

IRISE STORMWATER SYMPOSIUM



**University of Pittsburgh
O'Hara Student Center Ballroom
December 4, 2025
9:00–3:00**

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Planning Partners



IRISE Consortium Members

The University of Pittsburgh is joined by the organizations listed below that comprise the IRISE Consortium Partnership. Learn more about the IRISE Consortium at www.engineering.pitt.edu/irise/

Allegheny County
Pennsylvania Department of Transportation
Pennsylvania Turnpike Commission
CDR Maguire Corporation
Golden Triangle Construction

Michael Baker International
Constructors Association of Western Pennsylvania
Federal Highway Administration
Southwestern Pennsylvania Commission

AGENDA

Click on presentation title to advance to presentation slides

8:30-9:00 AM Light Breakfast & Networking

9:00-9:15 AM *Welcome*
Joe Szczur, Director IRISE Consortium

Planning & Stormwater

9:15-9:30 AM *PGH2050 and Stormwater Management*
Kyla Prendergast, City of Pittsburgh Department of City Planning

9:30-9:45 AM *Emerging Stormwater Regulations in Pennsylvania*
Jeff MacKay, MS, PE, CPESC, Vice President, NTM Engineering, Inc.

9:45-10:00 AM *How 10 Municipalities Came Together to Address Stormwater Management*
Dan Santoro, Township Manager, Cranberry Township
Mark Gordon, Chief, Economic Development and Planning, Butler County
Southwest Butler Stormwater Planning Group

10:00-10:20 AM Panel questions for Planning and Stormwater Panel

10:25-10:35 AM Break

Challenges in Financing & Implementing Stormwater Infrastructure

10:35-10:50 AM *A River Runs Through It: Tackling Stormwater at the Airport*
Michon L. Mulder Budziszewski, Manager, Environmental Services Allegheny
County Airport Authority

10:50-11:05 AM *Leveraging Grant Funds for Green Infrastructure*
Adriene Smochek, Recreation and Conservation Advisor, PA Department of
Conservation and Natural Resources

11:05-11:20 AM *Borough of Dormont Stormwater Authority Tackling Urbanized Stormwater
Management*
John Heyl, PE, CPESC, Principal, Lennon, Smith, Souleret Engineering, Inc.
John Valinsky, Assistant Engineer, Lennon, Smith, Souleret Engineering, Inc.

11:20-11:35 AM *Trees: Prioritizing Root Zones For Maximum Stormwater Absorption*
Meghan Cerveney, International Society of Arboriculture Certified Arborist,
Tree Pittsburgh

11:35-12:00 PM Panel Questions for Challenges in Financing & Implementing Stormwater
Infrastructure

12:00-1:15 PM Lunch

AGENDA

Click on presentation title to advance to presentation slides

Technical Challenges and Successes in Stormwater Management

- 1:20-1:35 PM *Corrective Stormwater Maintenance in Stormwater Detention Basins*
Tyson R. Clouser, P.E., Senior Engineer Project Manager, Pennsylvania Turnpike Commission
- 1:35-1:50 PM *Swept Away: Rethinking the Economy of our Floodplains*
Tom Batrone, Senior Water Resources Engineer, HDR
Lisa Brown, Executive Director, Watersheds of South Pittsburgh
- 1:50-2:05 PM *Digital Twins and Predictive AI for Stormwater, Watersheds, and Flood Resilience*
Damon Weiss, Principal at Ethos Collaborative & Faculty, Carnegie Mellon University, CEE Dept.
- 2:05-2:20 PM *Navigating Evolving Stormwater Regulations: A Technical Perspective*
Rachel Upadhyay, P.E., Project Manager, Civil & Environmental Consultants, Inc.
- 2:20-2:40 PM Panel Questions for Technical Challenges and Successes in Stormwater Management
- 2:40-3:00 PM Debriefing/Plenary Discussion

**Please provide feedback of this event by using the QR code below
or visiting bit.ly/IRISESymposiumEvaluation**



**Need Professional Development Hours?
Stop by the registration table to obtain the form.**

PITTSBURGH
2050:

COMPREHENSIVE PLAN

University of Pittsburgh
IRISE Stormwater Symposium
December 4th, 2025

PGH2050 AND STORMWATER MANAGEMENT

Kyla Prendergast, AICP

Senior Environmental Planner

City of Pittsburgh Department of City Planning

Kyla.prendergast@pittsburghpa.gov



AGENDA

- »» Overview of PGH2050
- »» State of stormwater in Pittsburgh
- »» Planning for different scenarios
- »» Regional Efforts
- »» Next Steps



What is PGH2050?



What is a Comprehensive Plan?

- 1. Creates a shared vision** for the Pittsburgh we want and need to work towards over the next 20+ years
- 2. Guides and prioritizes where development and infrastructure improvements** will happen across the city
- 3. Addresses the environmental, economic, cultural, and health inequities** experienced by some of the city's residents and neighborhoods
- 4. Involves the voices of all residents** in planning and decision-making about the plan, with focused attention on including communities who are often not heard from
- 5. Codifies policies and strategies** that guide land use, design, development, improvement, and maintenance of land, public infrastructure, and community infrastructure
- 6. Unique Opportunity for Regional Alignment** with collaboration on the County's plan update and other current planning processes

Why Do We Need a Just Transition?

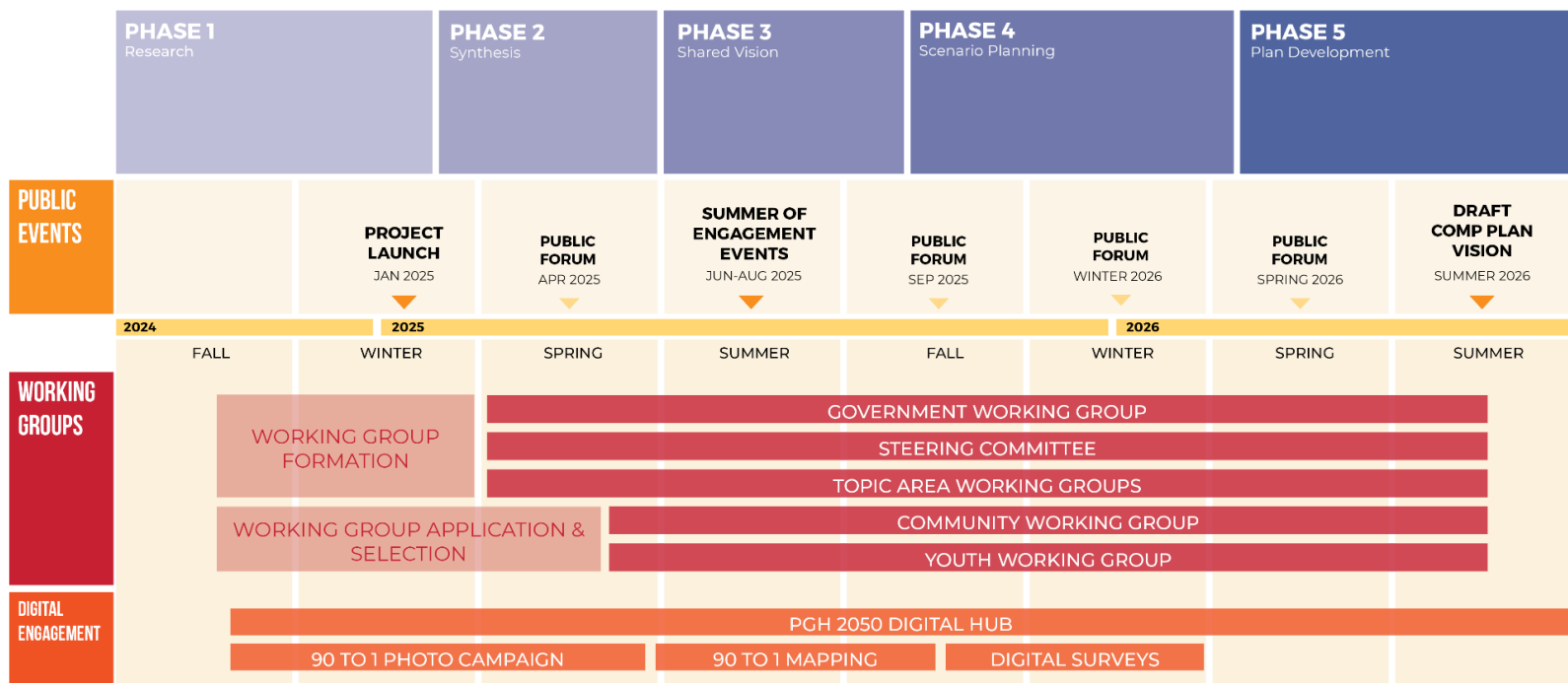
Not all Pittsburghers have benefited from past progress. By 2050, Pittsburgh has to grapple with significant issues in order to create a just future.

Critical Issues:

- **Growing infrastructure challenges**
- **Not enough housing density or variety**
- **More people & jobs needed inside city limits**
- **Hard choices about where people live & what we maintain**
- **A strong Pittsburgh is necessary for a stronger region**



Timeline and Working Groups



PGH2050 Working Groups & Committees

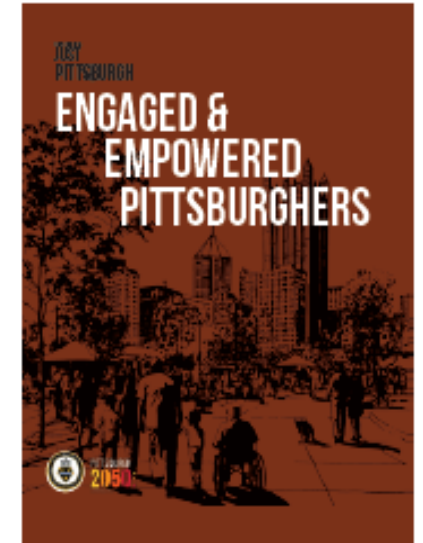
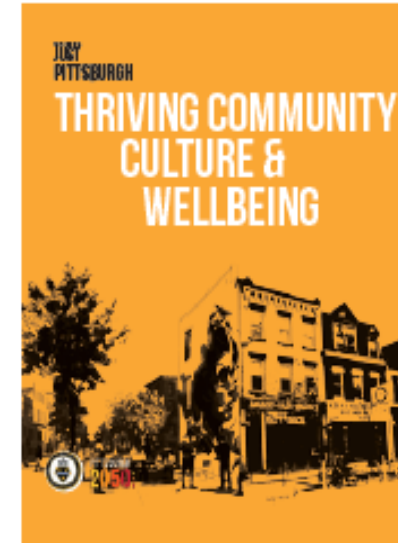
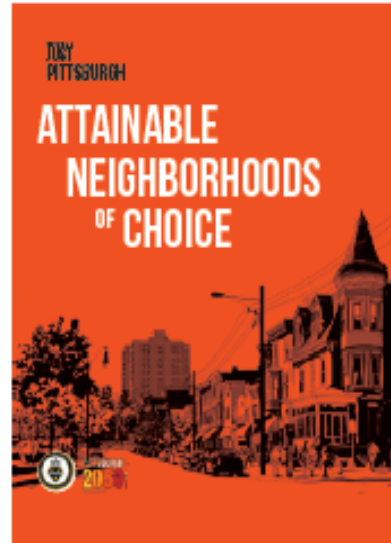
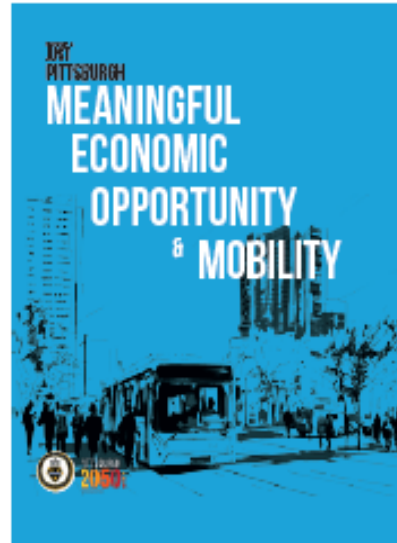
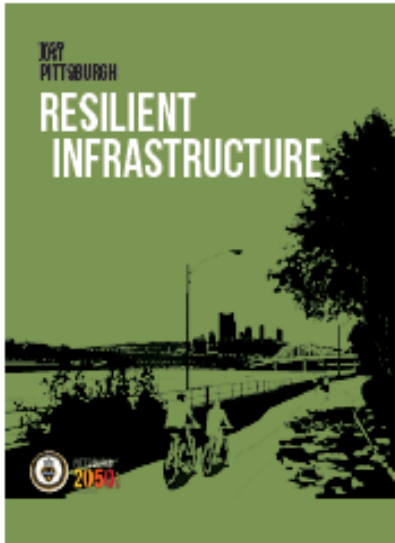


STATE OF A JUST PITTSBURGH

A series of comprehensive summary documents synthesizing **Pittsburgh's urgent conditions, what must be done to change and the tough policy choices** we must make together.

- RESILIENT INFRASTRUCTURE:** environmental justice, climate action, energy, waste, stormwater management
- MEANINGFUL ECONOMIC OPPORTUNITY & MOBILITY:** economic opportunity, mobility, digital equity
- ATTAINABLE NEIGHBORHOODS OF CHOICE:** housing, real estate & vacancy, parks & open space, neighborhoods, education
- THRIVING COMMUNITY CULTURE & WELLBEING:** public health & safety, food systems, historic preservation, arts & culture
- EMPOWERED & ENGAGED PITTSBURGHERS:** planning governance, civic engagement, racial equity frameworks

VISION WORKBOOKS



Pittsburgh & Stormwater

PITTSBURGH
2050:

COMPREHENSIVE PLAN

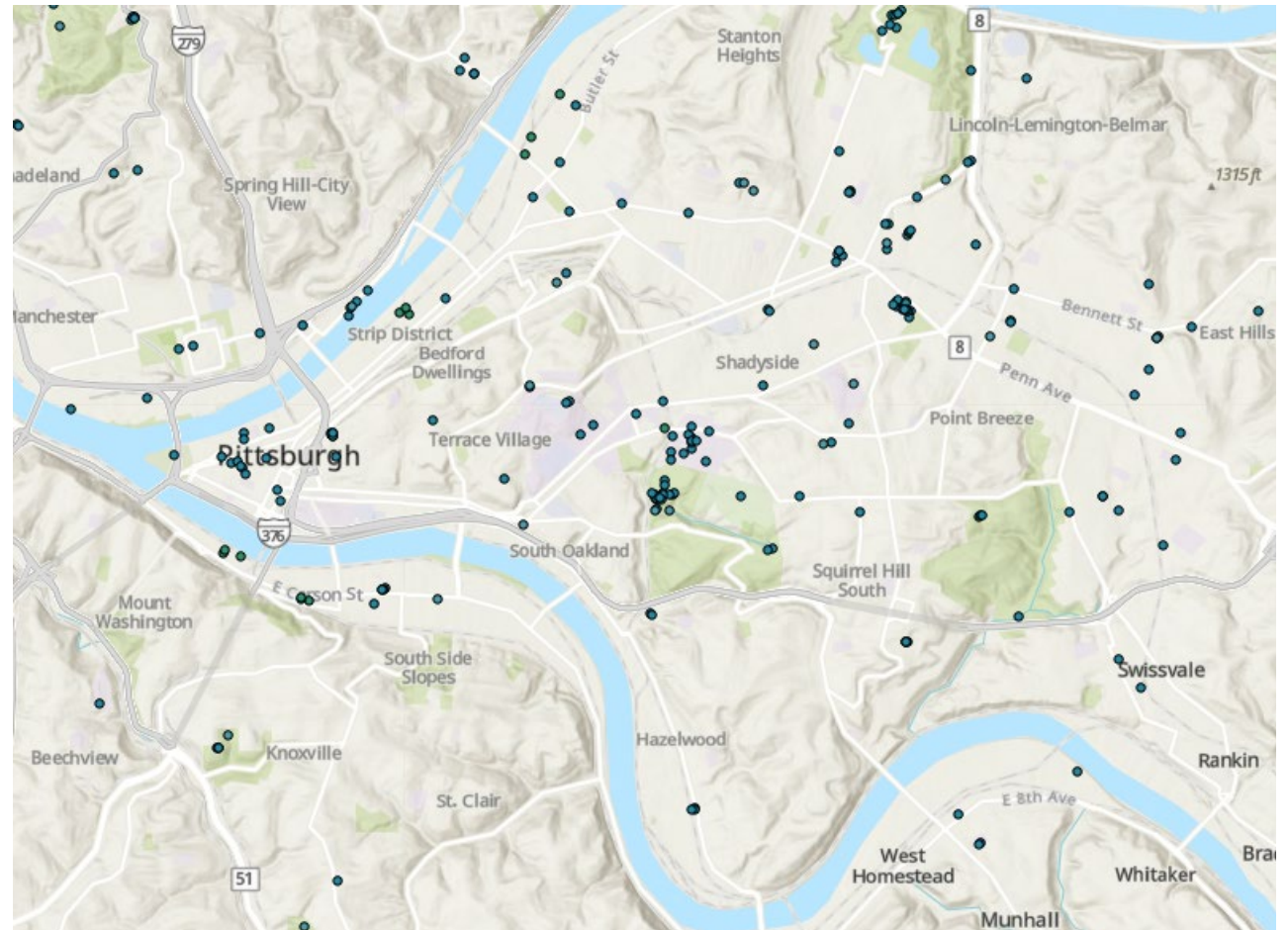


WHAT WE ARE LEARNING ABOUT
STORMWATER MANAGEMENT



STATE OF STORMWATER IN PITTSBURGH

- Aging infrastructure
- Combined sewer overflows
- Impaired streams
- Flash floods
- Basement flooding & backups
- Localized flooding
- Paved watersheds & floodplains
- Innovative stormwater regulations
- Recent infrastructure investments are improving conditions



Existing stormwater management infrastructure in the City of Pittsburgh from City of Pittsburgh permitting, Pittsburgh Water, and Three Rivers Wet Weather

COST OF DOING NOTHING...

2018 WAS ALLEGHENY COUNTY'S "WETTEST YEAR ON RECORD" WITH \$40M IN FLOOD-RELATED LANDSLIDE DAMAGE

- PENNDOT DISTRICT 11



Photo from SlowWaterMovement.Blogspot.com citing L. S. Vincent.

A VISION FOR STORMWATER IN PITTSBURGH

IMPERATIVES

MAINTAIN & RESTORE NATURAL SYSTEMS

Pittsburgh needs to preserve and add more trees, vegetation, and streams. These natural features act as a defense system against extreme weather and help to create a cooler, more comfortable environment.

SLOW AND SOAK UP WATER

Pittsburgh must identify flood- and landslide-prone areas and natural and engineered solutions to slow runoff, absorb water, and reduce risk to communities.

REPAIR ENVIRONMENTAL HARMS

Pittsburgh must correct past environmental harms and ensure all communities, especially those most impacted, share in the benefits of climate action.

CLEAN OUR WATER

Pittsburgh must upgrade water infrastructure to replace lead service lines and ensure safe, clean drinking water for all residents.

TOUGH CHOICES

PRIORITIZING STRATEGIC INFRASTRUCTURE INVESTMENTS

Pittsburgh must prioritize how and where to maintain, repair, upgrade, replace, or decommission streets, bridges, and city steps.

LOCATING IN-TOWN WASTE FACILITIES

Pittsburgh must carefully consider where to locate new waste facilities to improve service, reduce illegal dumping, and support sustainability.

MOVING TO CLEANER & DIVERSIFIED POWER SYSTEMS

Pittsburgh must expand clean energy options to protect homes and businesses from blackouts during storms and heat waves, without placing the burden of new infrastructure on overburdened communities.

CONSIDERING "NO-BUILD ZONES"

As climate risks grow, Pittsburgh may need to limit future development by creating "no build zones" in high hazard areas.

CONSIDERING RELOCATION

Some areas of Pittsburgh may become too unsafe or too expensive to safely support homes, requiring property owners and the City to explore potential relocation strategies.

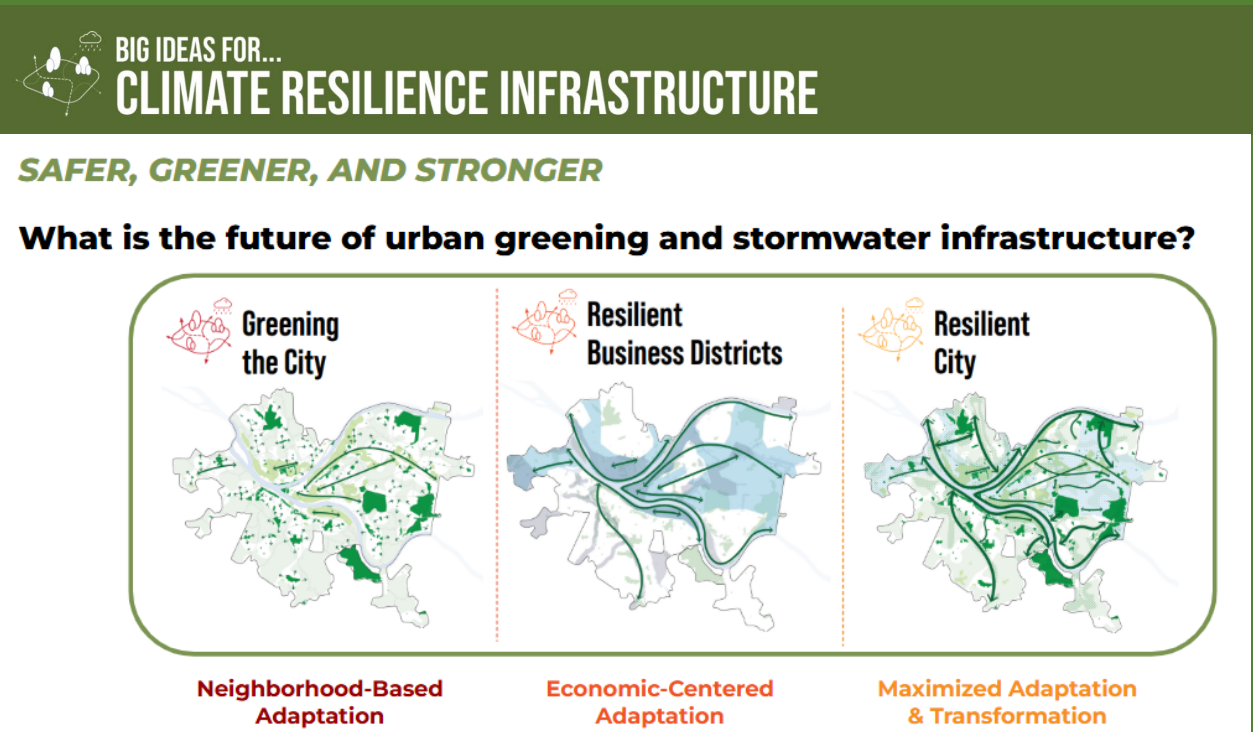
SYSTEMS FOR ADAPTATION & ACCESS

IN 2050, PITTSBURGH
**KEEPS RIVERS CLEAN,
AIR BREATHABLE,
& HILLSIDES SAFE**

We adapt to climate change by restoring natural systems, expanding green spaces, and planting more trees to reduce flooding and heat, protecting neighborhoods most at risk first.



Planning for different scenarios



ALL SCENARIOS ARE GROUNDED IN A JUST TRANSITION

**EQUITY
INCLUSION
AFFORDABILITY
SUSTAINABILITY
SHARED
PROSPERITY**

**SCENARIO A:
The Attainable City**

**SCENARIO B:
The Prosperous City**

**SCENARIO C:
The Climate-Ready City**



SCENARIOS



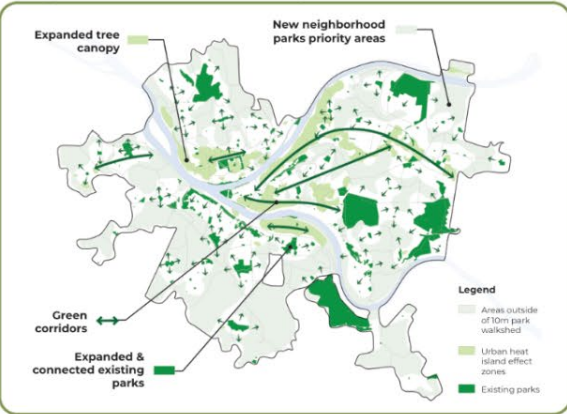
BIG IDEAS FOR... CLIMATE RESILIENCE INFRASTRUCTURE

A THE ATTAINABLE CITY GREENING THE CITY

Resilience is built into the fabric of daily life. A park in every neighborhood, an expanded tree canopy, cooling infrastructure, and incremental managed stormwater systems make communities more livable while reducing risk.



Neighborhood-Based Adaptation

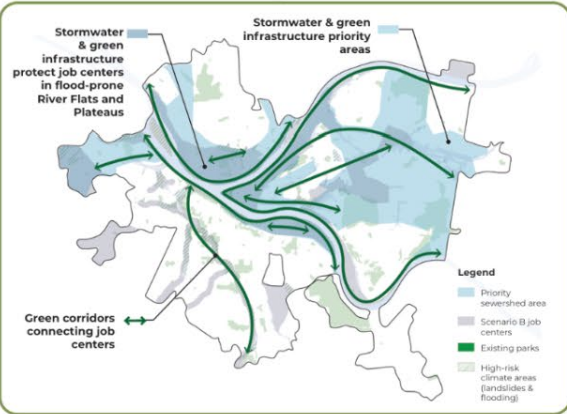


B THE PROSPEROUS CITY RESILIENT BUSINESS DISTRICTS

Climate investments are closely aligned with Pittsburgh's economic engines. Every major job center is connected by green corridors that allows people to commute comfortably and safely, whether they drive, bike, walk, or take transit.



Economic-Centered Adaptation

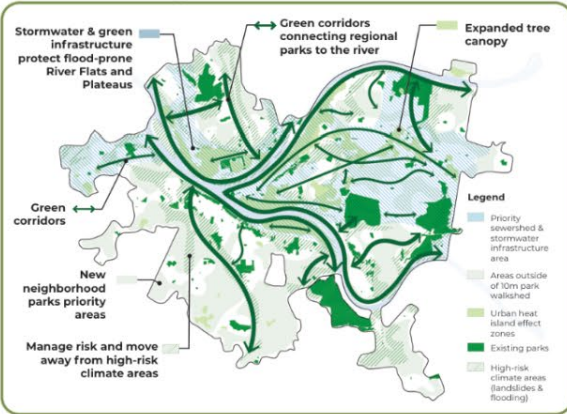


C THE CLIMATE-READY CITY RESILIENT CITY

Climate resilience is the defining framework for growth and development. Innovative, large-scale investments in cooling infrastructure, stormwater management, and urban greening reshape the city, creating a climate-ready haven that attracts newcomers seeking sustainability and stability in an era of increasing environmental hazards.



Maximized Adaptation & Transformation



EARLY FEEDBACK

KEY TAKEAWAY

Climate resilience is necessary but difficult to achieve equitably

Top 3 themes:

1. **Support for flood-mitigation, stormwater repair, and energy resilience.**
2. **Concerns about displacement and inequitable outcomes resulting from green investment.**
3. **Desire for transparent funding and accountability in project selection.**

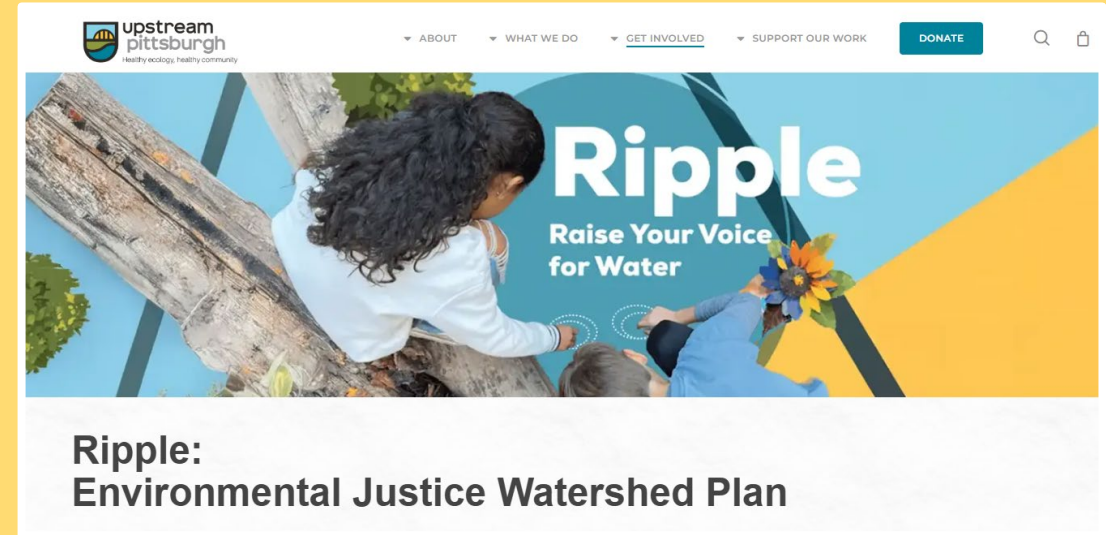
How can we plan for green infrastructure when our grey infrastructure is failing?

How to we help stabilize households after flooding and landslide disasters?

Green spaces shouldn't come at the cost of displacement.

If people need to relocate due to climate risk, we need to have safe affordable housing for them to go to.

Regional Efforts



REGIONAL EFFORTS

- Headwaters to the Ohio Water Network
- Ohio River Basin Alliance and the Ohio River Restoration Program Act
- Allegheny County Comprehensive Plan
- Upstream Ripple Nine Mile Run Environmental Justice Plan
- ALCOSAN Deep-Tunnel Project

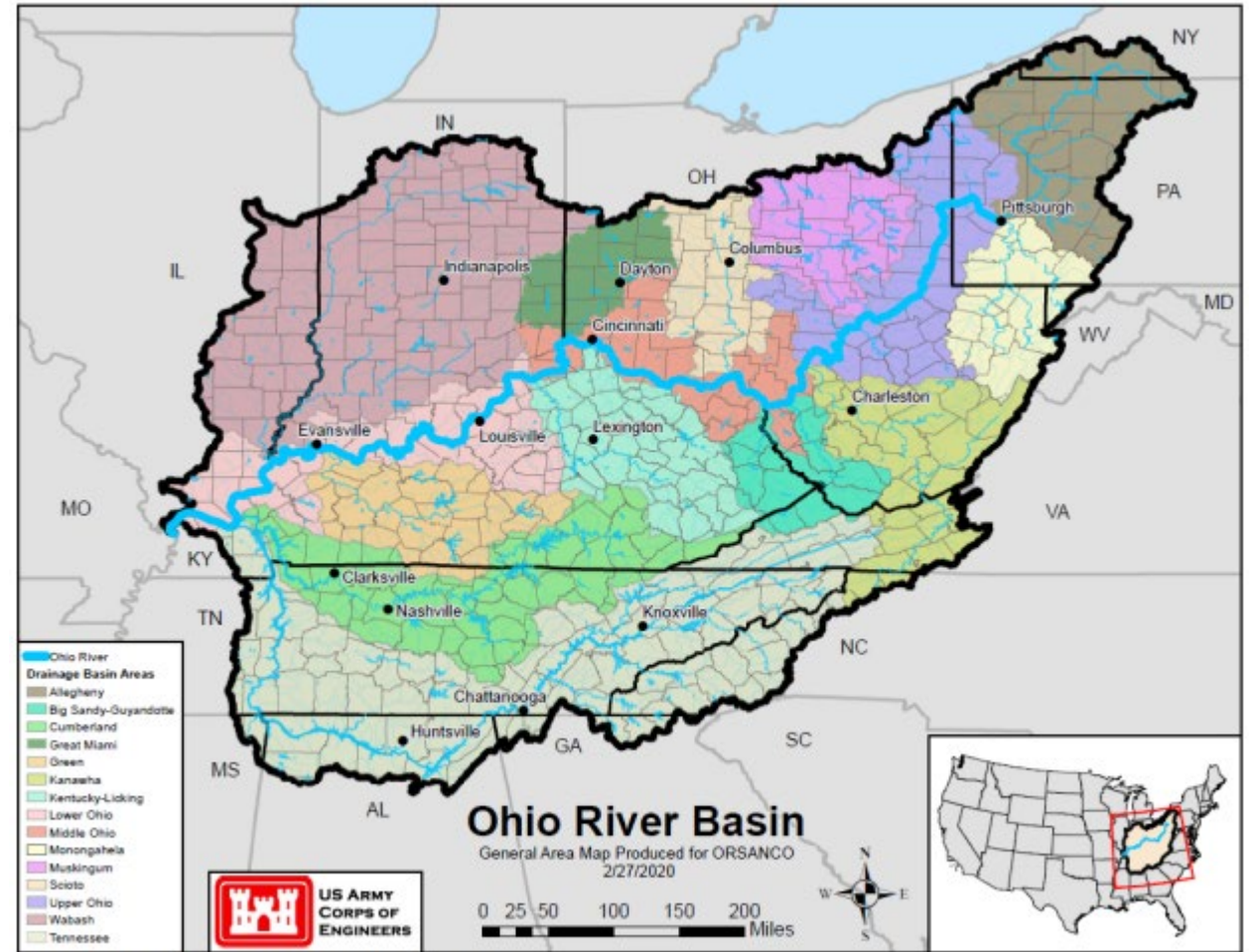
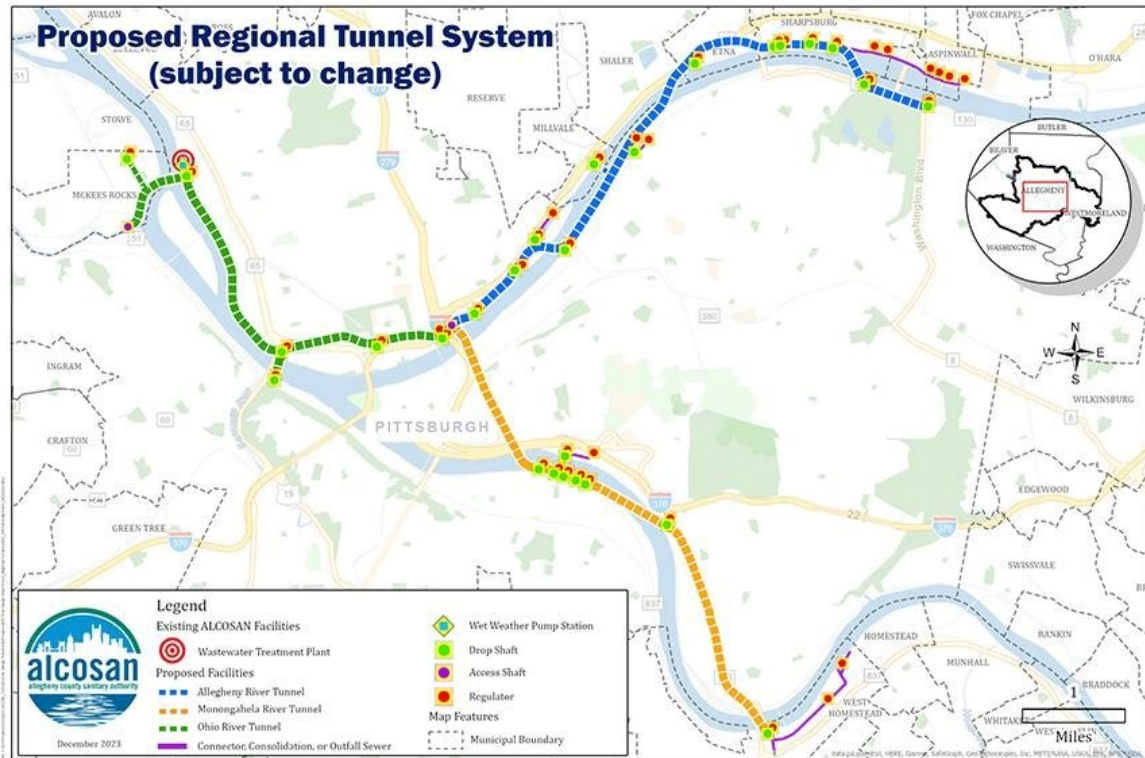


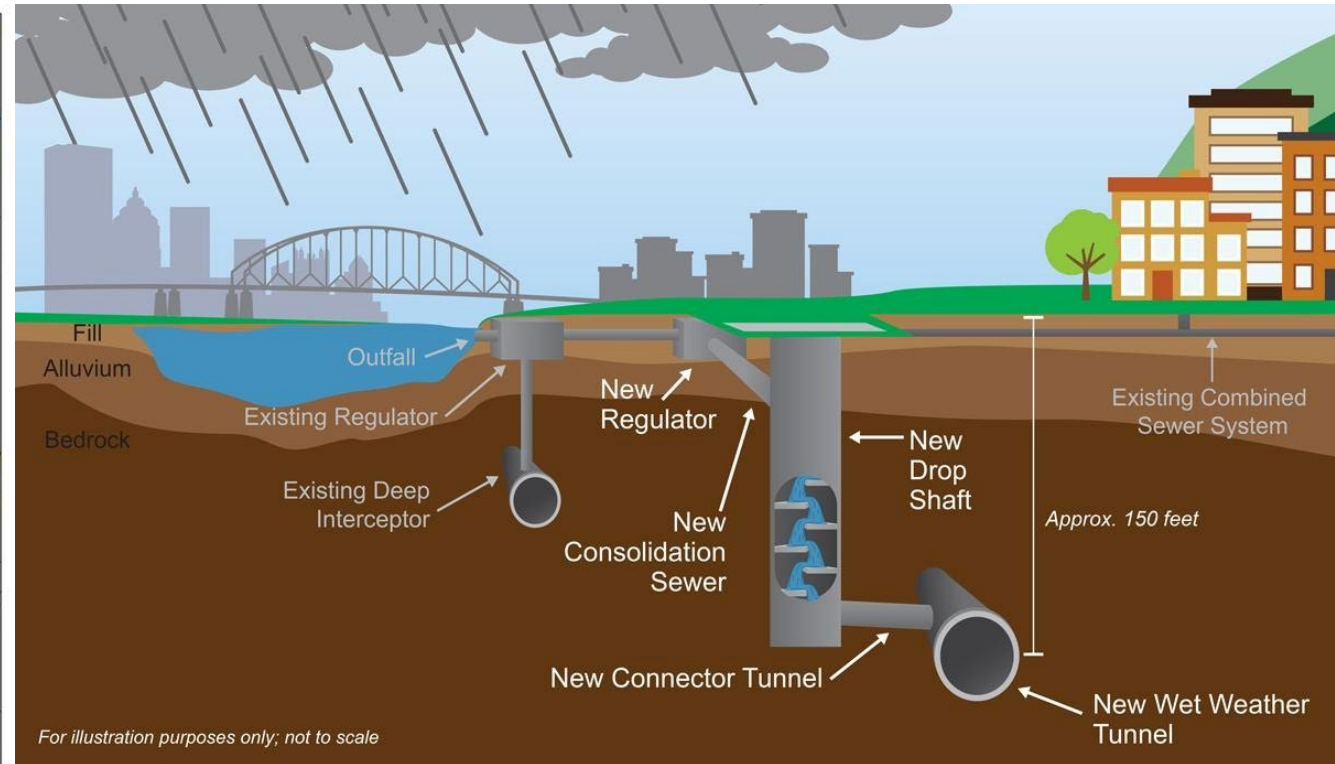
Figure 1: The 204,000 square mile Ohio River Basin.

REGIONAL EFFORTS

ALCOSAN Deep-Tunnel Project



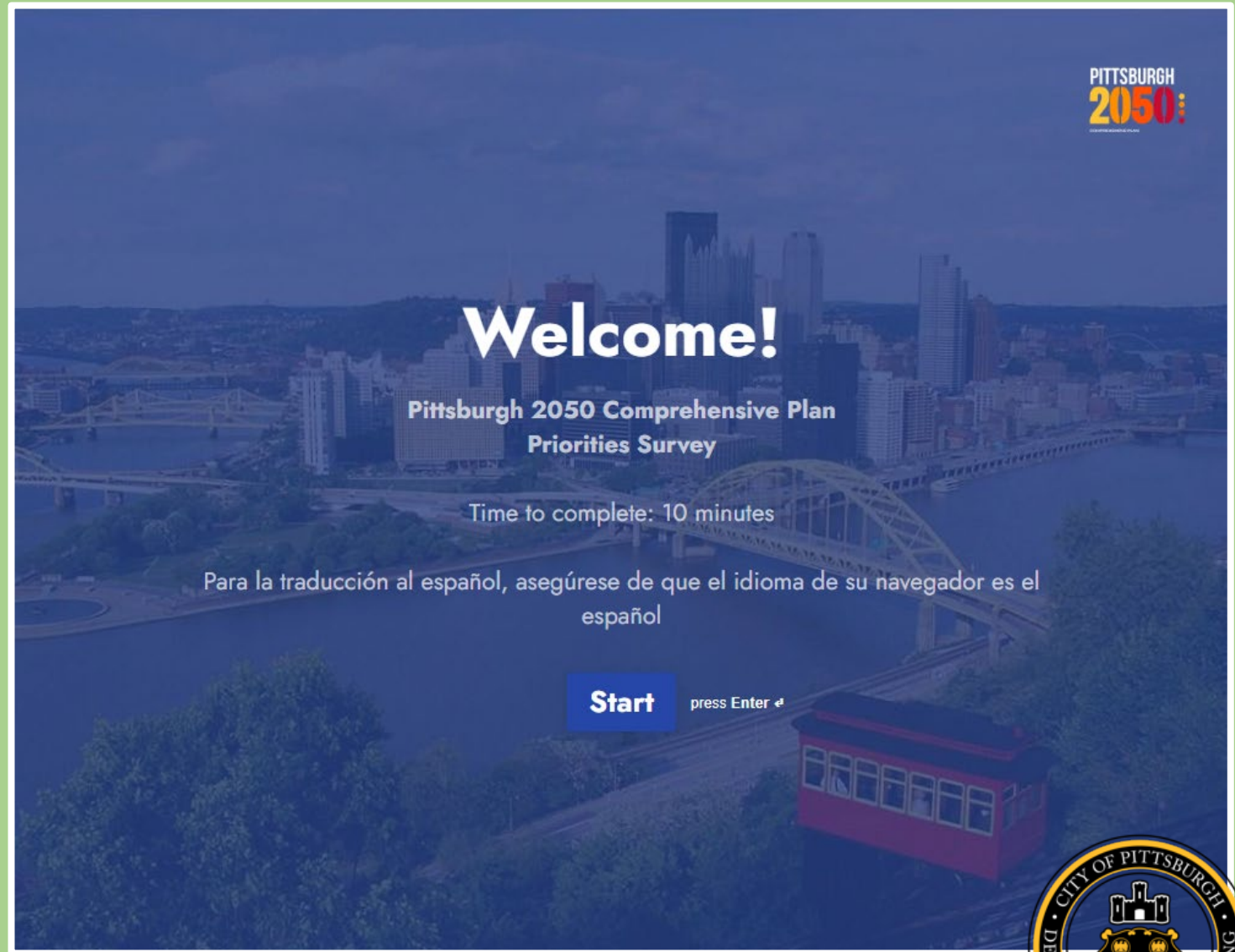
Source: ALCOSAN



Next Steps



COMPREHENSIVE PLAN



NEXT STEPS

[Read the Ohio River Basin Alliance Restoration Plan!](#)

[Take the Scenarios Survey!](#)

[Visit pgh2050.com to learn more!](http://pgh2050.com)



THANK YOU!

HOW TO STAY IN TOUCH!

REACH OUT OVER EMAIL:

KYLA.PRENDERGAST@PITTSBURGHPA.GOV



TAKE THE SCENARIO
SURVEY



PITTSBURGH
2050:
COMPREHENSIVE PLAN

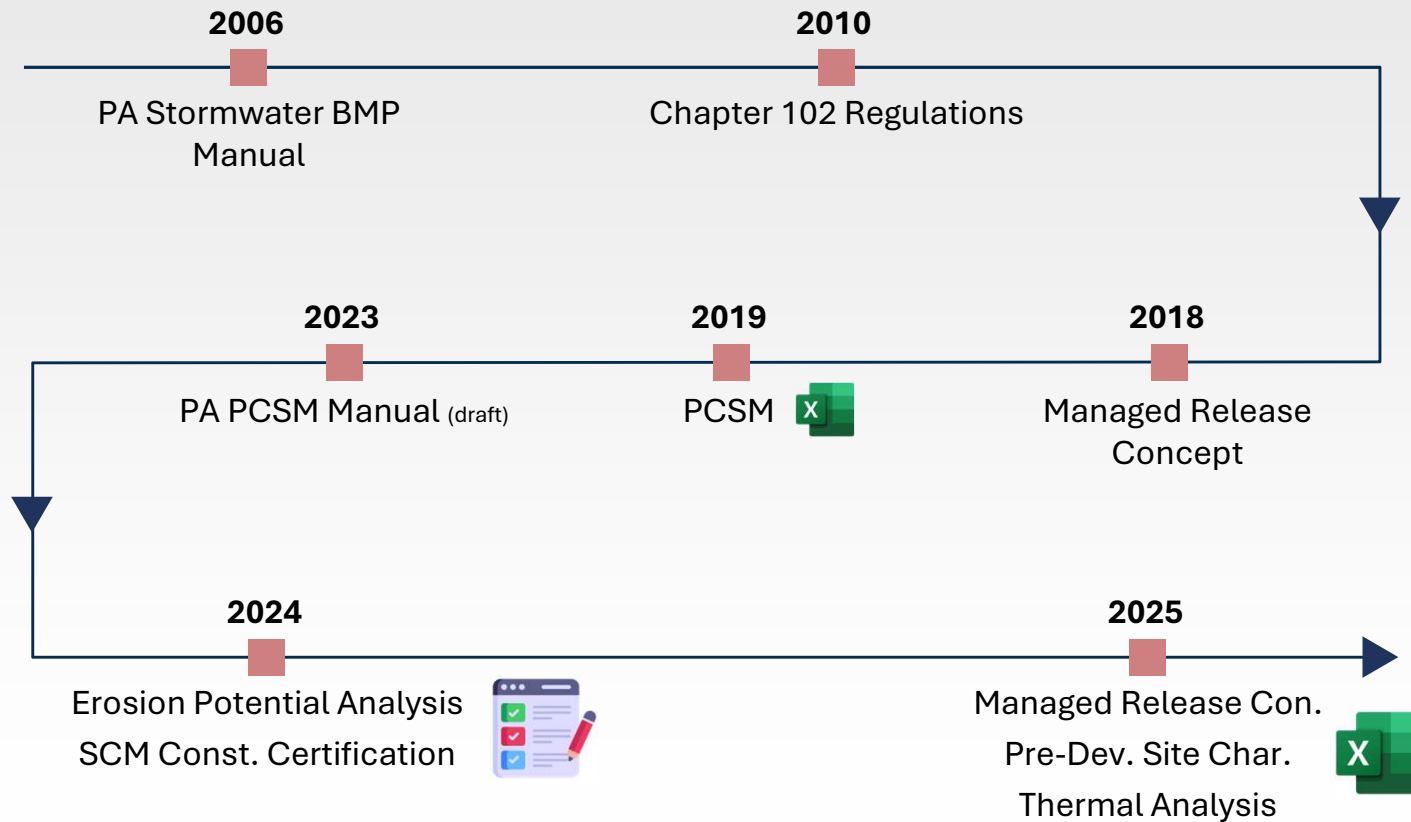
PITT | IRISE



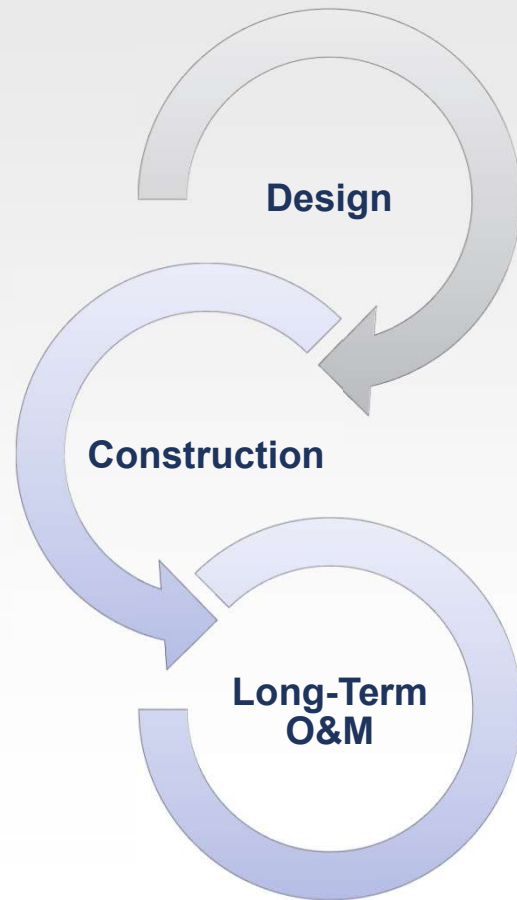
Emerging Stormwater Regulations in PA

Jeff MacKay, MS, PE, CPESC

Last 20 Years of Stormwater in PA



Stormwater Trends



Construction Phase



Are SCM being built correctly?
Why are SCMs failing?

- Visual Site Inspections
- As-Built PCSM Plan
- SCM Construction Certification Form
 - Critical stages
- Construction Confirmation Testing for Infiltration

Long-Term Operation & Maintenance



Do owners of SCMs comply with the O&M requirements of the PCSM Plan?

- Some yes, some no
- DEP does not audit O&M of SCMs for Ch. 102 permits
- MS4s must comply with MCM #5, which requires an O&M program
 - DEP can (and does) audit MS4s

Long-Term Operation & Maintenance



 **pennsylvania**
DEPARTMENT OF TRANSPORTATION
www.penndot.gov

PUB 888 (11-21)

- ***Maintenance-IQ***
- ***SCM Evals Mobile App***
- ***VSI & CAI Training***

- ***ArcGIS Online***
- ***Survey 123***



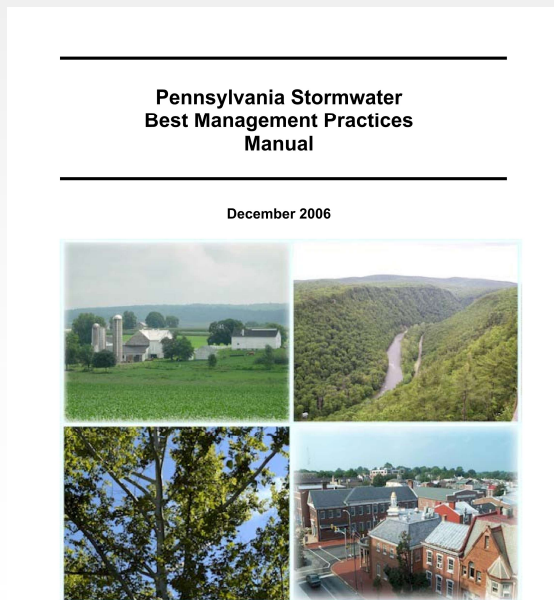
STORMWATER CONTROL MEASURE OPERATIONS AND MAINTENANCE MANUAL



2020
Revised 2/24/2025

New PA PCSM Manual

- PA Stormwater BMP Manual published in 2006

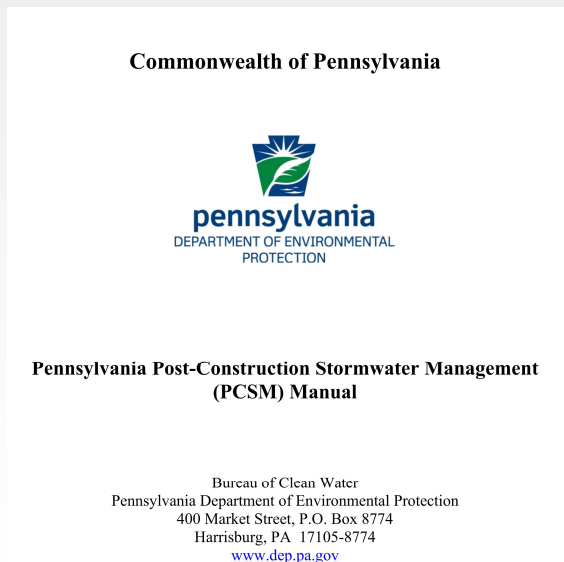


1. Introduction and Purpose
2. Making The Case For Stormwater Management
3. Stormwater Management Principles and Recommended Control Guidelines
4. Integrating Site Design and Stormwater Management
5. Non-Structural BMPs
6. Structural BMPs
7. Special Management Areas
8. Stormwater Calculations & Methodology
9. Case Studies

Appendices (A-D)

New PA PCSM Manual

- Draft published for public comment Jan. 2023



1. Introduction
2. PCSM Requirements
3. SCM Technical Guidance

Appendices (A-L)

- A: Precipitation
- B: Soil Physics, Characterization and Infiltration Testing
- C: Karst Geography
- D: Evapotranspiration
- E: Water Balance
- F: Volume Management Analysis Methods
- G: Water Quality Analysis Methods
- H: Peak Rate Analysis Methods
- I: Vegetation for Use in Stormwater Management
- J: SCM Components and Specifications
- H: Construction Inspection, Operation & Maintenance
- L: Definitions and Acronyms

New PA PCSM Manual

Why isn't the final manual published yet?

- It is not an update to the 2006 version, but rather a completely new document with many new concepts and methods
- 1,700 public comments
- Working through addressing comments
- Developing spreadsheet tools for SCMs
- Developing training for final roll-out

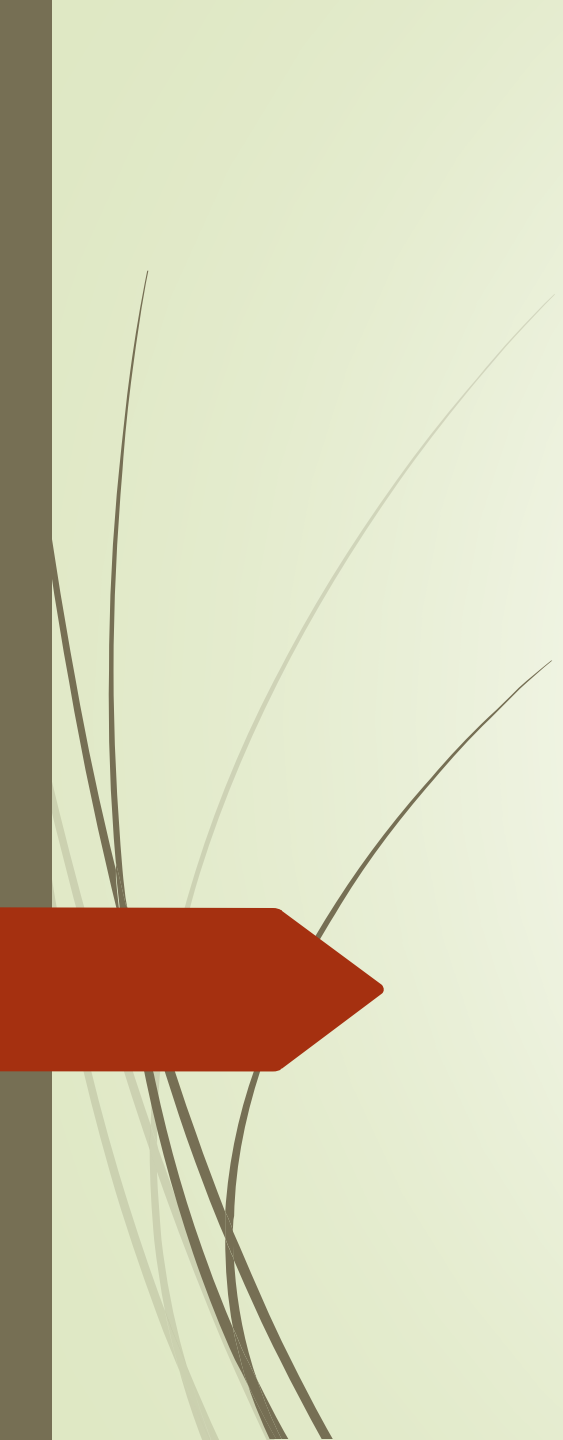
New PA PCSM Manual

What can you expect?

- DEP's goal is to publish the final manual by **2027**
 - Chapters 1 & 2 in DEP's eLibrary – revisions would require public comment
 - Chapter 3 & appendices will be “living” guidance and periodically revised
- Training to be provided in Clean Water Academy of various aspects of the manual



Thank You!



Southwest Butler Stormwater Presentation

Dan Santoro, Cranberry Township Manager

dan.santoro@cranberrytownship.org

724-776-4806

Mark Gordon, Chief, Economic
Development and Planning, Butler County

mgordon@co.butler.pa.us

724-284-5300

Summer 2019 – Catastrophic Flooding



CATASTROPHIC FLOODING HIT BUTLER COUNTY

County Commissioners Call to Action

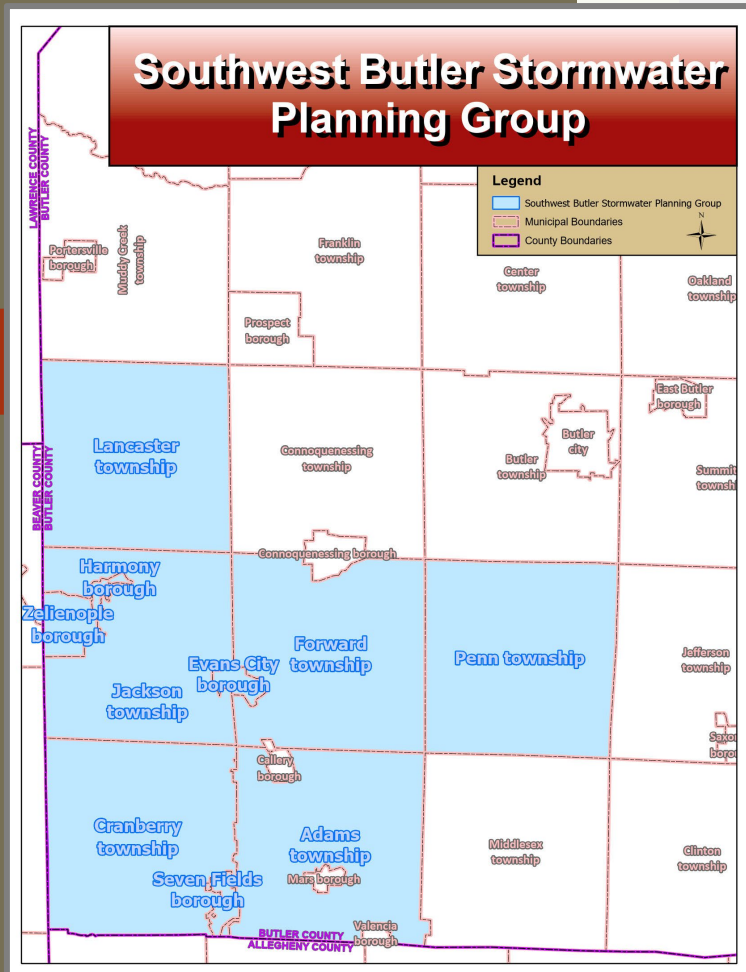


County Commissioners
convened all municipalities
in Fall 2019



Call for collaboration on
stormwater management

Ten Communities Responded



Adams, Cranberry, Forward, Jackson, Lancaster, Penn Townships & Harmony, Evans City, Seven Fields, Zelenople Boroughs & Butler County



First meeting held November 2019

Building Relationships

First year focused on
relationship-building

Understanding
municipal roles in
stormwater and
floodplain
management



Joint Stormwater Study

- Communities jointly funded watershed stormwater management study





Ordinance
Updates

Ordinances
updated
consistently across
all communities

Aligned with highest
standards allowed
by law

Major Infrastructure Funding

- Municipal Infrastructure Program grants awarded
- \$5.7M grants received supporting \$9.7M in improvements
- Largest stormwater investment in the area's history
- This resulted in 22 projects across the communities



Project Examples



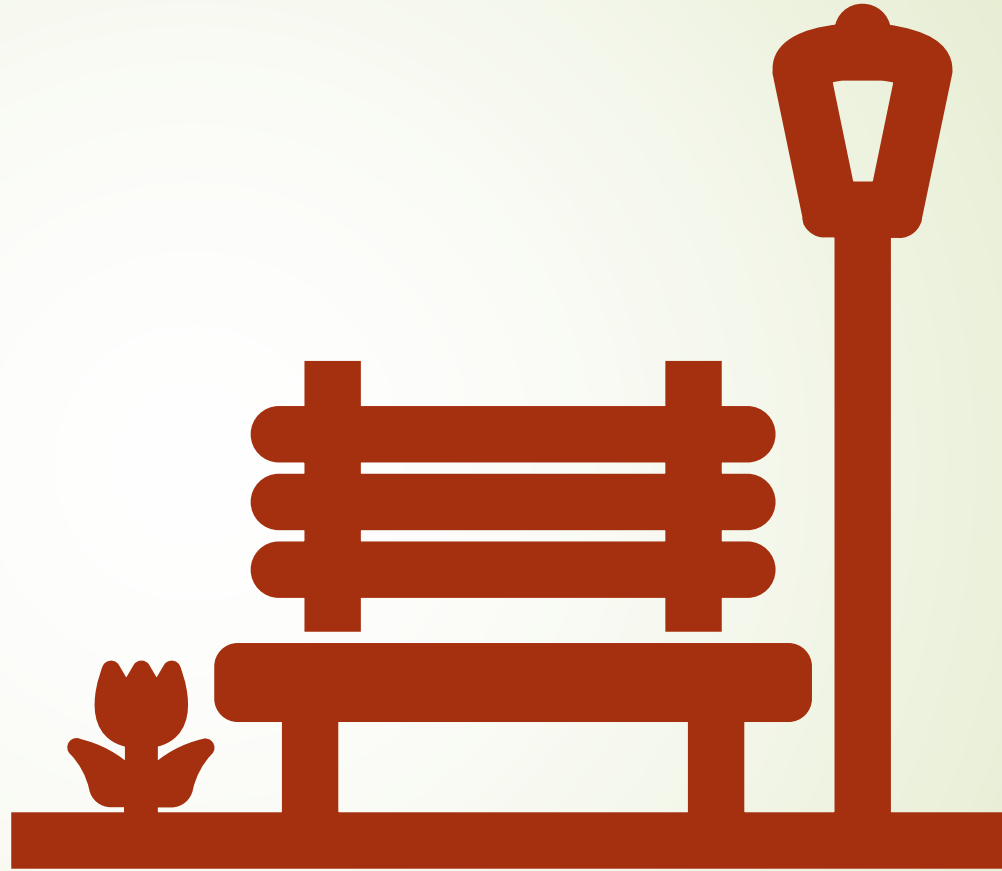
Dodds Road, Penn Twp.



Stream Restoration,
Cranberry Twp.

Creation of Stormwater Authority

- Zelienople, Harmony, Evans City, and Jackson Township collaborated
- Studied sustainable stormwater funding needs
- Southwest Butler Stormwater Authority created Feb 2025



Southwest Butler Municipal Collaborative



GROUP NOW PURSUING
SUSTAINABLE EMS
FUNDING



ONLY FEDERAL GRANT IN
PA FOR MULTI-MUNICIPAL
PEDESTRIAN SAFETY
PROJECT



RESEARCHING IMPROVED
EMA PLANNING



Pennsylvania

Department of Conservation
and Natural Resources

Leveraging Grant Funds for Green Infrastructure

STORMWATER SYMPOSIUM

University of Pittsburgh IRISE

Pittsburgh Water Collaboratory

Adriene Smochek

Regional Advisor

Southwest Region

asmochek@pa.gov

Climate Resiliency: A DCNR Priority



Climate Resiliency Priority for DCNR

- DCNR Climate Action Plan
 - Current Plan was released in 2018; update underway.

Director of Climate and Sustainability

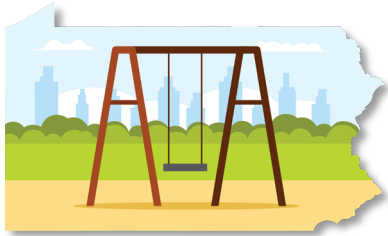
- Meredith Seltzer, DCNR Director of Climate and Sustainability as of Dec. 2025.

Climate Resiliency Priority for BRC

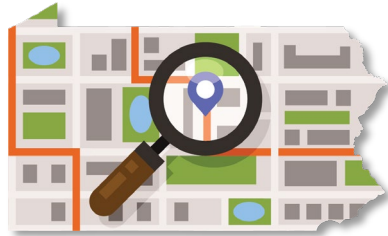
- Climate work integrated into BRC Strategic Plan.
- Grant applications receive additional consideration when addressing climate resiliency measures.



Project Types We Fund



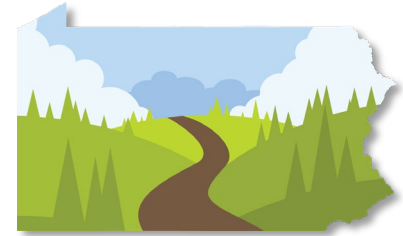
Park Rehab and
New Development



Planning



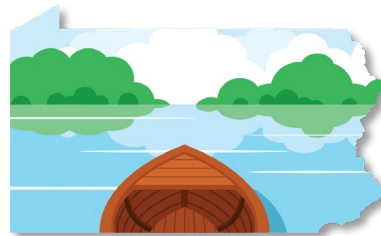
Acquisition



Trails



ATV and
Snowmobile



Rivers
Conservation



Community and
Watershed Forestry



State and Regional
Partnerships

Stormwater Related Project Types



- Rivers Conservation
- Community and Watershed Forestry
- Land Acquisition



**Community and Watershed Forestry
Tree Planting in Beaver County**



**Rivers Conservation
Streambank Stabilization Project
Cranberry Community Park**



**Upper Meeks Run Acquisition
Montour Woods Conservation Area**

Park Rehab and Development



- Rehabilitation and/or new development of outdoor recreation and park facilities that are open to the public
 - Playgrounds
 - Skate parks
 - Sport fields, courts, rinks
 - Swimming pools
 - Splash pads
 - Pavilions and comfort stations
 - Indoor recreational facilities
- Most common way to incorporate stormwater into local greenspace

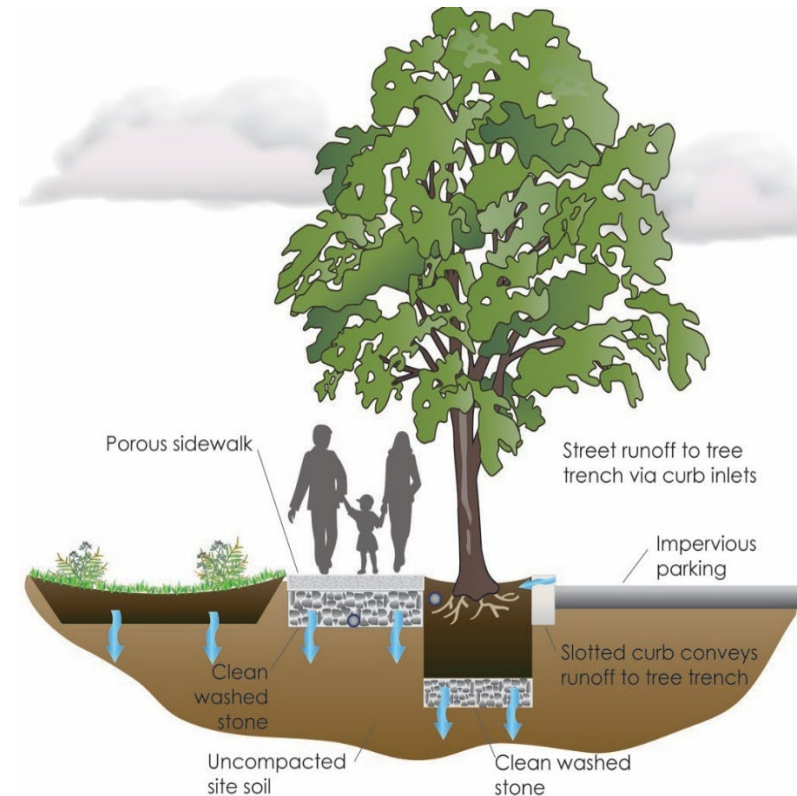


Green and Sustainable Practices



- Thoughtful incorporation of green and sustainable elements into design
- Green and Sustainable Community Parks webpage:
 - Guides, tools, and example projects that highlight green practices
 - Green practices include not only stormwater measures, but native tree plantings, rain gardens, and pervious surfaces

<https://www.pa.gov/agencies/dcnr/programs-and-services/community-outreach-and-development/green-community-parks.html>



Leveraging Funding



pennsylvania
DEPARTMENT OF COMMUNITY
& ECONOMIC DEVELOPMENT



pennsylvania
DEPARTMENT OF ENVIRONMENTAL
PROTECTION



Wightman Park – City of Pittsburgh



- Rehabilitation of Wightman Park
 - Picnic shelter, new park entrances, a bridge, basketball court, playground and safety surface, ADA access, walkways, and other site improvements.
- DCNR Investment: \$500,000 Land and Water Conservation Fund award in 2018



Wightman Park – City of Pittsburgh



- Project Budget
 - DCNR LWCF:
\$500,000
 - City Capital Budget:
\$2,033,433
 - Pittsburgh Water and Sewer Authority:
\$1,470,000
 - ALCOSAN:
\$368,300
- TOTAL: \$4,371,733



Wightman Park – City of Pittsburgh



Wightman Park Phase Two Stormwater Improvements

Neighborhood improvements will capture and direct rainfall to Wightman Park and improve pedestrian safety



Curbed bumpout planters at intersections, under-street channel drains, and upgraded sewer inlets will help reduce basement backups, neighborhood flooding, and combined sewer overflows into the Monongahela River.

Creating Safe, Flood-Prepared Communities

A PROJECT OF PGH2O

A Major Investment in Pittsburgh's Stormwater Infrastructure

Owner
Pittsburgh Water and Sewer Authority

Designer
Elnes Collaborative

Contractor
Zotola Construction

Construction Management
HR Gray

Funding Partner
Partially funded by ALCOSAN GROW Grant Program

Community Partner
Councilmember Strassburger
Council District 8

Project Questions
Rebecca Zito
Senior Manager, Public Affairs
(412) 689-1462
rzito@pgh2o.com

24-Hour Emergency Contact
PWSA Dispatch
(412) 255-2423

www.pgh2o.com/wightman-park-2



**Stormwater Cascade,
Wightman Park**

McCahill Park – Fox Chapel Borough



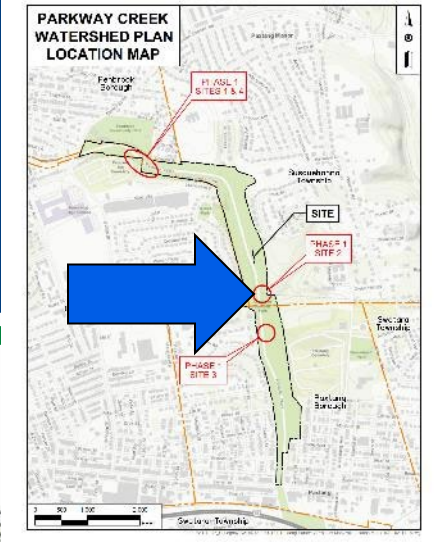
- DCNR Total Project Budget of \$322,200, funded sports courts, field upgrades, perimeter trail, and other improvements
- Overall project budget: \$835,000, included significant stormwater measures
- Other contributors: DCED, Western Pennsylvania Conservancy, Fox Chapel Parks Conservancy
- Additional amount above project budget for stormwater measures:
 - Funded by local stormwater fee of \$150 per EDU (Equivalent Dwelling Unit, or single-family household)
 - Generates about \$330,000 annually



Green & Sustainable Elements - McCahill Park – Fox Chapel Borough



Paxtang Parkway Rehabilitation



- Streambank restoration
- Manage stormwater runoff
- Trail reinforcement



More info: <https://caga.org/paxtang-parkway>

More Information



2026 GRANT ROUND OPENS ON

JANUARY 12, 2026

apps.dcnr.pa.gov/grants

APPLICATION DEADLINE

APRIL 30, 2026 @ 4:00PM

ADRIENE SMOCHKE

asmochek@pa.gov

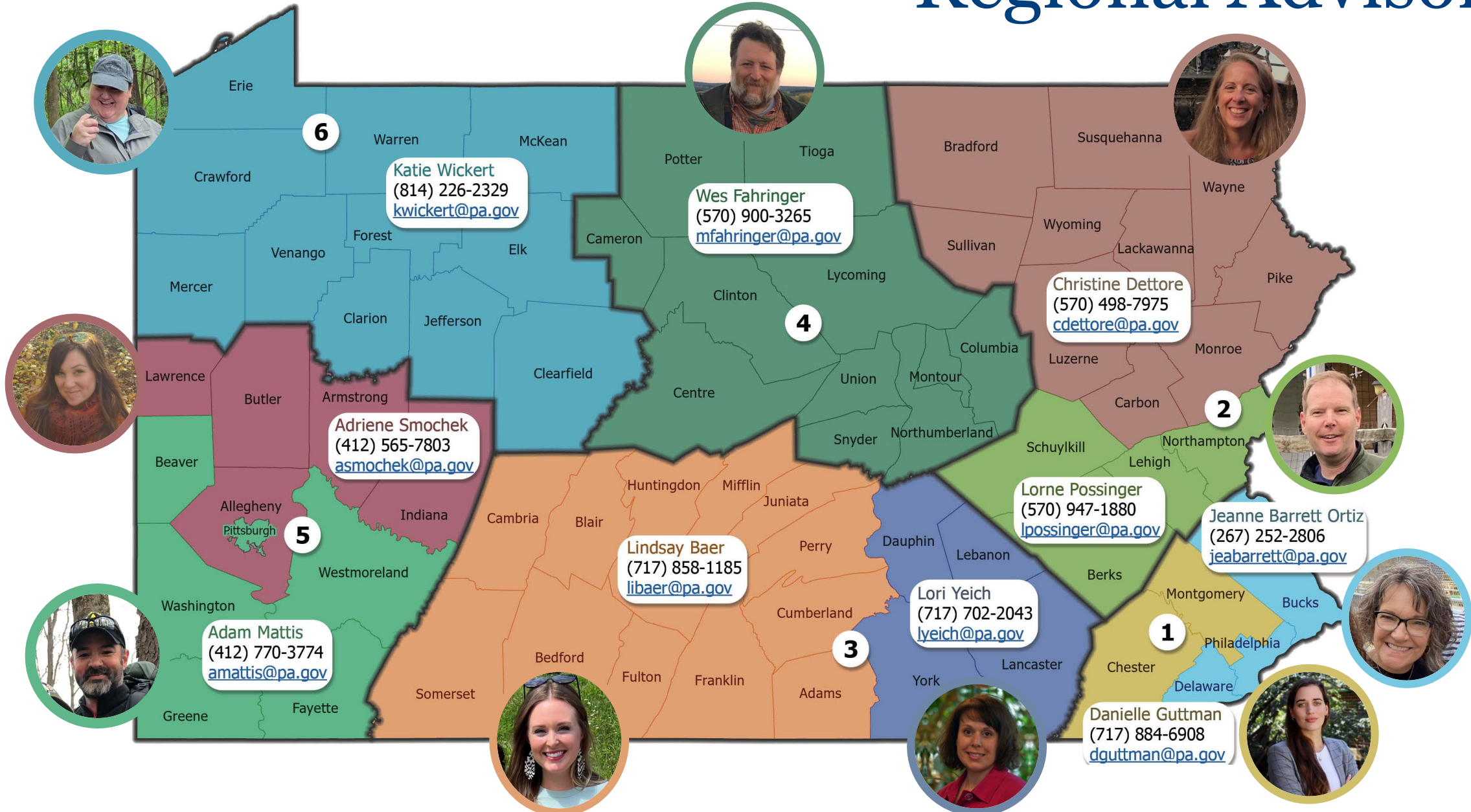


Tree Planting



Lawn to Meadow

Regional Advisors



Borough of Dormont Stormwater Authority Tackling Urbanized Stormwater Management

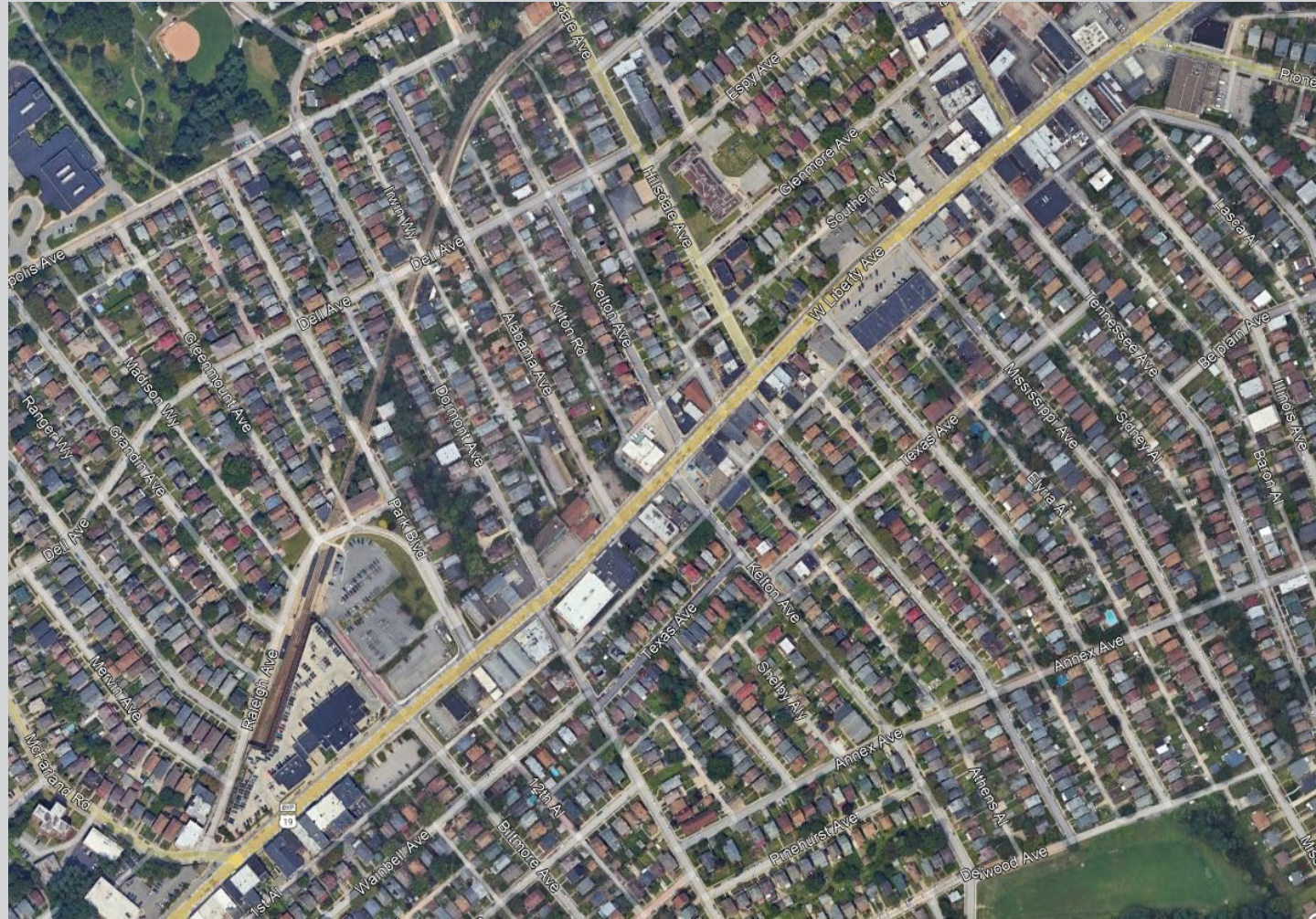


BOROUGH OF DORMONT

- **Background:**

- Developed in the early 1900s
 - Officially became Separate Borough in 1909
 - South Hills Community
- Densely Populated Community
 - Total Size of Borough is 0.75 Square Miles
 - Approximate Lot Size is 3600 Square Feet
- Borough is developed off West Liberty Avenue (top of Borough)
 - Significant Road Grades within Borough

BOROUGH OF DORMONT



BOROUGH OF DORMONT

- **Background:**

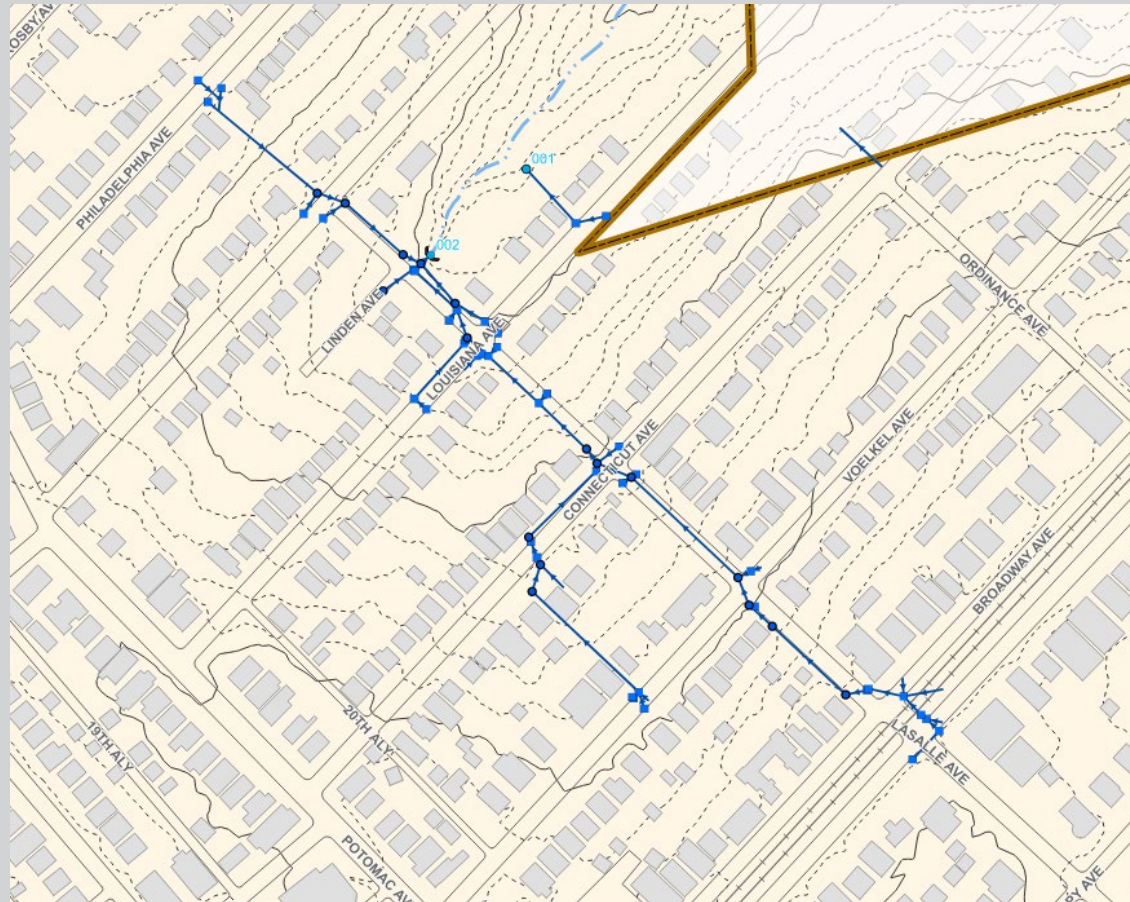
- Stormwater was considered afterthought when Borough was being developed
 - Storm Inlets typically just placed at low spots/intersections in the Borough
 - Hood Recessed Inlets installed



- **Due to Lack of Storm Inlets/Undersized Conveyance systems, resulted in localized flooding events within the Borough**

BOROUGH OF DORMONT

- Leads to Large Sections of Roadway all draining to a couple inlets



BOROUGH OF DORMONT STORMWATER AUTHORITY

- The Borough created a Stormwater Authority in 2015
- First Official Meeting held on March 23, 2016
- Stormwater Fee was collected starting in 2016
- Objective was to fund stormwater improvements projects within the Borough

BOROUGH OF DORMONT STORMWATER AUTHORITY

- **The Stormwater Fee**

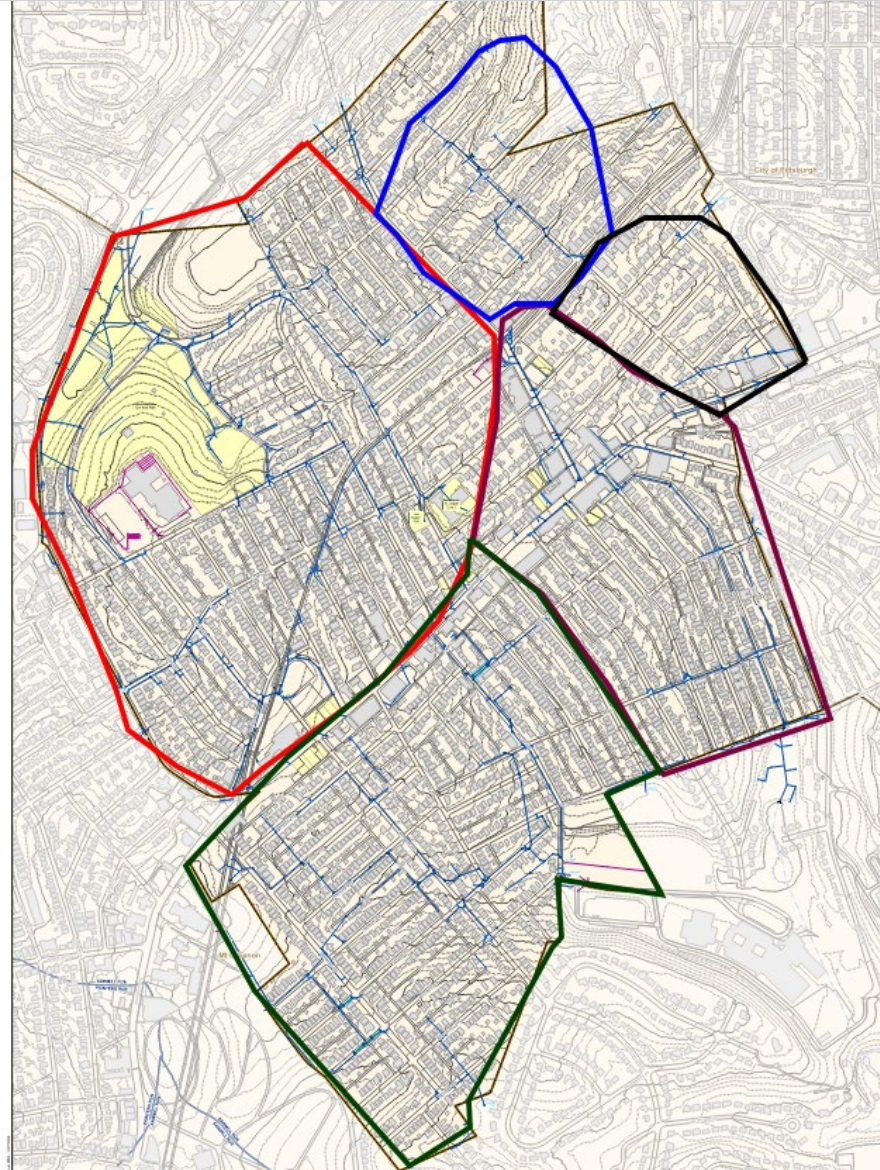
- Based on ESU (Equivalent Stormwater Unit)
- Residential Fee – 1 ESU = \$8/Month
 - Has Not Increased since 2016
- Commercial Properties – Based on total Impervious Area
- Authority Collects approximately \$350,000 in revenue from Stormwater Fees

BOROUGH OF DORMONT STORMWATER AUTHORITY

- **Watersheds Studied**

- Latonia
 - Athens Alley
 - Piedmont
- Arkansas
- Dormont Park
- Louisiana
- LaSalle

BOROUGH OF DORMONT



BOROUGH OF DORMONT STORMWATER AUTHORITY

- **Athens Alley (First Project)**

- Studied Completed of Entire Storm Sewer System (Upstream and Downstream) that is conveyed by the Storm Sewer System
- Identified areas of concern/points of interest
- Provided alternatives for the Authority Consideration to reduce the overland flow to areas of Concern
 - Various Alternatives included different iterations of underground detention facilities
 - Option included taking properties and demoing residential structures
 - Option selected included a series of underground detention tanks for the watershed

BOROUGH OF DORMONT STORMWATER AUTHORITY

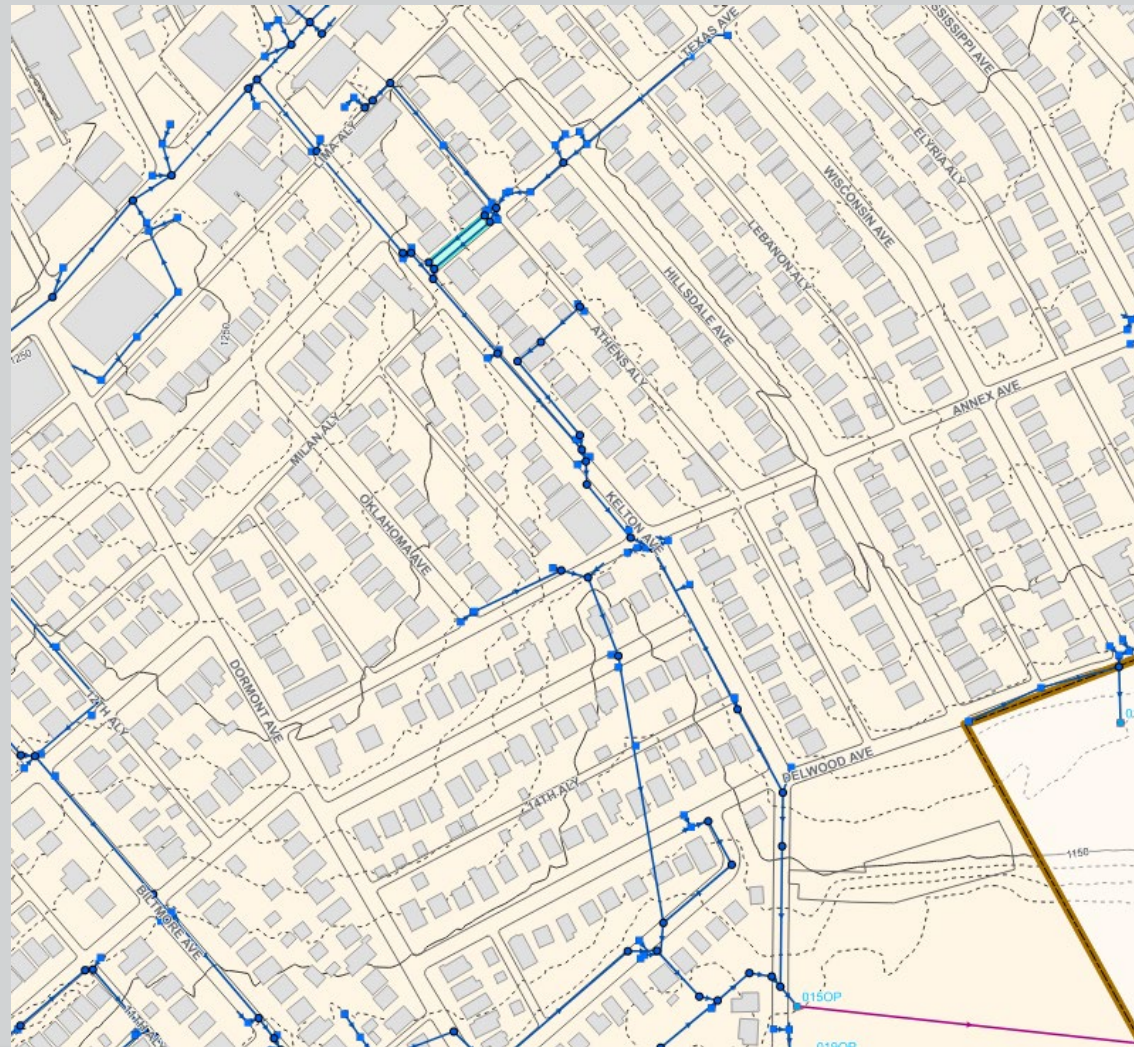
- **Athens Alley**

- Phases 1 and 2 of Project Completed
 - Included installation of 72" Oversized CMP in Section of Roadway for detention
 - Included additional storm sewer inlets to collect runoff upstream to lesser load on downstream inlets as well as re-routing upstream collection facilities

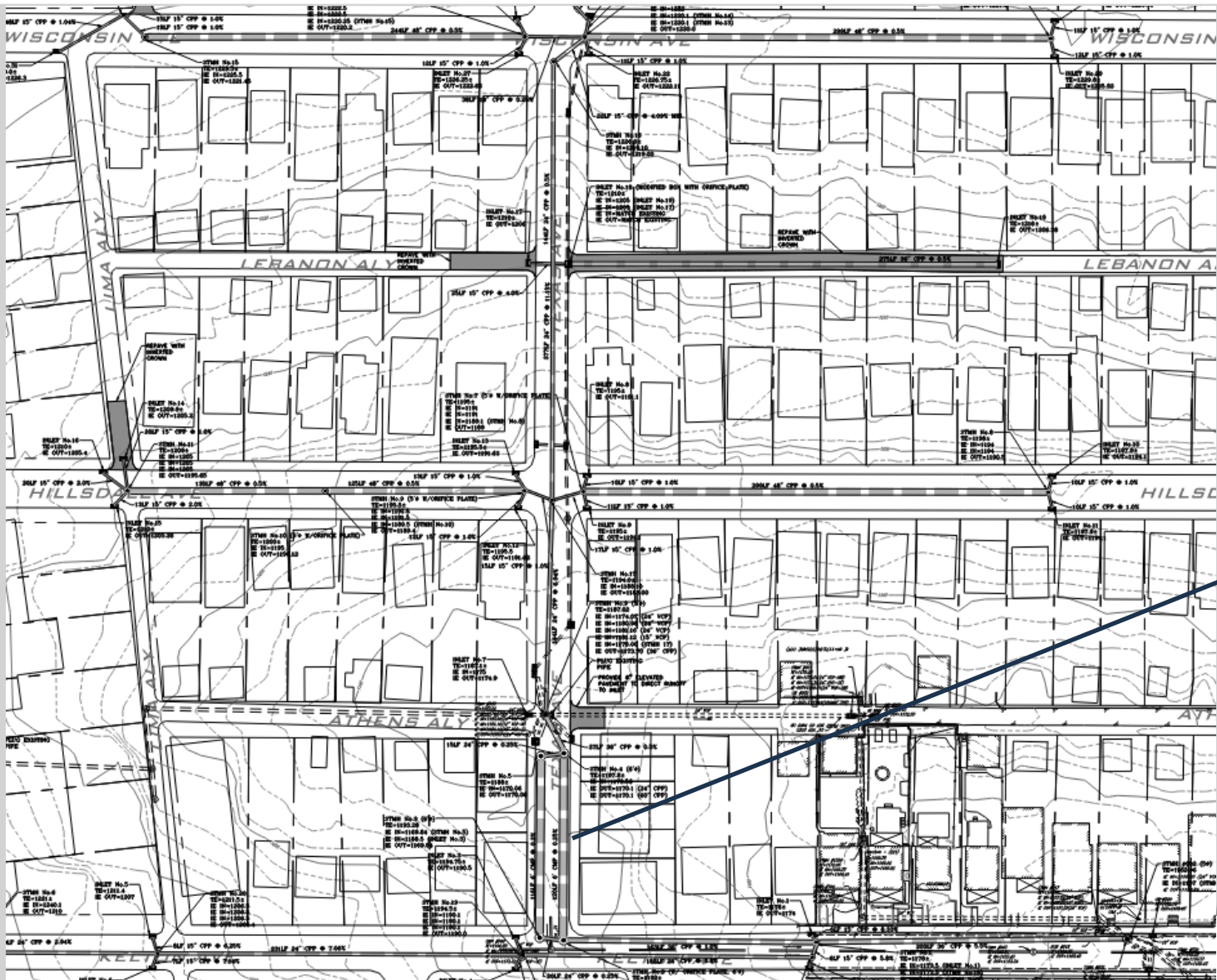


BOROUGH OF DORMONT STORMWATER AUTHORITY

- Athens Alley



BOROUGH OF DORMONT STORMWATER AUTHORITY – ATHENS ALLEY



PHASE 1
& 2
LIMITS

BOROUGH OF DORMONT STORMWATER AUTHORITY

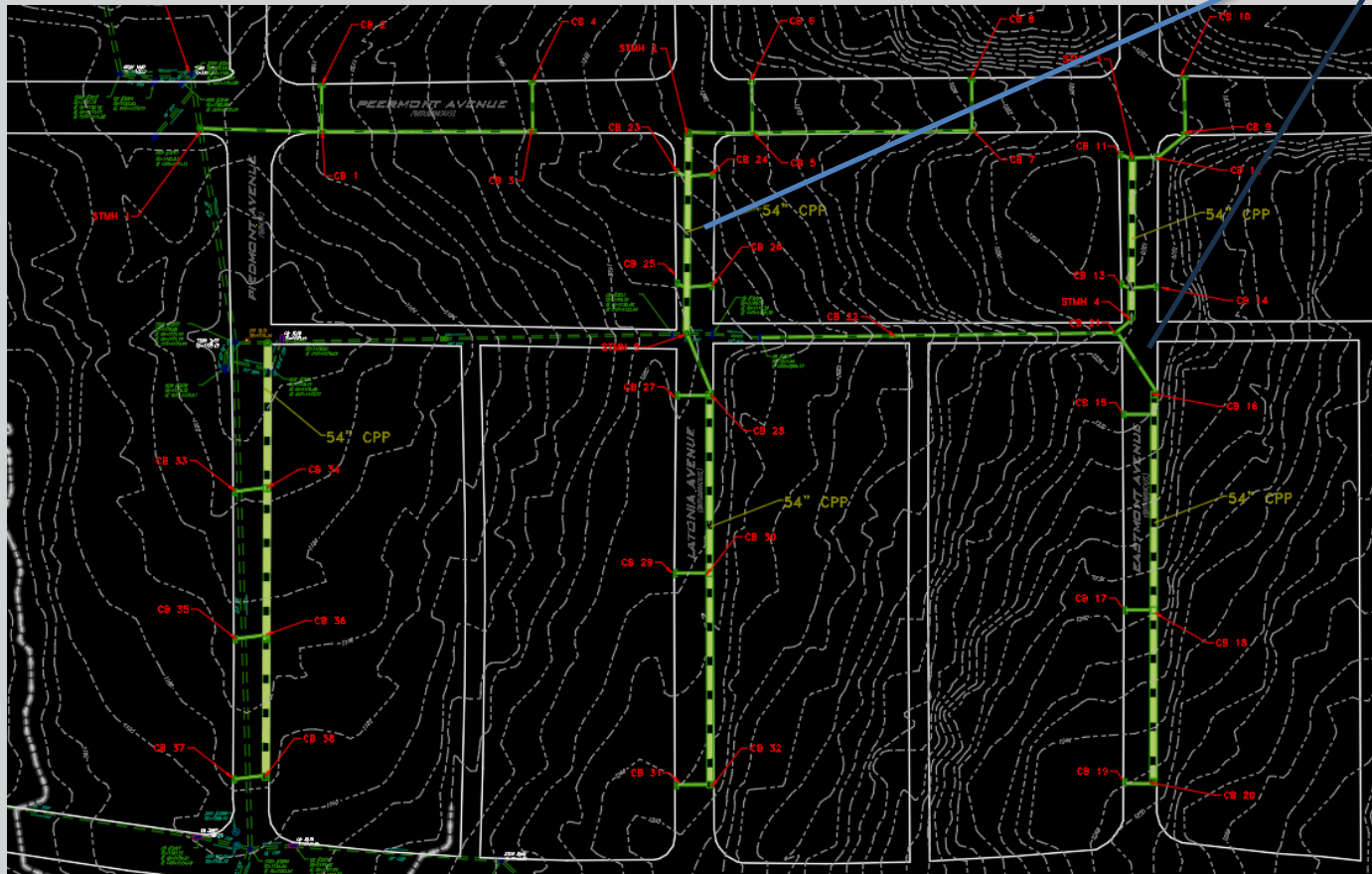
- **Piedmont (2nd Project)**

- Studied Completed of Entire Storm Sewer System (Upstream and Downstream) that is conveyed by the Storm Sewer System
- Identified areas of concern/points of interest
 - Series of Underground Oversized Pipes Selected to provide detention
 - Provided 60" and 48" Underground Storage Pipes

BOROUGH OF DORMONT STORMWATER AUTHORITY

- **Piedmont**

- Phase 1 and 2 Completed



PHASE
1 & 2
LIMITS

BOROUGH OF DORMONT STORMWATER AUTHORITY

● Arkansas

- Studied Completed of Entire Storm Sewer System (Upstream and Downstream) that is conveyed by the Storm Sewer System
- Identified areas of concern/points of interest
 - Considered upsizing of conveyance system to improve capture and conveyance of storm events
 - Storage not provided in this option
 - Potential for downstream flooding outside of Borough
 - Series of Underground Oversized Pipes Selected to provide detention
 - Pipes to be located within Alleys to minimize utility conflicts
 - Phased Plan over several years
 - No Work Completed in this Watershed to Date

BOROUGH OF DORMONT STORMWATER AUTHORITY

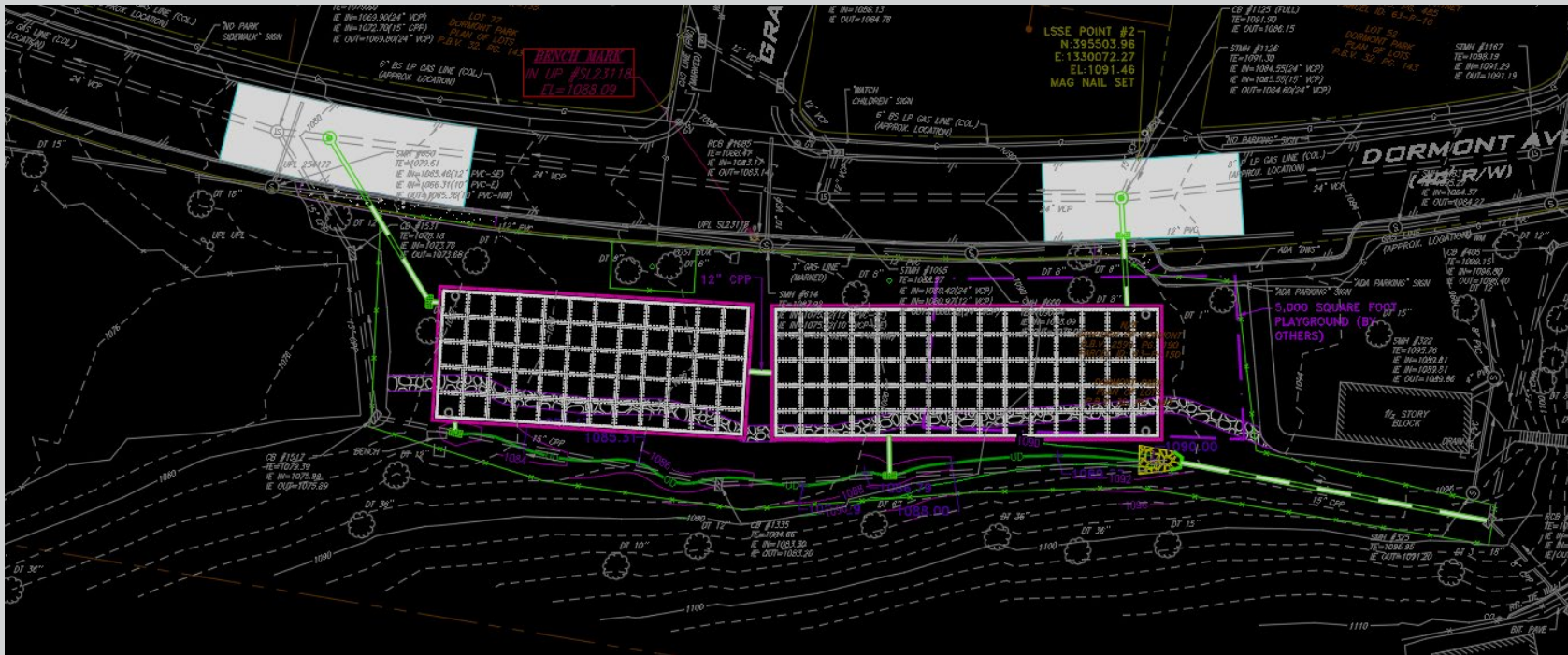
- **Dormont Park (Banksville Road)**

- Borough/Authority has a Municipal Separate Storm Sewer System (MS4) Permit
 - Administered by PADEP
 - Requires reduction of sediment discharge into the waters of the Commonwealth
 - Tributary to Sawmill Run Watershed
 - Proposed Underground Storage Tank at Dormont Park



BOROUGH OF DORMONT STORMWATER AUTHORITY

- Dormont Park
 - Provides Approximately 115,000 CF of Storage



BOROUGH OF DORMONT STORMWATER AUTHORITY

- **Green Initiatives**

- Rain Gardens

- Authority has installed multiple Rain Gardens in the Borough to provide Water Quality at Existing Parking Lots
 - Initiative in place to provide additional rain gardens within the Borough over several years

- Tree Plantings

- Authority provides trees to residents to plant within on residential property

- Rain Barrels

- Credit Available through Stormwater Authority for installation of rain barrels on properties within the Borough

BOROUGH OF DORMONT STORMWATER AUTHORITY

● Funding

- Total Project Scope for all Phases to date estimated at \$45 million.
- How to achieve project of this scope.
- Projects Completed to Date
 - Athens Alley Phases 1 and 2
 - Louisiana Phases 1 and 2
 - Piedmont Phase 1 and 2
 - 2 Rain Garden Installations
 - Total Approximate Construction Costs
 - Dormont Park Phase 1
 - \$3.3 million since 2019
- Authority has been successful in receiving grants through DCED and Allegheny County for Stormwater Projects
 - Total Awarded in Grants
 - Over \$1.9 million in grants awarded to cover construction costs

CONTACTS

John R. Heyl, P.E.
LSSE Civil Engineers and Surveyors, Inc.
john.hey@lsse.com

John W. Valinsky, E.I.T.
LSSE Civil Engineers and Surveyors, Inc.
jvalinsky@lsse.com

Trees: Prioritizing Root Zones for Maximum Stormwater Absorption

Meg Cervený

(B.S. Horticulture, B.S. Botany; & M.S. Horticulture/Arboriculture)

Senior Arborist @ Tree Pittsburgh

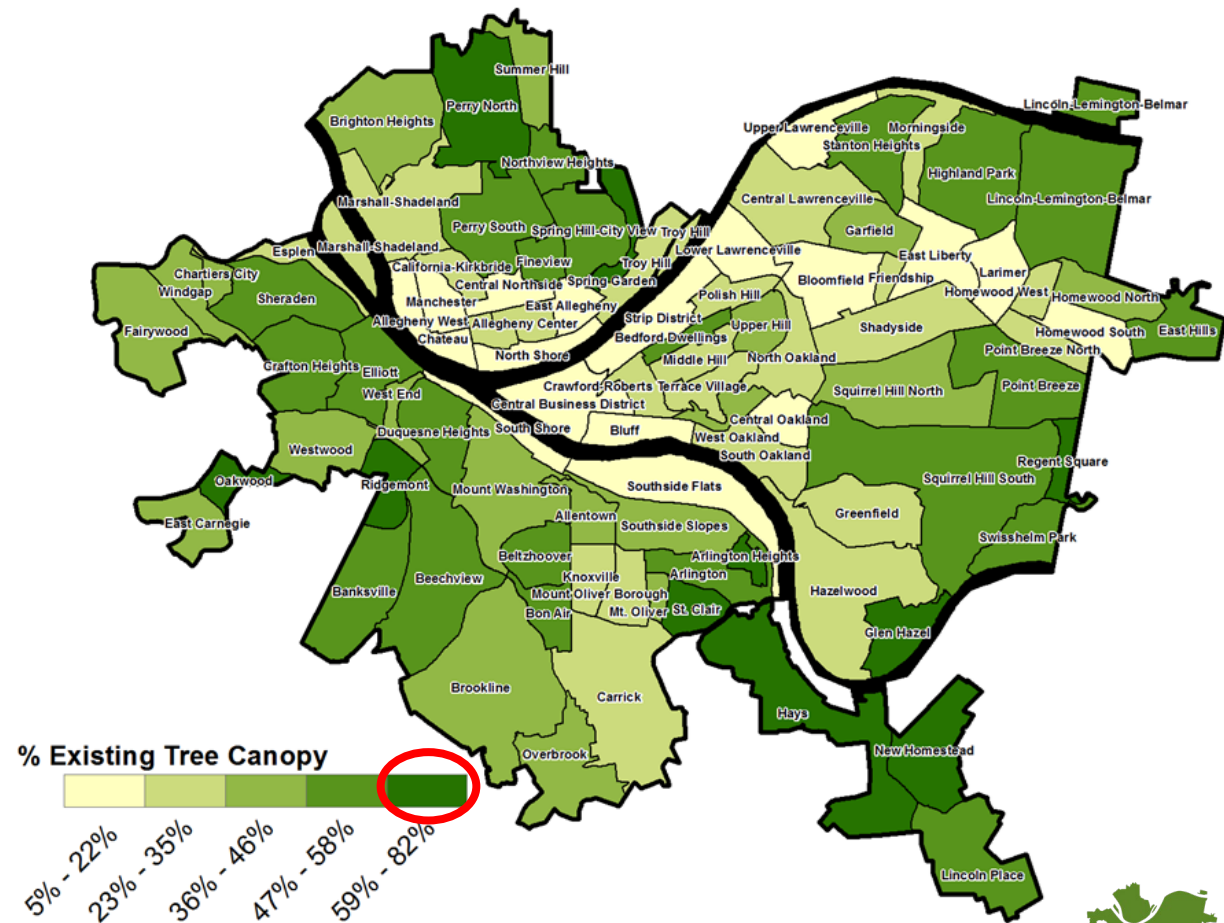


Urban Soils and Stormwater



Pittsburgh Climate Action Plan 3.0: 60% Canopy Goals by 2030

- How is this achieved?
 - Planning
 - Planting
 - Repeat



Synergy: Matching Goals (1+2) = 3

1. Stormwater Management Goals

- a. Absorb Majority of Rainfall Where It Lands
- b. Reduce Flooding
- c. Reduce Load to Stormwater Infrastructure

+

2. Canopy Goals

- a. 60% Canopy Coverage

= 3.

Increase maximum canopy size with larger root zones and boost soil functionality

WHY Should Canopy and Stormwater Goals Prioritize Root Zones?

Trees only grow as large as their roots
zones !

30 Year Old Ficus Tree



Maximum canopy growth
with **Limited** root space

15-30 Year Old Ficus Tree



Maximum canopy
growth with **UNlimited**
root space

Trees only grow as large as their root zones!

To achieve healthy, mature *canopy* (up to 60')

Requires

LARGE areas for roots to explore
and ongoing tree and soil health management

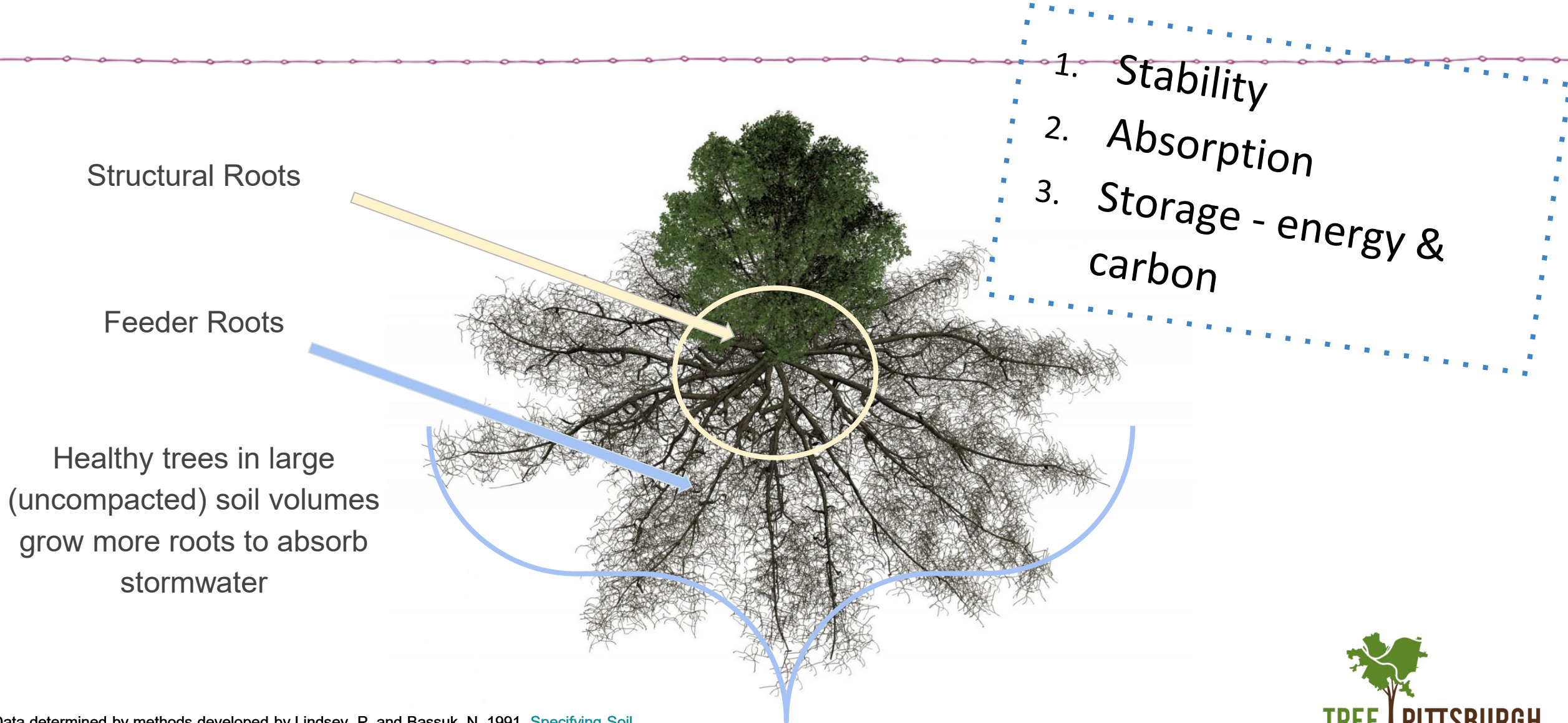
Back to Basics: Overview of Roots

Roots have 3 Functions

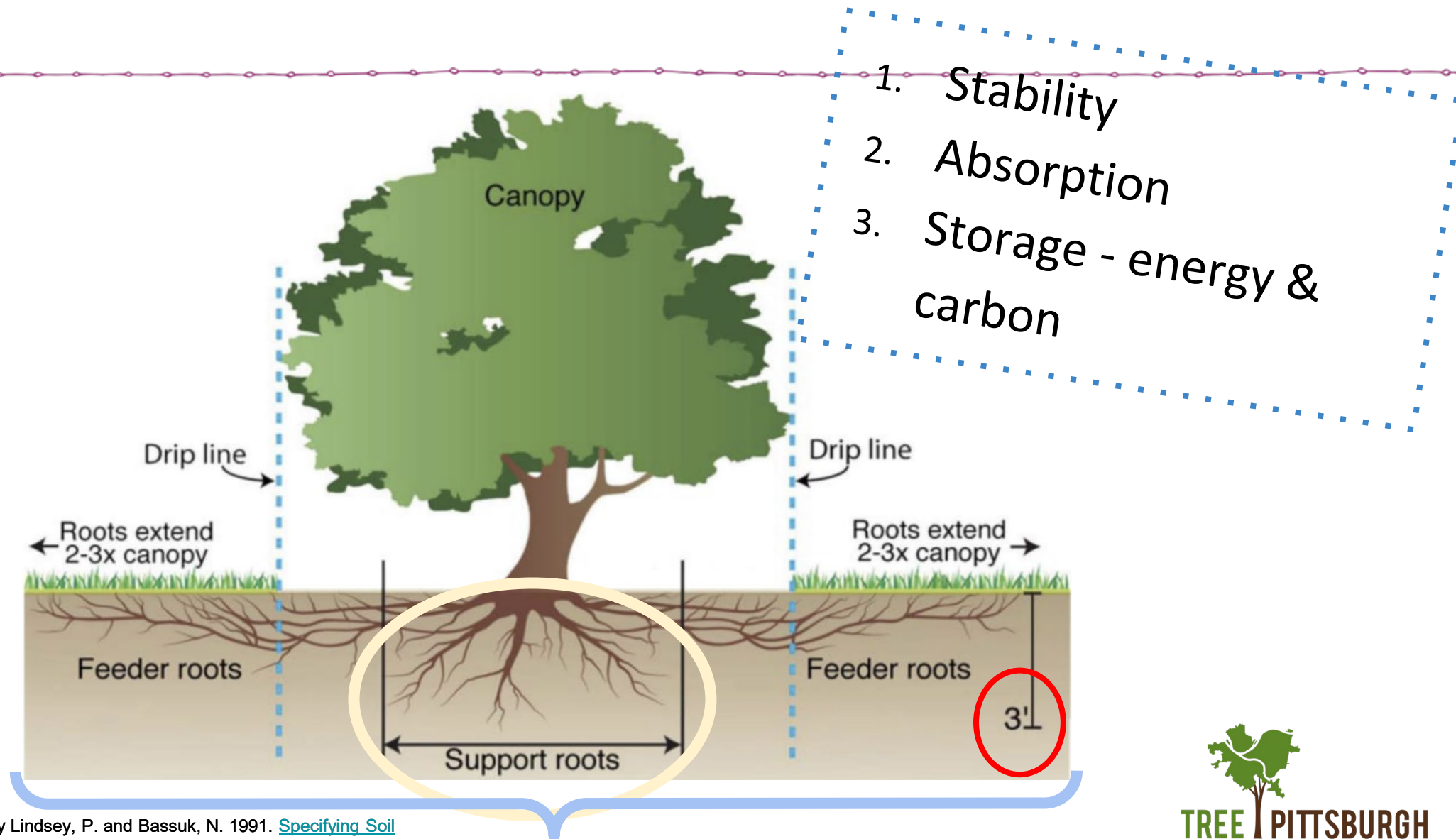
1. Stability
2. Absorption
3. Storage - energy reserves and carbon (wood)



Large Trees Canopies Require Large Soil Volume



Large Trees Canopies Require Large Soil Volume



Data determined by methods developed by Lindsey, P. and Bassuk, N. 1991. [Specifying Soil Volumes](#)

[to Meet the Water Needs of Mature Urban Street Trees and Trees in Containers](#). Journal of

Arboriculture, 17(6) 141-149.

For Trees to Thrive Consider Soil Volume

1. Stability
2. Absorption
3. Storage - energy & carbon

Stunting happens when roots run out of soil.

Singularly planted + small tree pits

Groupings + contiguous root zones

Measurement and Prediction of Tree Growth Reduction from
Tree Planting Space Design in Established Parking Lots
<https://hort.ifas.ufl.edu/woody/documents/articles/EFG0406.pdf>



For Trees to Thrive Consider Soil Quality

Quality is KEY:

- Quality Soil Mix
 - nutrition, anchorage, root exploration
- Manage Compaction
 - Maintain air spaces underground (O₂, H₂O)
 - Percolation Test to Manage Compaction
- Understand Drainage
 - Is it an underground container?
 - Is it an integrated stormwater system?

1. Stability
2. Absorption
3. Storage - energy & carbon



TREE | PITTSBURGH

Healthy Root Systems & Benefit Stacking

Root Systems Support <i>Canopy</i> Benefits	Root Systems Support <i>Soil</i> Benefits
Cooling (urban heat reduction)	Water absorption
Aesthetics	Water retention
Bioretainment	Soil stability
Host for urban wildlife	Enhance soil community (boost plant and soil health)
Sound dampening and wind screen	Soil decompaction
Pollution management	Pollution management

Financial Costs for Root Zone Solutions

Re-Design Tree Pits; grouping trees vs single tree; larger soil volume

- Changing parking or driving patterns so root zones are scaled to species selection/canopy goals and maximize stormwater absorption
 - Increases budget: re-design (planning) or construction (renovation), manage compaction

Proctor Density Approved Subsoils for Trees

- Below ground inventions to encourage root growth and exploration under hardscape (ex. Silva Cells- August Wilson Center)
 - Increases budget: technical expertise, labor, materials, installation, prolonged maintenance depending on system
- Engineered Soils
 - May or may not increase budget: technical expertise, materials, installation

Training for Proper Root Zone Management

- GOALS: De-compaction, soil nutrition, mulch requirements, green manure
- Increase budget: Ongoing trainings such as Best Management Practices Tree Care/Root Care



Thank you!

Meg Cervený

Senior Arborist at Tree Pittsburgh

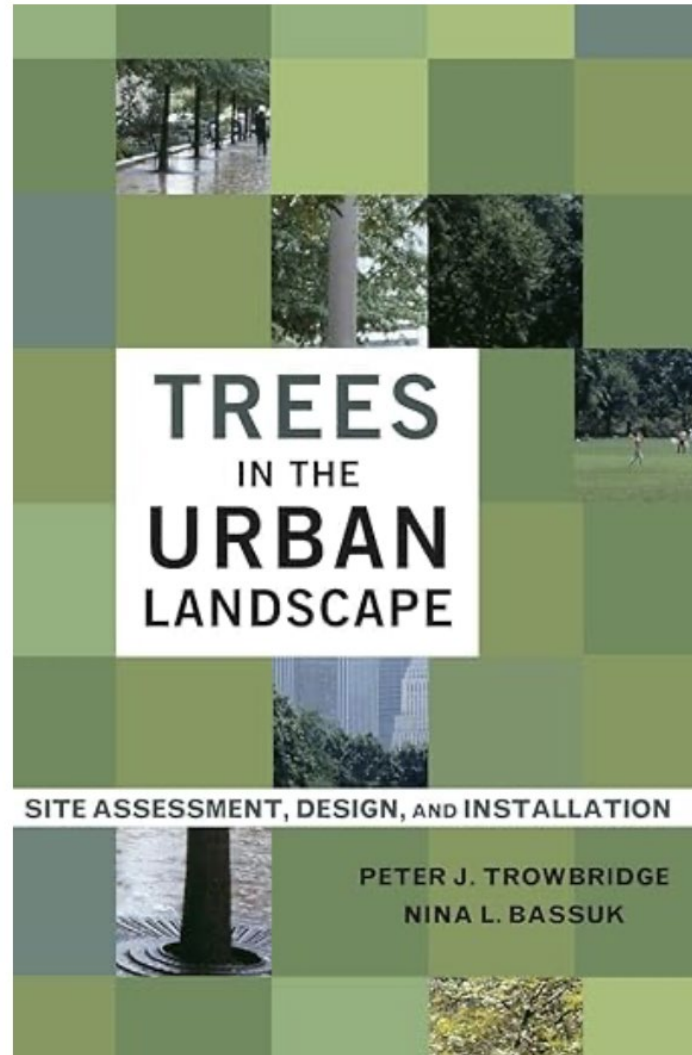
Certified ISA Arborist

meg.cervený@treepittsburgh.org



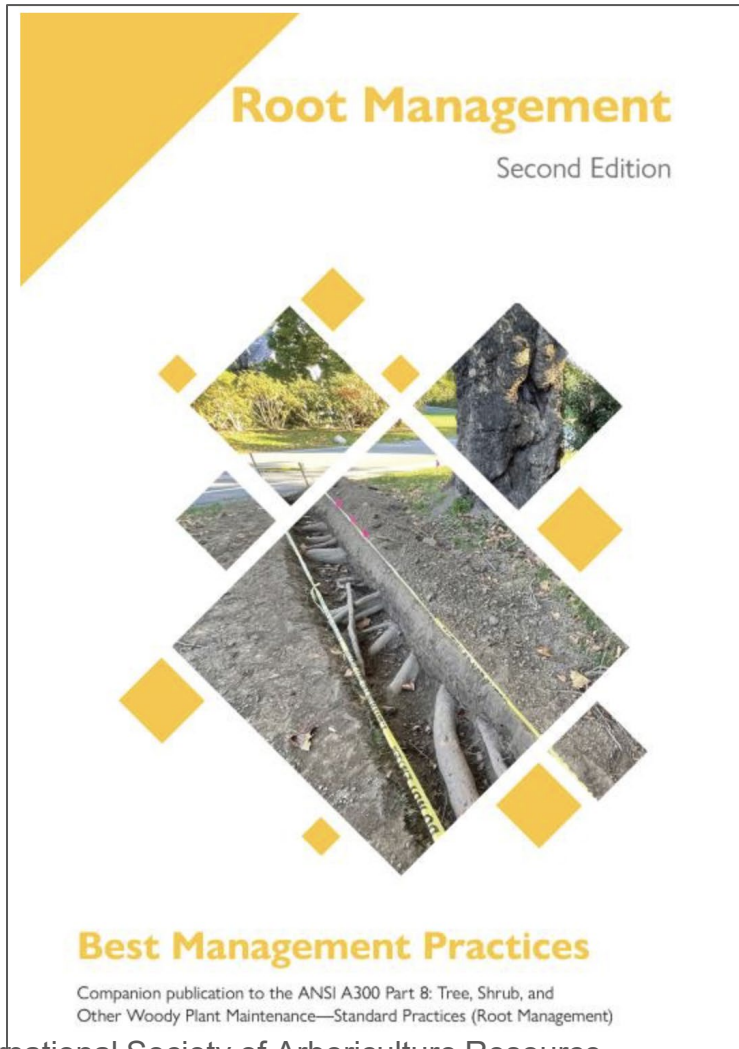
Reference: Tree Pit Details and Tree Selection

[Peter Trowbridge](#), Master Landscape Architecture: involved in planning, design and implementation of works of landscape architecture and site development for over thirty years. His innovative professional methods and techniques include landscape restoration, plant establishment, restoration of brownfield site and site design. Working with urban communities in New York State, specifically related to green space development.



[Nina Bassuk](#), PhD: Nina's has authored over 100 papers focusing on the physiological problems of plants growing in urban environments, including improved plant selections for difficult sites, soil modification including the development of CU-Structural Soil. She is on the Technical advisory committee of the Sustainable Sites Initiative (SITES) and works closely with municipalities to help implement best practices in urban forestry management.

Planning & Tree Health: Root Zone Managment



International Society of Arboriculture Resource

[Link to Digital Format](#)

Takeaways:

Planning for trees to grow to mature size involves creative root zone solutions.

Routine Maintenance:

Root zones must be managed as closely as canopies to ensure tree health and stability, continuous root growth, and point source stormwater retention and absorption.



Planting and Tree Pit Resources

- ★ [Tree Pit Costing Tool](#), CityGreen Urban Landscape Solutions, info@citygreen.com or fo@citygreen.com
- ★ Data determined by methods developed by Lindsey, P. and Bassuk, N. 1991. [Specifying Soil Volumes to Meet the Water Needs of Mature Urban Street Trees and Trees in Containers](#). Journal of Arboriculture. 17(6) 141-149.
- ★ Measurement and Prediction of Tree Growth Reduction from Tree Planting Space Design in Established Parking Lots <https://hort.ifas.ufl.edu/woody/documents/articles/EFG0406.pdf>
- ★ Trees in the Urban Landscape: Site Assessment, Design, and Installation 1st Edition, 2004 by Peter J. Trowbridge and Nina L. Bassuk https://www.amazon.com/dp/0471392464?psc=1&smid=ATVPDKIKX0DER&ref=chk_typ_imgToDp
- ★ [Urban Stormwater Management: Can Tree Roots and Structural Soils Improve Hydraulic Conductivity into Compacted Soils?](#) Lai Fern Genevieve Ow and Dloysius Chow, Arboriculture & Urban Forestry (AUF), March 2021, 47 (2), 72-84;
- ★ Ithaca Urban Forestry Guidelines developed with Nina Bassuk <http://www.hort.cornell.edu/uhi/outreach/pdfs/Ithacas-Trees.pdf>
Policies and Guidelines (Pages 5-7)
Appendix: 1 Specifications (Pages 17-30)



Species examples: Crabapple, Serviceberry,
Dogwood, Redbud

Small Tree (up to 20')

- Goal: 240 cu feet (9 Yards)
 - Ideal Depth: 36"
 - Minimum Depth: 24"
 - Minimum bed width: 5'
- Examples: 80' surface X 3' depth
 - 8' X 10' X 3' (depth)
 - 5' X 12' X 3' (depth)
 - 8.5' X 14' X 2' (depth) = (238 ft³)



Species examples: Flowering Cherry,
Japanese Maple, Sweetbay Magnolia

Medium Tree (up to 30')

- Goal: 430 cu feet (16 Yards)
 - Ideal Depth: 36"
 - Minimum Depth: 24"
 - Minimum bed width: 5'
- Examples: 144' surface X 3' depth
 - 12' X 12' X 3' (depth)
 - 10' X 14' X 3' (depth) = 435 ft³
 - 5' X 28' X 3' (depth) = (420 ft³)



Species examples: HopHornbeam, Hedge Maple, Carolina Silverbell

Med - Large Tree (up to 40')

- Goal: 950 cu feet (35 Yards)
 - Ideal Depth: 36"
 - Minimum Depth: 24"
 - Minimum bed width: 5'
- Examples: 320' surface X 3' depth
 - 10' X 32' X 3' (depth)
 - 8' X 40' X 3' (depth)
 - 12' X 40' X 2'(depth) = (960 ft³)



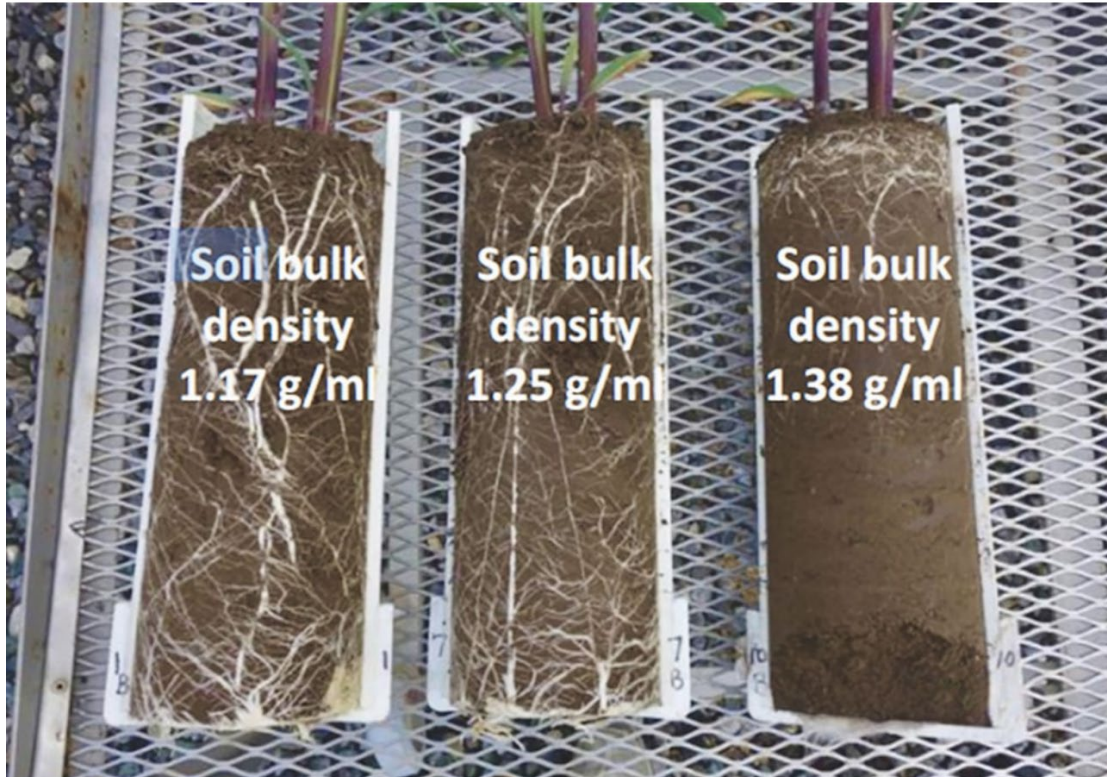
Large - XL Tree (50' +)

Species examples: Sycamores, Oaks, Dawn Redwood, Norway Spruce, Southern Magnolia, Ginkgo, Sweetgum, Tulip Poplar, Kentucky Coffee Tree, Honeylocust, Black Gum

- Goal: 1680 cu feet (62 Yards)
 - Ideal Depth: 36"
 - Minimum Depth: 24"
 - Minimum bed width: 5'
- Examples: 560' surface X 3' depth
 - 35' X 16' X 3' (depth)
 - 10' X 56' X 3' (depth)
 - 5' X 160' X 2' (depth) = (1600 ft³)



Compaction Restricts Roots



	Ideal bulk density	Bulk density restricts root growth
Soil Texture	g/cm ³	
Sand, loamy sand	< 1.60	> 1.80
Sandy loam, loam	< 1.40	> 1.80
Sandy clay loam, clay loam	< 1.40	> 1.75
Silt, silt loam	< 1.30	> 1.75
Silty clay loam	< 1.40	> 1.65
Sandy clay, silty clay	< 1.10	> 1.58
Clay	< 1.10	> 1.47

Large Maturing Trees Require Large Root Zones

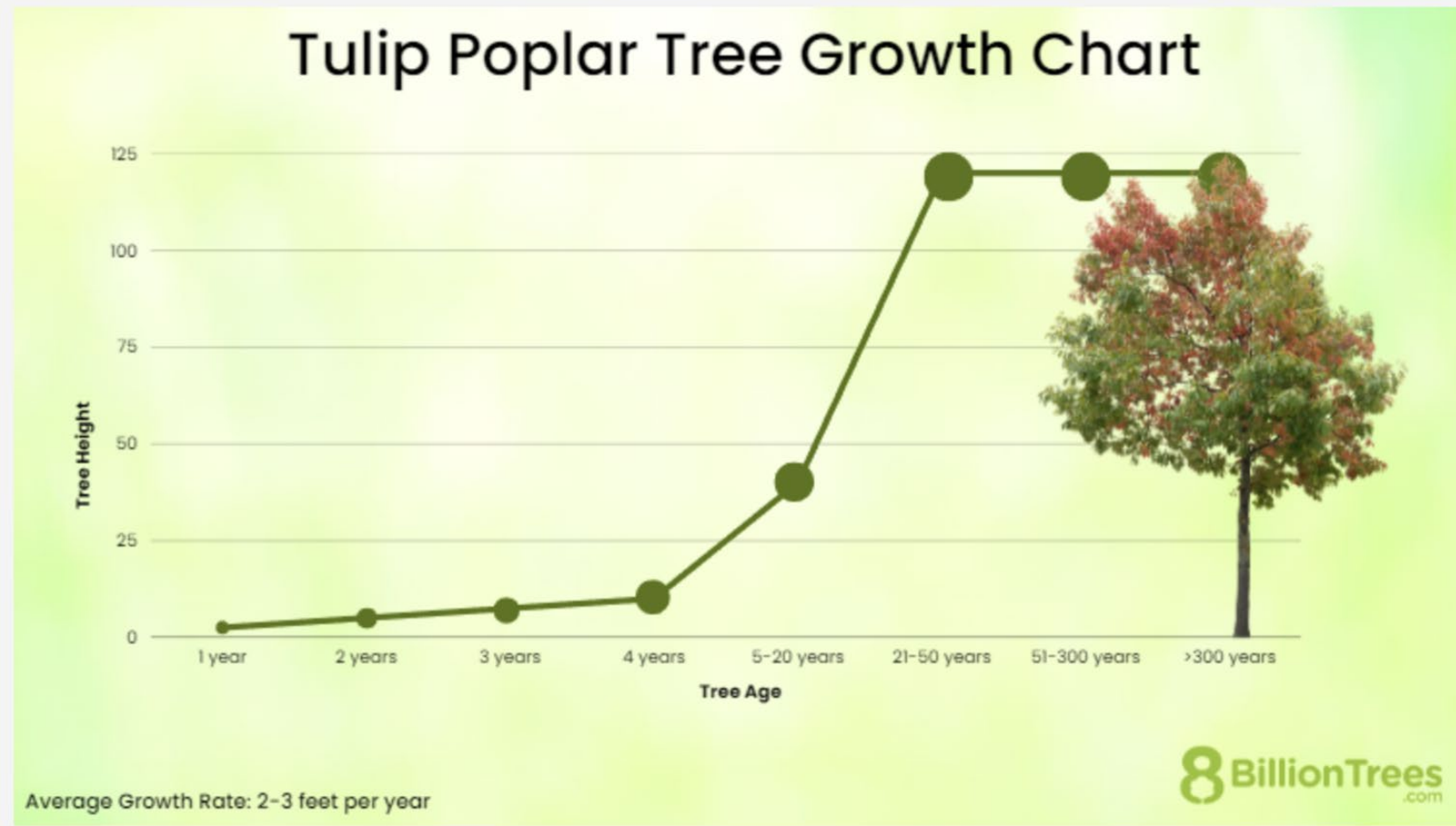
<https://8billiontrees.com/gardening/fast-growing-trees/>



Large Maturing Trees Require Large Root Zones

The Tulip Poplar Tree grows anywhere between two to four feet annually. It will grow up to 40 feet to 50 feet within a decade to 15 years.

<https://8billiontrees.com/gardening/fast-growing-trees/>



Large Maturing Trees Require Large Root Zones

Tree Growth: 16 years, 2008 - 2024



566 Miles of Stormwater O&M in 15 Minutes



Tyson R. Clouser, P.E.
December 4, 2025

WHY? STRATEGIC PLAN

CONNECTION

Enhance the customer experience and strengthen our partnerships.

CULTURE

Invest in and empower our people.

GROWTH

Become best in class through innovation and modernization.

SAFETY

Advance safety in all aspects of our business and operations.

STEWARDSHIP

Responsibly manage our finances, assets and social and environmental obligations.

STEWARDSHIP

Responsibly manage our finances, assets, and social and environmental obligations.

Responsibility Matters. We learned it at an early age, and it is one of our core values at the Commission. We see ourselves as stewards of this iconic landmark, and we take seriously our responsibilities to our customers and to the future generations of customers.

Part of our stewardship is responsibly managing our assets and our finances to ensure we are fiscally sound and have the best roadway around. It's about maintaining our highway to the highest standards, managing lifecycle costs and ensuring our customers receive the greatest value for their toll dollars. We will continue our commitment to working with diverse partners in our contracts, bringing new ideas to the Commission and providing open and transparent processes.

With a 30-year commitment to sustainable best practices, our goal is to become America's First Sustainable Superhighway by 2040. Sustainability drives every aspect of our work, from road projects to business operations. With each new initiative, we carefully assess the economic, environmental and social impacts. By prioritizing sustainability, we are paving the way for a greener, more resilient future.

WHY? PERMIT CONDITION

3606-PM-BCW0200a Rev. 8/2019
Permit

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

 pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
INDIVIDUAL PERMIT TO DISCHARGE STORMWATER FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4s)**

NPDES PERMIT NO. PA1139602

In compliance with the provisions of the Clean Water Act, 33 U.S.C. Section 1251 et seq. ("the Act") and Pennsylvania's Clean Streams Law, as amended, 35 P.S. Section 691.1 et seq.,

Pennsylvania Turnpike Commission
PO Box 67676
Harrisburg, PA 17106-7676

is authorized to discharge from a regulated small municipal separate storm sewer system (MS4) located within Urbanized Areas to surface waters of the Commonwealth in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

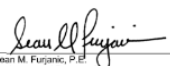
THIS PERMIT SHALL BECOME EFFECTIVE ON NOVEMBER 1, 2021

THIS PERMIT SHALL EXPIRE AT MIDNIGHT ON OCTOBER 31, 2026

The authority granted by coverage under this permit is subject to the following further qualifications:

1. The permittee shall comply with the effluent limitations and reporting requirements contained in this permit.
2. The application and its supporting documents are incorporated into this permit. If there is a conflict between the application, its supporting documents and/or amendments, and the terms and conditions of this permit, the terms and conditions of this permit shall apply.
3. Failure to comply with the terms, conditions or effluent limitations of this permit is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. (42 CFR § 122.41(a))
4. A complete application for renewal of this permit must be submitted to the Department of Environmental Protection (DEP) at least 180 days prior to the expiration date (unless permission has been granted by DEP for submission at a later date), using the appropriate NPDES permit application form (40 CFR § 122.41(b), 122.21(c)). In the event that a timely and complete application for renewal has been submitted and DEP is unable, through no fault of the permittee, to reissue the permit before the expiration date, the terms and conditions of this permit, including submission of the Annual MS4 Status Reports, will be automatically continued and will remain fully effective and enforceable against the discharger until DEP takes final action on the pending permit application. (25 Pa. Code §§ 92a.7(b), (c))

The permittee shall achieve pollutant load reductions for sediment, Total Phosphorus (TP), and Total Nitrogen (TN) from highway or highway maintenance facility stormwater runoff to nutrient and sediment impaired waters as specified in Part C II.

Date Permit Issued: October 29, 2021 Issued By: 
Sean M. Furman, P.E.
Environmental Program Manager
Division of NPDES Permitting

5. **MCM #5:** Post-Construction Stormwater Management (PCSM) in New Development and Redevelopment. (25 Pa. Code § 92a.32(a) and 40 CFR § 122.34(b)(5))

The permittee shall implement the BMPs identified below.

- a. **BMP #1:** The permittee shall comply with all applicable requirements under 25 Pa. Code Chapter 102 for Post-Construction Stormwater Management (PCSM). Compliance with this BMP will be demonstrated through the development of PCSM Plans and receipt of permits under Chapter 102 for applicable construction activities.
- b. **BMP #2:** The permittee shall ensure adequate O&M of all PCSM BMPs that have been installed at construction projects that disturb greater than or equal to one acre. The permittee's Stormwater Control Measure Operations and Maintenance (SCMOM) Manual shall be the basis for minimum required maintenance activity and maintenance frequency for the PCSM BMPs (i.e., stormwater control measures). The permittee shall submit any proposed change to the permittee's SCMOM Manual to DEP for approval prior to implementing the change. Modifications may be implemented upon submission to DEP unless DEP issues an objection in writing within 60 days. An inventory of PCSM BMPs shall be maintained and shall be continually updated during the term of coverage under the permit as construction projects are reviewed, approved, and constructed. The permittee must track the following information in its PCSM BMP database:
 - All PCSM BMPs covered by 25 Pa. Code § 102.8.
 - The exact location of the PCSM BMP (e.g., latitude and longitude, mile marker).
 - Information (e.g., name, address, phone number(s)) for BMP owners and entities responsible for BMP O&M, if different from BMP owners.
 - The type of BMP, the year it was installed, required maintenance, and the required inspection frequency.
 - The actual inspection/maintenance activities conducted for each BMP.
 - An assessment by the permittee if proper O&M has occurred since the last inspection and if not, what actions the permittee has taken, or shall take, to address compliance with O&M requirements.
 - The condition of the BMP at the time of inspection.
 - Municipal MS4 name and contact information, if a party other than the permittee has responsibility for O&M.



STORMWATER CONTROL MEASURE OPERATIONS AND MAINTENANCE MANUAL



2020

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STORMWATER CONTROL MEASURE OPERATION AND MAINTENANCE MANUAL

5

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Table 2.1.1: SCM Type and Type Code

SCM Type	Type Code	SCM Type	Type Code
Basin, Dry Detention	BDD	Non-Basin SCM, Other	NBO
Basin, Dry Extended Detention	BED	Pervious Pavement, Asphalt	PPA
Basin, Managed Release Concept	MRC	Pervious Pavement, Concrete	PPC
Basin, Infiltration Detention	BID	Pervious Pavement, Pavers	PPP
Basin, Naturalized Detention	BND	Reforestation/Tree Plantings	RTP
Basin, Wet Detention	BWD	Regenerative Step Pool	RSP
Basin, Other	BOT	Riparian Buffer Enhancement	RBE
Bioretention	BRE	Riparian Buffer Offset	RBO
Bioretention w/Underdrain	BRU	Soil Amendment Restoration	SAR
Constructed Stormwater Filter	CSF	Stormwater Wetland	SWE
Flow Dispersion, Forest/Buffer	FDF	Stream Restoration	SRE
Flow Dispersion, Veg. Filter Strip	FDV	Stream Stabilization	SST
Forest Preservation	FPR	Subsurface Detention Storage	SDS
Infiltration Berm	IBE	Subsurface Infiltration Trench	SIT
Landscape Restoration Meadow	LRM	Vegetated Filter Strip	VFS
Level Spreader Outfall	LSO	Vegetated Filter Strip, Steep Slope	VSS
Manufactured Treatment Device	MTD	Vegetated Swale	VSW
Media Filter Drain	MFD	Vegetated Swale w/ Check Dams	VSC

- Each SCM type has a unique name and an abbreviation called a Type Code

- Each SCM has a unique ID comprised of 5 attributes

X- 123.45 - YY - 5678 - SCM

- “X” → Route – PA Turnpike letter designation of the roadway
- “123.45” → Milepost – MP along the roadway
- “YY” → Direction – indicates the side of the roadway it is located: NB, SB, EB OR WB
- “5678” → Offset – four-digit number indicating how far off the center of roadway in feet
- “SCM” → SCM Type Code – indicates what type of SCM it is

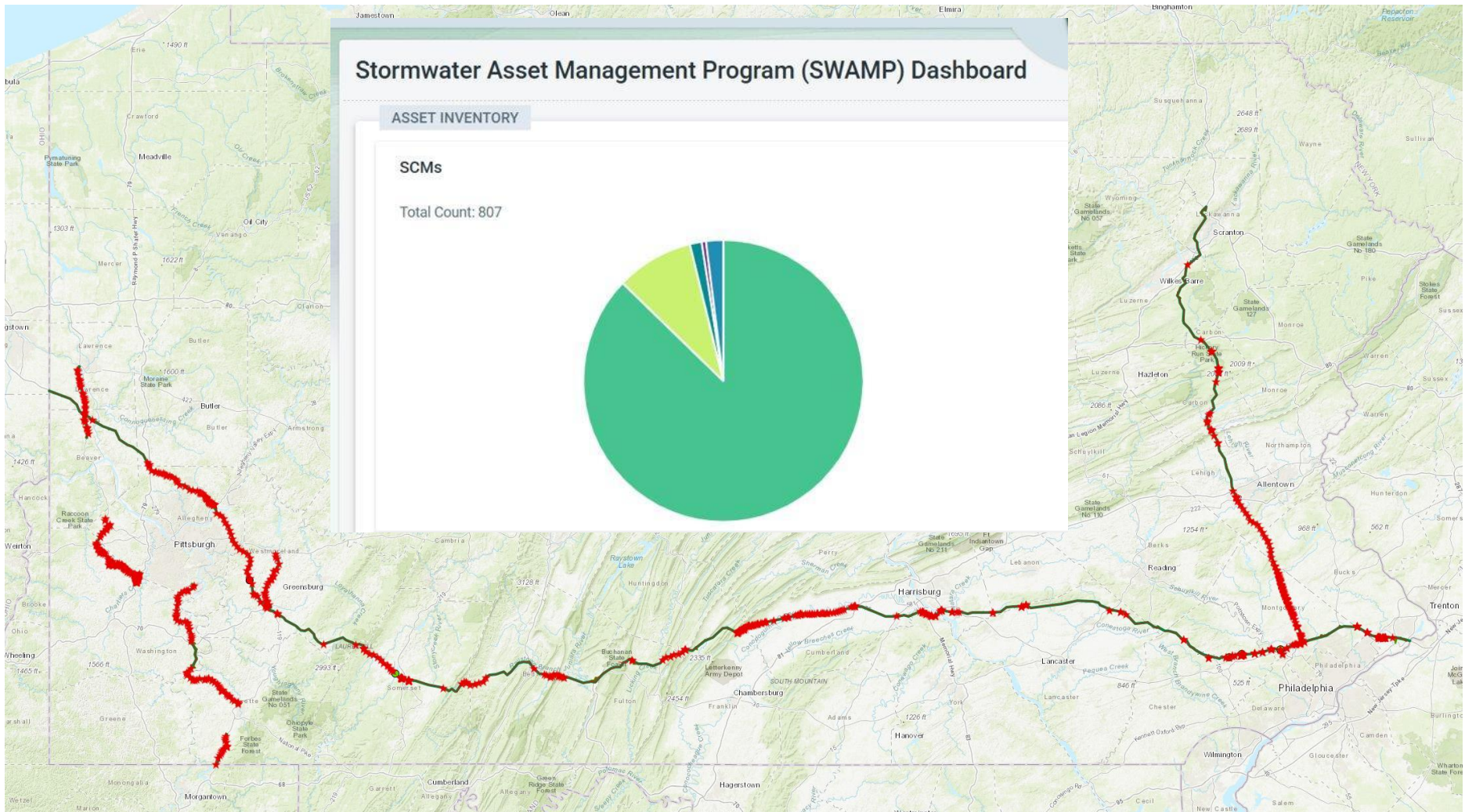
Route

- T = Mainline / I-76, I-70, I-276
- B = Beaver Valley Expressway / I-376
- G = Amos K Hutchinson (Greensburg) Bypass / PA 66
- M = Mon-Fayette Expressway / PA 43
- S = Southern Beltway / PA 576
- A = Northeast Extension / I-476
- C = Connector / Breezewood Connector to I-70
- H = Interstate 95 (Previously T-356.4 to 359)



HOW? STORMWATER ASSET MANAGEMENT PROGRAM

8



STORMWATER ASSET MANAGEMENT PROGRAM

9

SCMs

DETAILS

SCM ID	T-045.69-WB-0088-BID
SCM TYPE	Basin, Infiltration Detention
FEATURE STATUS	In Service
DISTRICT	District 1
ROUTE	Mainline
MILEPOST	045.69
DIRECTION	Westbound
LEGAL OWNER CODE	PA Turnpike
CURRENT INSPECTION FREQUENCY	
ROUTINE INSPECTION BY	PTC
ROUTINE MAINTENANCE BY	
CORRECTIVE MAINTENANCE BY	
MAINTENANCE AGREEMENT	
MAINTENANCE AND PROTECTION OF TRAFFIC (INSPECTION)	
MAINTENANCE AND PROTECTION OF TRAFFIC (MAINTENANCE)	No
DATE NOTICE OF TERMINATION RECEIVED	
NPDES PERMIT NUMBER	
NPDES PERMIT TYPE	
COUNTY NAME	Allegheny
PCSM PLANS EXIST	Fair
TOWNSHIP/MUNICIPALITY	Harmar Township
CHAPTER 93 DESIGNATED USE 1	
CHAPTER 93 DESIGNATED USE 2	
DISCHARGE DESTINATION CODE	
IMPAIRMENT 303D LIST	
IN KARST AREA	False
OFFSET FROM CENTERLINE ALIGNMENT	0088
STATE ROUTE NUMBER	
E&S PLANS EXIST	None
POST CONSTRUCTION STORMWATER REPORT	None

The screenshot displays the SCMs application interface. At the top, there is a navigation bar with a 'PENNSYLVANIA TURN PIKE' logo and a search bar. Below the search bar, a dropdown menu is open, showing a list of document classes. The map in the background shows a section of the Pennsylvania Turnpike with various features marked, including a blue area representing a basin and several red stars indicating specific locations.

Document Class
SCM

- SCM - Correspondence
- SCM - Design Reports and Stormwater Narratives
- SCM - Inspections - Field View
- SCM - Inspections - Routine
- SCM - O&M Determination Forms
- SCM - Operating Agreements
- SCM - Permits
- SCM - Permitted Drawings
- SCM - Stormwater Maintenance Activity Reports

MAINTENANCE TRACKING – OLD WAY

10

PA TURNPIKE COMMISSION

**STORMWATER MAINTENANCE
ACTIVITY REPORT**

Date: 6-30-2025 Day: Monday
SCM_ID: STWKS-E-006.36
Contract/PO#: _____

Contractor Company: _____

STORMWATER MAINTENANCE ACTIVITY (Applicator/Operator)

1. ☒ Mowing
2. ☐ Selective Tree Removal, Trimming
3. ☐ Tree/Shrub Care (planting, watering, fertilizing, etc.)
4. ☐ Seeding/Mulching (indicate formula/species in Remarks)
5. ☒ Other: Removed Litter

6. ☐ Herbicide Application (list herbicides below)

Trade Name/ Formulation	Qty:	Unit:	Volume/Acre:	Rate/Acre	Acres Treated	Amount of Material Used

Pesticide Business License #: _____ Applicator License #: _____ Pesticide Applicator Signature and Date: _____ Print Name: _____
By signing, I am certifying that the herbicide was applied per the manufacturer's label.

REMARKS: Weather Conditions: ☒ Sunny ☐ Cloudy ☐ Windy ☐ Rain (Time Started: _____ Temperature: 85 °F)
(The space below must be used to record additional details such as size of crew, seeding formulas, mulch types, soil supplements, routes and segments, start and end times, etc.)
Mowed Busin Slope 100% Removed Litter 1st Round

COST SUMMARY (Contractor Only)

Item #/Labor/Equipment Description	Quantity	Unit	Unit Price	Cost
Cost Summary Grand Total				

I certify that the services, hours and/or materials indicated herein have been furnished to the Department and this form is an accurate reflection of the same. The equipment used to provide the services and/or materials is regularly maintained and was in proper operating condition to reduce the potential of leaks, spills or other unintended discharges. I further certify that I am duly authorized to sign this form and able to make this certification on behalf of Contractor. I make the certifications contained on this form (including without limitation, where applicable, the herbicide certification above) under 18 Pa.C.S. §4904 (relating to unsworn falsification to authorities).

Contractor's Representative Signature and Date: _____ Printed Name: _____

DEPARTMENT USE ONLY (including Consultant Inspectors as applicable)

Verification via Field View (if checked yes, field viewer digital): Yes ☐ No ☐
Date Completed: _____

Inspector on Site Full-Time: Yes ☐ No ☐
Vehicle Location Verified via GPS: Yes ☐ No ☐

If Department Inspector: The above SCM Inspection Form is complete. My signature is not to be construed as admission of constant on-site supervision of the work performed, except where above I noted that I am an inspector on Site Full-Time.

If Consultant Inspector: I certify under 18 Pa.C.S. §4904 (relating to unsworn falsification to authorities) that to the best of my own personal knowledge, information, and belief, the above PA Turnpike Commission Form complete, accurate, and the information provided therein is justified and reasonable. My signature is not to be construed as admission of constant on-site supervision of the work performed, except where above I noted that I am an inspector on Site Full-Time.

Signature and Date: _____ Print Name and Title: _____
Name of Firm & Consultant Agreement # If Consultant Inspection is Used: _____

WOOF!





- Powerapps on IPAD integrated with SWAMP/Onbase
- Can record stormwater maintenance and access record documents from one location

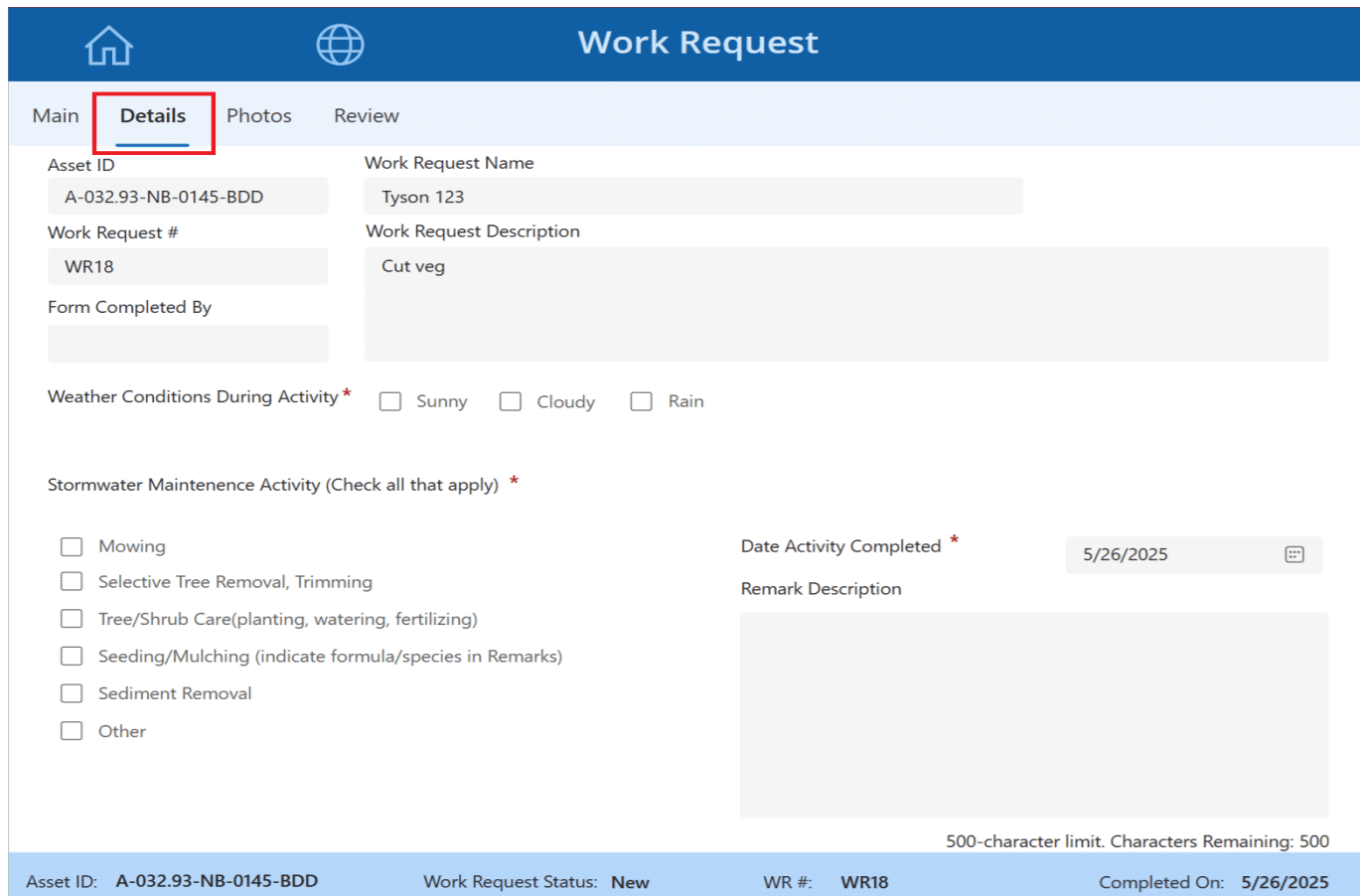
New Work Request		
New Work Requests	Requests: 12	>
Submitted Work Requests	Requests: 3	>
Returned Requests	Requests: 1	>

The Work Request Screen has 3 options

- New Work Requests
 - Working needing completed
- Submitted Work Requests
 - Work completed
- Returned Work Requests
 - Work that needs additional details added before acknowledgment of completed work

STARTING A MAINTENANCE ACTIVITY REPORT

13



Work Request

Main **Details** Photos Review

Asset ID: A-032.93-NB-0145-BDD

Work Request Name: Tyson 123

Work Request #: WR18

Work Request Description: Cut veg

Form Completed By:

Weather Conditions During Activity* ☐ Sunny ☐ Cloudy ☐ Rain

Stormwater Maintenance Activity (Check all that apply) *

☐ Mowing

☐ Selective Tree Removal, Trimming

☐ Tree/Shrub Care(planting, watering, fertilizing)

☐ Seeding/Mulching (indicate formula/species in Remarks)

☐ Sediment Removal

☐ Other

Date Activity Completed* 5/26/2025

Remark Description

500-character limit. Characters Remaining: 500

Asset ID: A-032.93-NB-0145-BDD Work Request Status: New WR #: WR18 Completed On: 5/26/2025

- After Opening a WR the Maintenance Activity Report Begins
 - 3 Screens starting with the details Screen
 - Can do in any order
- All fields with a “ * “ must be filled out
- Info pertaining to SCM is automatically populated



The screenshot shows a mobile application interface for 'Work Request'. At the top is a blue header bar with a back arrow, a home icon, a globe icon, and the text 'Work Request'. Below the header, the main content area is divided into two sections. The left section is titled '1. Add Photo Description *' and contains a text input field with the placeholder text 'This is a photo description'. Below the input field, it says '200-character limit (with spaces). Characters Remaining: 173'. The right section is titled '2. Select Photo *' and features a large dark blue square placeholder for a photo. Below this placeholder is a button labeled '3. Upload Photo', which is highlighted with a red rectangular border. At the bottom of the screen, there is a light blue footer bar containing the following information: 'Asset ID: A-041.00-NB-0016-BOT', 'Work Request Status: New', 'WR #: WR28', and 'Completed On: 6/1/2025'.

- Photo Description is required
- Uploading Photos
 - Can take a picture directly with camera
 - Can also upload photo from your library
- **PICTURES PICTURES PICTURES**
 - 2 Photos are Required ; can take more if needed

	STORMWATER MAINTENANCE ACTIVITY REPORT	DATE:	9/12/2025 12:00 AM
		SCM ID	T-208.22-EB-0075-BED
		WR ID	28

SCM ID T-208.22-EB-0075-BED	Work Request Name Cycle 2 Maintenance 2025	Work Request ID 28
Form Completed By melliott@paturnpike.com	Work Request Description Cycle 2 Maintenance 2025	

Weather Conditions

☒ Sunny	☐ Cloudy	☐ Rain
---	---------------------------------	-------------------------------

Stormwater Maintenance Activity (Check all that apply):

☒ Mowing	☐ Litter removal and trashrack cleaning
☐ Tree/Shrub Care	☐ Seeding/Mulching (indicate formula/species in remarks)
☐ Sediment Removal	☐ Other

Date Activity Completed 9/12/2025	Remark Description
--------------------------------------	--------------------

Created 9/12/2025 12:41 PM	Description West side
	

Created 9/12/2025 12:40 PM	Description East side
	



- Performed vegetation maintenance, restored low flow channel within basin bottom by removing sediment and replacing riprap
- Removed sediment and replaced riprap at inflow locations



- Performed vegetation maintenance, restored low flow channel within basin bottom by removing sediment and replacing riprap
- Removed sediment and replaced riprap at inflow locations



2022 Photo



2024 Photo



2025 Corrective Maintenance

- Performed vegetation maintenance, restored low flow channel by removing sediment and installing Turf Reinforcement Matting (TRM)
- Removed sediment and replaced riprap at inflow locations



2022 Photo

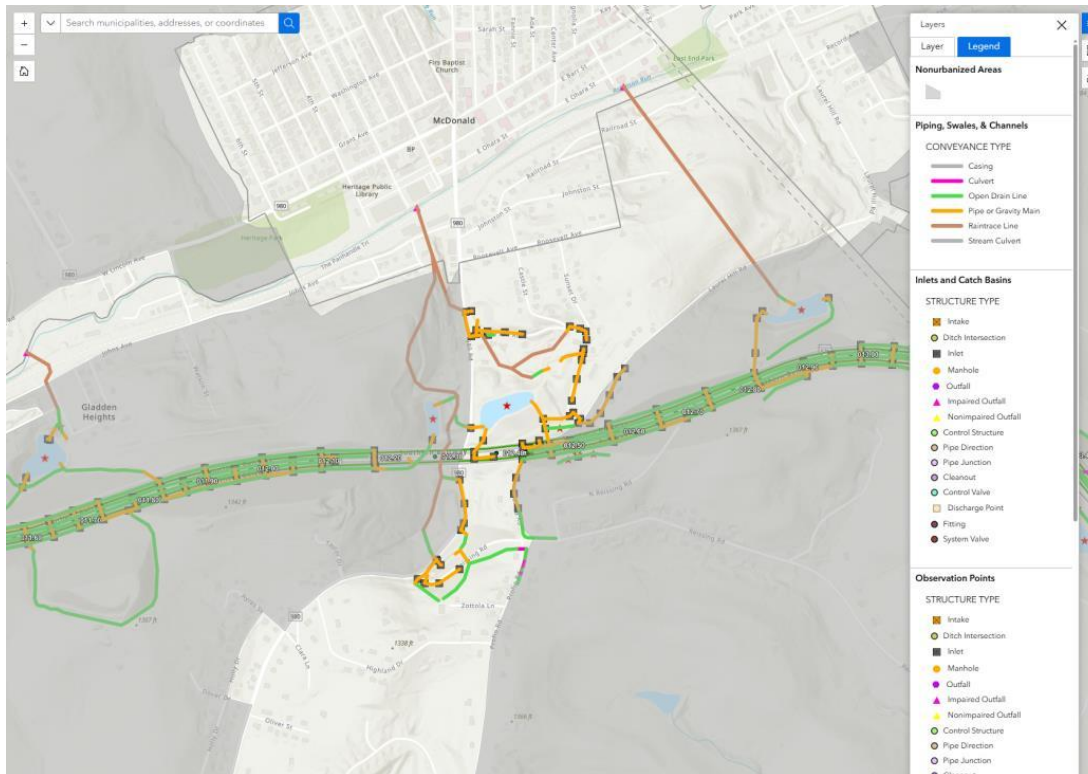


2024 Photo



2025 Corrective Maintenance

- Performed vegetation maintenance, removed sediment from basin bottom where ponding water was occurring
- Removed sediment and replaced riprap at inflow locations. The riprap was extended to the gabion running down the center of the SCM



Clean Water

[Home](#) » [Responsibility Matters](#) » [Clean Water](#)

The Pennsylvania Turnpike Commission is dedicated to our Clean Water initiative aimed at improved protection of the streams and rivers that pass beneath or near the PA Turnpike.

[Clean Water](#) [MS4](#) [Stormwater Compliance](#) [Clean Water Contact](#) [Clean Water Initiative](#)

The Journey Towards Clean Water

Water is essential to life. We, and all other living things, depend on water for health, happiness, and survival. Having access to clean water is even more important to sustaining health and life.

We created a comprehensive Clean Water initiative to take on the challenge of creating more sustainable clean water practices during and after construction that happens on our roadways.

Because clean water matters to us, too.



The Challenge

When it rains or precipitates, the water must go somewhere. Some of it serves purposes like replenishing groundwater, but some of it becomes runoff. Runoff flows downhill and through streams collecting pollutants such as dirt, fertilizer, bacteria, pesticides, metals, and petroleum byproducts.

While construction is necessary for optimizing travel, it can also be the culprit of runoff if storm water management isn't put into place. Excess nutrients like nitrogen and phosphorous from runoff can eventually make its way into streams, lakes, or water supplies and degrade water quality.

Questions?

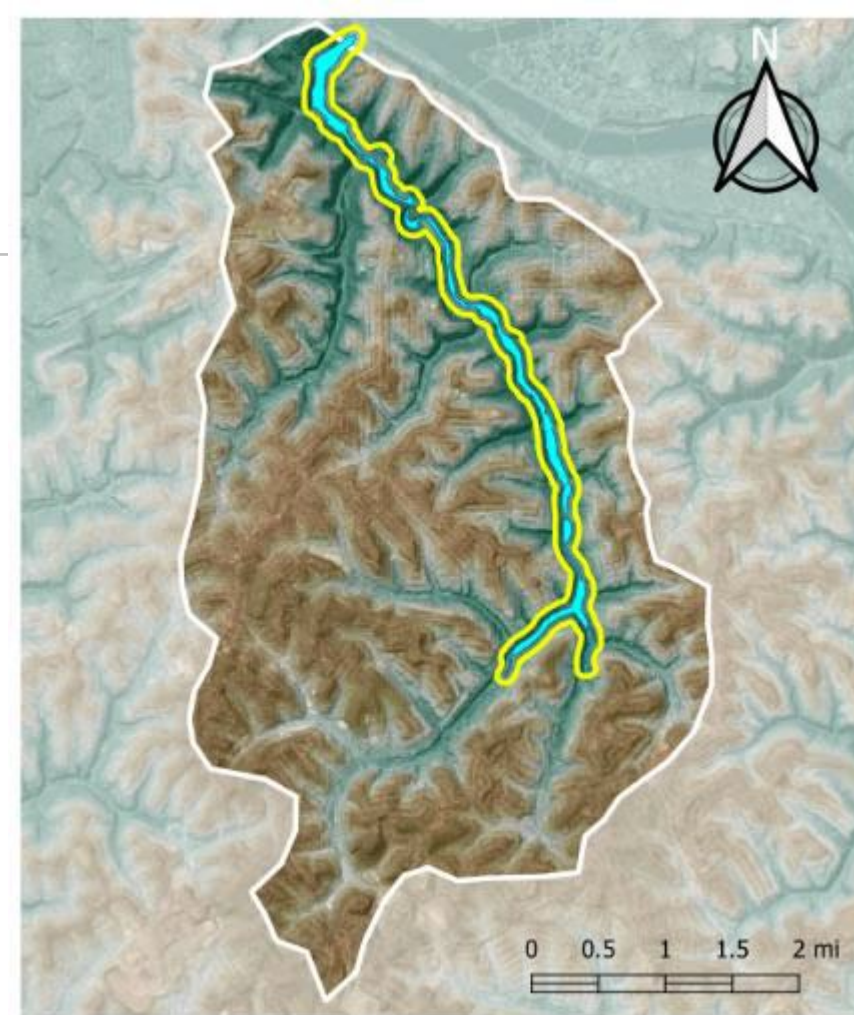


Swept Away: Rethinking the Economy of Our Floodplains

*Lisa Brown
Executive Director at Watersheds of South Pittsburgh*

*Tom Batrone, PE, CFM
Senior Engineer at HDR*

*December 4, 2025
IRISE Stormwater Symposium University of Pittsburgh*



- 2014 FEMA Flood Zones
- Flood Economic Study Area (~300 ft buffer)



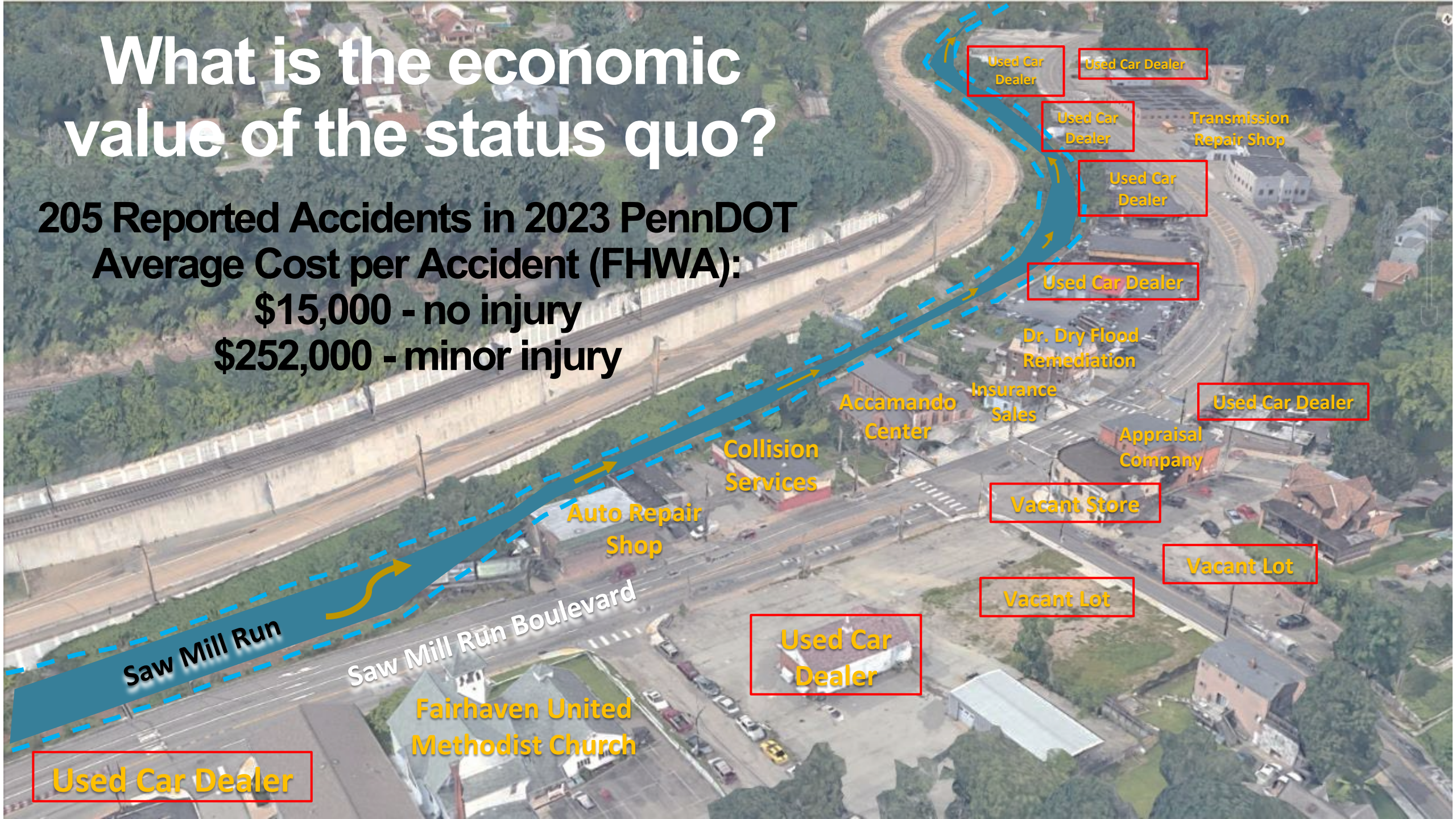
Presentation Overview

1. Saw Mill Run Watershed and History
2. Flooding Economic Study Objective
3. Baseline Economic Results
4. Project Opportunity Areas
5. Saw Mill Run Master Plan & Next Steps

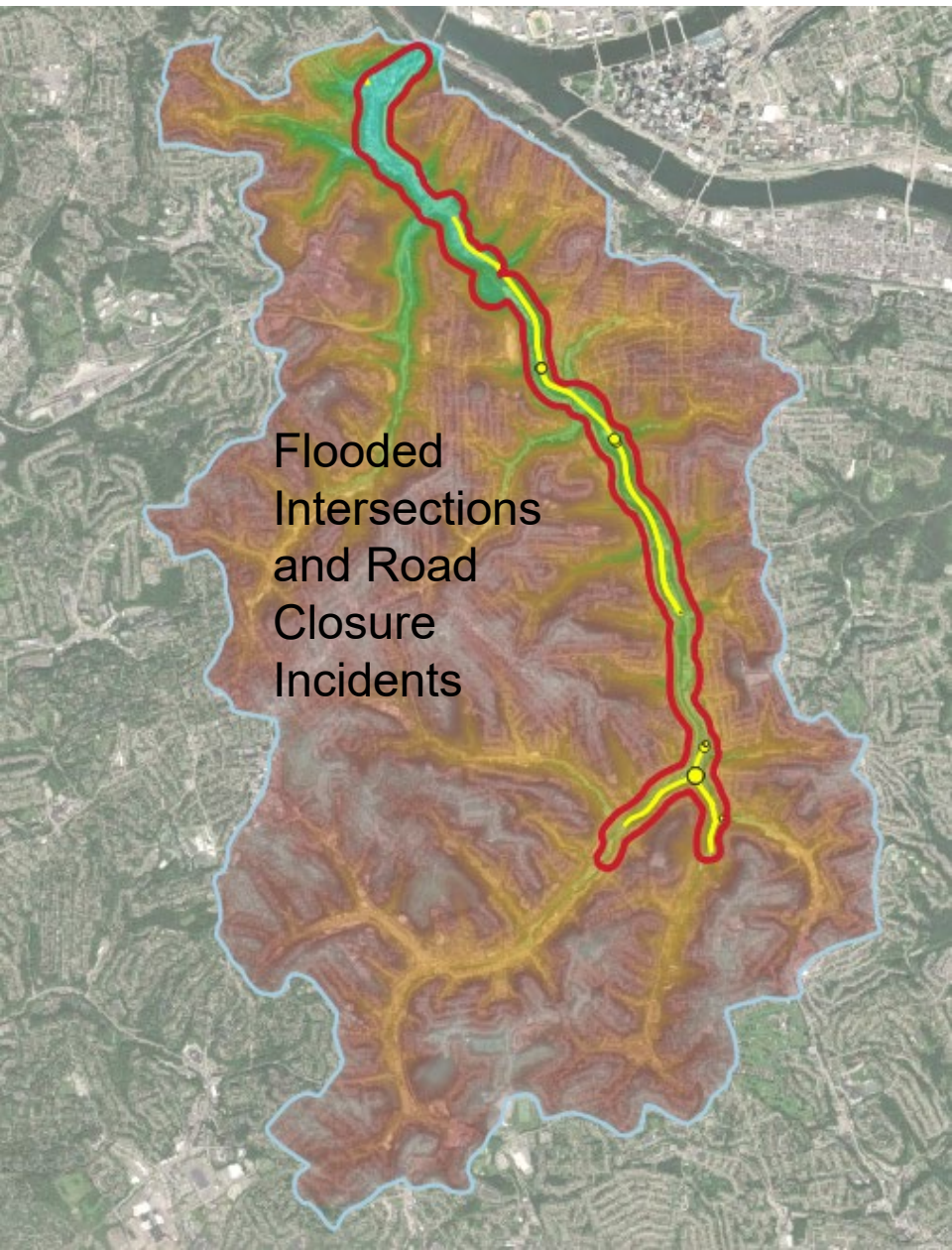


What is the economic value of the status quo?

205 Reported Accidents in 2023 PennDOT
Average Cost per Accident (FHWA):
\$15,000 - no injury
\$252,000 - minor injury



Recent Flooding Events (2018 Wettest Year on Record)



	7/20/2012	7	6/16/2016	13	6/20/2018	19	9/1/2019
	7/10/2013	8	7/7/2016	14	9/6/2018	20	3/28/2020
	7/22/2013	9	6/14/2017	15	9/21/2018	21	7/10/2020
	8/3/2014	10	7/28/2017	16	10/4/2018	22	6/13/2021
	8/12/2014	11	5/16/2018	17	7/6/2019	23	6/14/2021
	5/29/2016	12	6/10/2018	18	7/11/2019	24	8/12/2021



Saw Mill Run Economic Flooding Study Objective

The objective of the Saw Mill Run Flooding Economic Study is to change the perception of Saw Mill Run as it relates to floodplain management, land use practices, and the importance of creating natural stream buffers for creating healthy and economically vibrant stream corridor.

Phased Approach

Phase I – Baseline Economics

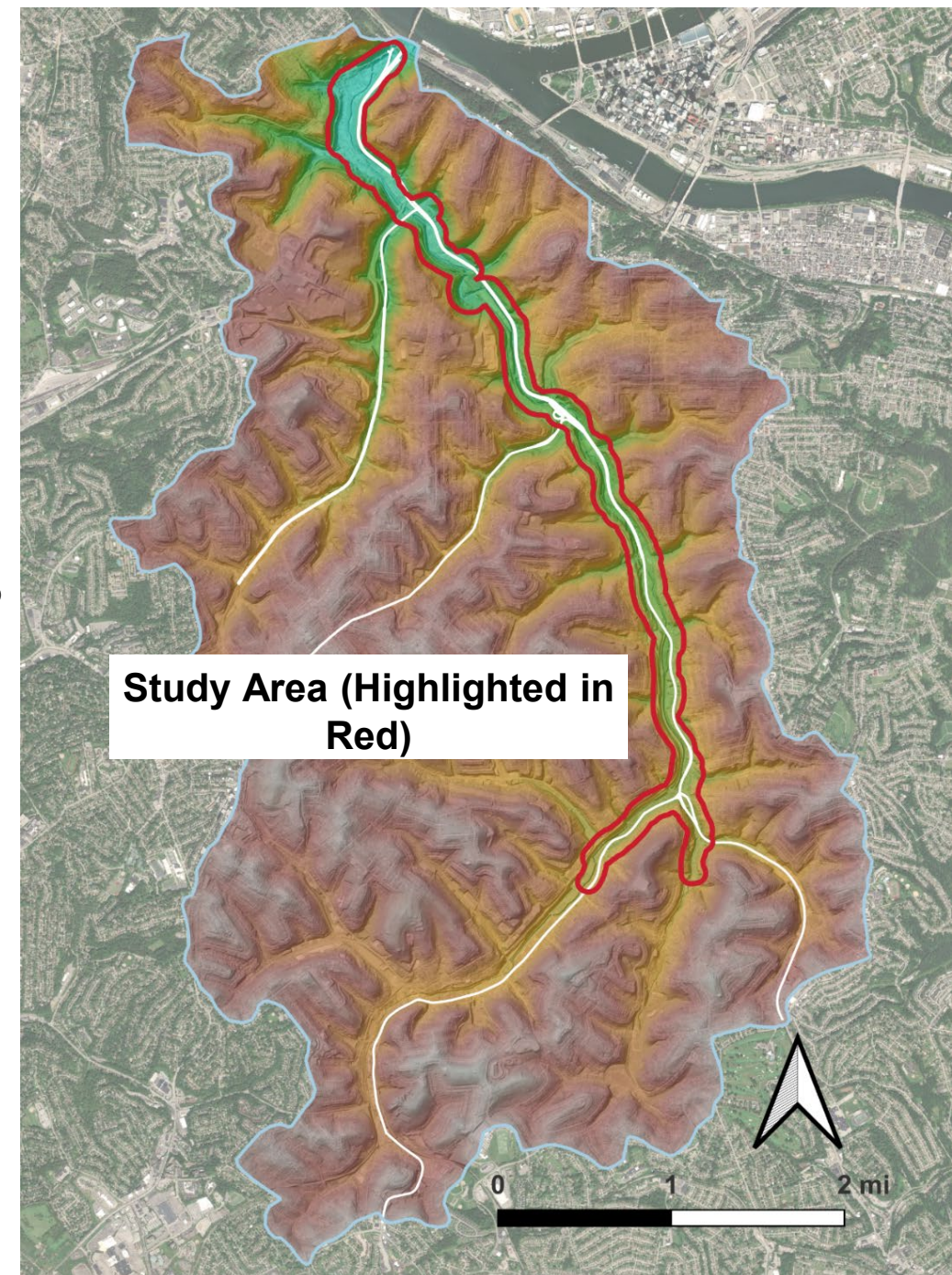
Three main questions:

1. What is the baseline economic condition?
2. What are the economic costs of flooding?
3. What are the potential economic benefits of green infrastructure & flood plain restoration?

Phase I Goal: Establish a baseline of economic viability versus flooding costs to determine the true value to the community, presented in a way that is easily understood by the community leaders.

Phase II – Opportunity Focus Areas

Phase II Goal: Identify target areas for economic opportunity for additional green space and quantify economic and environmental impact of concepts.



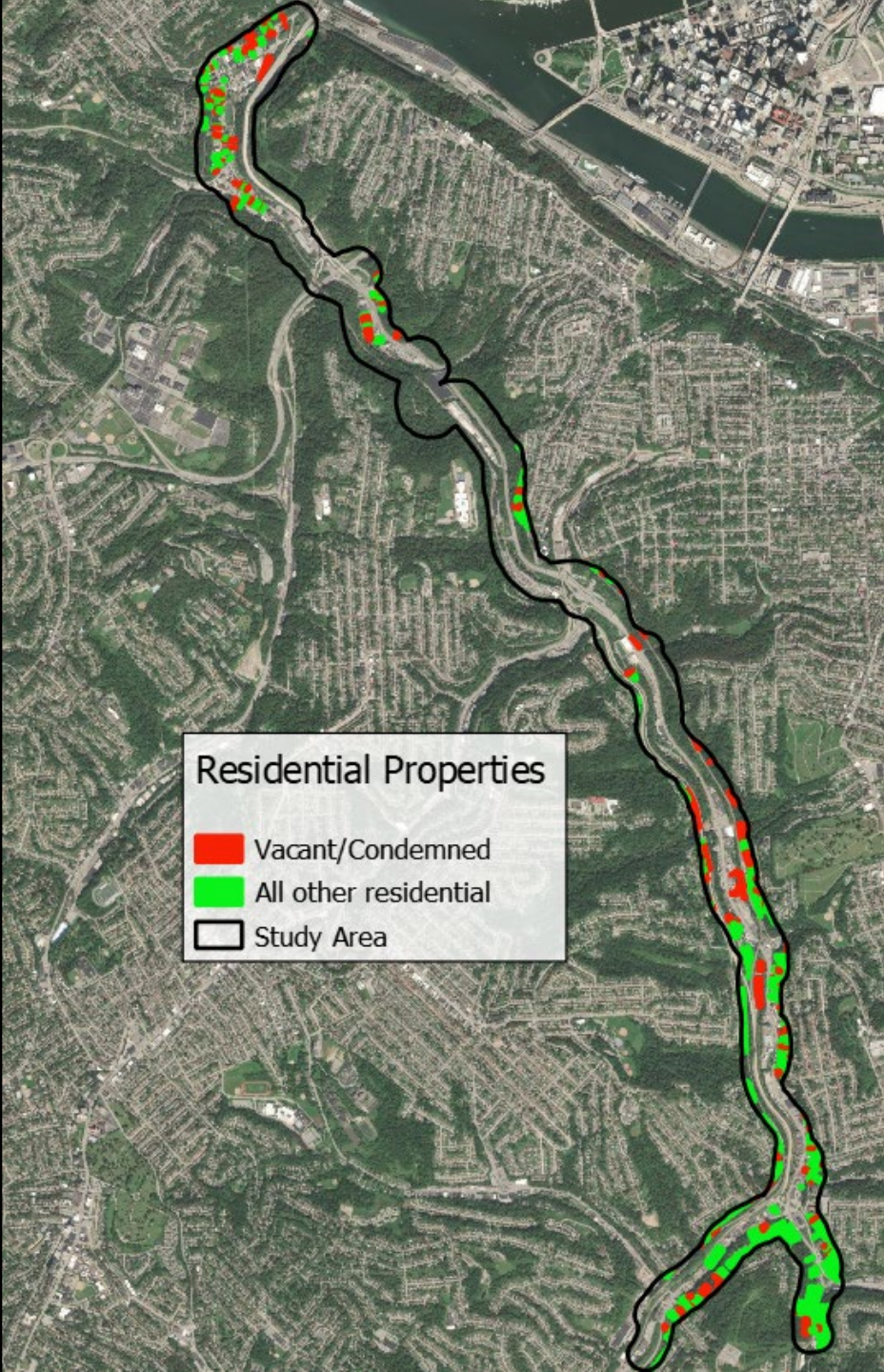
Q1: What is the baseline economic condition?

Study Area Composition

Property Type	Study Area #	Study Area %	County #	County %
Agricultural	1	0.1%	2,382	0.4%
Commercial	403	23.7%	36,211	6.2%
Government	353	20.7%	16,857	2.9%
Industrial	48	2.8%	3,650	0.6%
Other	1	0.1%		0.0%
Residential	826	48.5%	520,329	89.5%
Utilities	70	4.1%	1,946	0.3%
Total	1,702		581,375	

Study Area Vacancy Rates

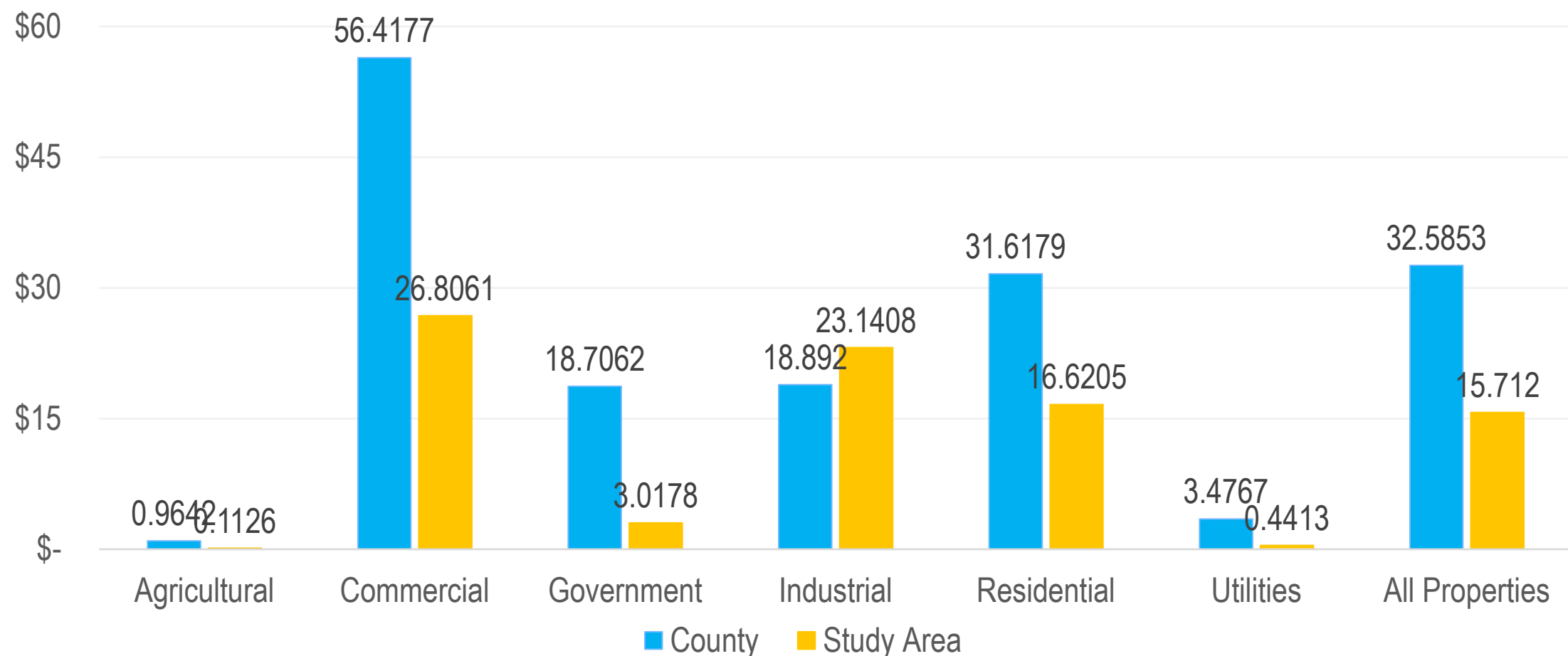
Property Type	Study Area #	Vacant Parcels	% Vacant
Agricultural	1	1	100%
Commercial	403	113	28%
Government	353		0%
Industrial	48	13	27%
Other	1		0%
Residential	826	259	31%
Utilities	70		0%
Study Area Total	1702	386	23%
County Total	582,162	72,268	12%



Q1: What is the baseline economic condition?

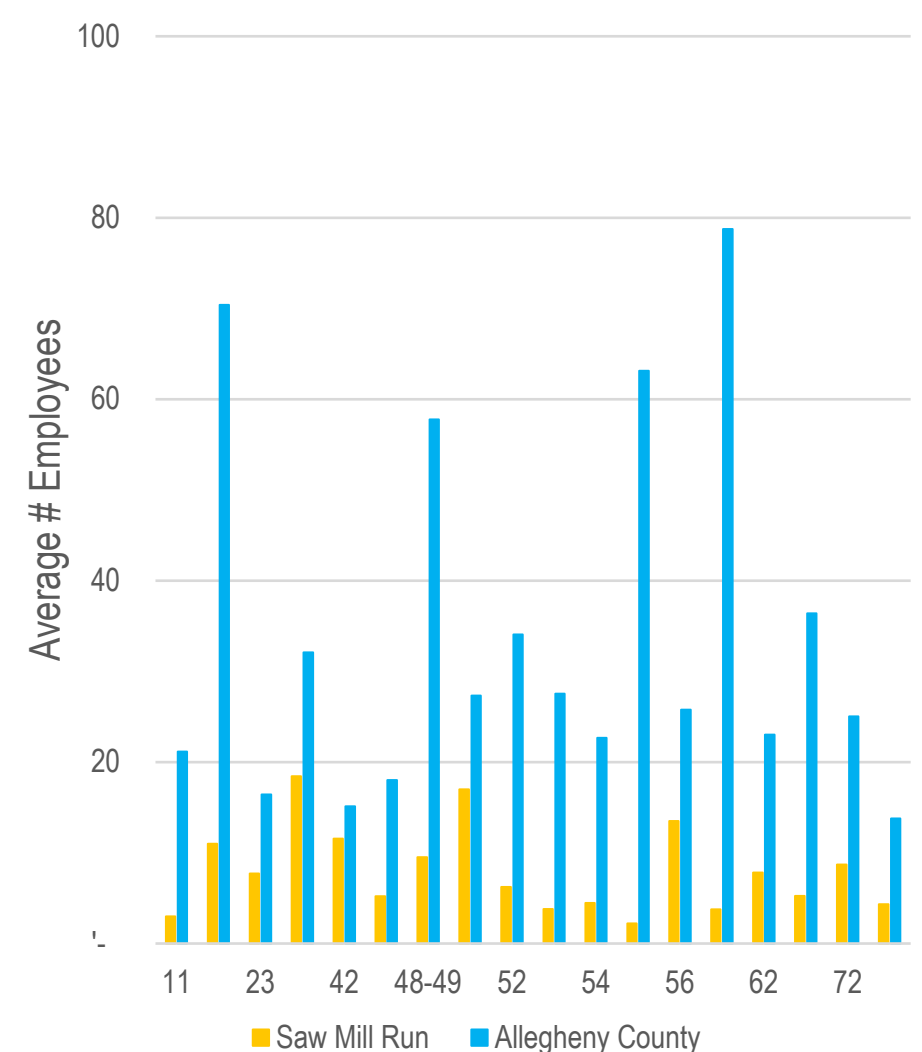
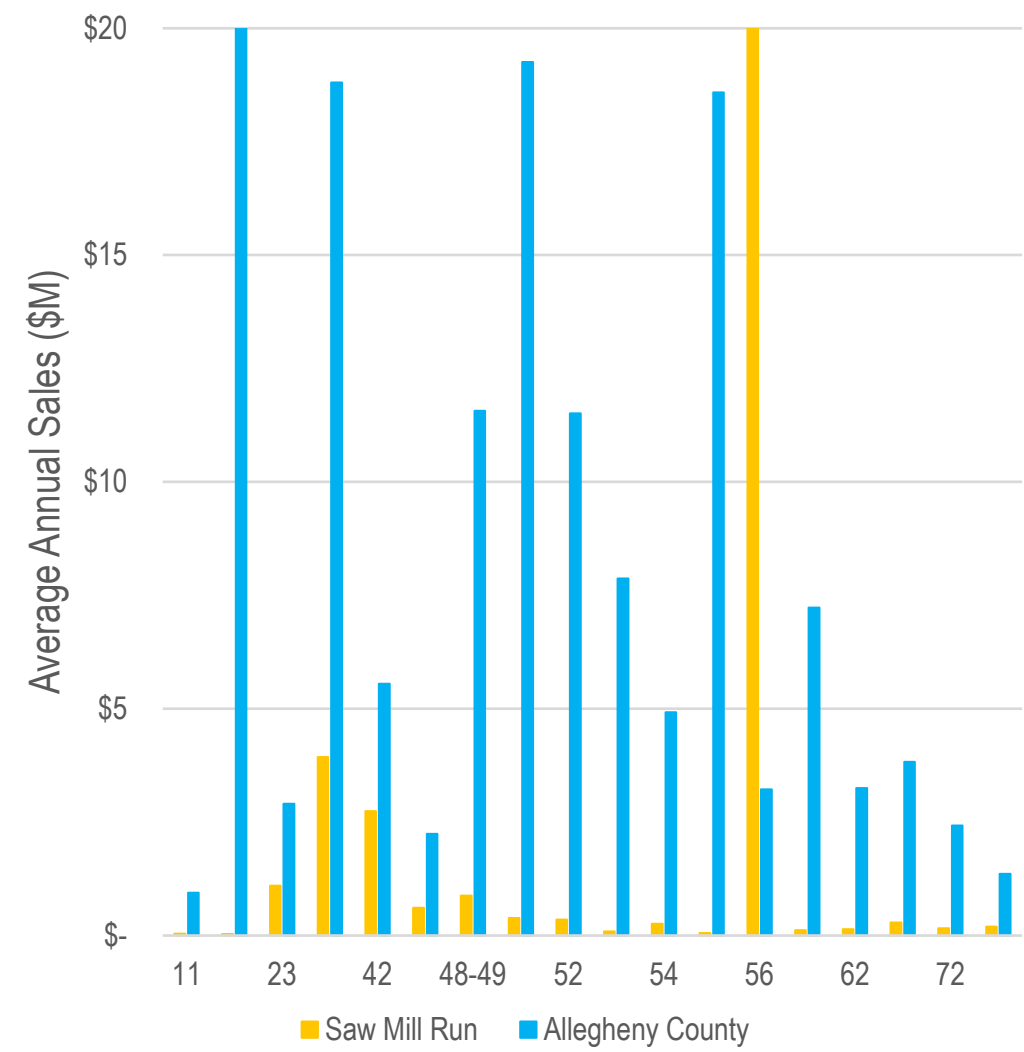
Property Values

Fair market value per square foot by property type



Q1: What is the baseline economic condition?

Economic Output and Employment



NAICS business type code descriptions:
11 = Agriculture, forestry, fishing and hunting
22 = Utilities
23 = Construction
31-33 = Manufacturing
42 = Wholesale trade
44-45 = Retail trade
48-49 = Transportation and warehousing
51 = Information
52 = Finance and insurance
53 = Real estate and rental and leasing
54 = Professional and technical services
55 = Management of companies and enterprises
56 = Administrative and waste services
61 = Educational services
62 = Health care and social assistance
71 = Arts, entertainment and recreation
72 = Accommodation and food service
81 = Other services

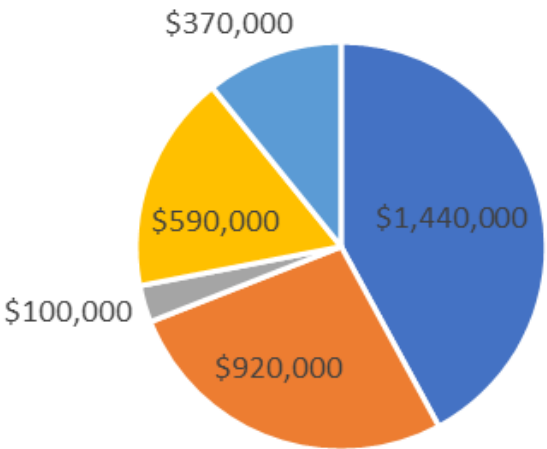
Q2: What is the economic cost of flooding?

Average Annual Damages Over 100 Years

Total Existing Conditions EAD: \$3.42 M

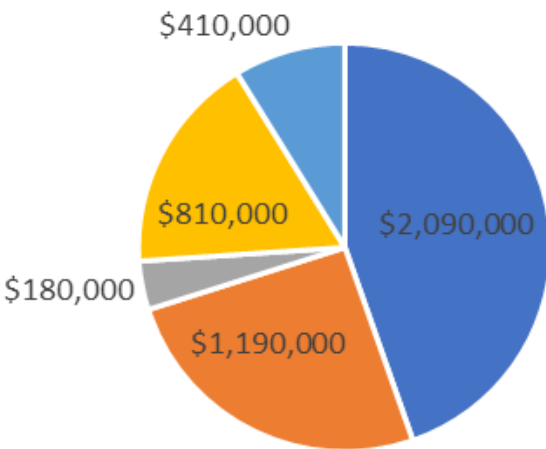
Total Future Conditions EAD: \$4.68 M

Existing Conditions



■ Commercial ■ Industrial ■ Public ■ Residential ■ Social

With Future Climate Change



■ Commercial ■ Industrial ■ Public ■ Residential ■ Social

Phase II - Design Workshops



Ansonia Place

Former FEMA buyout of 22 homes

Missed opportunity for flood mitigation and natural amenity to Route 51 corridor



ESRI COMMUNITY MAPS CONTRIBUTORS, COUNTY OF ALLEGHENY, DATA.PA.GOV, WEST VIRGINIA GIS, © OPENSTREETMAP, MICROSOFT, ESRI, TOMTOM, GARMIN, SAFEGRAPH, GEOTECHNOLOGIES, INC, METI/NASA, USGS, EPA, NPS, US CENSUS BUREAU, USDA, USFWS GATE BY RAHMAD ROMADONI FROM NOUN PROJECT (CC BY 3.0)
USE FOOTBRIDGE BY VICONS DESIGN FROM NOUN PROJECT (CC BY 3.0)

- Pipe
- Trail
- Bridge
- Low Wall
- Trail
- Footbridge
- Crosswalk
- Overlook
- Ripple
- Rock
- Flow Structure
- Flow



Economic Benefit Cost Analysis

Benefits	30-year Present Value	
	(2023 Dollars)	
	Seldom Seen	Ansonia Place
Flood Reduction	\$1,500,000	\$1,500,000
Recreational Opportunities	\$5,265,000	\$5,540,000
Habitat Creation	\$433,000	\$507,000
Water Quality	\$27,000	\$17,000
Carbon Sequestration	\$13,000	\$14,000
Increased Property Values	\$307,000	\$181,000
Total Benefits	\$7,545,000	\$7,759,000
Tax Impacts		
Increased Property Tax Revenues	\$87,100	\$507,400
Lost Property Tax Revenues	(\$408,200)	(\$56,700)
Total Tax Revenue Change	(\$321,100)	450,700

Planning Level Construction Cost
Estimate (2023 Dollars)

Seldom Seen = \$5,780,000

Ansonia Place = \$7,450,000

Saw Mill Run Watershed Goals



**Increase
Green Space
Recreation**



**Recreational
Benefits**



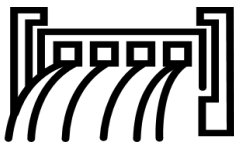
**Improve Safety
Pedestrian Mobility**



**Community
Benefits**



Reduce Flooding



**Flood-Risk
Reduction**



**Create a Corridor Specific
Task Force**



**Leverage for
Grant Funding**

Next Steps to a Resilient Future



WEST END



SELDOM SEEN GREENWAY



“BATHTUB” SOUTH OF WOODRUFF



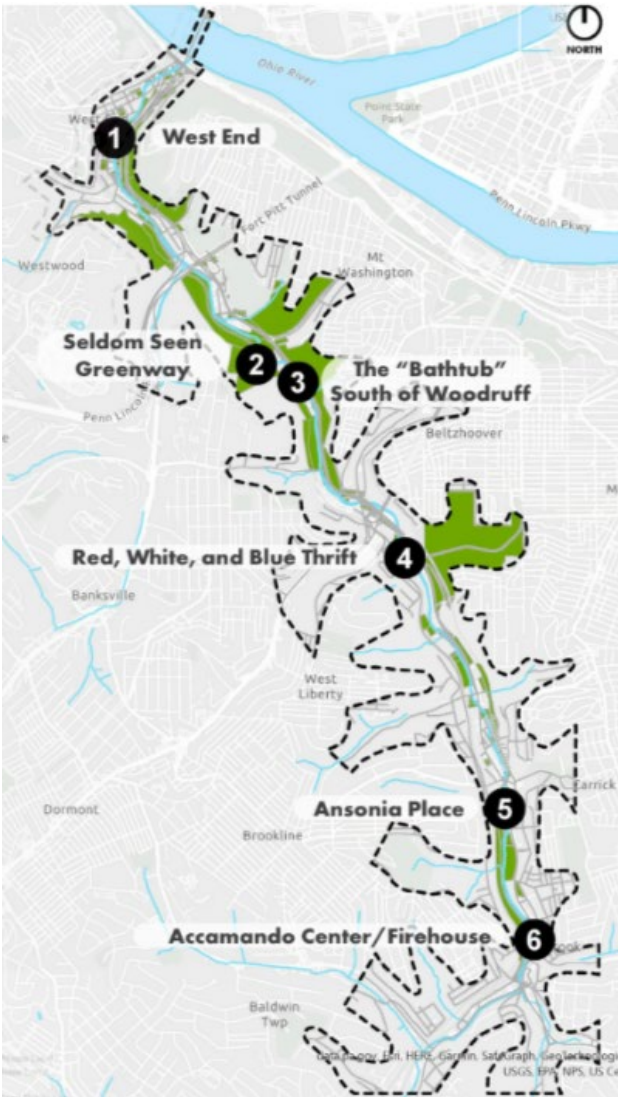
RED, WHITE, AND BLUE THRIFT



ANSONIA PLACE



ACCAMONDO CENTER



Cost effective areas identified in economic analysis

Acknowledgements



Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

FIRM OVERVIEW

ETHOS COLLABORATIVE PROVIDES CIVIL ENGINEERING DESIGN AND CONSULTING SERVICES TO ADDRESS A WIDE RANGE OF GREEN INFRASTRUCTURE, WATER RESOURCES, AND SOCIAL NEEDS WITHIN THE URBAN ENVIRONMENT. WE STRIVE TO DIFFERENTIATE OURSELVES FROM TRADITIONAL ENGINEERING FIRMS BY STAYING FOCUSED ON THE SOCIAL, ENVIRONMENTAL, AND ECONOMIC ASPECTS OF DESIGN, THE TRIPLE BOTTOM LINE OF SUSTAINABILITY.

Water and Ecology

Ethos Collaborative offers a wide range of water resources and ecological engineering services including green infrastructure design, stormwater master planning, water policy advising, hydrologic and hydraulic (H&H) analysis, watershed management, wet weather CSO/SSO remediation, stream and habitat restoration, and GIS and hydroinformatics.

Energy and Climate

Ethos offers holistic insight into the long-term economic and environmental costs and benefits of site-related infrastructure, institutional operations, and regional community patterns. Energy-related services provided by Ethos include regional energy baseline analysis, energy efficiency planning, sustainability analysis, life cycle assessments, climate change mitigation and adaptation consulting.

Resilient Site Design

Our approach to design is to provide context-sensitive, regenerative and community-focused solutions. We offer site design, planning, landscape architecture, 3D and graphic rendering, net zero water design, land development and environmental permitting.

Urban Agriculture

Food is, and always has been, an essential focal point of human life. It is therefore no surprise that urban agriculture is becoming increasingly popular for reasons relating to health, nutrition, environmental stewardship and for strengthening communities and local economies. Ethos provides numerous services related to urban agriculture, including site feasibility assessment, water harvesting and irrigation design, site, greenhouse and compost facilities design, permaculture consulting, and regulatory permitting.

GIS and Intelligent Cities

Ethos is a non-traditional design firm, both in our business model and in the innovative tools we use to provide added value to our customers. Specifically, we believe in the importance of collecting, maintaining, analyzing, visualizing and sharing data, as it relates to the built environment. Our design toolbox includes knowledge of web and mobile application design, real-time sensing and performance monitoring, geographic information systems (GIS), data visualization, machine learning, and artificial intelligence methodologies. We are actively seeking research partners for data sharing initiatives.

Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

Carnegie Mellon University

MS Advanced Infrastructure Systems, 2008

CMU ONLINE
Carnegie Mellon University



ONLINE GRADUATE CERTIFICATE AI ENGINEERING - DIGITAL TWINS & ANALYTICS

+17 Years, Spring 2024 CEE Magazine

FEATURED STORY

MAKING SENSE OF OUR Civil Infrastructure

The U.S. infrastructure is a trillion dollar investment, defined broadly to include road systems and bridges, water distribution and wastewater collection systems, water and wastewater treatment plants, power distribution systems, telecommunication network systems, commercial and industrial facilities, etc. Civil and Environmental Engineers play a major role in creation and management of our critical infrastructure. At Carnegie Mellon, our students learn that CEE researchers are at the forefront of a national movement to bring much greater use of sensing and information and communication technology to the construction and management of this infrastructure. We describe some of these research efforts in this article.



Figure 1: Sonar inspection image
Source: Redstone 2007, <http://redstone.com/>

Providing Situation Awareness on Construction Projects

Buildings and other types of built infrastructure, such as bridges, are getting more and more complex in terms of the geometries and integrated subsystems used, and as such have become more difficult to construct properly. Yet most of the time the engineers managing these projects rely on infrequent and spatially sparse data being collected using mostly manual methods in the field, such as transit-based surveying, to assess the as-built and as-is conditions of the construction project and to make decisions accordingly. Possessing a limited understanding of the 3D as-built conditions during construction can potentially result in missing deviations and construction defects that actually exist in projects. Similarly, limited understanding of the 3D as-is conditions that exist during the lifetime of infrastructure, such as a highway bridge, can result in not being able to assess adequately the conditions of the infrastructure effectively.



Figure 2: Laser scan of highway bridge

Professor Burcu Akinci and her colleagues and students are exploring a variety of sensing and tracking technologies, such as laser scanners and radio frequency identification (RFID) tags, that can help increase situation awareness. Laser scanners are able to capture millions of points on the surfaces of the infrastructure being constructed such that a very detailed survey of the three-dimensional geometry is captured (see Figure 2 and front cover). RFID tags are

used to keep track of the location and the actions taken on high-value engineered systems being stored and installed on a construction site. Akinci and her team of researchers have been focusing on assessing the capabilities of such technologies in capturing the data needed by engineers. They have also been developing approaches to process automatically the data collected so as to help engineers by providing proactive quality control during construction and providing proactive identification of deterioration and damage during the life-cycle of these infrastructure systems.

Determining Site-Specific Seismic Design Loads

The increasing complexity of buildings, bridges and other life-lines requires that careful attention also be given to the design process, especially under the action of transient loads, such as those due to wind, man-made changes, and earthquakes. Since a knowledge of the predicted ground motion to which a structure will be subjected during its lifetime is a key first step for determining the seismic design loads, and the seismic ground motion at a site depends strongly on the in-situ material properties of soil deposits and the deeper geological structure, it is essential to be able to characterize accurately the material profiles of spatially heterogeneous individual sites and complex basins alike. Professor Jacobo Bielak and his colleagues and students are integrating recently developed powerful inversion techniques with earthquake records and data from in-situ tests to perform high-fidelity site and basin characterization.

They have already verified their inversion algorithms with

Story continued on page 4

Revolutionizing Engineering with AI and Digital Twins

How are AI and digital twins transforming infrastructure? What education and skills do we need to implement them in our businesses? What are the opportunities and challenges to adoption?

These were some of the questions explored at the Civil & Environmental Engineering (CEE) Department's first annual Spring Industry Workshop on AI & Digital Twins: The Future of Civil & Environmental Engineering. Nearly 100 industry leaders, experts, and academics gathered on campus and virtually to discuss the transformative power of AI and digital twin technologies in their field.

Applying it to the real can be challenging, digital twins enable AI algorithms to have robust analysis capabilities tailored for each infrastructure system. At the same time, AI algorithms enable digital twins to be up to date and provide insights to be used to effectively control the built environment.

The day-long event kicked off with keynote speaker Atul Khanzode, chief technology officer at DPI Construction, sharing insights on the company's early adoption of a digital twin platform in the architecture, engineering, and construction industry. Participants from over 20 unique organizations then heard from head of innovation lab at Oracle, Saurabh Kapur, who shed light on the transformative potential of AI-driven automation in reshaping the built environment. The final keynote speaker, Chris McComb, associate professor of mechanical

findings from his research on human relationships with AI as a tool and as a collaborator.

Engaging panel discussions dove deeper into the intricacies of AI and digital twin implementations, exploring the state of the art, opportunities, challenges, and the crucial enablers and barriers shaping the landscape. Panelists included Mario Berges, professor at CEE, Jessica Chambers, vice president of engineering and design technologies at Michael Baker International, and Sean Qian, professor at CEE.

The second panel, titled "Empowering the Future: Addressing Skills Gaps, Education, and Business Cases for AI & Digital Twin Technologies," offered a glimpse into the future workforce and the pivotal role of education in preparing the next generation of engineers for the challenges ahead.

"WE'RE CURRENTLY IN THE NEW WAVE OF AI WHERE ALGORITHMS ARE NO LONGER JUST PROCESSING DATA, BUT ALSO CONTEXTUALIZING IT TO HELP US PREDICT THE FUTURE!"
-BURCU AKINCI, CEE DEPARTMENT HEAD
AND PAUL CHRISTIANO, UNIVERSITY PROFESSOR



Hingbo Tang, associate professor at CEE, Katherine Hangan, assistant professor at CEE, Frank Frisby, CEE alumnus and technology enthusiast, and Olan Oumoussou, technical architect at Gannett Fleming spoke about designing relevant educational programs and fostering a culture of innovation to support the integration of AI and digital

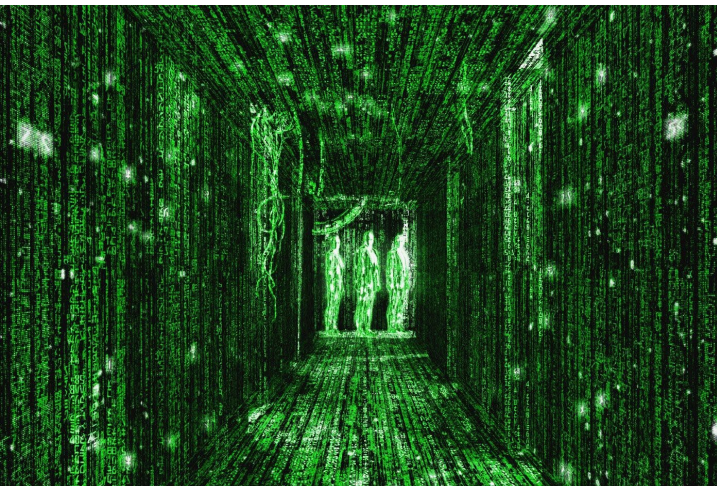
twins into engineering curricula and professional practice. Opportunities like CEE's AI Engineering online certificate program, designed to teach industry professionals how to bring these cutting edge technologies back to their organizations, are imperative for engineers to stay ahead in a fast-moving field.

The inaugural event concluded with CEE PhD student presentations and a networking happy hour. "The knowledge gained from these conversations between industry and academia experts are essential in advancing our understanding of these state-of-the-art technologies and in forging the future of our field," said Akinci.

Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

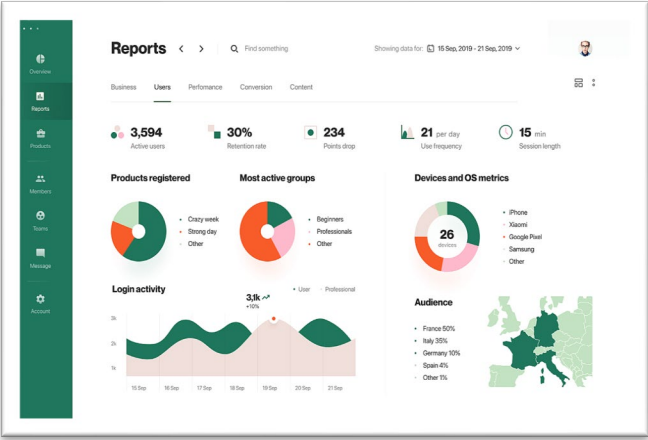
Hollywood Interpretation of AI and Digital Twins



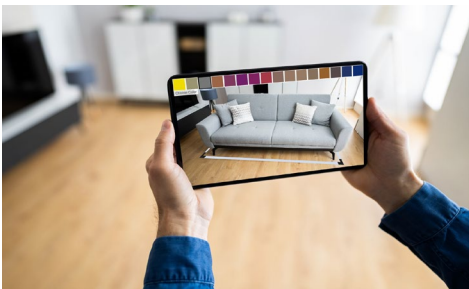
Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

Enabling Technologies for AI & Digital Twins



Data-Rich Dashboards and Visualizations



Augmented Reality (AR)



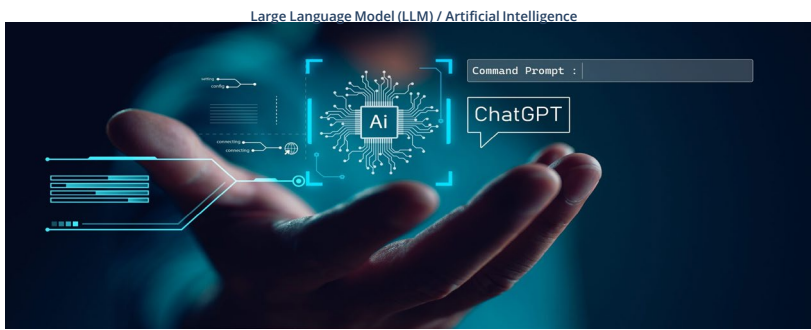
Consumer Robotics and Sensors



Physics-Based Gaming and Simulation (Unreal Engine / Unity3D)



Virtual Reality (VR)



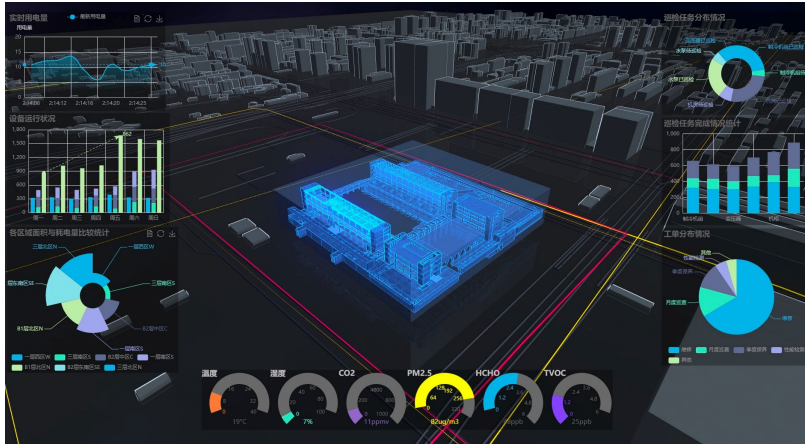
Lidar in our Pocket and on our Cars



Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

Emerging AI & Digital Twin Applications in Engineering



Facility-Scale Digital Twin (Dashboard)

Drone Bridge Inspection



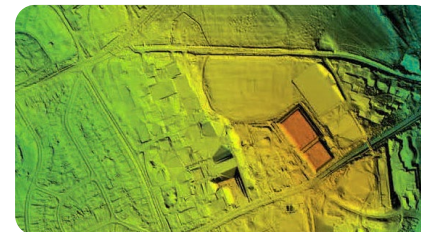
Augmented Reality for Utility Management



City-Scale Digital Twin (Hologram Projection)



3D Reconstruction
of
Bridge from Drone
Aerial



Lidar Aerial Imagery

Neighborhood-Scale Digital Twin (3D Model)

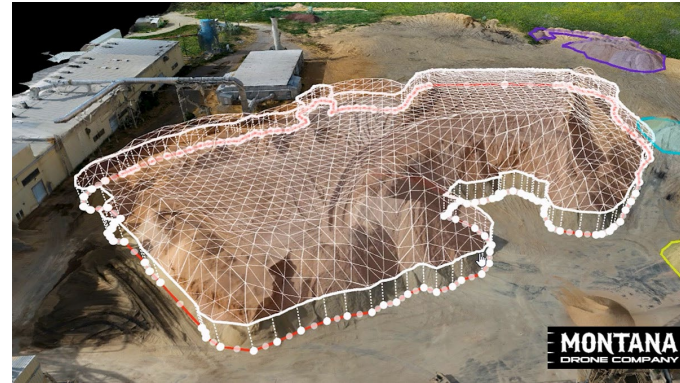


Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

Emerging AI & Digital Twin Applications in Engineering

Smart City Dashboard (3D Dashboard)



Drone-Enabled Construction Excavation Volumes



Smart LEDs in Connected Cities



Transportation Digital Twins & Autonomous Vehicles



Robotics
in Construction

Bridge Lidar Scan



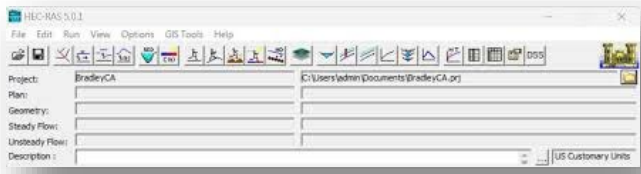
Augmented Reality Facility Management



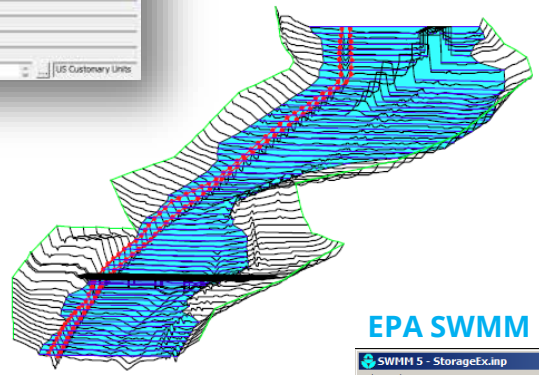
Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

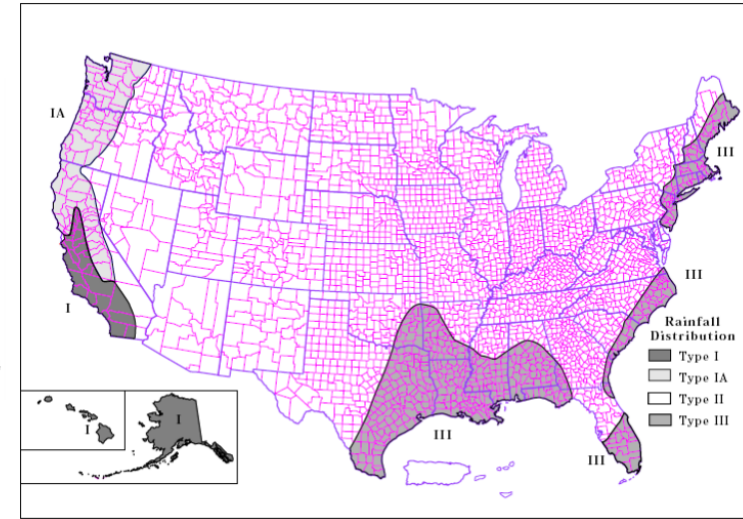
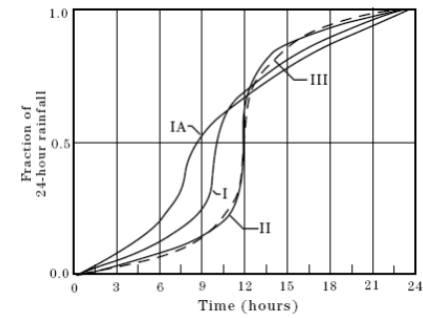
So... What about State of Technology for Water Resources?



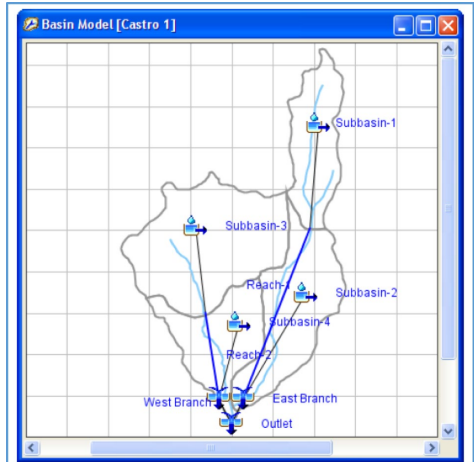
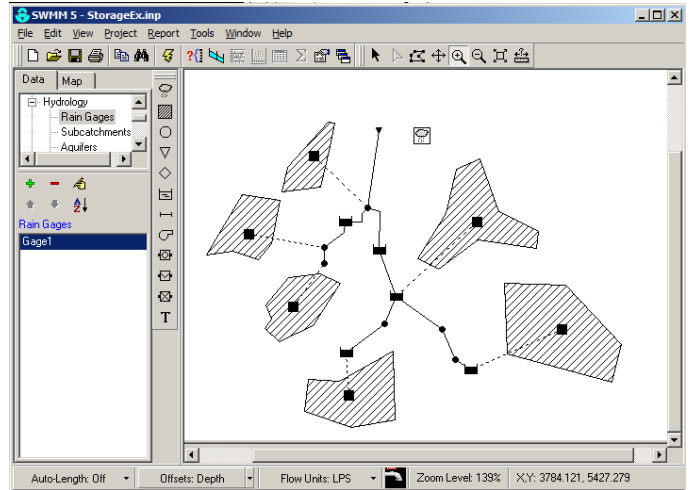
HEC-RAS



SCS Rainfall Distributions



EPA SWMM



HEC-HMS



TR-55

Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

So... What about State of Technology for Water Resources?

Hydrology & Rainfall-Runoff Models

Tool	First Release
SCS Curve Number Method (CN)	1954–1972
TR-20	1975
TR-55	1986
HSPF	1980
SWMM (EPA SWMM)	1971
HEC-HMS	1998
GSSHA	circa 2000–2002

Hydraulics & Flood Modeling Tools

Tool	First Release
HEC-2	1976
HEC-RAS 1.0	1995
HY-8	1993
FLO-2D	1988
TUFLOW	1992
MIKE 11/21/She/FLOOD	1970s–1990s

Stormwater System & Collection System

Tool	First Release
SWMM (again)	1971
XPSWMM	1984
InfoWorks CS / ICM	1990s (CS), ~2012 (ICM)
SewerGEMS	1990s
StormCAD / PondPack / FlowMaster	1990s

Green Infrastructure / LID Models

Tool	First Release
WinSLAMM	1990s
EPA LID Calculator	2012
SUSTAIN	2009
HydroCAD	mid-1980s

Watershed Planning & Pollutant

Tool	First Release
AGNPS	1980s
BASINS	1996
STEPL	2000
SLAMM	1970s–1980s
WARMF	1990s

Digital Twins & Predictive AI:

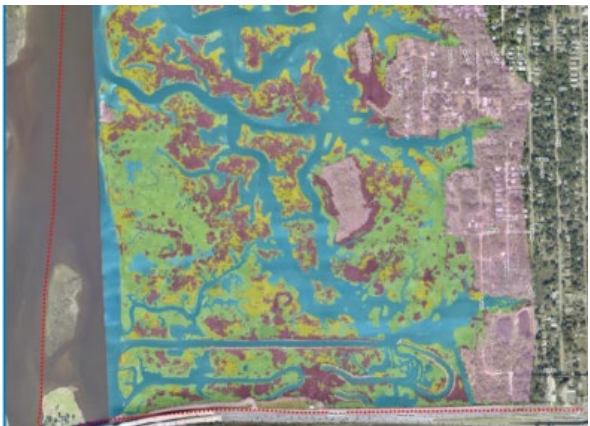
Applications in Stormwater Management, Watersheds and Flood Resilience

AI & Digital Twin Applications in Water Resources (Lagging, but Poised for Change)

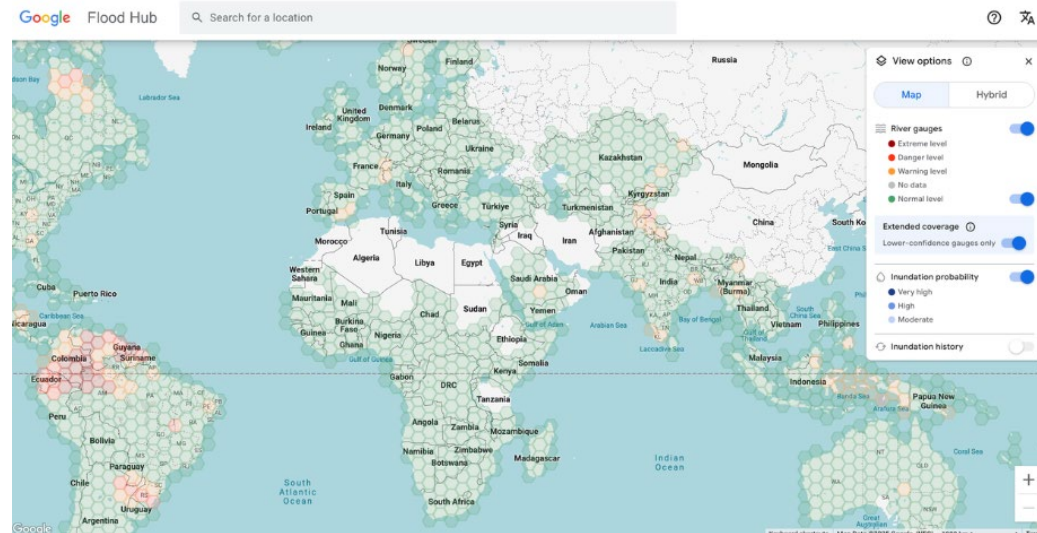


Flood Inundation Digital Twins

Foundational AI
Models for Land
Cover and
Habitat
Segmentation



Predictive
Flood Alerts



Predictive AI Smart Valves



Dam & Reservoir Digital Twins



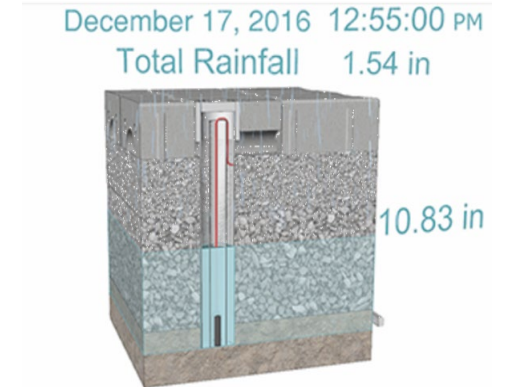
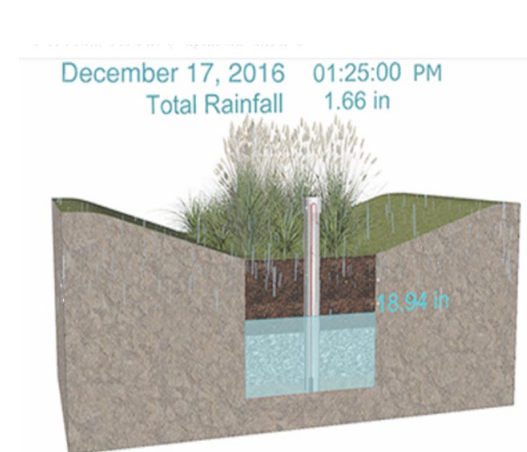
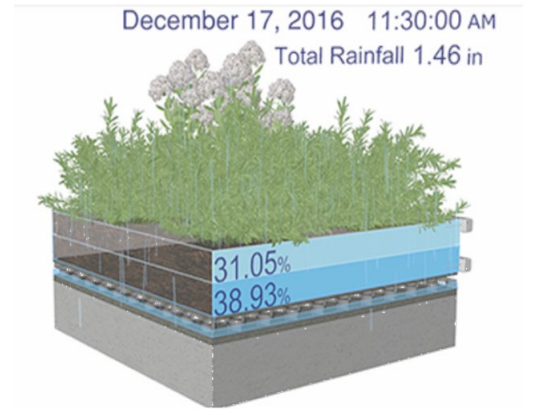
Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

AI & Digital Twin Applications in Water Resources (Lagging, but Poised for Change)



Panther Hollow Lake, Smart Valve

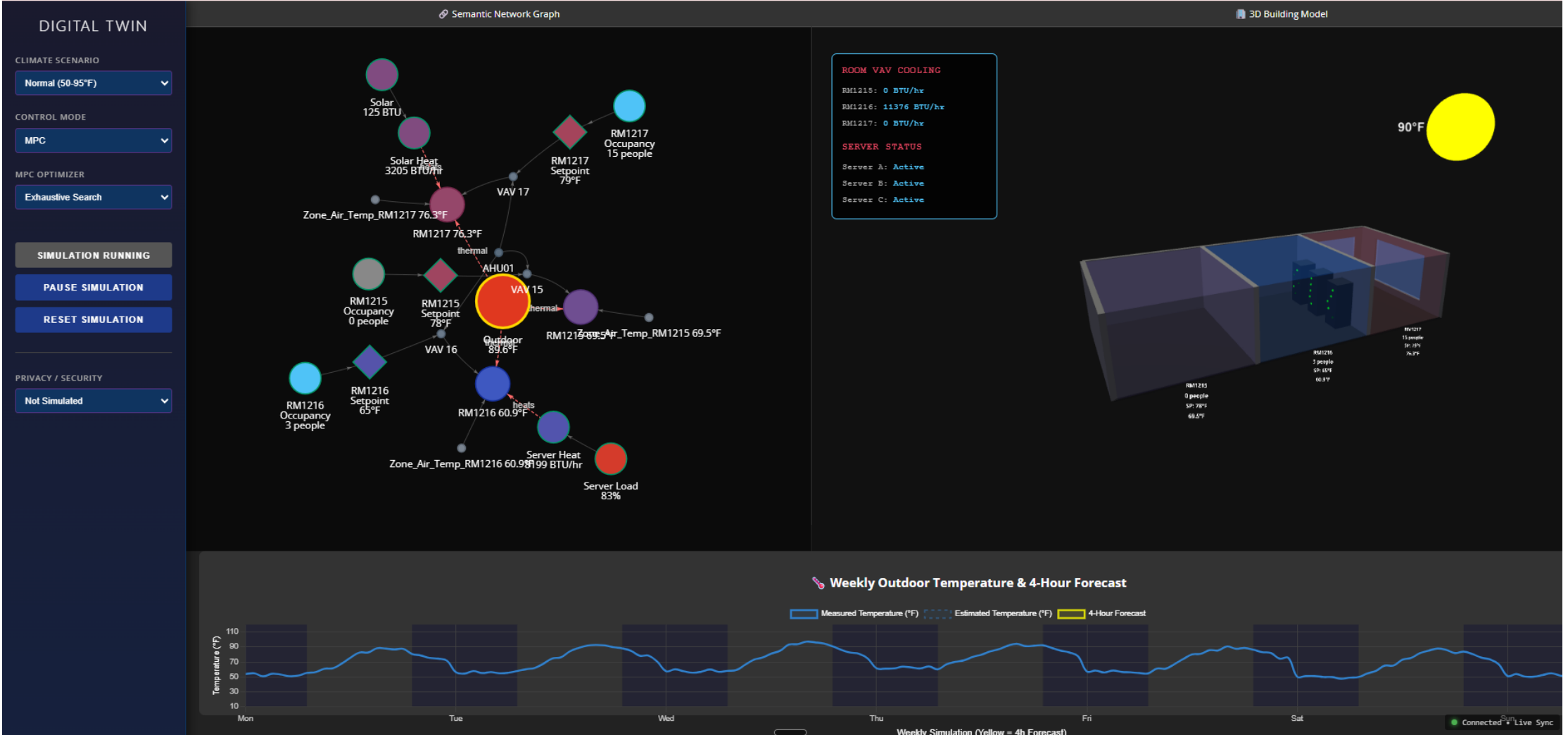


Westmoreland Conservation District, GSI Digital Twins

Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

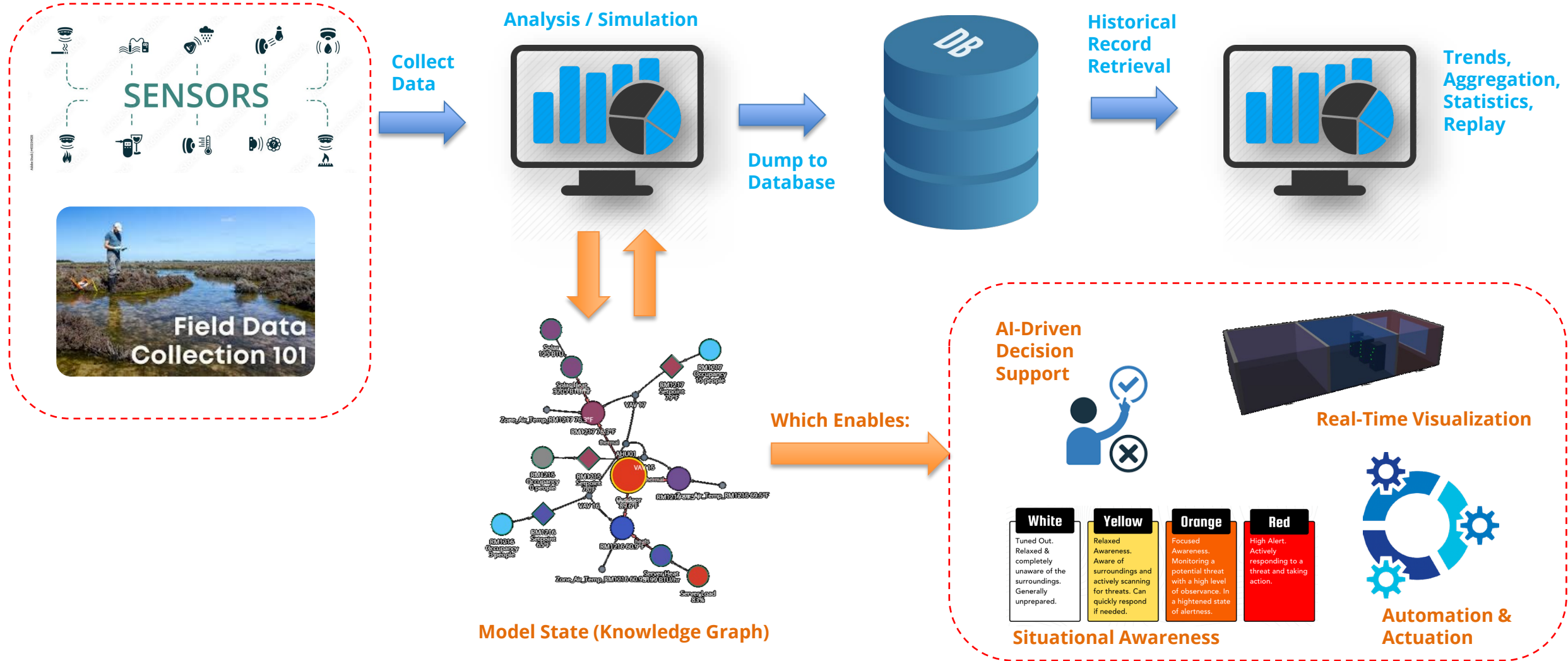
AI and Digital Twin Primer



Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

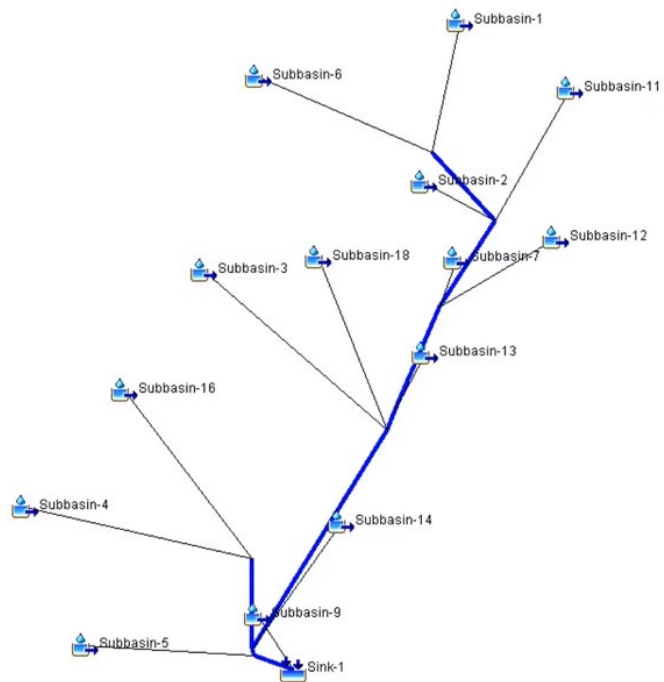
Powering AI / Digital Twins with Model State and Knowledge Graphs



Digital Twins & Predictive AI:

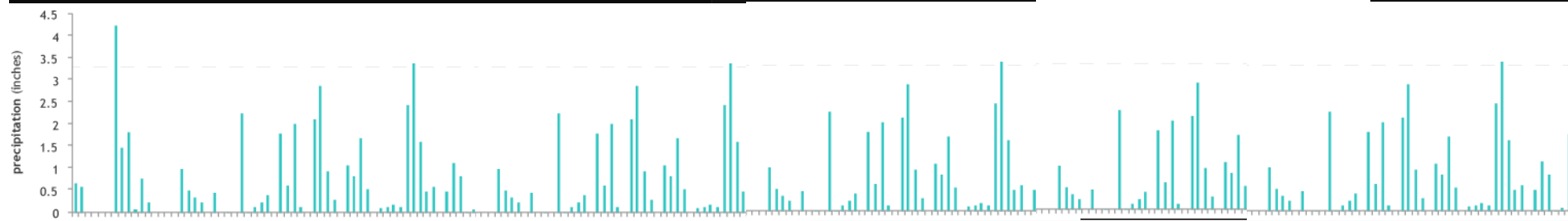
Applications in Stormwater Management, Watersheds and Flood Resilience

Towards a Collaborative AI & Digital Twin Vision for the Greater Pittsburgh Area



```
ROOM VAV COOLING
RM1215: 0 BTU/hr
RM1216: 11376 BTU/hr
RM1217: 0 BTU/hr

SERVER STATUS
Server A: Active
Server B: Active
Server C: Active
```

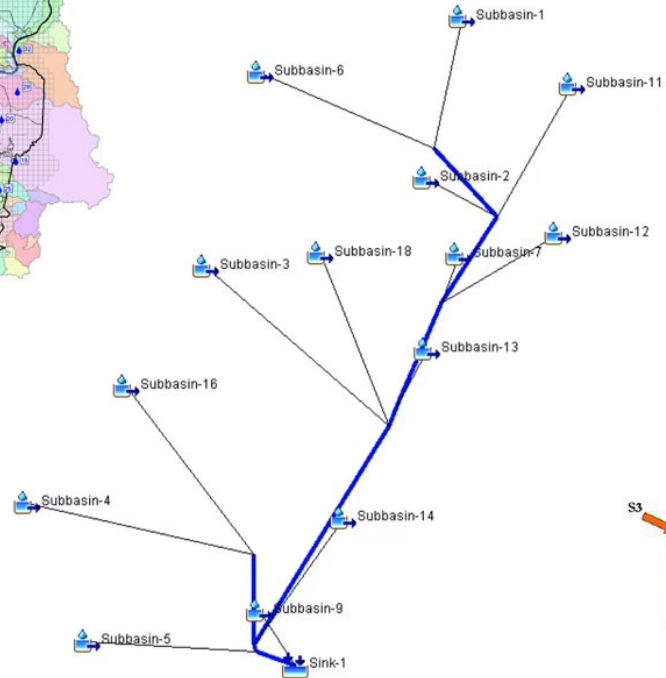
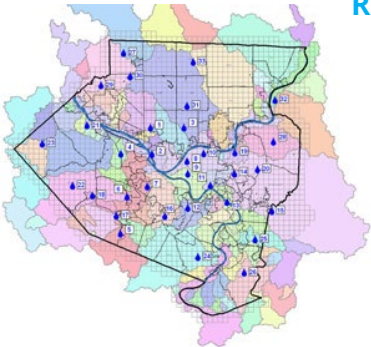


Digital Twins & Predictive AI:

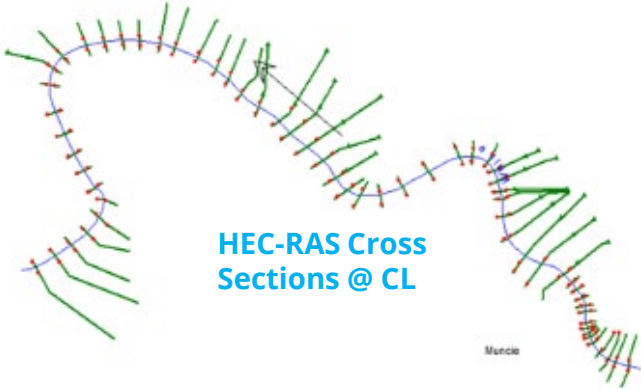
Applications in Stormwater Management, Watersheds and Flood Resilience

Towards a Collaborative AI & Digital Twin Vision for the Greater Pittsburgh Area

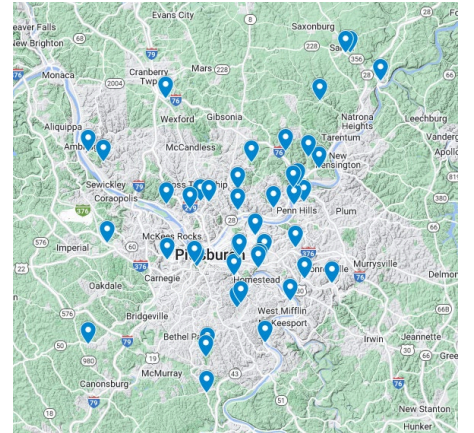
Rain Gauges



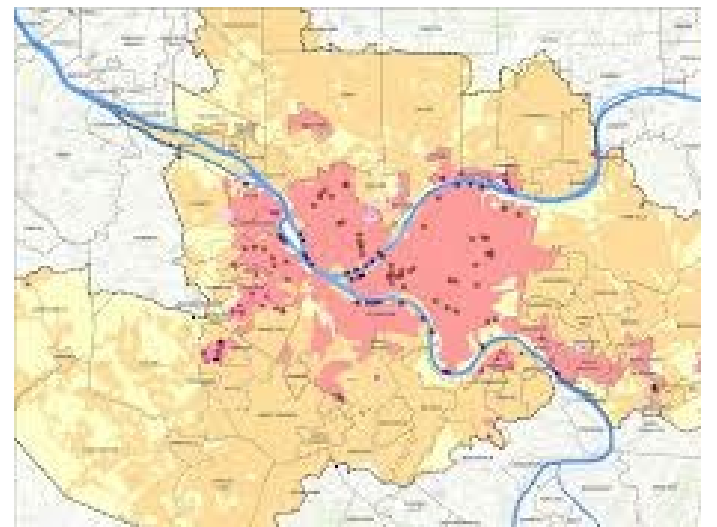
HEC-RAS Cross Sections @ CL



Water Quality Sampling Locations



CSO / SSO and Point Source Discharges

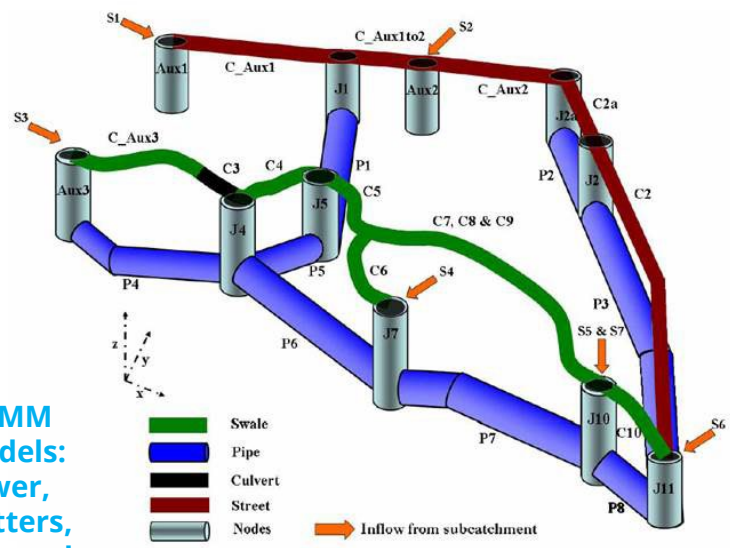


Groundwater and Gas Wells



Hydrology Knowledge Graph, HEC-HMS Derived

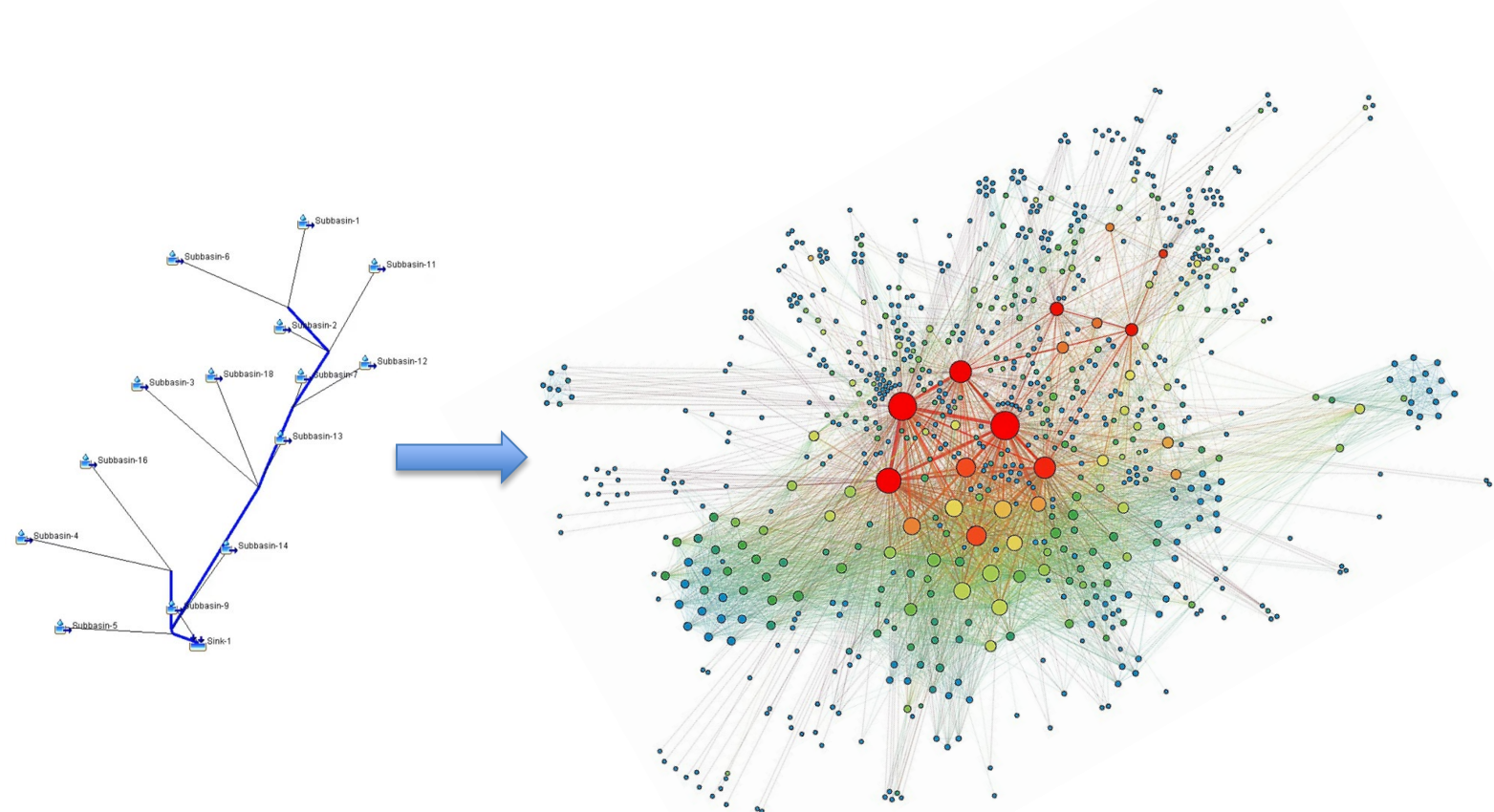
SWMM Models: Sewer, Gutters, Channels



Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

Towards a Collaborative AI & Digital Twin Vision for the Greater Pittsburgh Area



Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

Why This Matters: Unlocking AI and Real-Time Decision Support



We understand not just what flooded, but why.

Graph reasoning links causes: rainfall → soil moisture → storage → surcharge → overflow.



We stop reacting to storms and start anticipating them.

AI forecasts turn panic-driven operations into planned, proactive response.



Every storm becomes a learning opportunity.

Digital twins update their internal models after each event, improving predictions continuously.



We direct field crews where they matter the most.

Real-time insights triage maintenance, route personnel, and deploy resources with precision.



We make infrastructure investments defensible.

AI quantifies benefits, risks, costs, and ROI for GI, detention, culvert upgrades, and resilience projects.



Digital Twins & Predictive AI:

Applications in Stormwater Management, Watersheds and Flood Resilience

Questions



Contact Information

Damon Weiss, PE

damonweiss@ethoscollaborative.com

412.266.2492



Navigating Evolving Stormwater Regulations: A Technical Perspective

University of Pittsburgh
2025 IRISE Stormwater Symposium

December 4th, 2025

1

Common Acronyms

ABACT	Appropriate Best Available Combination of Technologies
BMP	Best Management Practice
CCD	County Conservation District
DP	Discharge Point
EP Analysis	Erosion Potential Analysis
MSC	Medium-Specific Concentration
NOT	Notice of Termination
NOV	Notice of Violation
PADEP	Pennsylvania Department of Environmental Protection
PAG	Pennsylvania General (Permit)
PDSC	Pre-Development Site Characterization
POA	Point of Analysis
POI	Point of Interest
SCM	Stormwater Control Measure



2

Today's Topics

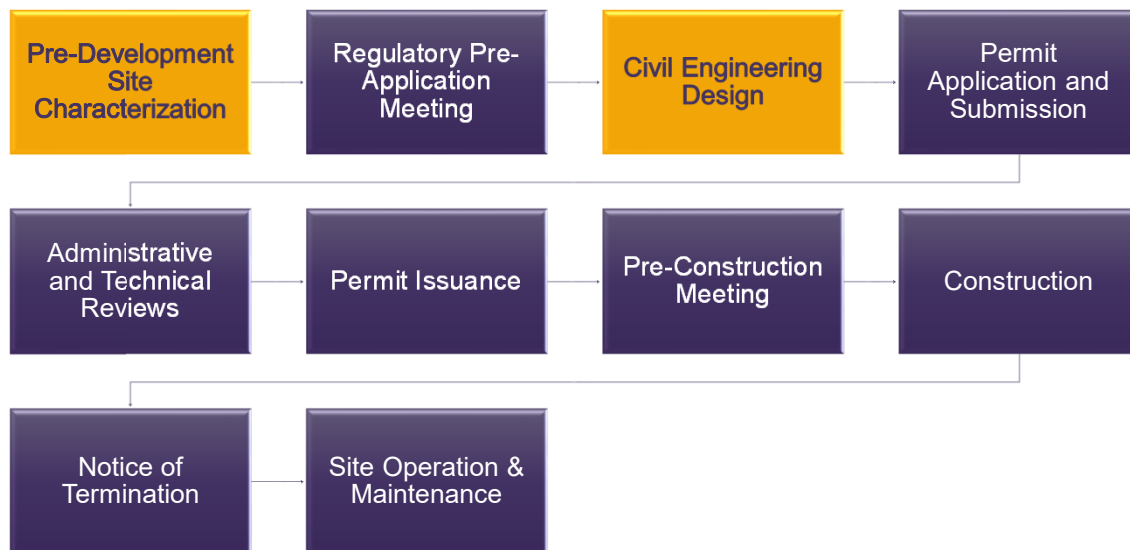
With an emphasis on how evolving regulations are impacting:

1. **Pre-Development Site Characterization (PDSC):** How pre-development site characterization shapes the project and establishes the framework for technical design
2. **Design:** Technical guidance updates intended to improve resilience of stormwater systems, impacts to site layout and design
3. **Key Takeaways**



3

Typical Steps



4

Typical Early Planning Activities

- Conceptual Site Layout
- Project Financing
- Existing Conditions Survey (NSPS/ALTA, Topographic, Boundary)
- **Phase I Environmental Site Assessment**
- **Preliminary Geotechnical Investigation**
- **Infiltration Testing**
- Streams and Wetlands Delineation
- Cultural Resources Desktop Assessment
- Traffic Impact Study



5

Contaminated Soils?

4. Soils in the area of the earth disturbance are not contaminated at levels exceeding residential or non-residential medium-specific concentrations (MSCs) in 25 Pa. Code Chapter 250 at residential or non-residential construction sites, respectively, unless a site-specific standard has been met or evidence is provided that the contamination is naturally occurring or the result of widespread atmospheric deposition.

☐ True

☐ False

- Consideration of past site uses
- Consideration of adjacent property site uses
- Phase I Environmental Site Assessment (ESA)
- Phase II ESA

19. ☐ An Environmental Site Assessment (ESA) has been completed ☐ Soil samples have been analyzed

20. The site is currently or was previously enrolled in DEP's Act 2 Program. ☐ Yes ☐ No

21. Act 2 cleanup standards have been met. ☐ Yes ☐ No



6

Contaminated Soils Technical Implications



- Evaluation of site contamination is helpful early in project timeline
- Will impact location of stormwater management features
- Will impact anticipated permitting framework and timeline



7

Typical Early Planning Activities

- Conceptual Site Layout
- Project Financing
- Existing Conditions Survey (NSPS/ALTA, Topographic, Boundary)
- **Phase I Environmental Site Assessment**
- **Preliminary Geotechnical Investigation**
- **Infiltration Testing**
- Cultural Resources Desktop
- Traffic Impact Study



8

Infiltration Testing

- Goals:
 - Assess the potential for infiltrating stormwater into the soil
 - Assess existence of limiting layers (bedrock, seasonal high groundwater table)
- Before 2025:
 - Two infiltration tests (averaged result) at bottom elevation of designed stormwater facility
- Now:
 - 1 infiltration test per 40,000 sf of project area, subject to exclusions
 - Still requires infiltration testing at bottom elevation of designed stormwater facility
- Future (Updated PCSM Manual):
 - TBD



9

Double-Ring Infiltrometer Method



- Typically requires test pit excavation to reach anticipated SCM bed bottom elevation
- Identification of limiting layers - easier
- Simultaneous testing - challenging



10

Cased Borehole Permeameter Method



- Can be concurrent with geotechnical investigation mobilization
- Identification of limiting layers - challenging
- Simultaneous testing - easier



11

Infiltration Testing Technical Implications



Site Infiltration Potential	Infiltration Rate	Implications
Limited	≤ 0.25 inch / hour	• Managed Release Concept (MRC)
Marginal	0.25 inch / hour to 0.4 inch/hour	• SCMs to be sited where infiltration is favorable • Site to be designed around those SCMs
Feasible	≥ 0.4 inch/hour	

- Follow-up mobilization to support detailed design
- Post-construction confirmation infiltration testing



12

Today's Topics

With an emphasis on how evolving regulations are impacting:

1. **Pre-Development Site Characterization (PDSC):** How pre-development site characterization shapes the project and establishes the framework for technical design
2. **Design:** Technical guidance updates intended to improve resilience of stormwater systems, impacts to site layout and design
3. **Key Takeaways**



13

Design

- **PCSM Design Parameters**
 - Stormwater Runoff Rate (reduce post-development flows to pre-development)
 - 2-year, 24-hour Volume management
 - Water Quality (TSS, TP, TN)
- **New Analyses**
 - Thermal Impacts Analysis
 - Erosion Potential Analysis
 - Discharges to Wetlands Analysis



14

PCSM – Rate, Volume, and Water Quality

- Precipitation Depth Projections
- Synthetic Rainfall Distribution Curves
- Stormwater Modeling Approach
- Managed Release Concept

The PADEP draft PCSM manual, when finalized, is anticipated to have appendices containing technical guidance. As regulatory requirements and industry understanding of stormwater management and treatment evolve, these technical appendices are anticipated to be updated independently of one another and/or iteratively.



15

Precipitation Depth Projections

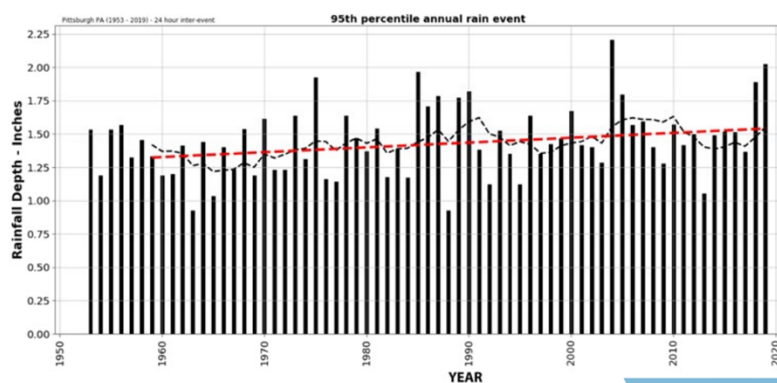


Figure 2.2. Observed 95th Percentile Rain Event at the Pittsburgh International Airport from 1953 to 2019

19

The City of Pittsburgh Stormwater Design Manual

95th percentile rainfall event. The 95th percentile rainfall event represents a precipitation amount which 95 percent of all rainfall events for the period of record do not exceed. In more technical terms, the 95th percentile rainfall event is defined as the measured precipitation depth accumulated over a 24-hour period for the period of record that ranks as the 95th percentile rainfall depth based on the range of all daily event occurrences during this period.



16

NRCS Synthetic Rainfall Distribution Curves

- A September 2022 NPDES Permit Technical Review Comment – portending methodology updates

102.8(f)(8); NOAA rainfall was used with a Type II distribution curve. NOAA rainfall data is compatible with NOAA distribution curves. Discuss why this methodology was chosen. Modify the calculations/submission as necessary.

- §102.8(f): *PCSM Plan contents.* The PCSM Plan must contain drawings and a narrative consistent with the requirements of this chapter. The PCSM Plan shall be designed to minimize the threat to human health, safety and the environment to the greatest extent practicable. PCSM Plans must contain at a minimum the following:
 8. Supporting calculations.



17

NRCS Synthetic Rainfall Distribution Curves

NOAA

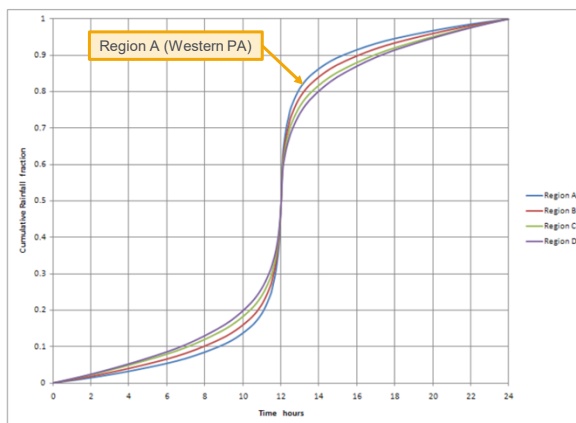


Figure A3-1, Plots of the Ohio Valley and neighboring states rainfall distributions.

SCS

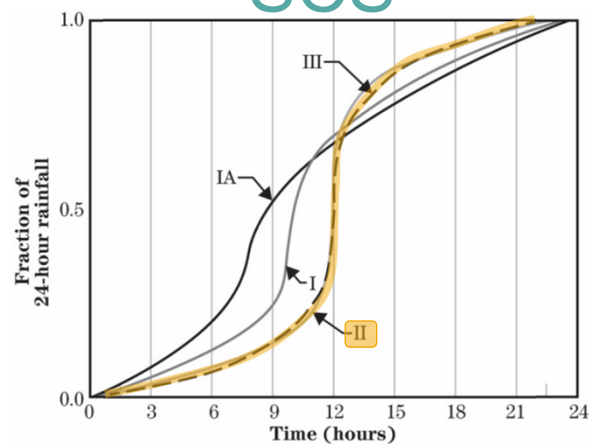


Figure 4-29: Plot of Types I, IA, II, and III Synthetic Rainfall Distributions



18

Stormwater Modeling Approach - Volume

- Draft PCSM Manual:

Table F-1: Volume Management Analysis Methods

Volume Management Analysis Methods*	Design Storm	Water Balance	Continuous Simulation
Discharge Volume Used to demonstrate Volume Management	2-year/24-hour volume, unless MRC, engineered stormwater treatment wetland, or stormwater capture and use [†]	90% of annual volume for rainfall events up to an including the 1.2-inch storms on a 24-hour basis	2-year/24-hour volume, unless MRC, engineered stormwater treatment wetland, or stormwater capture and use [†]
Geomorphologic Management [†]	Required for MRC, engineered stormwater treatment wetland, and stormwater capture and use [†]		
Expected Application of Volume Management Analysis Method	For non-complex sites in which a more in-depth analysis of SCM processes is not needed to assess performance	Sites with resilient SCMs whose analysis are not well represented by design storm**	For complex sites and sites in which a more in-depth analysis of SCM processes provides a better understanding of the long-term SCM performance
Applicability to SCMs	Applicable to all SCMs	Limited**	Applicable to all SCMs



19

Stormwater Modeling Approach - Rate

- Draft PCSM Manual
- Design Storm (statistical approach)
- Storm of Record
 - Used in conjunction with continuous simulation modeling
 - Rainfall based on 5 recorded storm events ranging from the upper and lower bounds of the 90% confidence interval of predicted rainfall depths



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Stormwater Modeling Approach - Quality

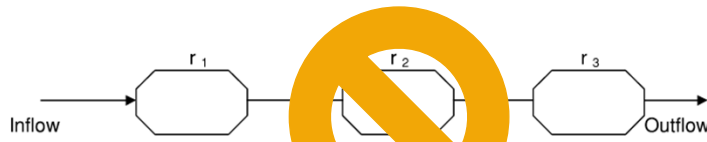


Fig. 8-1 BMPs Connected in Series

SCMs in Series
("Treatment Train")

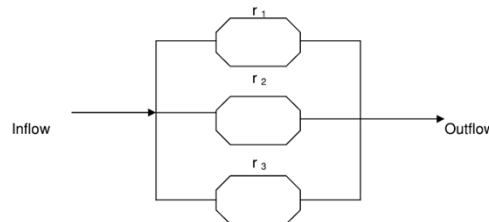


Fig. 8-2 BMPs Connected in Parallel

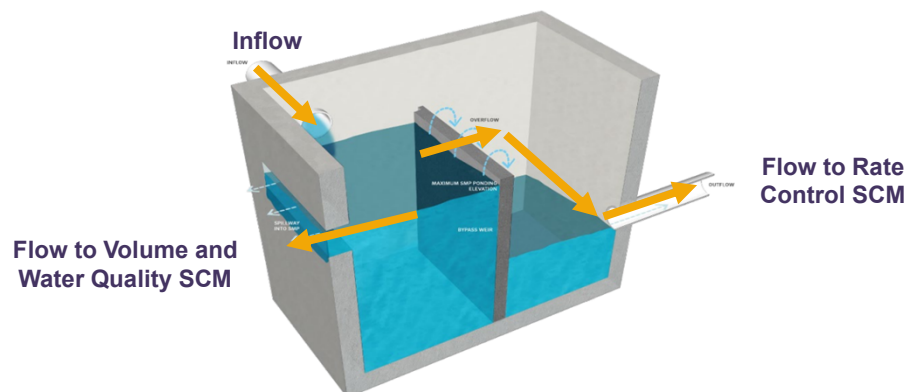
SCMs in Parallel
("Flow Splitting")



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Stormwater Modeling Approach - Quality

Figure J-6: Flow splitter example (P3/D 2020)



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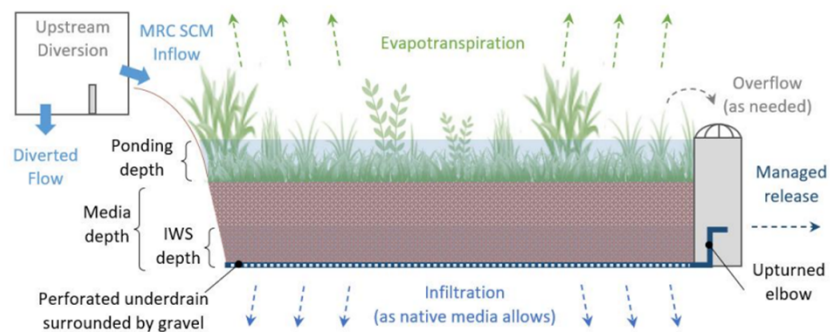


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Managed Release Concept

- White paper version 1.5 released August 15, 2025
- Controlled release rate for the 1.2-inch, 2-hour storm event = 0.02 cfs
- Cumulative/compounding credit “penalties” for design deviations.

Figure 1: MRC Bioretention SCM with Internal Water Storage (IWS) and Upturned Elbow



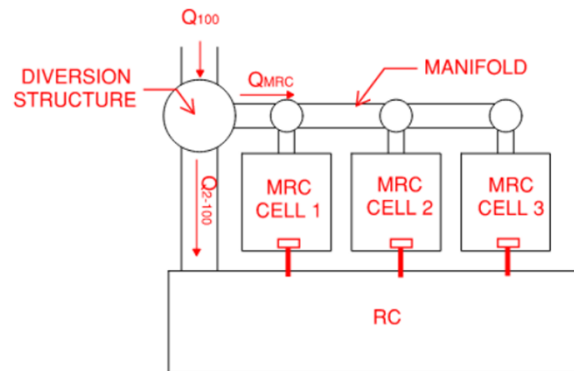
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Managed Release Concept

Design Parameter	Standard
MRC SCM Type	MRC Bioretention
Maximum Drainage Area	1 acre
Maximum Equivalent Impervious in Drainage Area	0.5 acre
Maximum Flow (Storm Event) Routed to SCM	2-year/24-hour storm (higher flows are diverted or bypassed)
Maximum Ponding Time	72 hours
Minimum Soil Media Depth (includes a minimum of 1 foot IWS)	2 feet
Maximum Ponding Depth @ 2-Year/24-Hour Storm	1.5 feet (or 6 inches above the Ponding Depth @ 1.2-Inch/2-Hour Storm)
Maximum Ponding Depth @ 1.2-Inch/2-Hour Storm	1 foot (no overflow)
Controlled Release Rate for 1.2-Inch/2-Hour Storm	0.02 cfs/acre equivalent impervious
Underdrain Outflow Rate for 1.2-Inch/2-Hour Storm	≤ Controlled Release Rate
Post-Construction 2-Year/24-Hour Peak Rate	Managed Back to Pre-Construction 1-Year/24-Hour Peak Rate in a Separate SCM as necessary
Separation Distance to Groundwater or SHWT, minimum (ft)	1 foot (2 feet recommended)

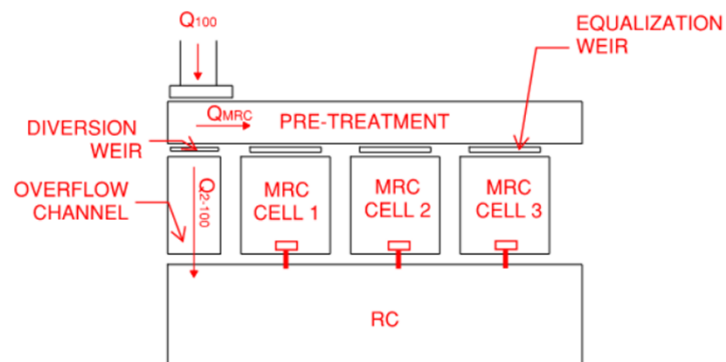
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Managed Release Concept



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Managed Release Concept



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PCSM Rate, Volume, and Water Quality Technical Implications



- Upcoming revised PCSM Manual and alternate design methodologies are anticipated
- Larger percentage of site needed to meet stormwater management design goals and criteria
- MRC guidance will continue to evolve
- Achievement of required PCSM credits will be aided by designs that include flow splitting and meeting fundamental design criteria from latest guidance document(s) (e.g., PCSM Manual, technical white papers, etc.)



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Design

- PCSM Design Parameters
 - Stormwater Runoff Rate (reduce post-development flows to pre-development)
 - 2-year, 24-hour Volume management
 - Water Quality (TSS, TP, TN)
- New Analyses
 - Thermal Impacts Analysis
 - Erosion Potential Analysis
 - Discharges to Wetlands Analysis



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Thermal Impacts Analysis

- Draft guidance released October 14, 2025
- Intended to evaluate the impact of PCSM SCM discharge temperature on receiving watercourse during summer months (June through September) when likelihood of exceeding state water quality standards for temperature is highest
 - **Thermal Analysis Scenario** – Select from the dropdown list the scenario for thermal analysis (corresponding with PCSM Module 2):
 - **Scenario 1** – One or more peak rate control SCMs are proposed that will receive stormwater from a drainage area containing more than 25% impervious surface. Only the last peak rate control SCM in a series of SCMs, which discharges to a surface water or conveyance to a surface water, should be considered for this scenario.
 - **Scenario 2** – A Wet Basin or Engineered Stormwater Treatment Wetland is proposed that does not include shading and/or a reversed slope outlet pipe and discharges to a surface water or conveyance to a surface water.
 - NOTE** – If both Scenarios 1 and 2 apply to an SCM, select Scenario 1.
 - **Scenario 3** – There will be post-construction undetained areas, within the limit of disturbance, that contain impervious surface.



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Erosion Potential Analysis

- Design team to evaluate impact of concentrated stormwater runoff from discharge point to receiving waterbody (stream or wetland)
- Requires detailed existing conditions information, which may require another mobilization to site
- Off-site discharge to another property (different owner) requires indication of permission to discharge

6. Will stormwater flow off the project site through properties owned by others prior to reaching a surface water or storm sewer during or following construction? ☐ Yes ☐ No

If Yes to #6, has an easement been obtained? ☐ Yes ☐ No

NOTE – The applicant is expected to: 1) secure legal authority for discharges on or through property not owned by the applicant; 2) provide for adequate E&S controls and a stable conveyance as necessary to prevent accelerated erosion; and 3) complete an EP Analysis when necessary according to the NOI Instructions.



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Discharges to Wetlands

- Not special protection (HQ/EV)
- Intent is to preserve hydrology of the existing wetland
- 2-year, 24-hour design storm event evaluation of pre- and post-development stormwater runoff



6. ☐ There are pre-construction stormwater discharges to wetlands from the project site.					
Wetland ID	Pre-Construction		Post-Construction		
	Drainage Area (ac)	Volume (CF)	Drainage Area (ac)	Volume (CF)	Ponding Depth Increase or Decrease (±%)



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New Analyses Technical Implications



- Managing runoff from impervious surfaces with multiple SCMs will help to mitigate thermal impacts
- Evaluation of concentrated sources of stormwater runoff (point source discharges)
- Offsite flowage/stormwater easements may be required
- Preservation of hydrology of existing wetlands



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Key Takeaways



- Evaluation of site contamination is helpful early in project timeline. It will impact location of stormwater management features, anticipated permitting framework, and timeline.
- Infiltration will drive siting of PCSM SCMs which will drive site layout. Potential for larger percentage of site to be dedicated to stormwater management.
- Follow-up site mobilizations may be needed to support detailed design and construction.
- Evaluation of offsite flow and associated stormwater/flowage easements
- Preservation of hydrology of existing wetlands



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Questions?



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Contact Information



Rachel A. Upadhyay, P.E.

Civil & Environmental Consultants, Inc.

Pittsburgh Office

700 Cherrington Parkway, Moon Township, PA 15108

Mobile: 412.216.5895

Email: rupadhyay@cecinc.com

www.linkedin.com/in/rachelupadhyay

www.cecinc.com



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Resources

- [Construction Stormwater \(pa.gov\)](http://pa.gov)
- [Civil & Environmental Consultants, Inc. \(cecinc.com\)](http://cecinc.com)
- [25 Pa. Code Chapter 102. Erosion And Sediment Control \(pacodeandbulletin.gov\)](http://pacodeandbulletin.gov)
- [- DEP eLibrary \(pa.gov\)](http://pa.gov)
- [E&S Resources | Department of Environmental Protection | Commonwealth of Pennsylvania](#)



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