lot design it can be combined with bioretention areas, helping to provide vegetative cover and tree canopy, which reduces the effects of urban heat island as well as stormwater treatment and infiltration. In hardscape and plaza areas, permeable pavement is often considered to minimize impervious surfaces.

Landscape Position Treated:

- Interior Amenity Zone
- Streetscape
- Right of Way Zone (Bike trails)
- Riverfront Trails

Highlights:

- Alternative paving techniques help provide a visual reminder of pedestrian and cycling usage
- Create a new aesthetic in the streetscape



photo by Jennifer Dowdell, Biohabitats



photo by Biohabitats



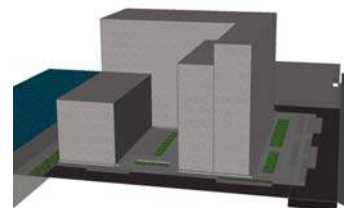
photo by Biohabitats

top: Permeable pavers, Ocean City, Maryland; above left: Pervious pavement and pavers, Swarthmore, Pennsylvania; above right: Permeable pavers, Lynchburg, Virginia

PRACTICES

Swales

Swales can collect and convey surface stormwater runoff from streets, sidewalks and plazas. These practices are placed adjacent to impervious areas and should be designed to complement or enhance the existing landscape plantings. The swale contains permeable soil media which is planted with native vegetation. That vegetation then helps to absorb stormwater, while the soil captures and retains additional runoff. A series of bioswales within rights-of-way will filter and treat runoff from streets and adjacent areas, and will collect and convey flows from smaller BMPs on the site. Underdrains and overflow drains collect water that is not absorbed by vegetation.



Landscape Position Treated:

- Interior Amenity Space
- Streetscape Zone
- Right of Way Zone
- Riverfront Zone

Highlights:

- Vegetated alternative to traditional pipe systems promote water filtering and uptake by plants
- Visual amenity
- Decrease effects of urban heat island

left: Swale, Toledo, Ohio; right: Swale, Rockville, Maryland

PRACTICES

Rail Plantings



Landscape Position Treated:

- Right of Way Zone

Highlights:

- Noise reduction
- Urban heat island mitigation
- Aesthetic amenity
- Educational opportunity

This concept promotes establishing vegetation between and adjacent to light rail tracks. Among the positive outcomes is a reduction in polluted stormwater running into local waterways. Some stormwater that would otherwise run off will be captured by the vegetation and soil. The temperature in the immediate area will be moderated, being a little cooler in the summer, reducing the urban heat island effect, and the noise from the trains will be dampened. This is envisioned as pilot project, to allow for monitoring of plant success. Currently this practice is being piloted in Baltimore, MD and across Europe (http://www.urbantrack.eu/images/site/publications/FinalConference/presentations/07_ASP_Grassed%20Track.pdf).



photo by Biohabitats



photo by Biohabitats

top and bottom: Green Tracks pilot project on the Baltimore Light Rail System, in Baltimore, MD



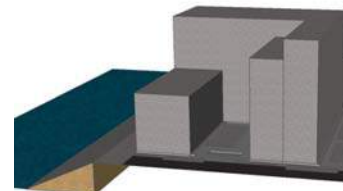
photo by Biohabitats

above: trail along river's edge at Pitt Ohio HQ provides recreation opportunity along planted, abandoned rail line.

PRACTICES

Soil Conditioning

Soil supports organisms that are essential for a healthy environment. Soils are therefore one of the most important, albeit virtually invisible, components in the landscape. Especially in landscapes dominated by urban fill, conditioning the soil with a balance of nutrients, mycorrhizal fungi, compost, and other organic elements like biochar, promotes healthy soil function and processes. Soils in areas along the riparian corridor, as well as in locations where ornamental plantings or stormwater plantings are planned, require attention. Soils can also store legacy contaminants from previous uses so all soils should be tested for contaminants and treated accordingly. In cases where contamination is noted appropriate measures may include capping in place, remediation or removal.



Landscape Position Treated:

- Right of Way Zone
- Riverfront Zone
- Open Space Zone

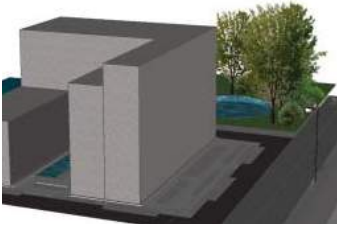
Highlights:

- Promoting ecological function
- Plant health
- Infiltration

iStock photos

PRACTICES

Stormwater Amenity



Landscape Position Treated:

- Interior Amenity Zone
- Open Space Zone
- Riverfront Zone

Highlights:

- Visual amenity in open space areas
- Opportunity for artistic interpretation and education

Parks, courtyards and public plazas often incorporate landscape elements including lawns and garden plantings in combination with hardscape paths, plazas, and seating areas. These areas can be planted with native vegetation that provide aesthetic accents, vibrant colors and texture, and spatial organization. Bioretention can be artistically integrated into this spaces as naturalized water features, providing aesthetic amenity as well as enhanced spaces for recreation and respite.



Washington Avenue Green design and photo by Biohabitats



photo by Biohabitats

top: Bioretention designed to invoke the forms of ancient streams in this urban waterfront park in Philadelphia, PA. bottom: A wetland park in Portland, Oregon.

PRACTICES

Regenerative Stormwater Conveyance

Regenerative Stormwater Conveyance (RSC) is a type of green engineering outfall treatment system. It helps to convey, filter, and infiltrate runoff. This is not simply outfall stabilization (e.g., with riprap), but rather a vegetative regenerative design that creates a more stable stream-like system to help convey and filter water, while providing important habitat and open space opportunities.

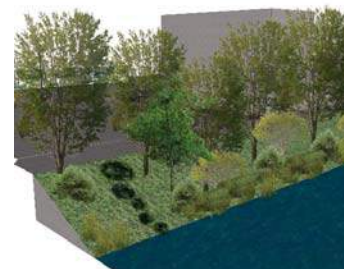


photo and design by Biohabitats



photo and design by Biohabitats

center: Regenerative conveyance design near Swan Harbor, Maryland;
bottom: Regenerative conveyance near Washington, DC.

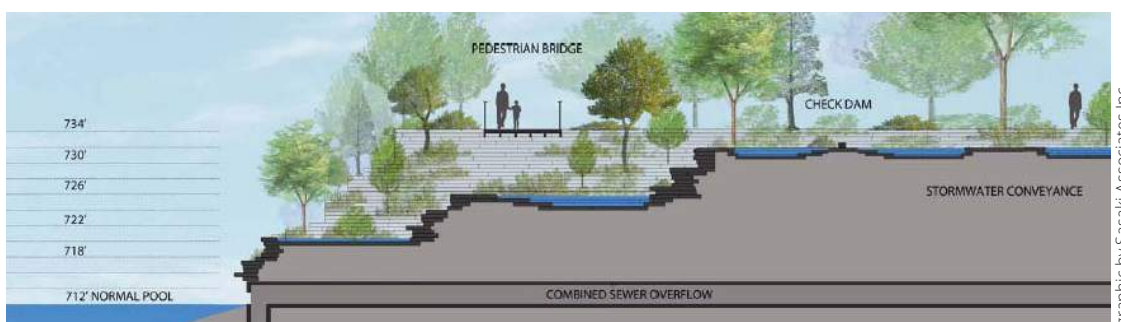


Landscape Position Treated:

- Riverfront Zone

Highlights:

- Vegetated treatment of stormwater runoff
- Aesthetic appeal along the riparian corridor



Regenerative surface conveyance concept along the Allegheny River.

Zoning Recommendations

Zoning Recommendations

While significant amounts of the river's edge have been modified, a critical goal of both the 2011 Vision Plan and the 2012 Green Boulevard plan is to encourage riverbank restoration and stabilization. Riparian buffers along the river's edge help stabilize and, in some locations, restore the riverbank while improving ecosystem functions such as habitat, flood mitigation, sediment and nitrogen removal, water temperature moderation, and aquatic food web support. To adequately stabilize the riverbanks, historic and current analyses prefer a slope ratio between 4:1 (run: rise) and 5:1. While the full extent of the Green Boulevard travels along an urbanized area of the river, the riverfront characteristics vary over the six-mile course. Property ownership and economic development considerations will impact buffer recommendations and implementation.

The 2011 Vision Plan recommended a general 200-foot wide buffer zone along the river that includes setbacks and development with green infrastructure. The Green Boulevard plan builds on this recommendation and encourages three different buffer zones tailored to the existing river's edge and development conditions. These three zones are a dense urban development buffer zone (11th Street to 31st Street), a mixed industrial and residential buffer zone (31st Street to 62nd Street), and an ecological conservation and open space buffer zone (62nd Street to the city limit). Overall along the riverfront, a 95-foot setback or buffer zone is recommended, subject to private property rights and local, state, and federal regulations. Within this zone, development will stabilize the river's edge and promote habitat health. Wider buffers are recommended in the ecological conservation and open space buffer zone, 125-150 feet and 200 feet, respectively. The purpose for the wider buffers in the ecological conservation and open space buffer zone is to mitigate the steep slopes in these areas and to increase the currently minimal infrastructure to support development; development in this area and provision of necessary supporting infrastructure has the potential for significant environmental degradation. Protecting buffer areas often involves public/private efforts formed through partnerships with landowners and shared knowledge of the benefits.

A suggestion for implementation of the three different buffer zones recommended in the Green Boulevard Plan is to revisit the city's current zoning, which contains

the Riverfront Overlay District (Section 906.03), implemented in 1985 and revised in 1991 as a product of the 1989 Riverfront Plan. The Riverfront Overlay District is a subsection of 906.01, Environmental Overlay Zoning Districts. The purpose of the Environmental Overlay Districts is as follows:

1. Reduce hazards to life and protect structures and uses from damages which may be caused by construction on or use of land which is unsafe for development
2. Protect land, public infrastructure, and waters of the city from damages caused by improper use or construction on land which has physical, environmental, or aesthetic limitations or development
3. Maintain and enhance natural land features which are environmentally significant or which constitute a natural resource of importance to the community at large, including especially wooded hillsides, river frontages, and stream valleys
4. Enhance public access to and enjoyment of the city's rivers and riverfronts
5. Implement the policies enumerated in the Vacant, Environmentally Sensitive Land Management Study of 1979
6. Carry out the mandates imposed upon governments in Pennsylvania by Article I, Section 27 of the Commonwealth's constitution, which states, "The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic, and aesthetic values of the environment. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all of the people."

The Riverfront Overlay District is part of the zoning code dealing with environmentally sensitive lands. The purpose of the Riverfront Overlay District is to maintain an open space area with the potential for public access along the banks of the rivers, to improve the scenic quality of the city's riverfronts, to establish a classification of land and water area, and to establish an application, review, and

permitting procedure appropriate to these special lands and waters. While it based on site and condition, the Riverfront Overlay roughly extends inland 660 feet from the shoreline (water elevation at the normal pool).

The Riverfront Overlay District is organized around three sub-districts:

1. Preservation Sub-district
2. Conservation Sub-district
3. Development Sub-district

These three sub-districts provide the framework for potential proposed modifications to the zoning code. For example, the Preservation Sub-district could be defined to align with the current state code (Section 102.14) and city zoning requirements (Chapter 906.03.E) for a 50-foot riverfront setback. Similarly, recommendations from the Green Boulevard plan for buffers extending beyond the currently required 50 feet could be defined to align with the Conservation and Development Sub-districts; specifically, the Conservation Sub-district could be defined as a 45- to 150-foot zone from the Preservation Sub-district (depending on where it corresponds to the Green Boulevard plan's recommended Dense Urban Development Buffer, Mixed-Use Buffer, or Ecological Conservation Buffer). The original intent of the Riverfront Overlay District was to create specific design criteria for riverfront development; however, this was never implemented. An additional recommendation is to define the design criteria for the Sub-districts, potentially including recommendations for development within the Conservation Sub-district to strictly require and regulate green infrastructure, and to define design criteria for the Development Sub-district to encourage green infrastructure up to the edge of the Riverfront Overlay Zone.

Ultimately, any proposed changes to Title 9 in the city code and zoning regulations will require action by the City Planning Commission and approval by City Council.

Performance Measures

The implementation of a stormwater network would reduce the hard surface run off and ultimately change the stormwater dynamics of the Allegheny Riverfront Green Boulevard study area. This reduction represents 89 million gallons of stormwater runoff being eliminated from the combined sewer system annually. Table 1 presents the stormwater management performance measures of the study area by comparing the current condition and proposed plan in terms of reduction of hard surface and annual rainfall directed to the combined sewer system. Table 2 presents the benefits of the implementation of the stormwater network using green

Table 1: Stormwater Performance Measures

	Before Plan	After Plan	Reduction	Percent Reduction
Hard Surface	270 Acres	221 Acres	49 Acres	18%
Annual Rainfall directed to Combined Sewer System (gals)	274 M	224.5 M	49.5 M	18%

Table 2: Benefits of Stormwater Network

Stormwater Strategy	Estimated Area	% of Total Area	Reduction in Annual Rainfall Directed to Combined Sewer System (gals)
Railroad Corridor	32 Acres	9%	33 M
Treed / Green	0 Acres	0%	0 M
Open Space 1 (Strip District)	23.5 Acres	7%	23.5 M
Open Space 2 (43rd Street District)	9.0 Acres	3%	9.2 M
Open Space 3 (Highland Park Regenerative Stormwater System)	16.5 Acres	5%	16.8 M
Riverfront Corridor	36 Acres	10.5%	37 M
Roof Systems	20 Acres	5.5%	20.7 M
Street Corridors	12 Acres	4%	12.1 M
47th Street Regenerative Stormwater System	6.7 Acres	2%	6.8 M

Total study area is 338 Acres.

Source: Riverlife, Allegheny River Green Boulevard Stormwater Network Report, Pittsburgh, PA, March 2013.

The Allegheny Riverfront Green Boulevard plan establishes an additional 29 acres of new park space creating a network of 523 acres. The plan produces 7 miles of new trails that link to an existing network of approximately 24 miles of trails. The plan also creates 120 acres of riverfront buffers improving bank stabilization, water quality, and habitat creation throughout the study area.

Table 3: New Open Space

Open Space	Area/Length
New Trails	7 miles
Riverfront buffers	120 Acres
Strip Open Space	9 Acres
Lawrenceville Open Space	12 Acres
Green Boulevard	8 Acres

Performance Measures

Riparian Buffer Performance Measures

Buffer	Location	Transition Zones	Minimum Width	Ideal Width	Tree Canopy Cover Within the Buffer	Minimum Native Vegetative Cover*	Maximum Impervious Cover
1) Dense Urban Development Buffer Zone	11th Street to 31st Street	25th to 31st Street	95'	125'	80%	75%	25%
2) Mixed Industrial & Residential Buffer Zone	31st Street to 65th Street	25th to 31st, and upstream of 62nd bridge	125'	150'+	80%	85%	15%
3) Ecological Conservation & Open Space Buffer Zone	65th Street to Washington Boulevard	Upstream of 62nd street bridge	250'	300'+	80%	95%	5%

*The goal is to achieve additional maximum imperviousness with porous surface practices that help filter and convey water to stormwater management practices. Infiltration is not recommended in areas with potential soil contamination.

Focal Species Performance Measures Opportunities

Habitat	Focal Species Common Name	Focal Species Scientific Name	Buffer Zone	Project Opportunities	Potential Performance Measures
Aquatic Fish	Paddlefish	<i>Polyodon spathula</i>	River/ Shoreline	Gravel bar creation, habitat structures, education and interpretation, pollution runoff control	Fish counts, habitat mapping, monitoring, education programs
Terrestrial Pollinator	Eastern tiger swallowtail	<i>Papilio glaucus</i>	Buffer Zones 1, 2, & 3	Native woodland and meadow conservation and restoration, plant pollinator gardens, education and interpretation	Community plantings and stewardship, butterfly counts& monitoring, signage
Terrestrial Mammal	Least weasel	<i>Mustela nivalis</i>	Buffer Zones 2 & 3	Riparian restoration, habitat for prey, survey, least weasel camera, education programs	Survey of species, monitoring of potential nesting sites (weasel cam)
Woodland/ Wetland Amphibian	Wood frog	<i>Rana sylvatica</i>	Buffer Zones 2 & 3	Protect and restore vernal pools and lowland forests, corridors and buffers, reduce toxic herbicides with education and alternatives, enhance dissolved organic carbon and protect low acidity,	Species surveys and monitoring, signage and brochures
Forest/Stream Bird	Louisiana waterthrush	<i>Parkesia Motacilla</i>	Buffer Zone 3	Forest core protection, increase riparian buffers to meet maximum recommended targets, species education, monitoring, birding group stewards	Monitoring, birding counts, educational programs
Riparian Edge Bird	Bank swallow	<i>Riparia riparia</i>	Buffer Zones 2 & 3	Unarmored shoreline areas, protect nesting sites (signs, leashed pets, limited access) manage exposed bank/bluffs, education and monitoring inventory	Signage and education programs, monitoring through partnering institutions, nesting site inventory

Riverfront Trail - 21st Street to 26th Street



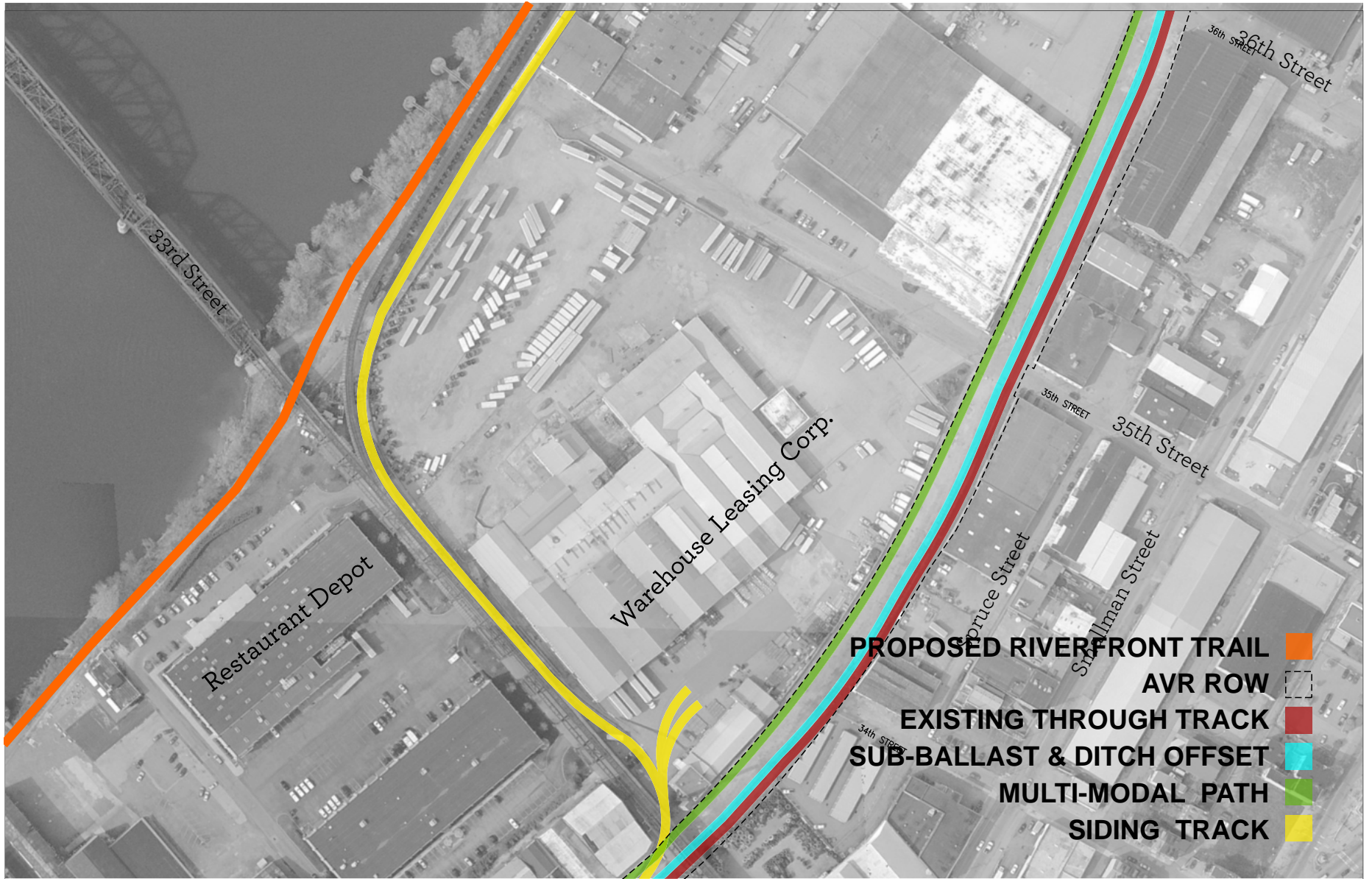
Riverfront Trail - 26th Street to 29th Street



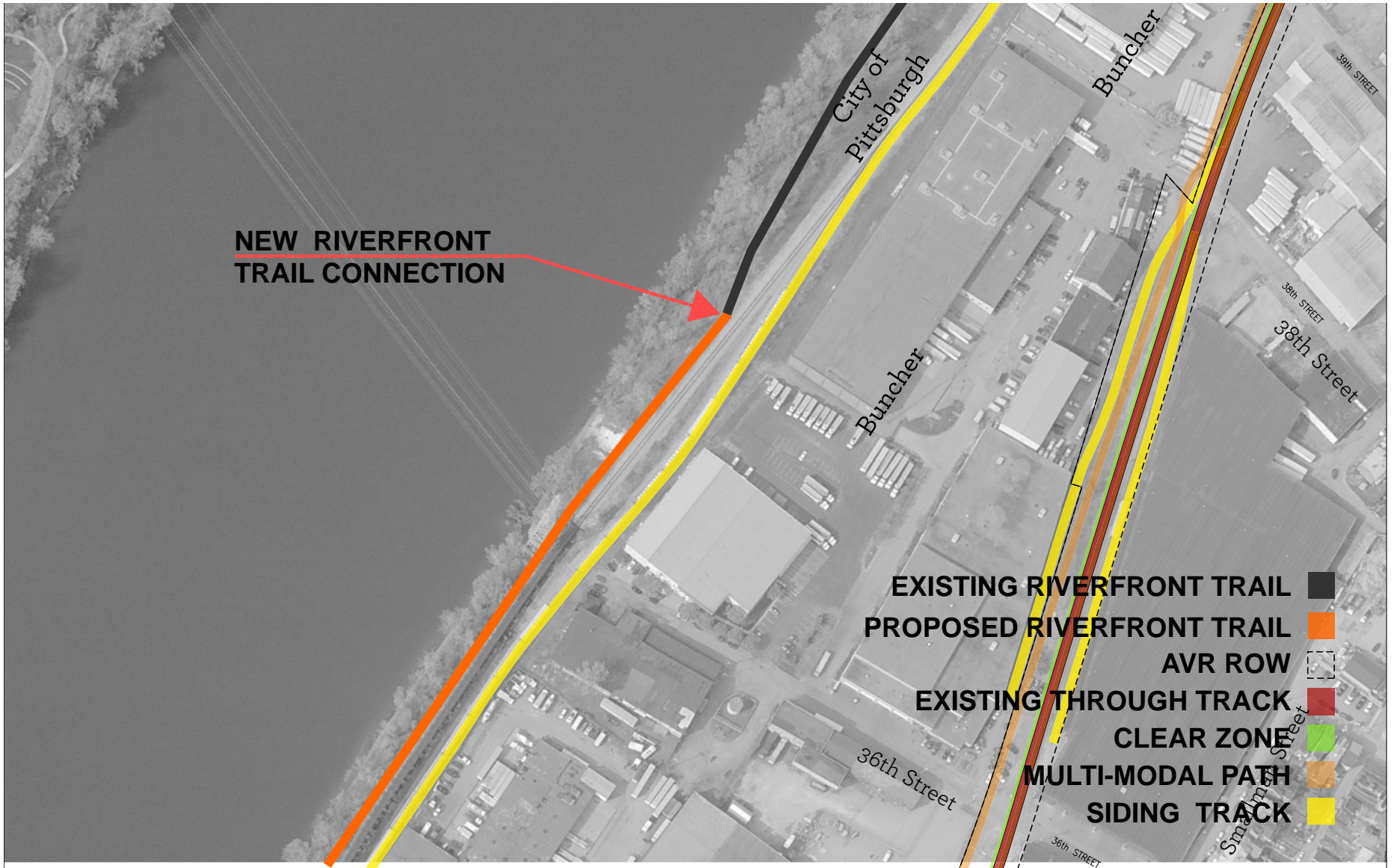
Riverfront Trail - 29th Street to 33rd Street



Riverfront Trail - 33rd Street to 36th Street



Riverfront Trail - 36th Street to 38th Street



Statement of Estimated Probable Construction Cost
 Allegheny Riverfront Park
 Concept Design
 Riverfront Trail 24th to 36th

Sasaki Associates
 March 25, 2013

Item No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
4	Riverfront Trail 24th to 36th	5,698	LF	\$ 306.22			
	Demolition	28,490	SF	\$ 5.00	\$ 142,450		R&D everything from saw cut line to ROW, both sides
	Sawcut Pavement		LF	\$ 2.00	\$ -		
	Dedicated Bike Lanes		LF	\$ 12.00	\$ -		
	Stone Dust Paving	68,376	SF	\$ 1.00	\$ 68,376		4" thick stone dust paving, includes layout and finish grading
	Thermoplastic Bike Lane Paint		SF	\$ 2.50	\$ -		
	Road Crossing	0	EA	\$ 250,000.00	\$ -		
	Security Fence	5,698	LF	\$ 50.00	\$ 284,900		
	Benches	8	EA	\$ 5,000.00	\$ 40,000		
	Turf Shoulder	45,584	SF	\$ 1.20	\$ 54,701		Assume 4' shoulder on each side of trail
	Tree Planting	175	EA	\$ 1,200.00	\$ 209,400		50' O.C.
	Biofilter	11,396	LF	\$ 8.00	\$ 91,168		
	Lighting	113	EA	\$ 3,500.00	\$ 395,500		
	Trash Receptacle	6	EA	\$ 3,500.00	\$ 21,000		
	Signage	1	LS	\$ 10,000.00	\$ 10,000		
	Electrical	5,698	LF	\$ 75.00	\$ 427,350		
	Drainage Upgrade		LF	\$ 250.00	\$ -		
	Sewer Upgrade		LF	\$ 150.00	\$ -		
	Water Upgrade		LF	\$ 50.00	\$ -		
	Gas		LF	\$ 100.00	\$ -		
	Green Boulevard					\$ 1,744,845	

