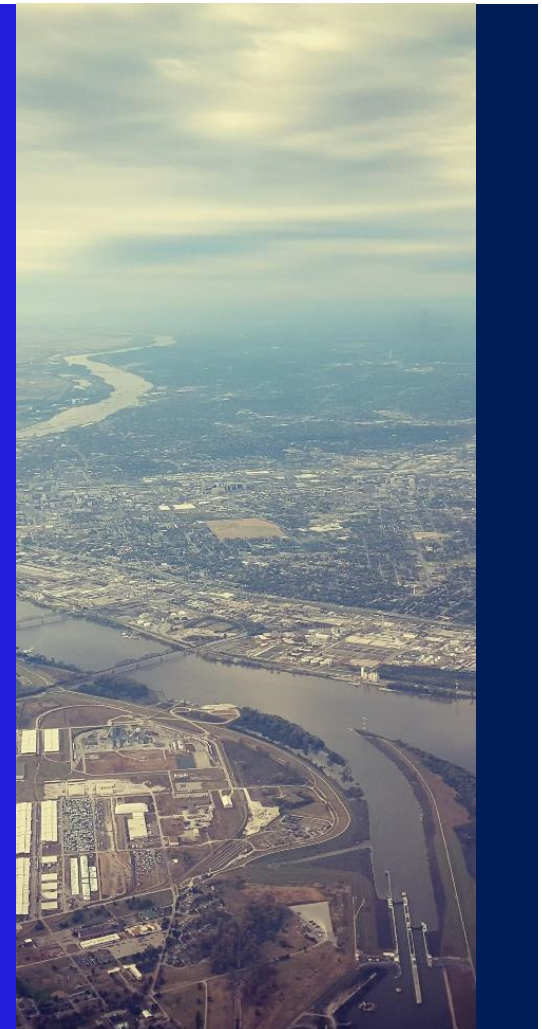


Driving Community Improvement Through Urban Flood Mitigation



In the kNOW Webinar Series

Nov. 17, 2020



Welcome & Introductions

Why This Issue is Important

- Adam Hosking, Jacobs, Vice President, Global Director for Water Resources

Understanding and Mitigating Urban Flooding

- Erik Haniman, Linear Asset Planning Manager, Philadelphia Water Department, PA, USA
- Elise Ibandahl, Jacobs, Global Technology Leader | Flood Modelling & Planning

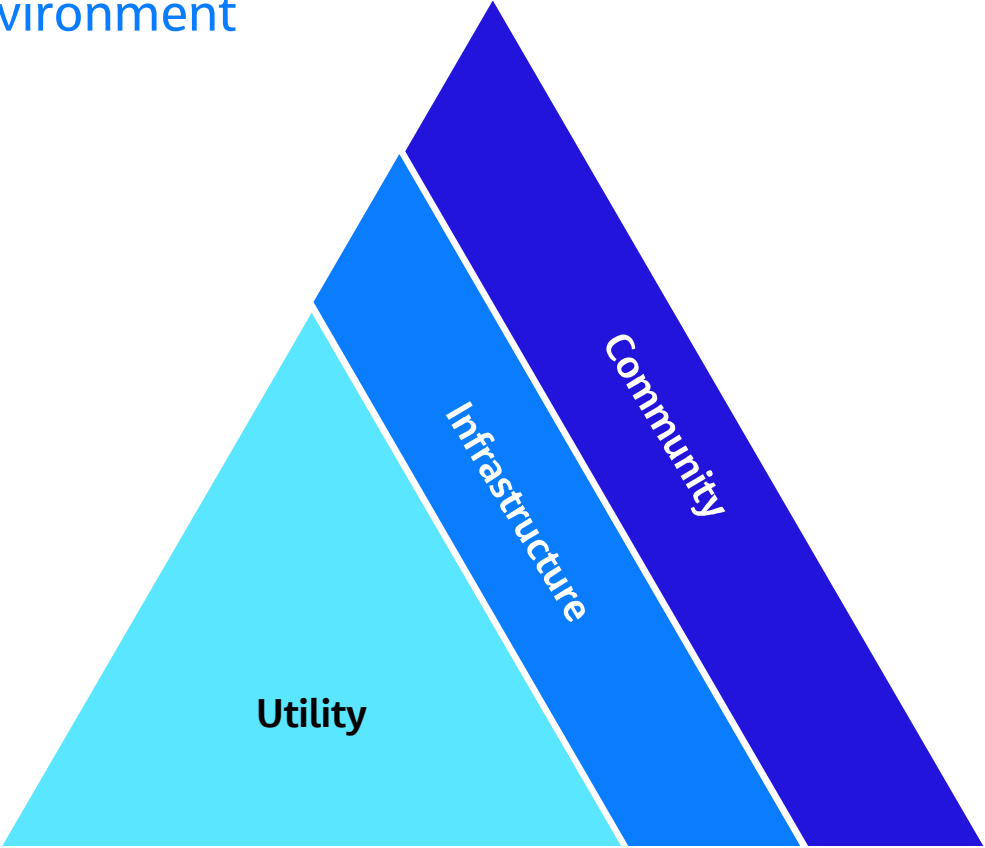
Community Engagement & Opportunity in Urban Flood Mitigation

- Lisa Koerkenmeier, Director of Planning and Development, City of Brentwood, MO, USA
- Phil Blonn, Jacobs, Senior Subject Matter Expert | Flood Mitigation

Questions & Answers

What is Urban Flooding?

Inundation by flood waters in an "urban" environment

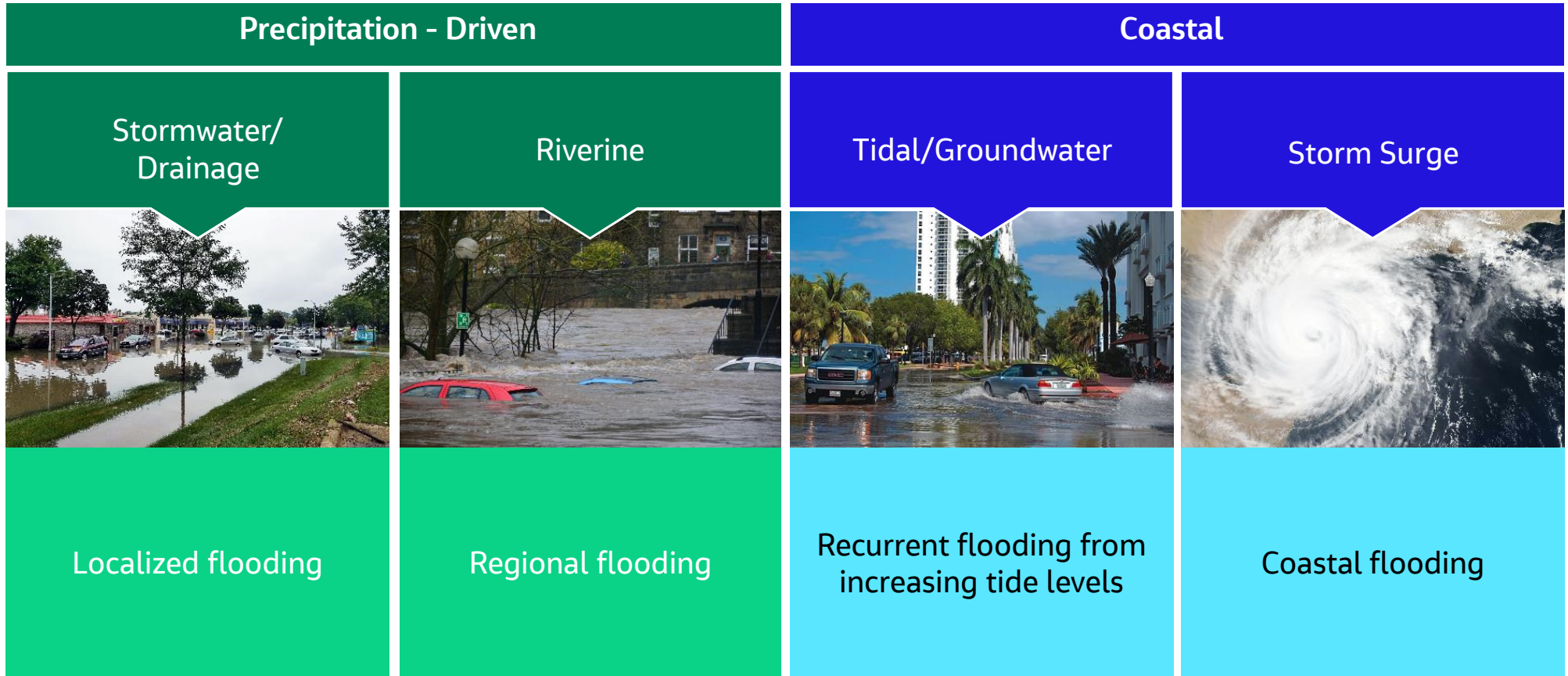


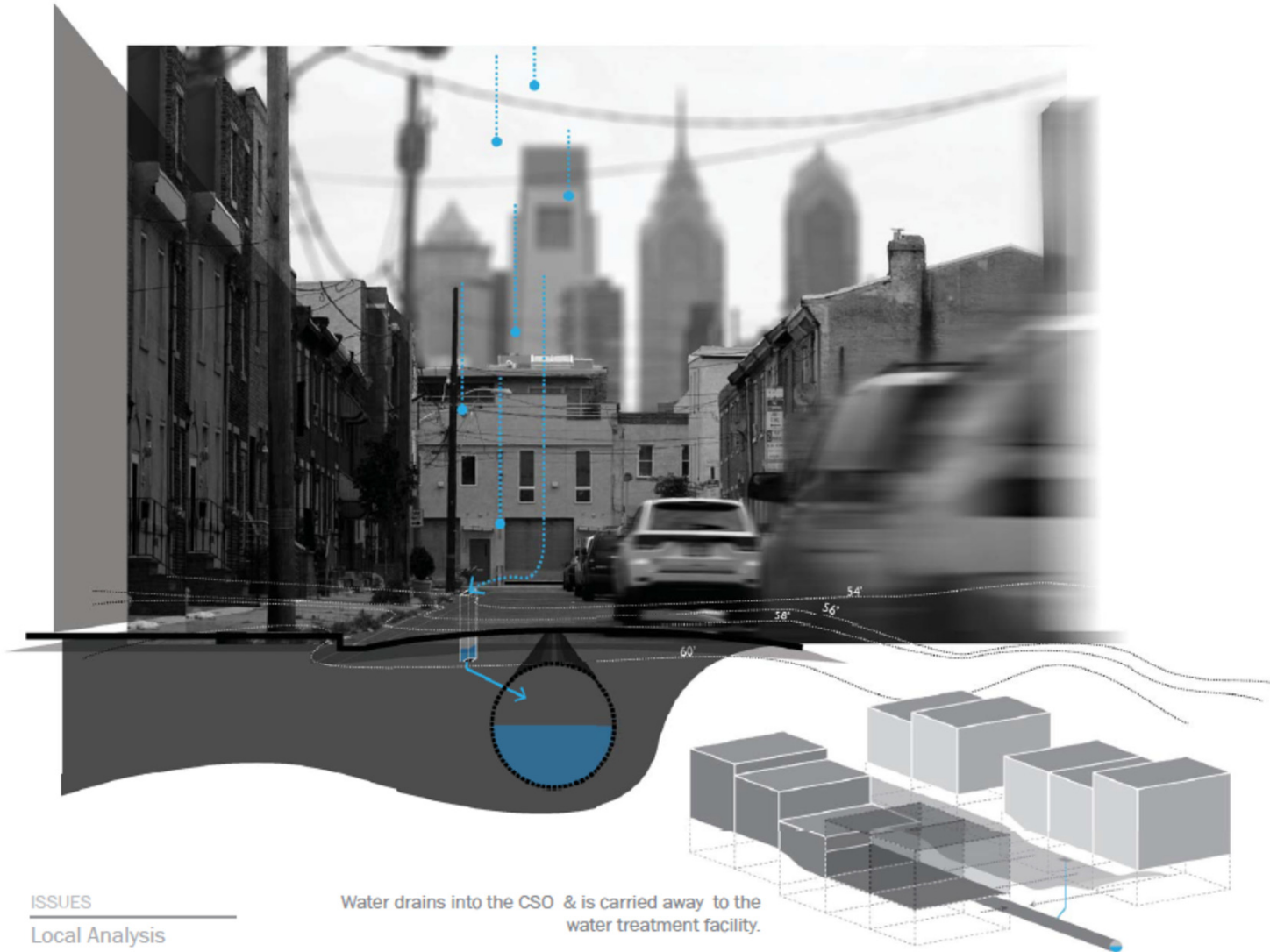
Understanding and Mitigating Urban Flooding

Erik Haniman, Linear Asset Planning Manager,
Philadelphia Water Department, PA, USA

Elise Ibendahl, Jacobs, Global Technology Leader
Flood Modelling & Planning

Urban Flooding: Many Causes, Many Challenges



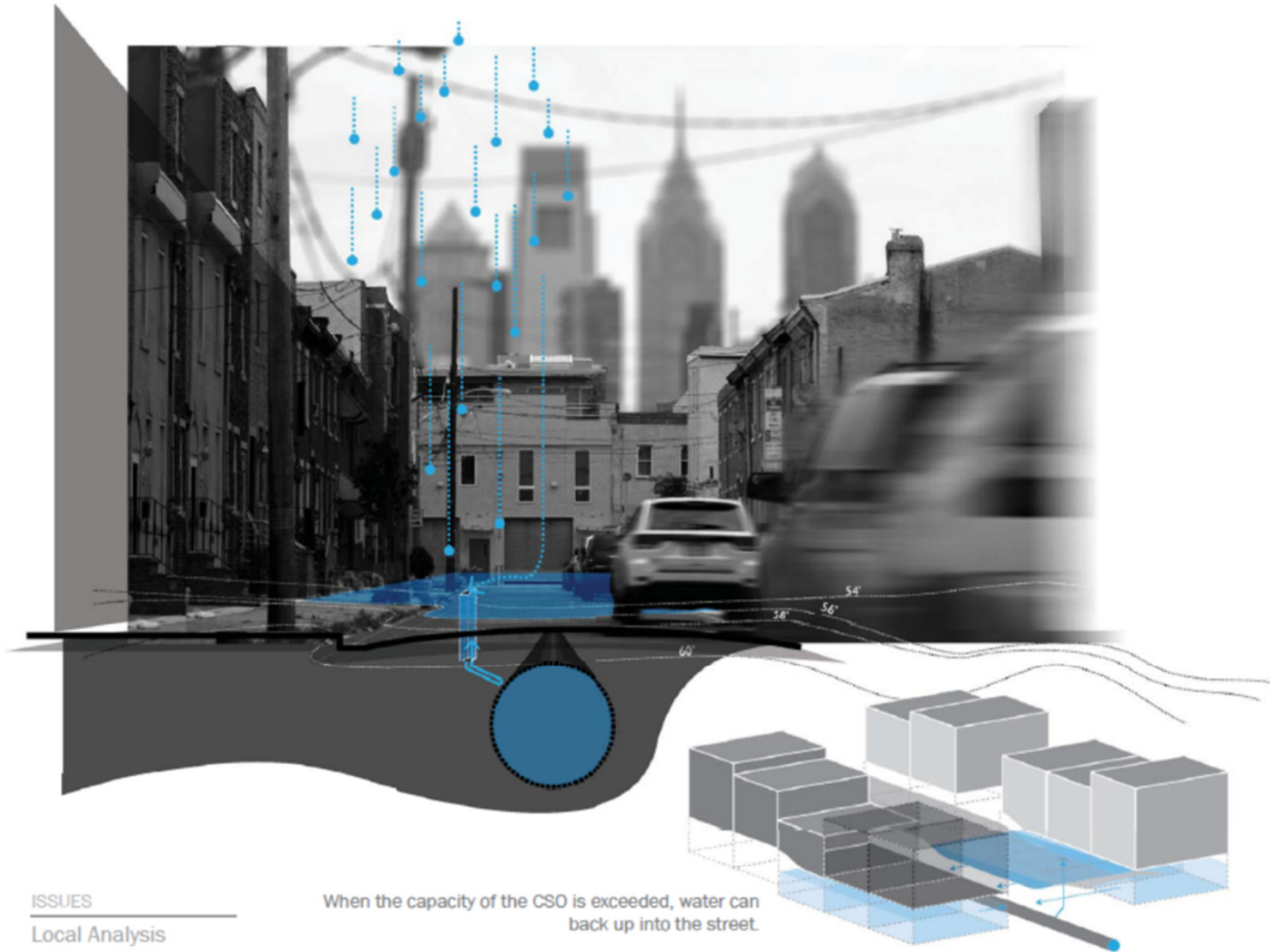


ISSUES

Local Analysis

Water drains into the CSO & is carried away to the water treatment facility.

SECTION-PERSPECTIVE OF A CSO PIPE - NORMAL RAIN EVENT



ISSUES

Local Analysis

SECTION-PERSPECTIVE OF A CSO PIPE - EXTREME RAIN EVENT

Multi – Function Solutions Are Essential

Structural

- Tunnels (CSO + flood)
- Storage (CSO + flood)
- Conveyance (CSO + flood)
- Green Infrastructure
- Barriers, Gates, Levees, Pumps
- Floodproofing
- Structural Elevation
- Small-Scale Property Specific Improvements
- Design – factor of safety

Non-structural

- Emergency Action Plans (manage impacts)
- Understand the problem (studies/data)
- Policy Modification (including local development/redevelopment)
- Community Engagement
- Risk Education/Data
- Property Acquisition + Relocation
- Incorporate cloudburst-based rainfall into design standards
- Homeowner financial assistance and how-to resources for localizes issues (i.e., backflow prevention, simple floodproofing)
- Realtime Monitoring/Controls
- Insurance
- Integration with CWA obligation

Resilient Communities

- Understand History, Cause and Risk
- Choose to adapt
- Tolerate and rebound
- Embrace OneWater
- Shape policy
- Engage
- Partner
- Invest financially
- Increase insurance

Resilient Urban Flood Mitigation

Healthy Infrastructure

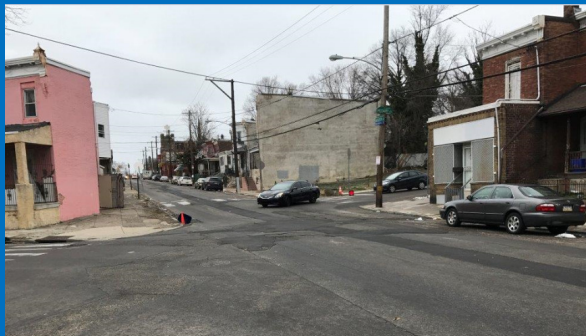
Integrating Policy, Outreach, Education,
and Financial Assistance





PHILADELPHIA WATER

DEPARTMENT



PRESENTATION OVERVIEW

1. Problem Evolution
2. Mission Statement
3. Study Process
4. Selected Alternatives
5. Path Forward

THE EVOLUTION OF THE WINGOHOCKING WATERSHED



PHILADELPHIA
WATER
DEPARTMENT



THE EVOLUTION OF THE WINGOHOCKING WATERSHED



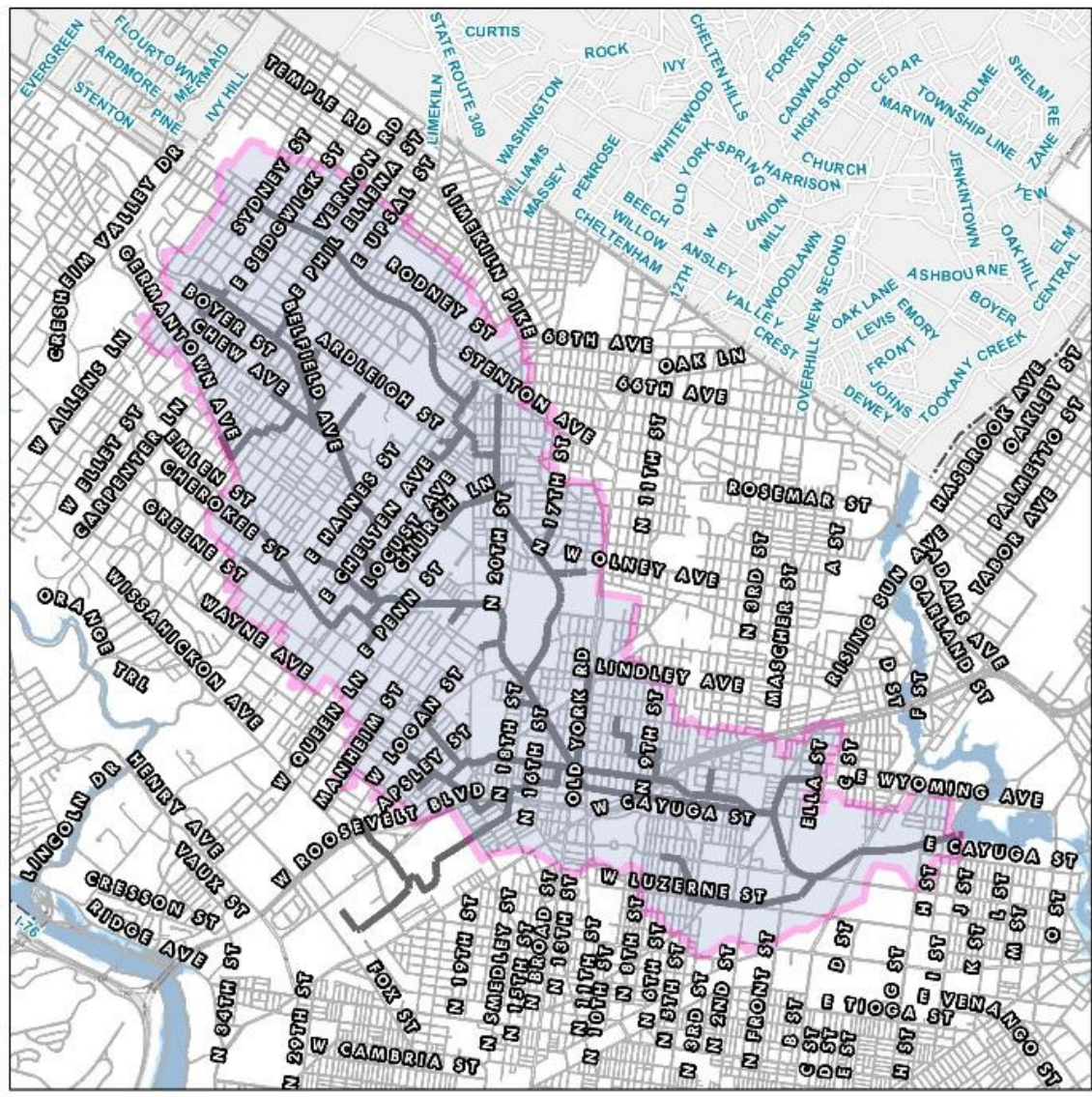
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THE EVOLUTION OF THE WINGOHOCKING WATERSHED



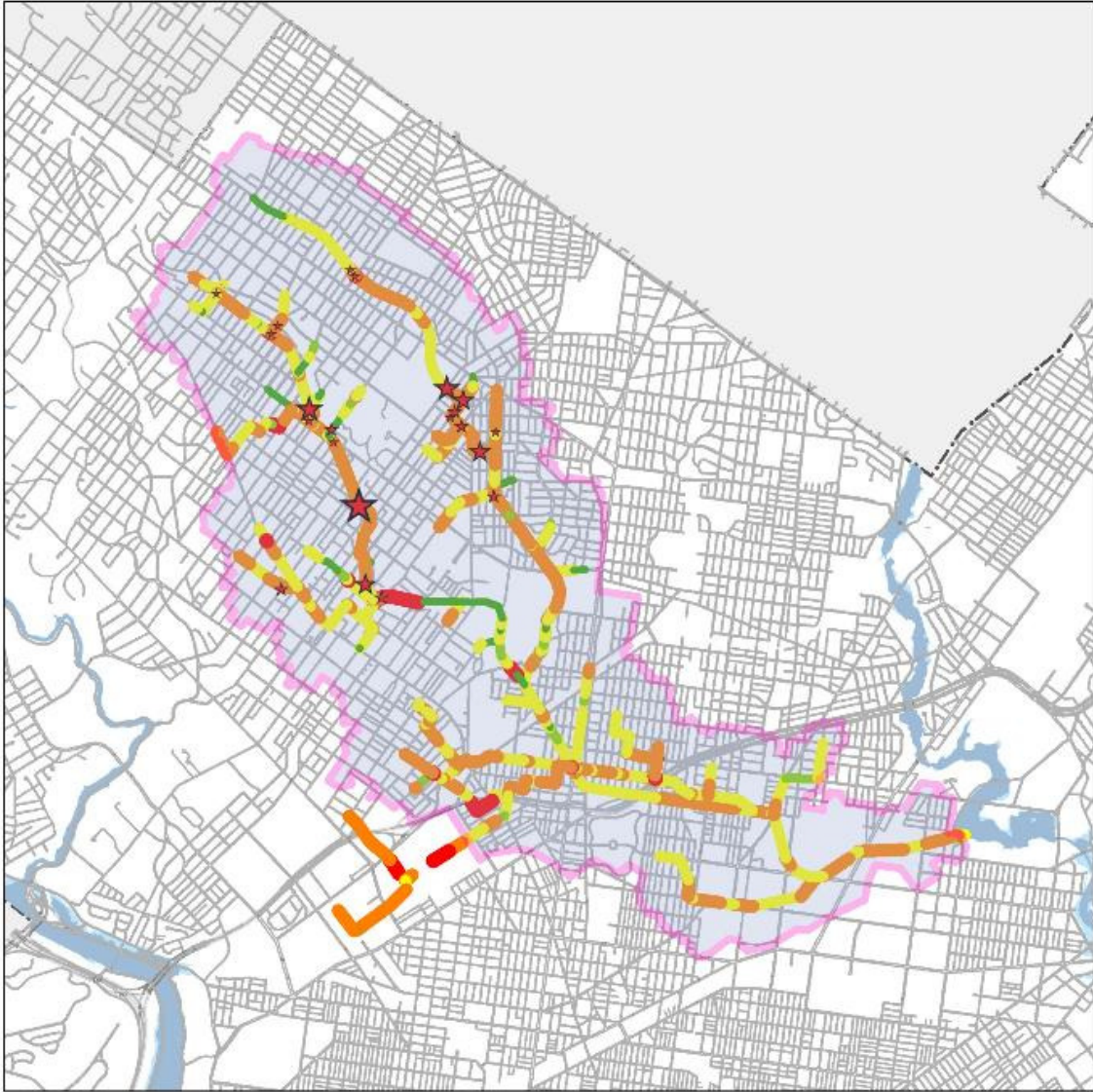
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THE EVOLUTION OF THE WINGOHOCKING WATERSHED



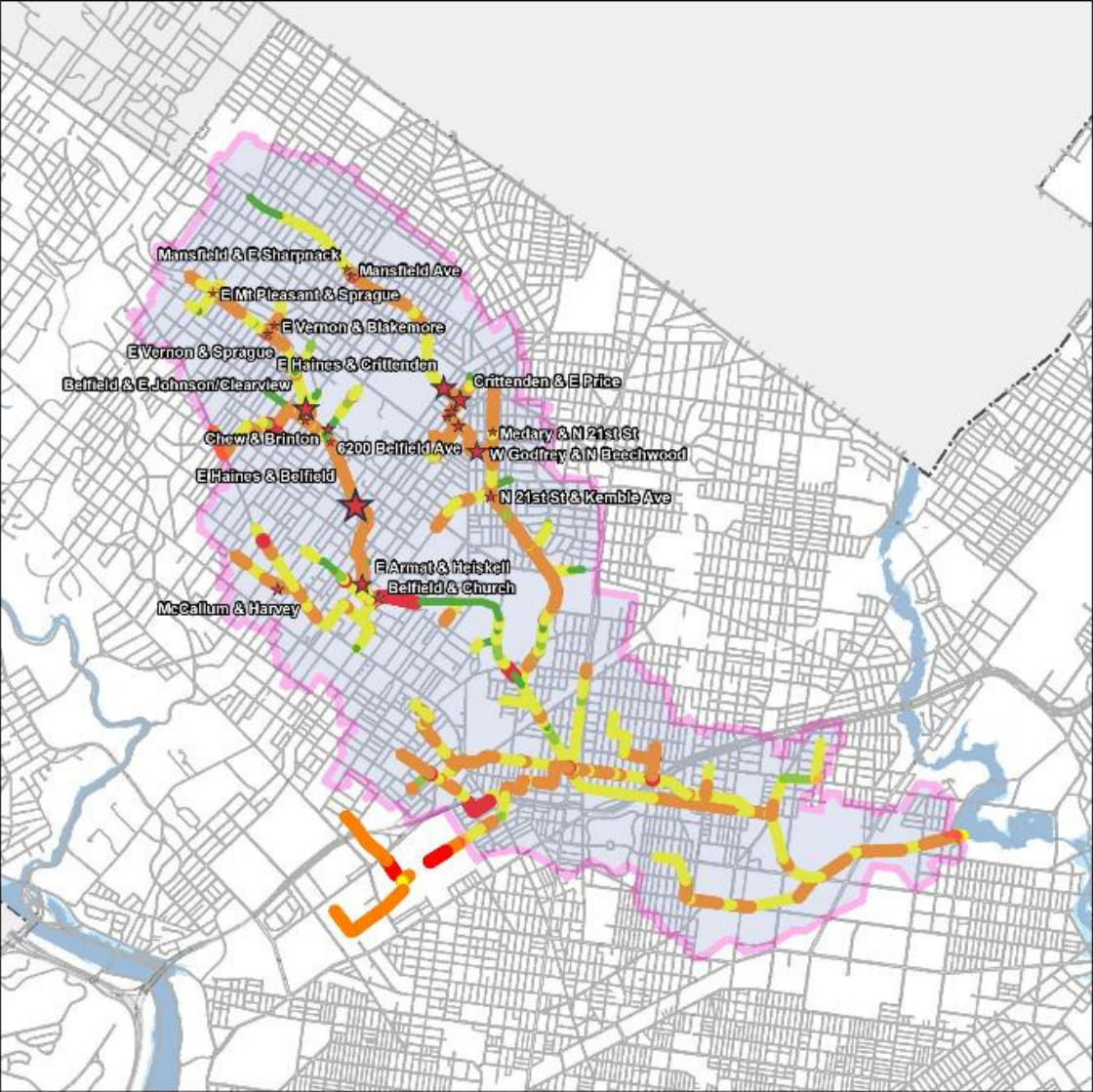
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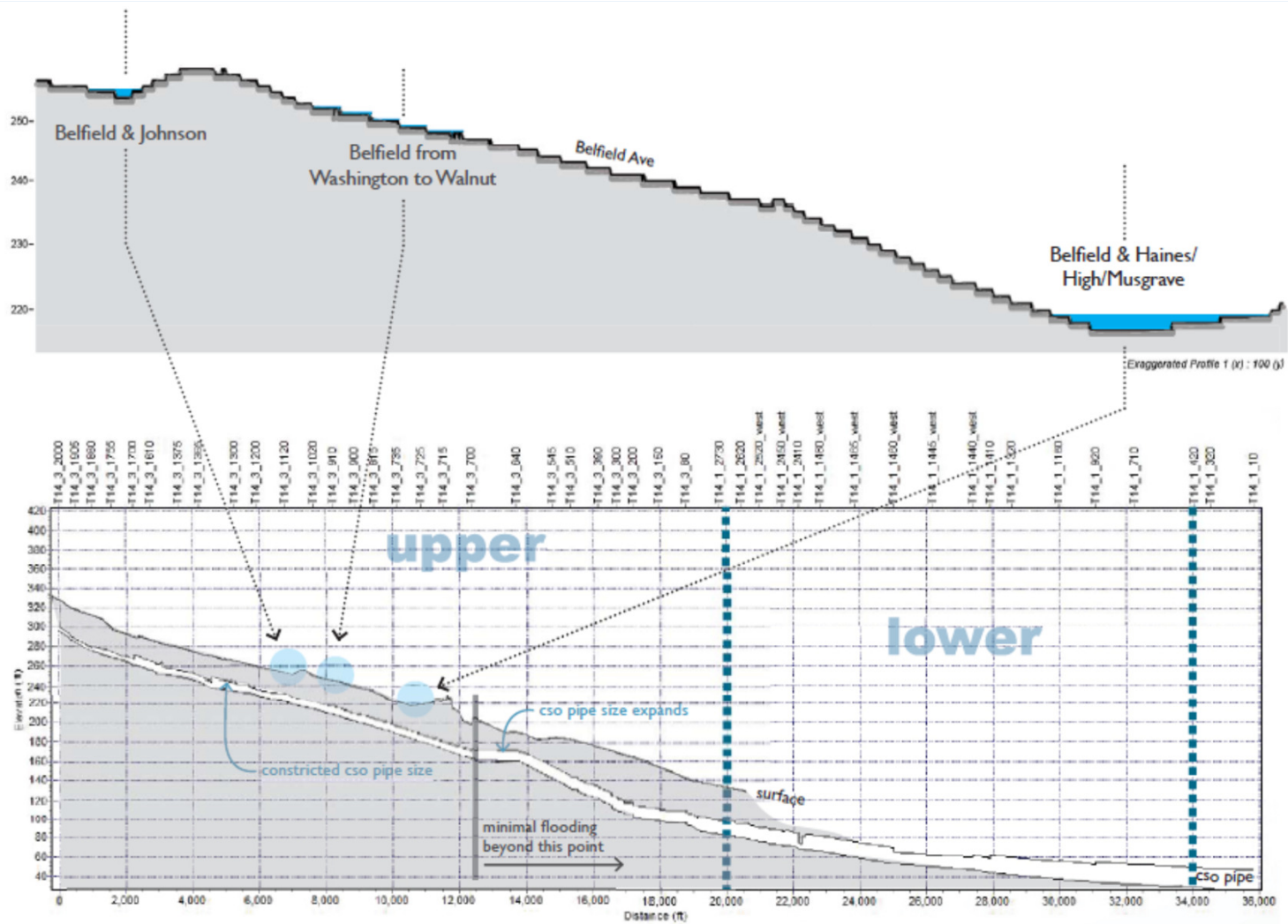


THE EVOLUTION OF THE WINGOHOCKING WATERSHED



PHILADELPHIA
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ISSUES

Local Analysis

CROSS-SECTIONAL PROFILES OF BELFIELD AVE

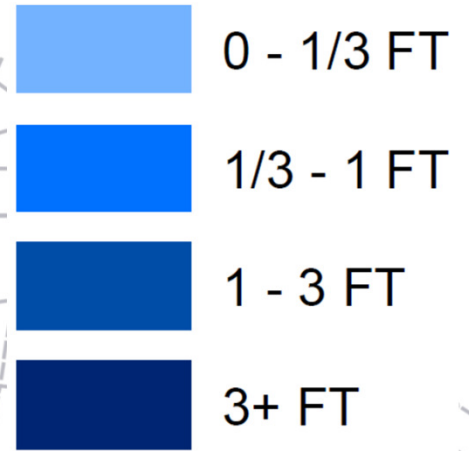
Flooding corresponds with surface depressions and the size of the CSO pipe.

MISSION STATEMENT

Germantown Stormwater Flood Relief Study

The mission of the Philadelphia Water Department and Jacobs team is to determine the optimum and sustainable combination of structural and non-structural control measures to mitigate the effects of flooding in the Germantown neighborhood **while also reducing combined sewer overflows**. The system of improvements must be affordable, supported by the Germantown Community, and capable of timely design and construction.

10-YR DEPTHS



Freakish Flood Kills Local Man

By JOHN GRANT
Courier Staff Writer

As eyewitnesses to last week's freakish drowning of a West Oak Lane man in a Germantown street, claim the victim as "roaring like an ocean."

According to interviews with witnesses Gus Israel and Alid police, this is what happened to victim Kenneth Hurst Friday night.

Hurst, 49 had just his job as a guard at the Civic Center and was heading home to his residence at 7122 N. 31st St. despite the night's unusually heavy rain. He was driving north on Wissler Street, when 12:30 a.m., he met a steady wave of water rushing south, down a long hill facing him on Wissler Street.

His Mustang stalled in the deep water, which reached above the hood of the car. According to Israel, who lives in a home just in front of where the car stalled, Hurst waited in his car with his front window open for a half-hour or more. The water was coming down Godfrey Street three-to-four feet deep. It was coming at such a speed, Israel said, "You couldn't stand out there."

"It looked like a 'whole lake on FLOOD

Continued From Page One

Godfrey Street," he said.

Israel said what he kept telling Hurst to remain in his car until the water slowed down, that he apparently wanted out enough to risk it. He opened the door against the pressure of the water and squeezed out.

"The water just took him right away," Israel said. "He didn't have a chance to get out."

Hurst stopped his fingers. "It took him just like that."

Hurst was thrown about by the currents in the water as it swung him around the corner of Water and Godfrey. The Godfrey water was moving east, according to some reports, up to four feet deep. Israel said it was near the top of a trailer parked on Godfrey.

Water was also rushing west on Godfrey. This wall of water met the water carrying Hurst eastward, and two streams continued down Godfrey.

Hurst's body recovered by firefighters at 1:30 a.m. on the corner of Godfrey and Birchwood, where his clothes had snagged on the small railing in front of Kitty's Beauty Shop.

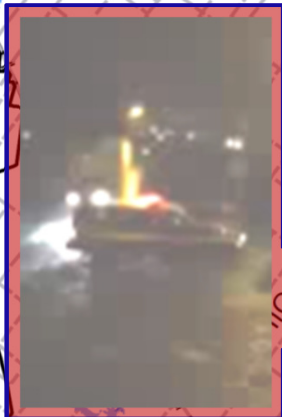
Gus Israel shook his head. "If he'd stayed in his car, he'd be alive today."

The Water Street and Godfrey Avenue area, according to Israel and other residents, is flooded with floodwaters with the Gulfstream.

The last flood of Saturday's magnitude came on the morning of June 21 that time, Israel said. It came up to the top of his house.

As a result of Saturday's flood, the Philadelphia Police Department's Office of Investigation was a routine to repair the water main there, while the fire department worked to pump out the basement of a house on that block.

Please Turn To Page 21



Woman Found Dead In Flooded SUV Towed From East Germantown

September 20, 2013 8:15 AM
Filed Under: Flood, Germantown, Philadelphia Police Officer, SUV

Flooding Victim
Deanna Compton

[Watch & Listen](#)

[Credit: Facebook](#)

PHILADELPHIA (CBS) — A woman's body found in the back of her SUV is believed to be Philadelphia's first flood-related fatality.

The tow truck operators called to haul away the silver SUV had no clue.

Neither did the Eyewitness News viewer who shot cell phone video of the flooded intersection. The video shows the same SUV in the background.

What they did not know at the time is that inside the SUV was the body of a 27-year-old woman identified by friends as Deanna Compton.

Authorities say her father, who is a Philadelphia police officer, reported Deanna missing Thursday night. He told police he last heard from his daughter when she called to say she was stuck in fast flood waters at Haines & Muggave streets in Germantown. That was around 2:30 Thursday morning.

According to sources, Deanna's father called the towing company and continued to search for his daughter. When detectives got involved, they began their investigation at the towing company to examine the car.

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Study Process

Feasibility Analysis

AIM 1

Preliminary alternative identification

Feasibility Assessment Screening

High level review of feasibility risk

Baseline Hydraulic Modeling

Development of 2D model
Hydraulic evaluation of AIM1 alternatives



AIM 2

Optimization

Robust evaluation of alt combinations to identify cost-benefit (10-year storm)

Damage Analysis

Quantify surface and flooding risk reduction (1-year -100-year)

High-Performing Alternatives

Identify distinct alternatives for engineering review



AERO

Hydraulic Refinement

Maximize storm flood risk and CSO benefits of select alternatives

Engineering Evaluation

Constructability, implementation and feasibility analysis

Performance Comparison

Basement and surface flooding risk, CSO performance, residual risk, and damage analysis evaluations

Integrated Solution Considerations

Potential tanks at sites with open land near the hydraulically overloaded trunk sewers

STORAGE TANKS

Deep tunnels that relieve the east and west trunk sewers and convey flows eastward to Tacony Creek

INVERTED SIPHON TUNNELS

Upsizing of the east and/or west trunk sewers, relief sewers

CONVEYANCE UPGRADE

Managing impervious areas to reduce inflow rates

GREEN INFRASTRUCTURE

Backflow prevention or property acquisition to reduce or mitigate the influence of surcharged sewers

NON-STRUCTURAL ALTERNATIVES

Hydraulic Optimization of Alternatives

» Enables a broader and deeper search of alternatives

- Evaluate solutions in combination
- Automatically roll up scores and costs

» Builds on engineering understanding

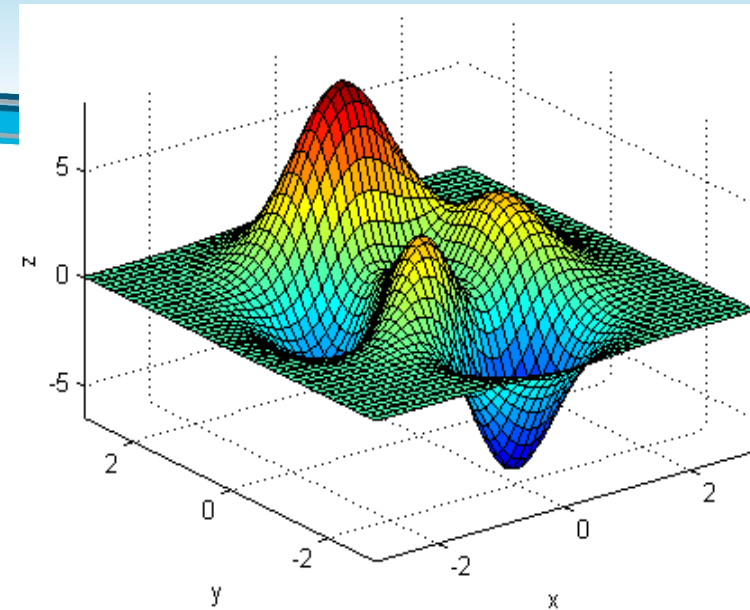
- Definition of alternatives
- Scoring of alternatives

» Value

- Better understanding of system response
- Detailed understanding of alternative effectiveness (jointly and alone)
- Repeatable, consistent process for scoring alternatives

» Workflow

- Not the endpoint → Focuses deeper evaluation
- Identification of a subset of high-performing alts for further analysis

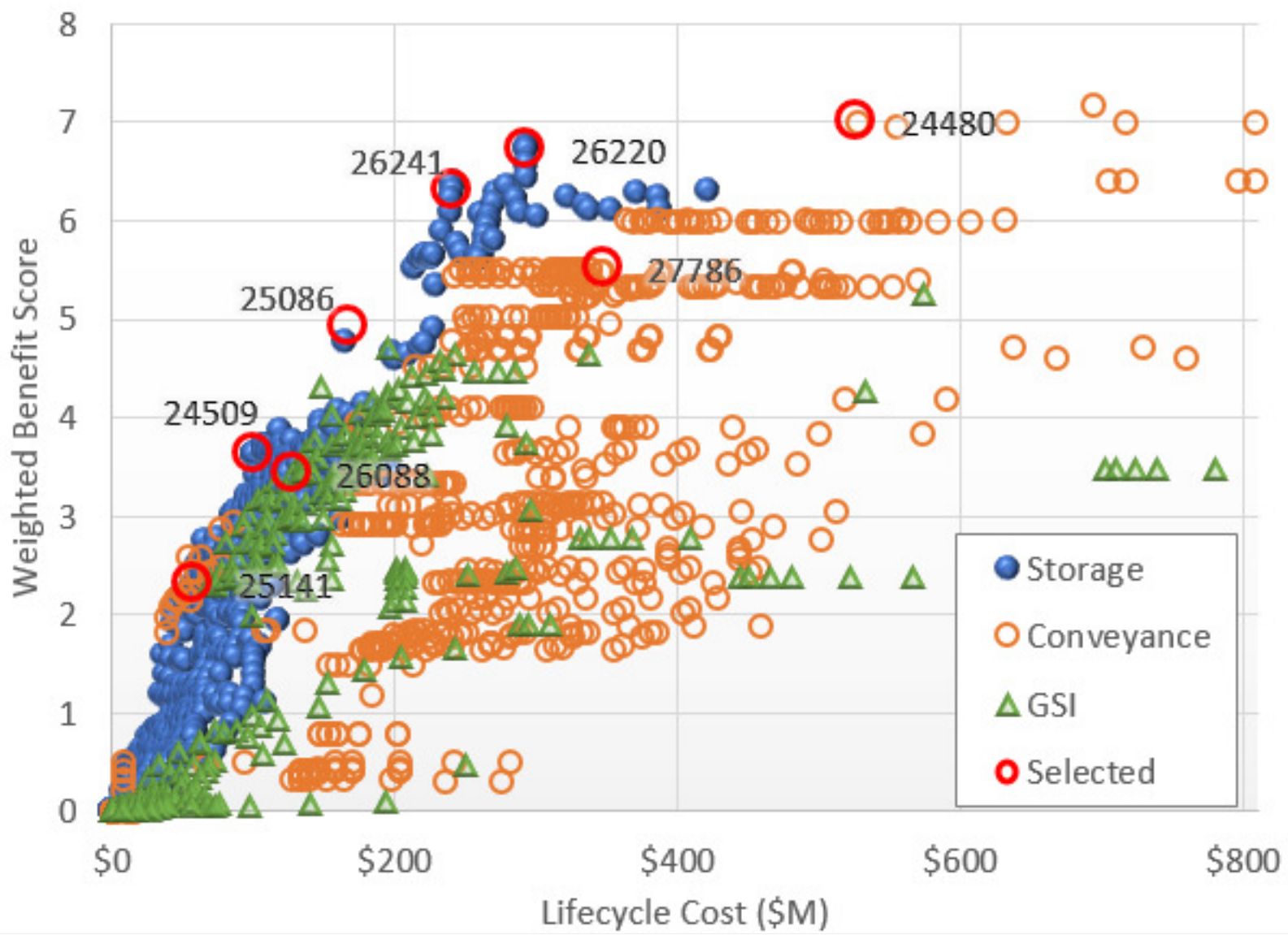


Optimization Supports Selection of Alternatives with Higher Performance

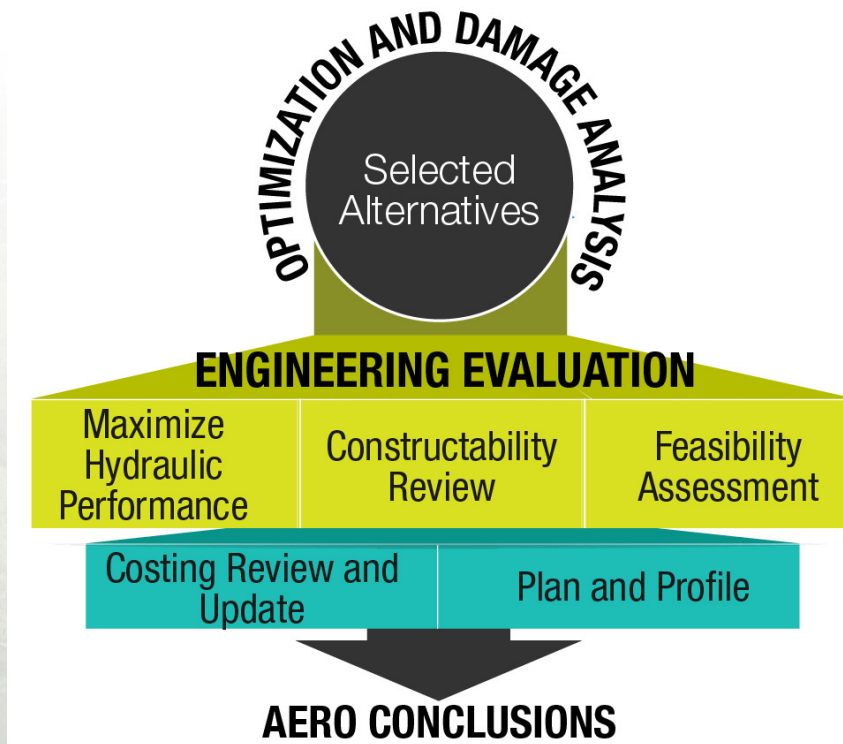
Each point (1,698 total) on the graphic is an alternative, a unique combination of specific alternative components.

Each alternative is modeled for the 10-year storm and the proxy event to produce a benefit score.

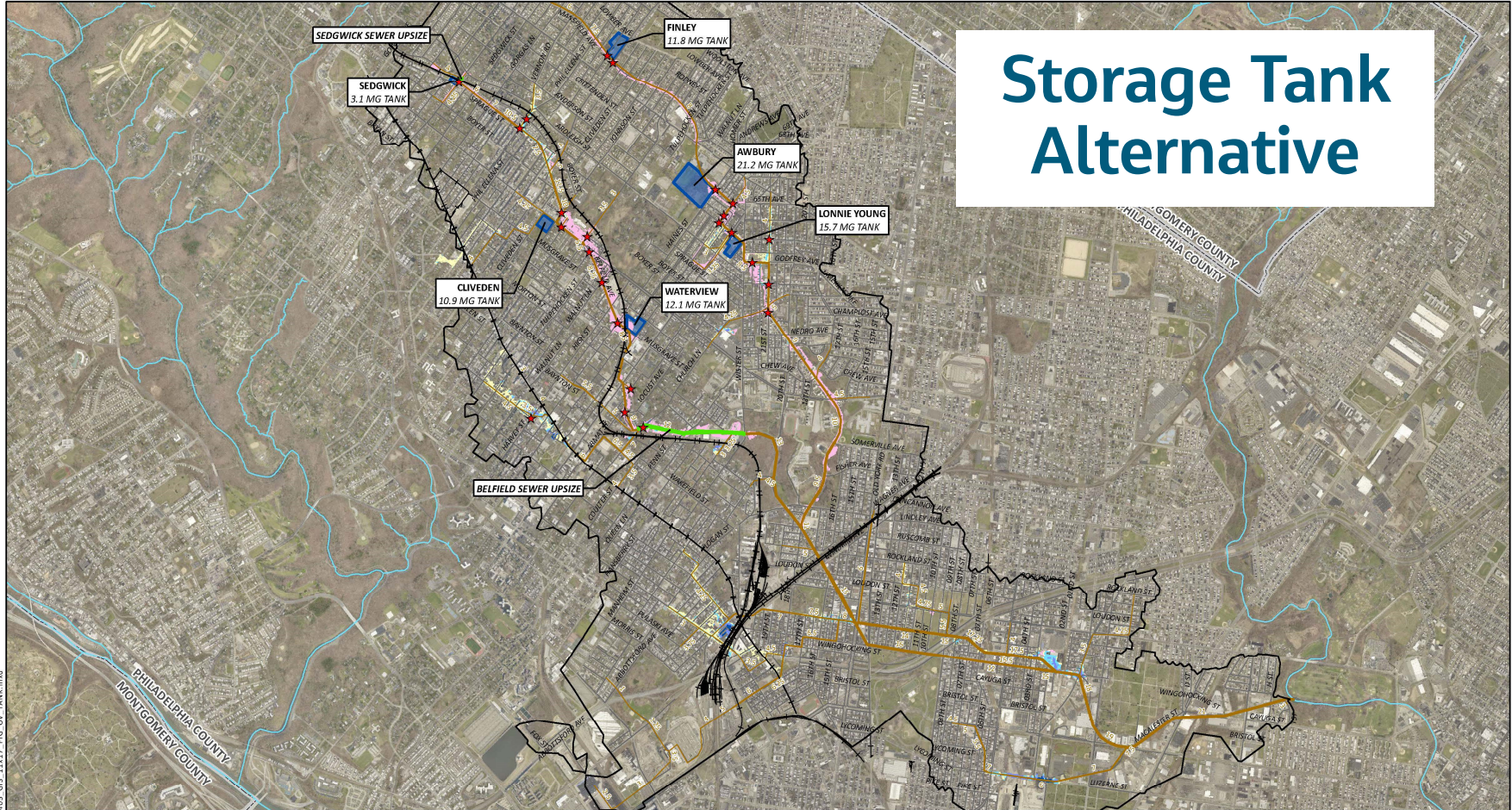
A Cost estimate is developed for each alternative shown.



AERO Report: Selected Alternatives



Storage Tank Alternative



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DOCUMENT PREPARED BY:



54 Main Street, Unit 2
Sturbridge, MA 01566
t: 855.432.9663

DOCUMENT PREPARED FOR:



LEGEND:

- ★ FLOOD PRONE INTERSECTION
- RAILROAD
- WATERWAY
- FLOOD DISTRICT BOUNDARY

10-YEAR SURFACE FLOODING EXTENTS

- 0 - 1/3 FT
- 1/3 - 1 FT
- 1 - 3 FT
- 3 - 6 FT
- MITIGATED FLOOD RISK

SEWER DIAMETER

- < 5 FT
- 5 TO 8 FT
- 8 TO 12 FT
- > 12 FT
- UNMODELED SEWER

ALTERNATIVES

- SEWER UPSIZE
- STORAGE TANK

GERMANTOWN STORMWATER FLOOD RELIEF STUDY

STORAGE TANK ALTERNATIVE

PHILADELPHIA COUNTY, PENNSYLVANIA

SCALE: 1" = 2,500'

2,500 1,250 0 2,500 FEET

DATE: 08/13/2019

PROJECT NUMBER: 217084.03

DRAWN BY: TRW

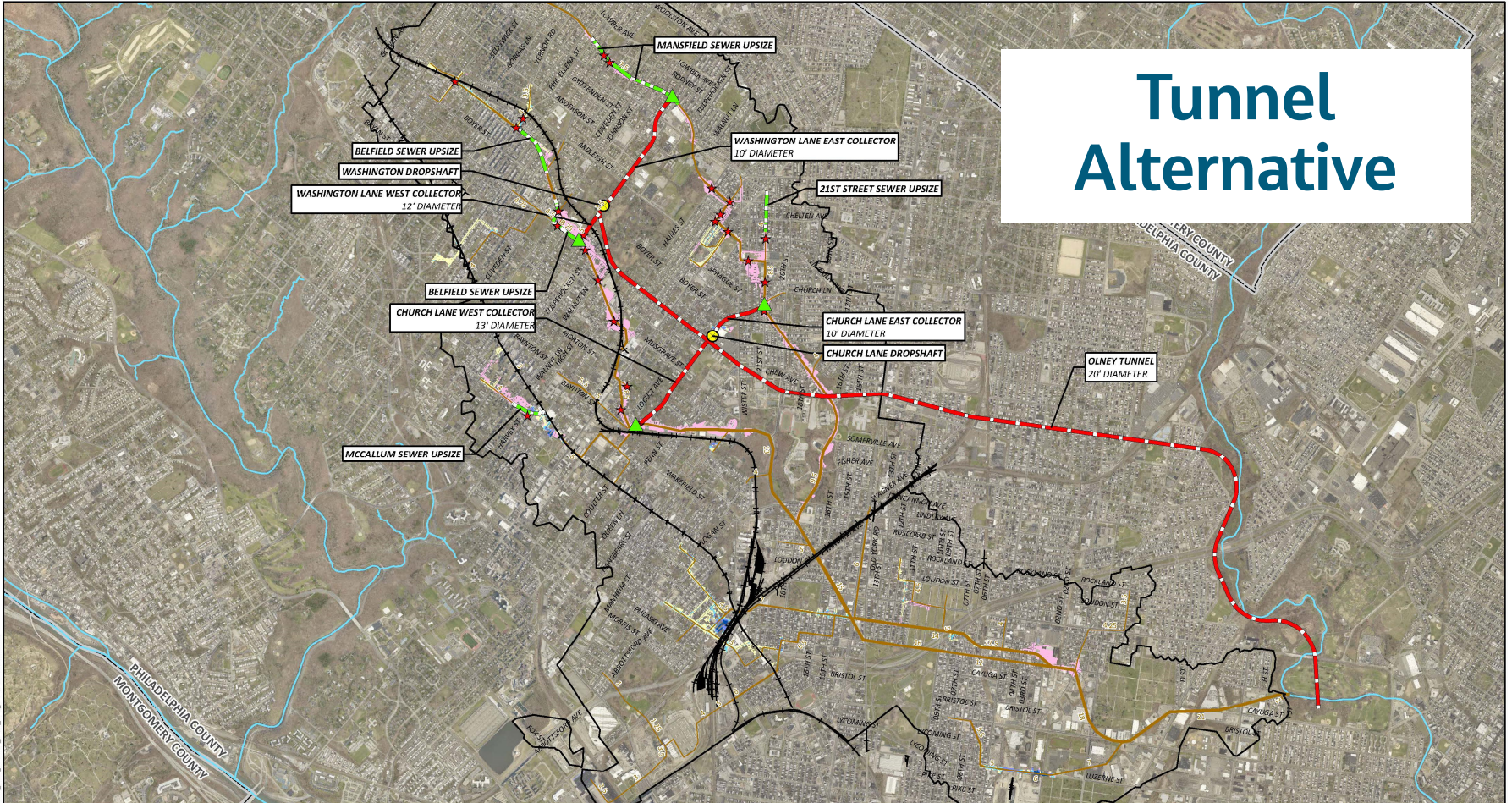
REVIEWED BY: JMG

APPROVED BY: JTP

SHEET: 1 OF 1

Basemap Source: Philadelphia Aerial Photography 2016.3in, City of Philadelphia, 2016

Tunnel Alternative



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 Sturbridge, MA 01566
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SEWER DIAMETER

- < 5 FT
- 5 TO 8 FT
- 8 TO 12 FT
- > 12 FT
- UNMODELED SEWER

ALTERNATIVES

- DIVERSION
- DROPSHAFT
- PROPOSED OLNEY TUNNEL
- CONVEYANCE IMPROVEMENT

GERMANTOWN STORMWATER FLOOD RELIEF STUDY

TUNNEL ALTERNATIVE

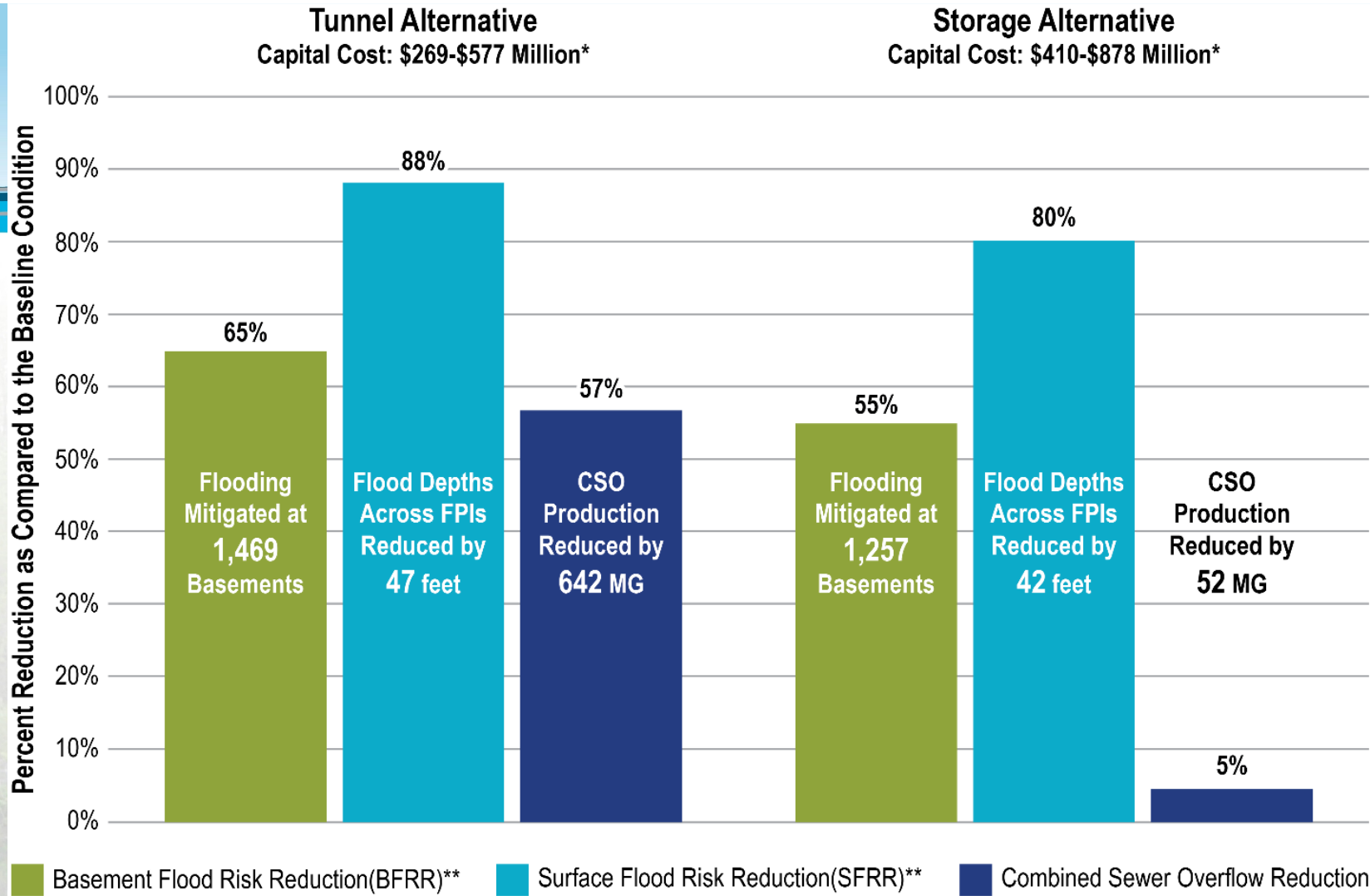
PHILADELPHIA COUNTY, PENNSYLVANIA

SCALE: 1" = 2,500'

DATE: 08/13/2019
 PROJECT NUMBER: 217084_03
 DRAWN BY: TRW
 REVIEWED BY: JMG
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 SHEET: 1 OF 1

Basemap Source: Philadelphia Aerial Photography 2016 3in, City of Philadelphia, 2016

Selected Alternative Cost/Benefit Summary

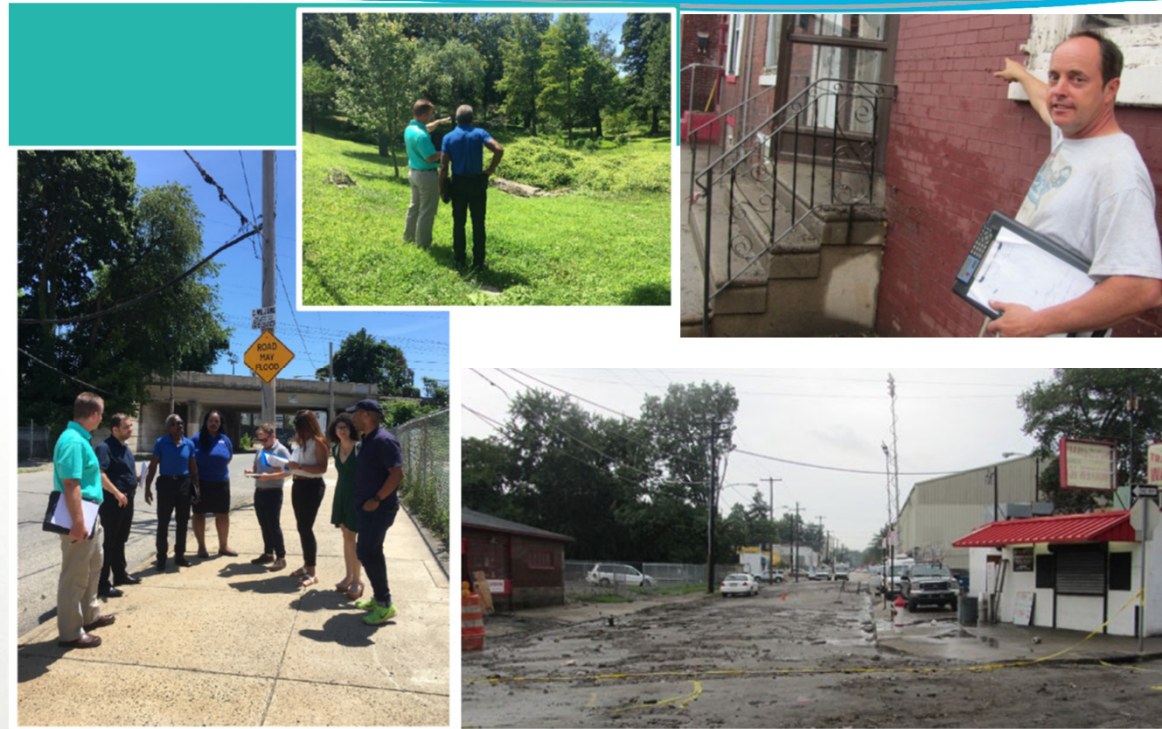


* Capital costs refer to Class IV Estimate range (-30%/+50%)

** BFRR and SFRR values are for the 10-year, 24-hour design storm event

Looking Forward

- » Community Outreach
- » Integrated City Planning
- » Non-Structural Options
- » Capital Planning



Polling Question

Community Engagement & Opportunity in Urban Flood Mitigation

Lisa Koerkenmeier, Director of Planning and
Development, City of Brentwood, MO, USA

Phil Blonn, Jacobs, Senior Subject Matter Expert | Flood
Mitigation

Brentwood Bound – Flood Mitigation

Address ongoing flooding issues

- Solve 100-year recurring public health & safety problem
- Area has flooded over 30 times since 1957
- Remove Manchester Road from the 100-year floodplain
- Reduce 100-year floodplain from 60 acres to 29 acres (reclaim approximately 31 acres)
- 29 acres remaining in floodplain will adequately handle anticipated storm water volume
- Most of the property removed from the floodplain (including 10 residential properties) is along the Manchester Road corridor
- Opportunity for sustainable urban creek area and redevelopment unique in St. Louis



Community Engagement and Project Development Timeline



The City experienced 11 damaging floods since 2000

Stakeholder Engagement

- Preliminary Flood Mitigation Study
- USACE Silver Jackets Report Funding obtained

USACE Report

Deer Creek and Black Creek Comprehensive Flood Mitigation Analysis Report

Detailed Design Begins

2011

2012

2013

2014

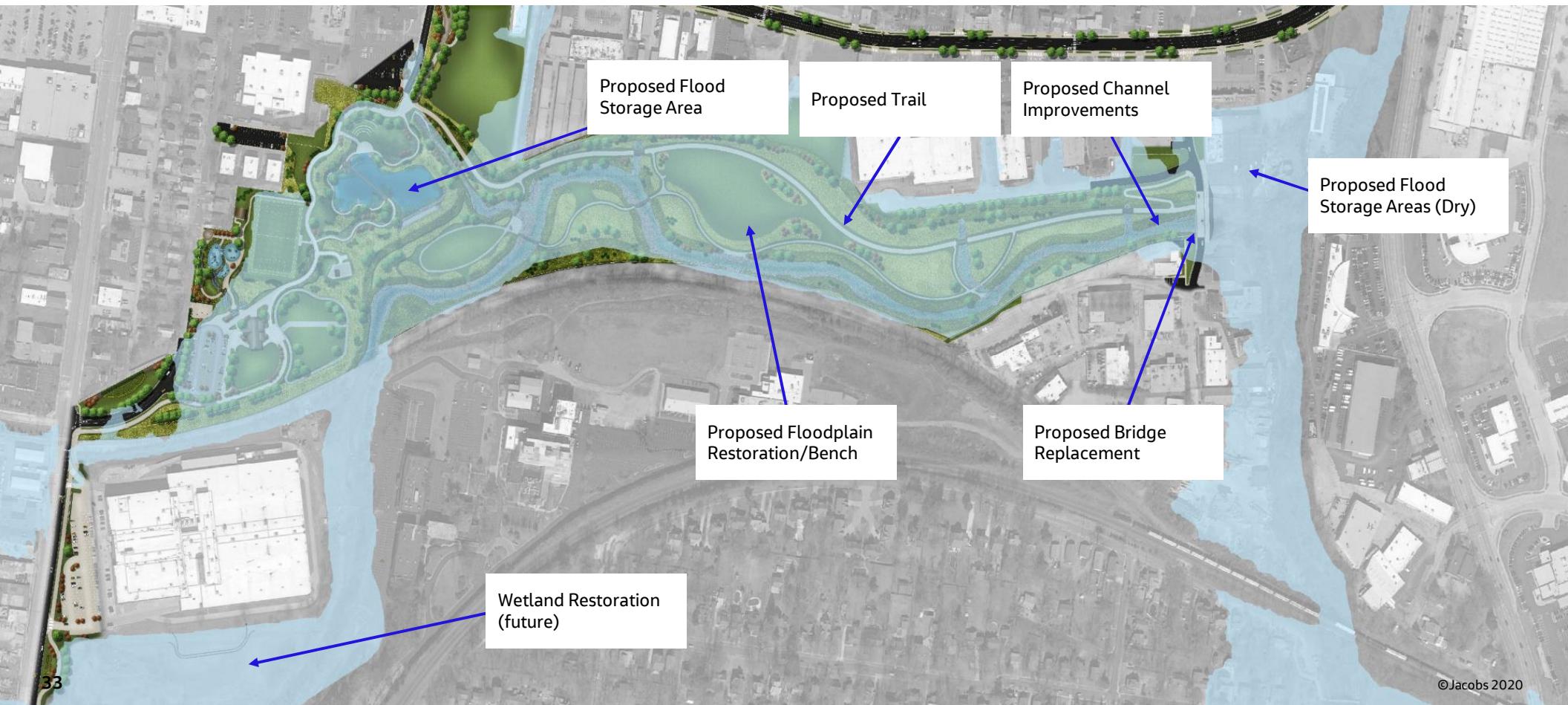
2017

2018

Brentwood Bound – Project Area Current Floodplain



Brentwood Bound – Project Area Current Floodplain



Channel Improvements

- Bank Stabilization
- Widening
- Benching
- Improved Profile Slopes



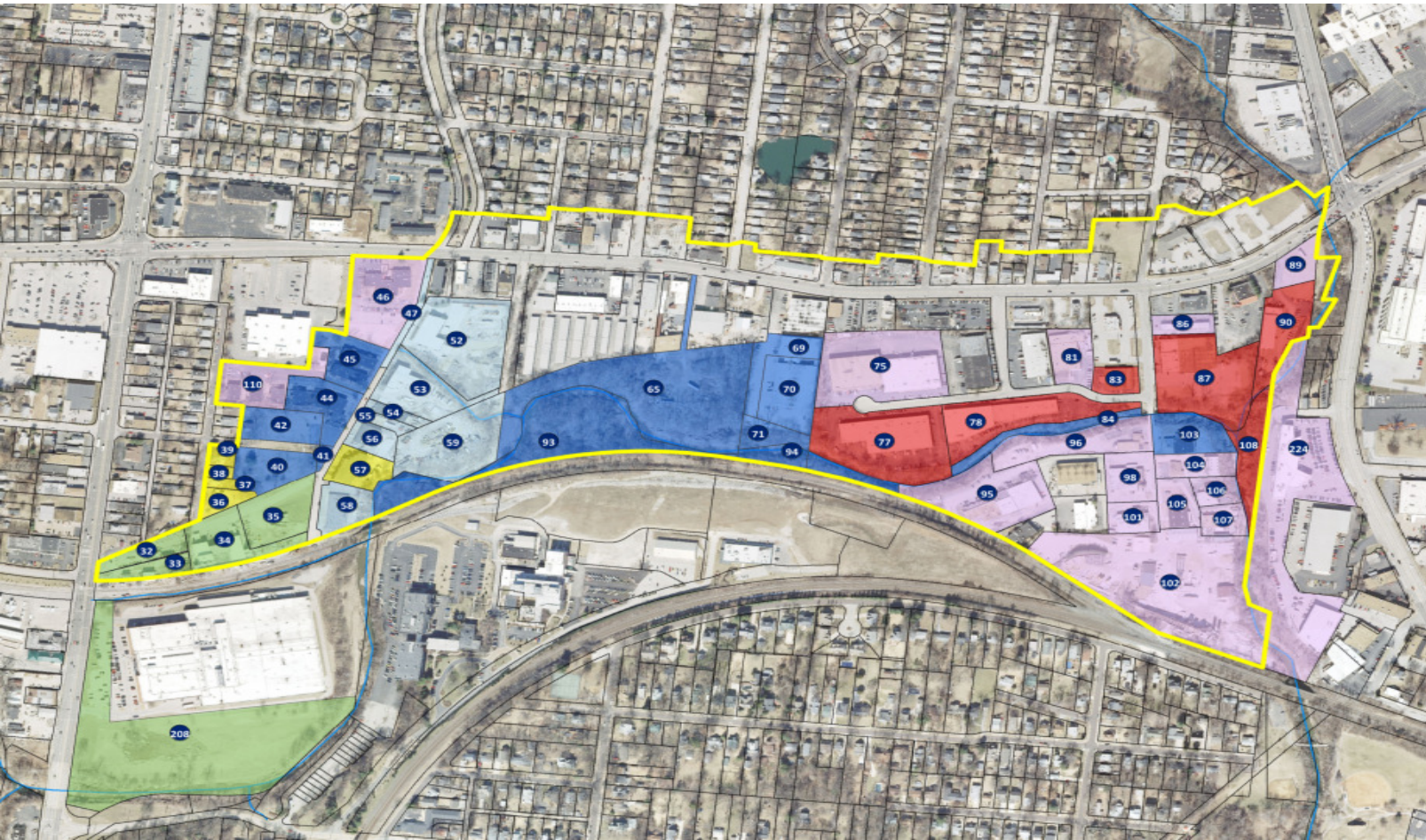
Floodplain Restoration



Existing and Proposed View from Northeast



Brentwood Bound – Project Boundary



Legend

- Project Area Boundary
- Parcel Locator
- Acquisition**
- City Closing on Property
- City Owned
- Greenway Recommendations
- MSD Owned
- Necessary for Construction
- Temporary & Permanent Easements
- Streams

0 500 1,000 Feet



Parcel Acquisition
City of Brentwood, MO
Deer Creek
Flood Mitigation

Brentwood Bound – Manchester Road Improvements

Enhance the Manchester Corridor between Hanley and Bremerton

- MoDOT-funded enhancements
 - Mill and overlay pavement
 - Manchester Rd. bridge replacement near Hanley Rd.
 - Sidewalk and ADA improvements
 - Traffic signal upgrades
- Brentwood-funded enhancements
 - Pedestrian tunnel
 - Decorative street signage
 - Decorative lighting
 - Improve access management
 - Manchester Rd. bridge enhancements near Hanley Rd.
 - Trailheads - Pedestrian destinations
 - Accessible 6" curbs & 5' sidewalks on north side
 - Accessible 6" curbs & 10' shared use path on south side
 - Monument signage – privately funded



Brentwood Bound – Deer Creek Greenway Connector

Design Update

- Parks Master Plan completed for City in 2015
- Design will commence following EDST BOA passage and authorization of Phase 2 Consultant Contracts
- 16-month community engagement, design and permitting process

Great Rivers Greenway Update

- Presented to GRG Board on August 13, funding commitment
- If approved, Staff and Board will then review budgets and work on a partnership agreement between GRG and City of Brentwood

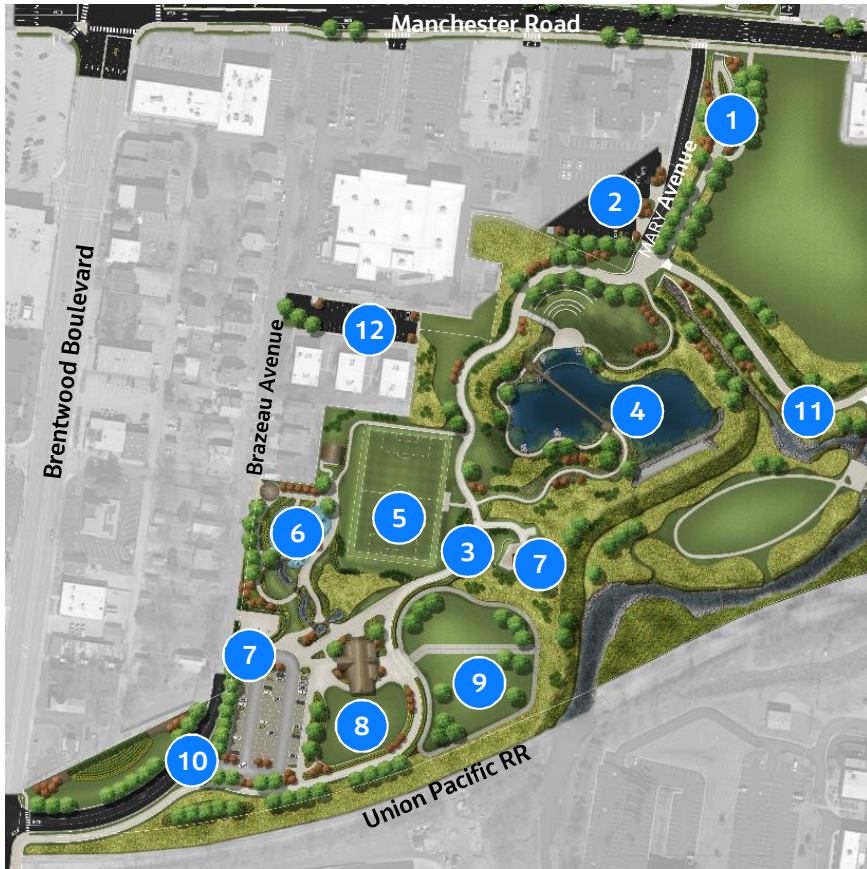


Brentwood Bound – Master Plan



Park	Acres
Brentwood Bound	35.99
Current Norm West Park	4.81
Additional Park Acreage	31.18

Brentwood Bound – Deer Creek Greenway Connector Master Plan



Legend

- | | | | |
|---|--|----|---------------------------------------|
| 1 | Manchester Road Underpass - South | 7 | MSD Facilities Additional Landscaping |
| 2 | 8702 Manchester Road Improvements | 8 | Event Lawn and Building |
| 3 | Rogers Greenway Trail (GRG Connector) | 9 | Dog Park |
| 4 | Mary Avenue Flood Storage | 10 | Brazeau Avenue Extension and Parking |
| 5 | Active Play Area | 11 | Deer Creek Trail – Loop Trail |
| 6 | Destination Playground with Water Play | 12 | 8736 Brentshire Walk Improvements |

Manchester Underpass



Lake



Marshall Road Plaza



Brentwood Bound – Project Budget

Estimated Program Budget	Flood Mitigation	Manchester Road Improvements	Deer Creek Greenway Connector	Totals
Construction Costs	\$21,471,274	\$4,949,799	\$6,577,126	\$32,998,199
Soft Costs	\$8,002,056	\$1,182,986	\$2,606,344	\$11,791,387
Property Acquisitions	\$17,708,359	\$3,396,773	\$3,350,000	\$24,455,132
Contingency	\$6,949,540	\$581,478	\$2,791,198	\$10,322,216
Total	\$54,131,229	\$10,111,036	\$15,324,668	\$79,566,933
January 2019 Budget	\$54,323,557	\$10,158,667	\$15,153,584	\$79,635,809

\$79,566,933

Under Budget!

- Soft costs include consultant fees, permitting, communications, printing, and legal fees
- Property acquisition costs include property costs, relocation costs, and closing costs

Brentwood Bound **Conceptual** Redevelopment Plan



Questions & Answers

Thank You!

Jacobs

