

The Impact of *Green City, Clean Waters* on Philadelphia

Measuring the Triple Bottom Line Impact
of Green Stormwater Infrastructure





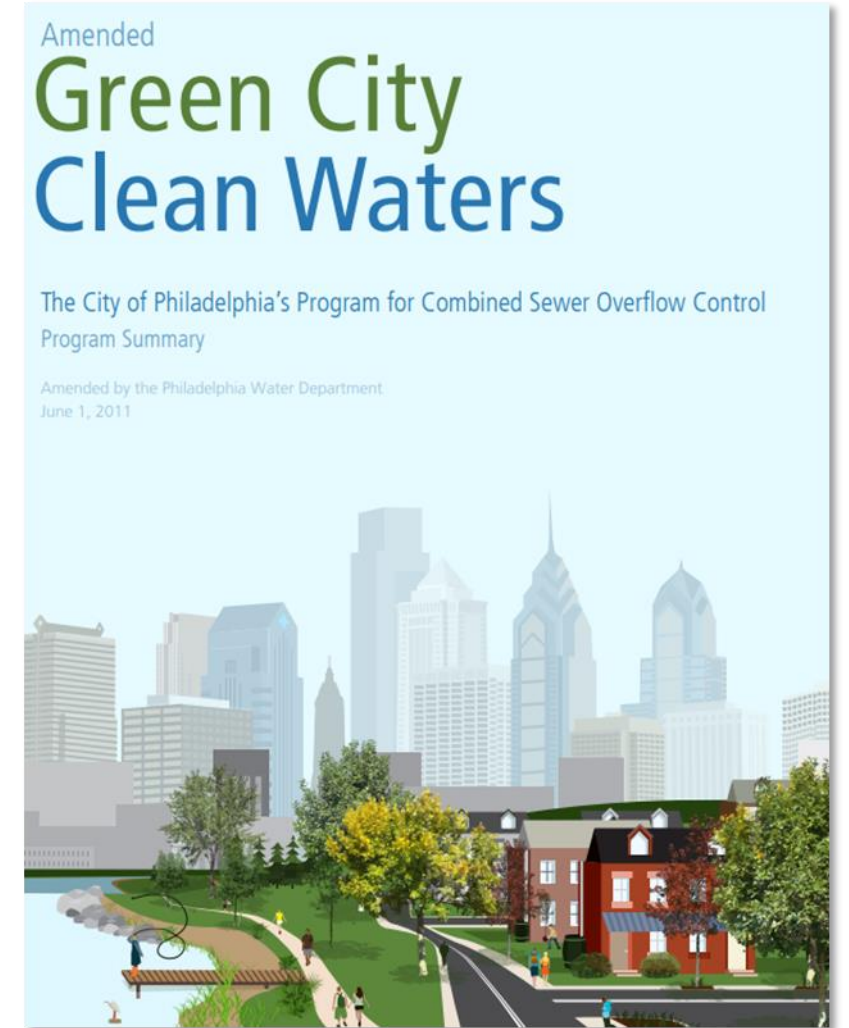
Overview

- Background on SBN; GSI Partners; GSI; Green City, Clean Waters
- GCCW: GSI Projects in Philadelphia
- Measuring the Triple Bottom Line
 - Economic Impact of GSI Partners and *GCCW*
 - Annual benefit; Total 25-year benefit
 - Social Impact of *GCCW*
 - Crime reduction; Access to open space
 - Environmental Impact of *GCCW*
 - Heat island effect reduction
- Conclusion

Background



GSI PARTNERS™
REIMAGINING STORMWATER



Sustainable Business Network of Greater Philadelphia

SBN

- Started in 2001
- Mission: To build a just, green, and thriving local economy in the Greater Philadelphia region
- SBN has hundreds of members in the Greater Philadelphia region



SBN's GSI Partners

- Signature initiative of SBN
- Formed in 2012 in response to *GCCW*
- Goal: To advance the local GSI Industry
- Currently there are over 70 GSI Partners



GSI PARTNERS™
REIMAGINING STORMWATER

Green Stormwater Infrastructure (GSI)

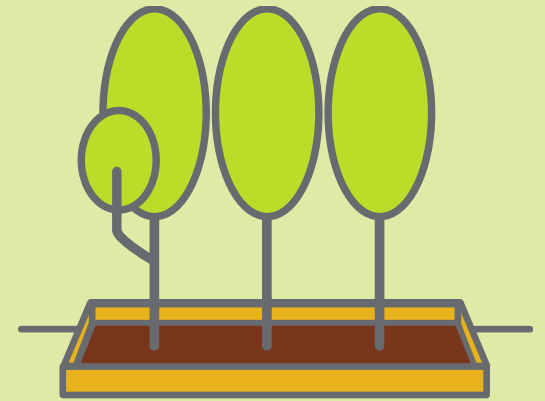
Defining GSI

- Soil-water-plant systems that manage wet weather through infiltration and/or retention
- Provide economic, social, and environmental benefits



Forms include:

TREE TRENCHES



RAIN GARDENS



GREEN ROOFS



PLANTERS



Green City, Clean Waters (GCCW)

Mission and Commitment

- The City of Philadelphia's commitment to meet regulatory obligations while helping to revitalize the city
- \$1.2 Billion (2011\$) commitment over 25 years to improve combined sewer overflow control

Impact of GSI

- In 2016, SBN valued the impact of GCCW on Philadelphia at \$3.2B over 25 years
- In this update, SBN had ESI evaluate the triple bottom line benefits of GSI: economic, environmental, and social impacts



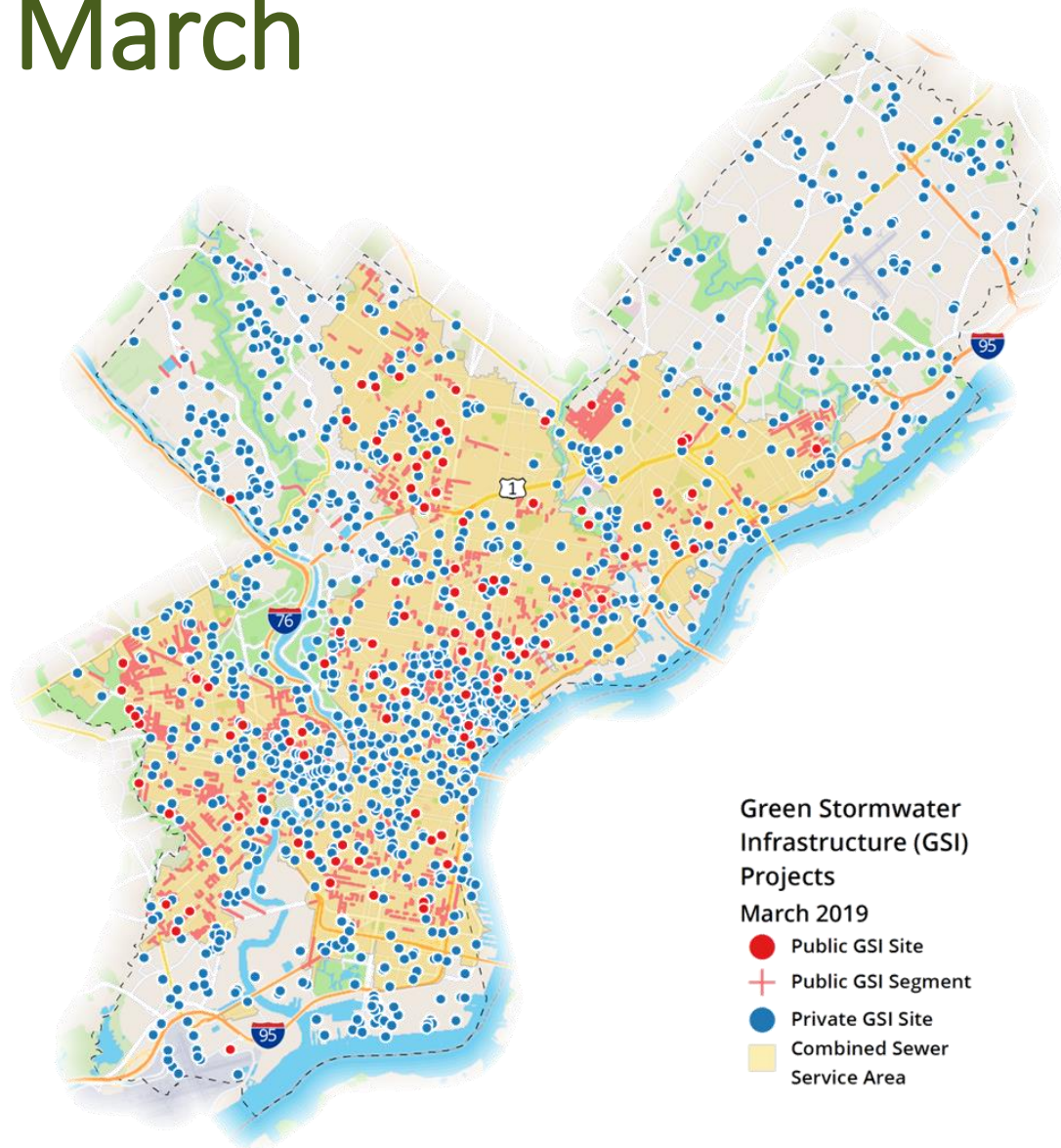
GCCW: GSI Projects in Philadelphia



Photos courtesy of Philadelphia Water Department



GSI Projects: March 2019



Green Stormwater Infrastructure (GSI) Projects

March 2019

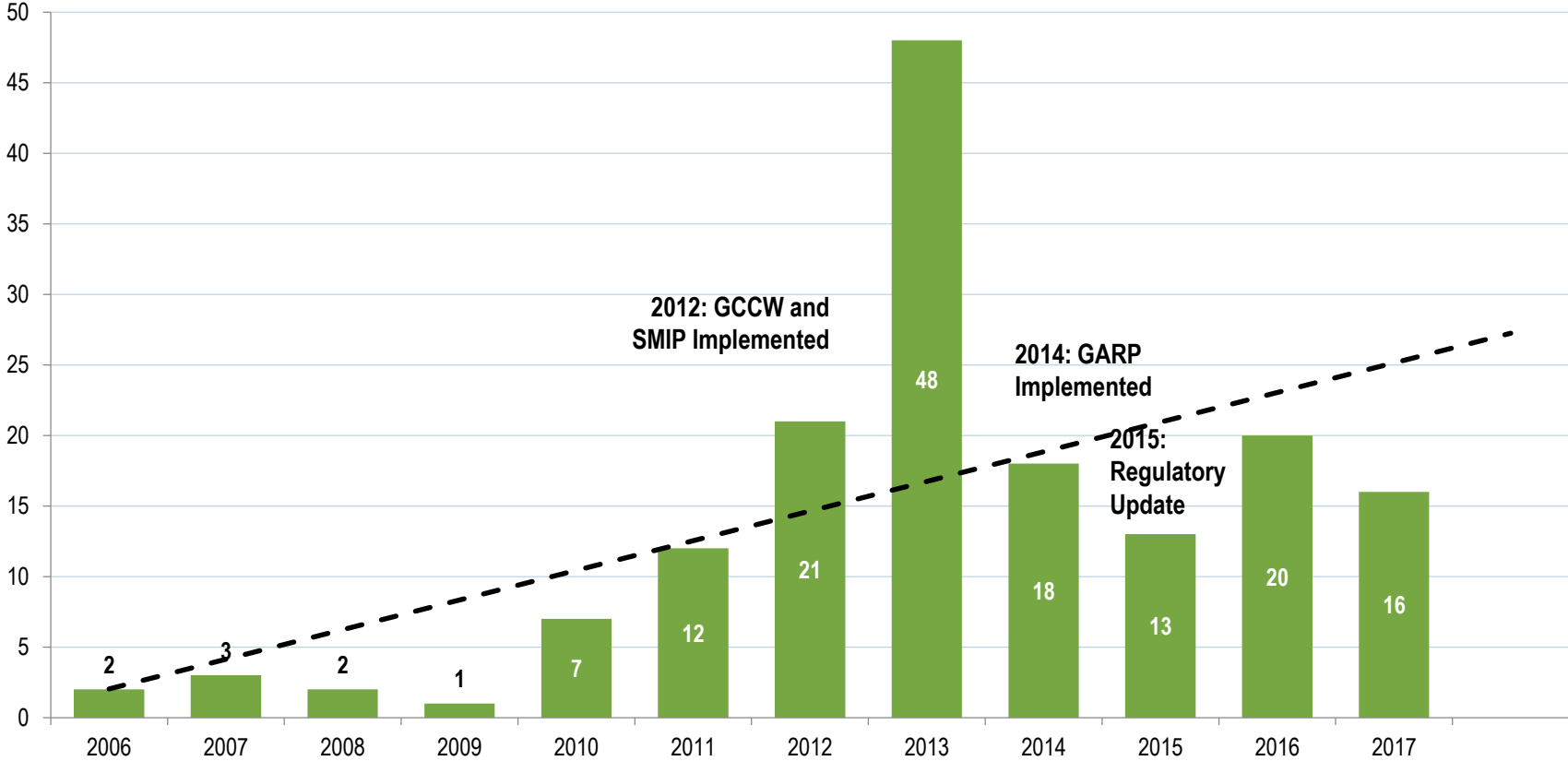
- Public GSI Site
- + Public GSI Segment
- Private GSI Site
- Combined Sewer Service Area

10 Miles

Number of New Public GSI Projects Per Year (2006 – 2017)

178

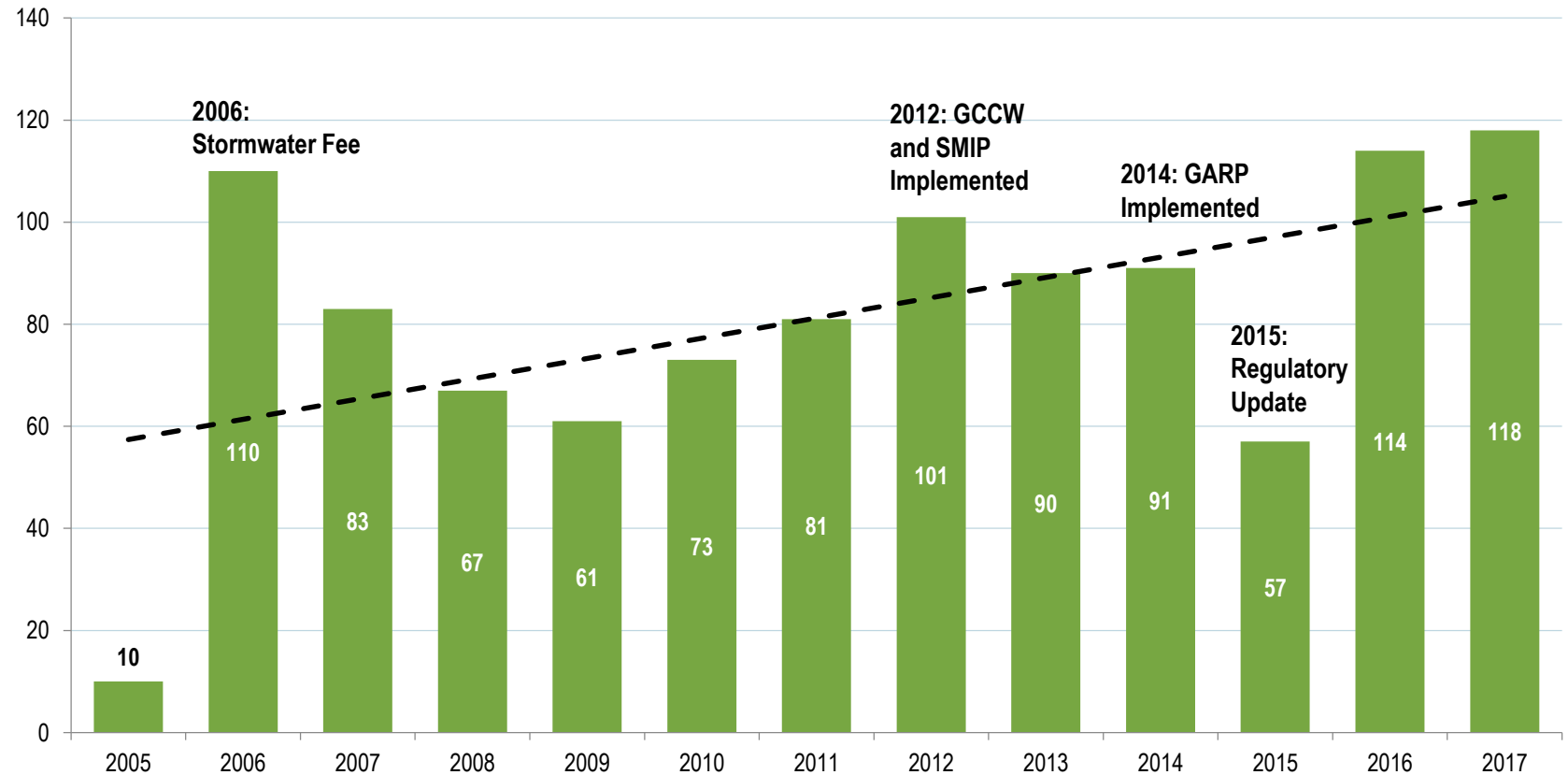
public projects completed since 2006



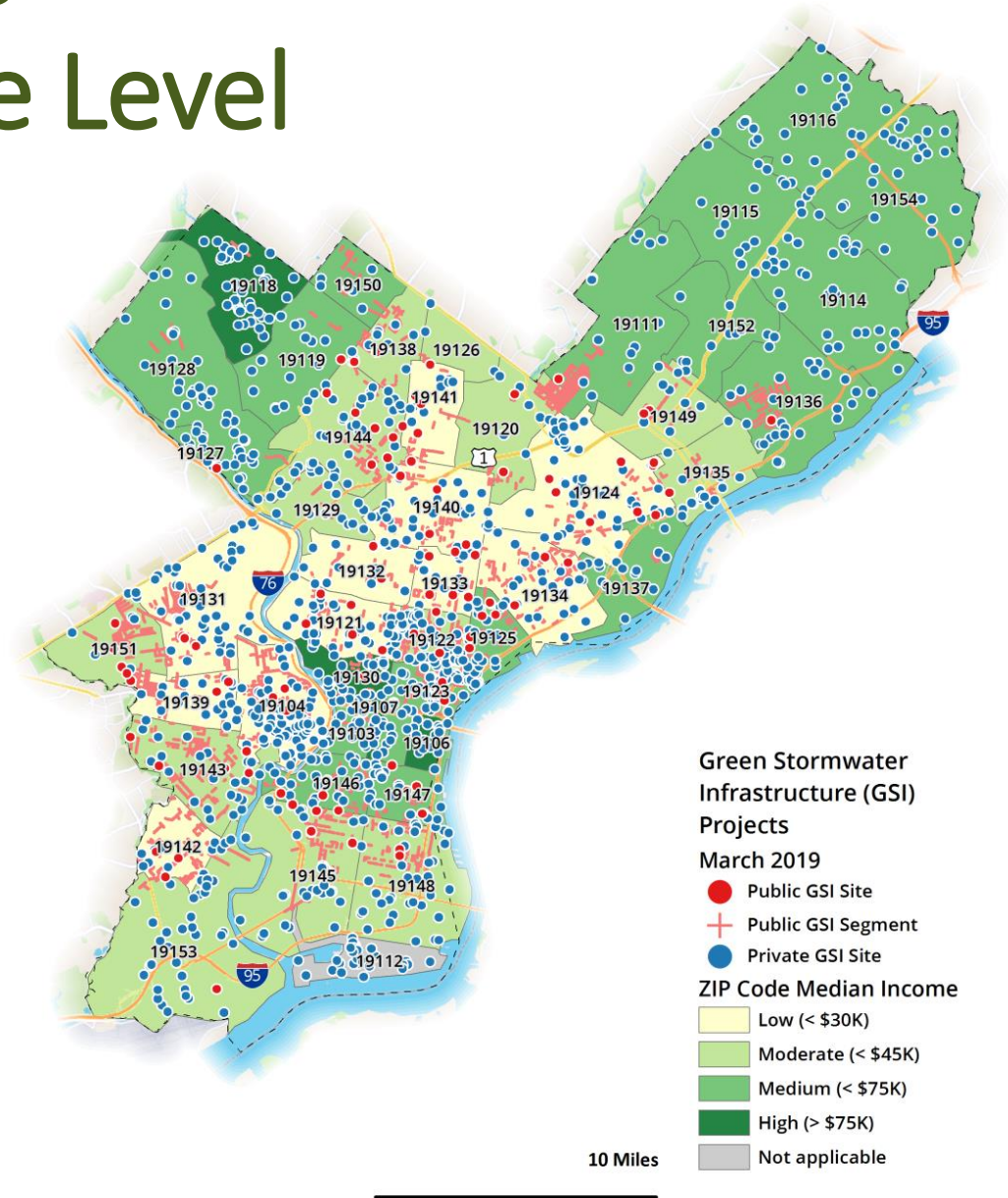
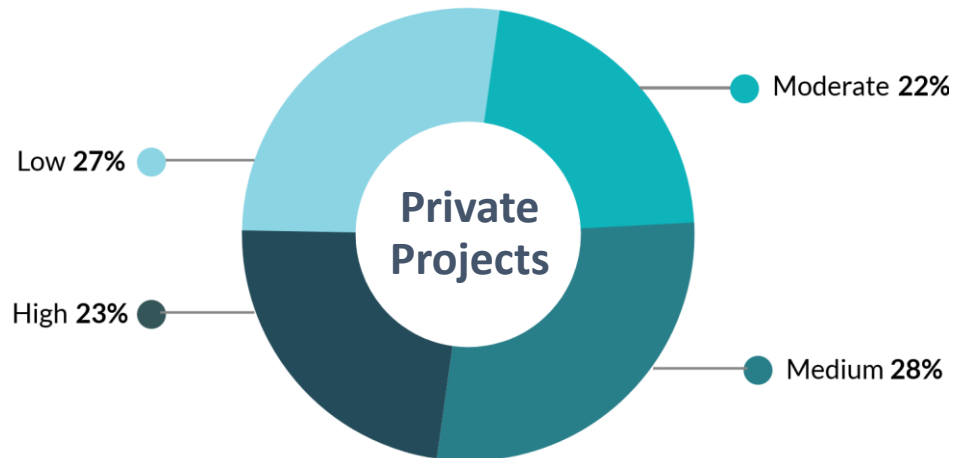
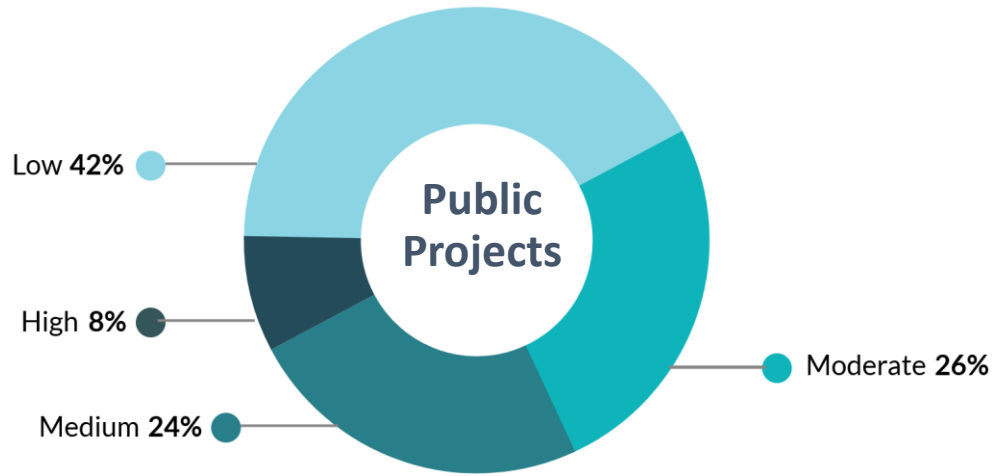
Number of New Private GSI Projects Per Year (2005 – 2017)

1,135

private projects
completed
since 2005



Location of GSI Projects by Census Block Income Level



Project Features (as of March 2019)

SOURCE: City of Philadelphia (2019)

Private Projects

GSI Feature	Constructed	Planned	Total
Surface Infiltration Basin	103	68	171
Subsurface Infiltration Basin	219	756	975
Surface Detention Basin	17	118	135
Subsurface Detention Basin	92	432	524
Bioinfiltration	105	188	293
Bioretention	105	353	458
Cistern	9	15	24
Green Roof	119	195	314
Porous Pavement	145	383	528
Water Quality Treatment Device	53	61	114
Total Features	967	2,569	3,536
Total Private Projects	889	256	1,145

Public Projects

GSI Feature	Constructed	Planned	Total
Tree Trench	255	809	1,064
Planter	55	169	224
Bumpout	25	302	327
Rain Garden	99	150	249
Basin	4	5	9
Infiltration Storage Trench	164	582	746
Pervious Paving	17	27	44
Swale	18	41	59
Wetland	0	4	4
Green Roof	2	0	2
Other	0	0	0
Stormwater Tree	100	62	162
Drainage Well	0	4	4
Green Gutter	0	3	3
Blue Roof	0	0	0
Depaving	6	1	7
Infiltration Columns	0	0	0
Total Features	745	2,159	2,904
Total Projects	194	291	499



Measuring the Triple-Bottom Line Impact



Valuing the Economic, Social, and Environmental Benefits of GSI

Economic

Direct, indirect, and induced investments + jobs supported by GCCW investments and by the business activity of GSI Partners

Social

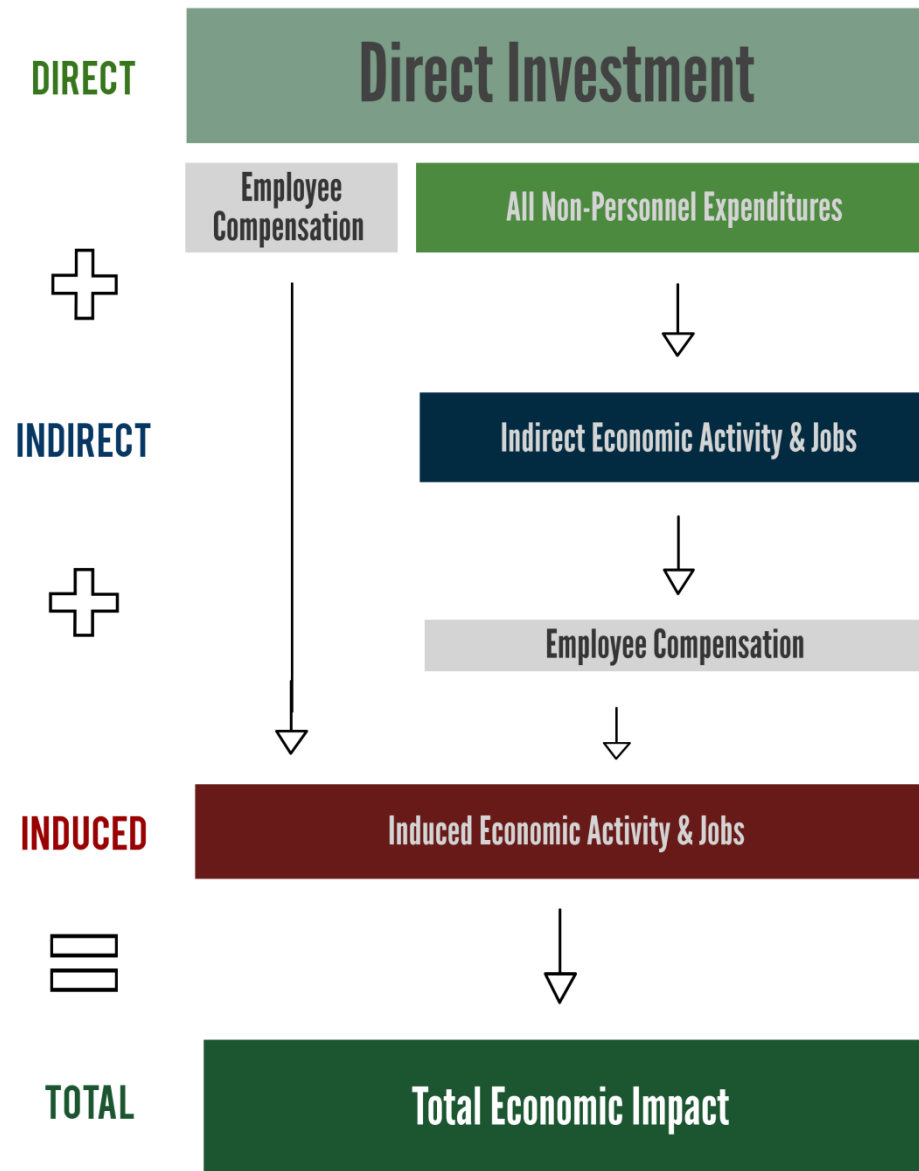
Reduction in crime rate, improved access to open space and recreational opportunities, better health outcomes (and lower health care costs), reduced health impacts from extreme temperatures

Environmental

Reduce the urban heat island effect, mitigating increased energy consumption, elevated air pollution emissions and impaired water quality that can be fatal to aquatic life.



Economic Impact Methodology



The Economic Impact of SBN's GSI Partners and GCCW

GCCW Methodology

- ESI conducted an economic impact analysis of the 25-year economic impact of GCCW in 2016
- In 2018\$, the total economic (direct, indirect, and induced) impact of GCCW on Philadelphia is \$4.0 Billion and an average of 1,160 jobs per year

SBN's GSI Partners Methodology

- As a leader in GSI, Philadelphia is home to a hub of GSI businesses, creating ripple effects in the city's economy.
- ESI modeled the direct, indirect, and induced impacts of SBN's GSI Partners for work on GSI projects in Philadelphia
- Employed data from the 2016 SBN's GSI Partners survey, adjusted for revenue growth and inflation



SBN's GSI Partners Impact in Philadelphia

Annual
Economic
Impact of
GSI Partners
(2019\$)

Economic Impact

City of Philadelphia

Direct Impact

\$55 million

Indirect & Induced Impact

\$34 million

Total (Direct, Indirect, Induced) Impact

\$89 million

Employment Supported

927 jobs

Employee Compensation

\$30 million



The Social Impact of GCCW



Crime Reduction



GSI PROJECTS

reduce crime within
1/4 mile of site by 10%

COSTS AVOIDED:

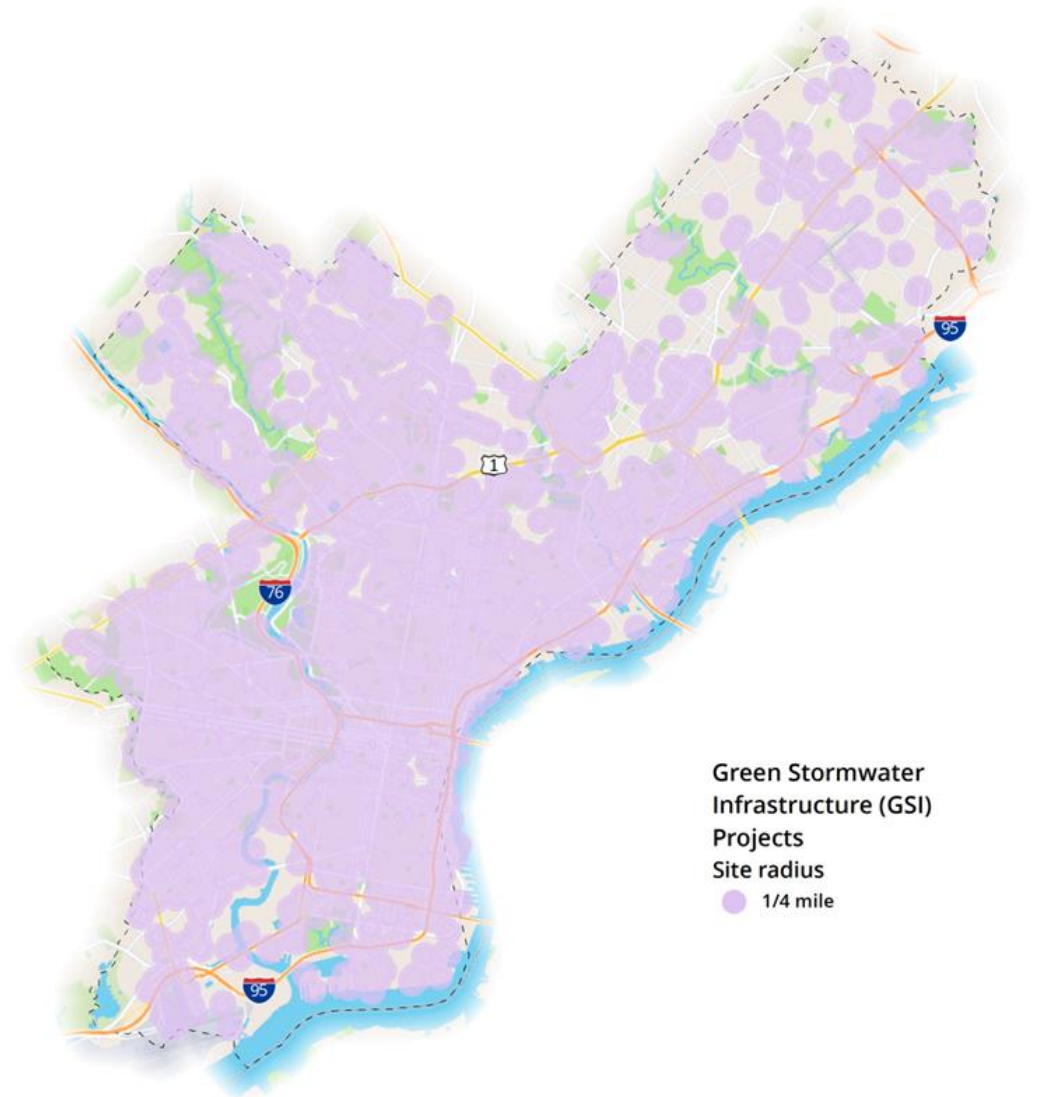
\$337M

The Social Impact of GCCW



Crime Reduction Methodology

- Existing research has demonstrated that vegetated GSI projects reduce crime within $\frac{1}{4}$ mile of sites by 10% (Branas, et al., 2011)
- We calculated all crimes that occurred within $\frac{1}{4}$ mile of vegetated GSI sites in 2018 by crime type (PPD, 2018)
- We then estimated how much crime would have occurred if the vegetated projects hadn't been built. That is, what crime rates would have been without the 10% reduction.



Crime Reduction

Crimes within
a quarter mile
of GSI projects

Type of Crime	2018 (actual)	2018 Crime reduction (without GSI)	due to GSI
Homicide	204	227	23
Rape	580	644	64
Aggravated Assault	4,508	5,009	501
Robbery	3,271	3,634	363
Arson	245	272	27
Motor Vehicle Theft	1,429	1,588	159
Stolen Property	24,951	27,723	2,772
Household Burglary	4,000	4,444	444
Total Crime	39,188	43,542	4,354

Crime Reduction Benefit

Cost of crimes within a quarter mile of GSI projects

Type of Crime	Crime reduction due to GSI	Costs per Crime	Crime reduction due to GSI (\$M)
Homicide	23	\$9.73 M	\$220
Rape	64	\$240,900	\$16
Aggravated Assault	501	\$114,500	\$57
Robbery	363	\$43,900	\$16
Arson	27	\$21,400	\$1
Motor Vehicle Theft	159	\$10,800	\$2
Stolen Property	2,772	\$8,000	\$22
Household Burglary	444	\$6,500	\$3
Total Crime	4,354		\$337

Total crime reduction benefit of
\$337 million
 due to proximity to a GSI project

This equates to
\$413 per resident
 living within a quarter mile of a GSI project



The Social Impact of GCCW

Health Benefits

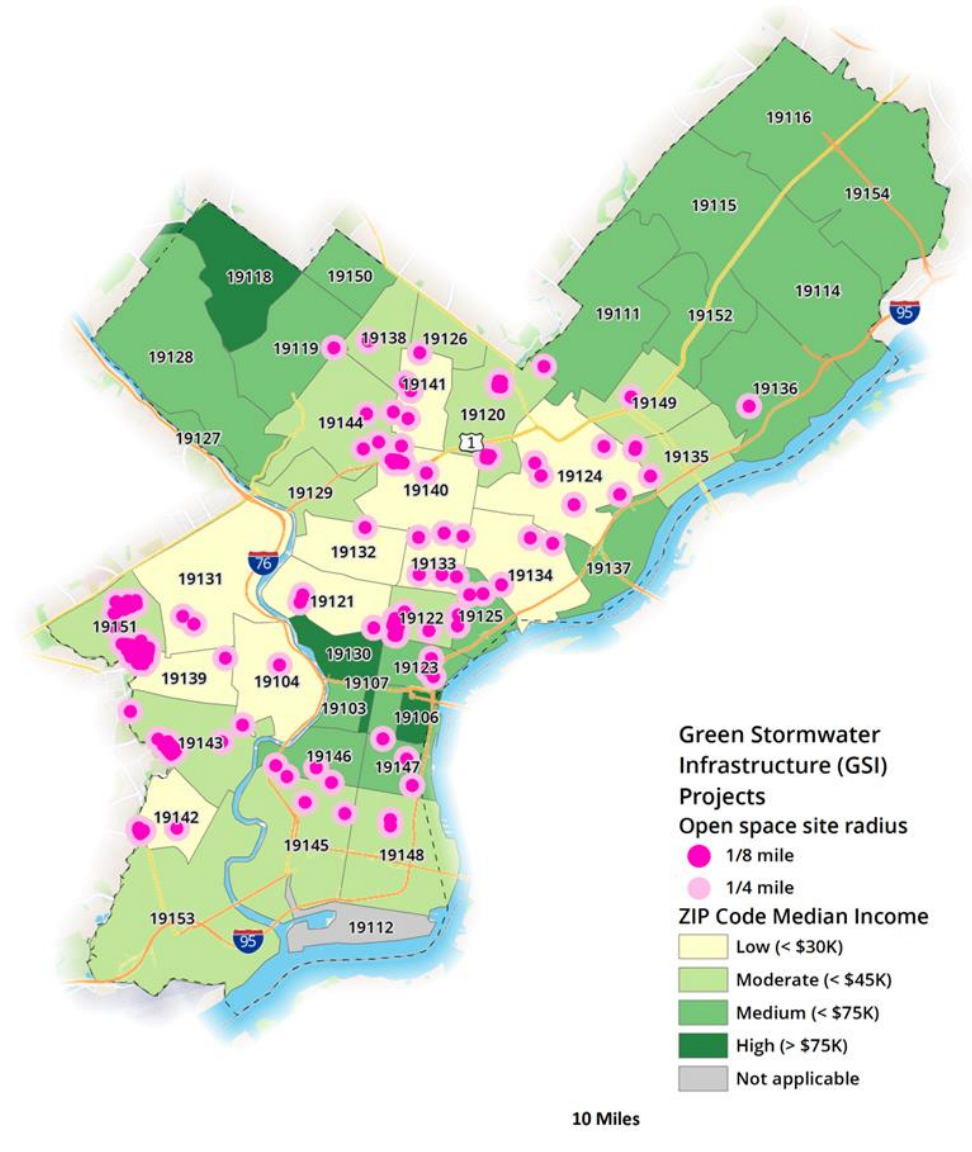


Total Health-Related Cost Savings of Open Space



Open Space Methodology

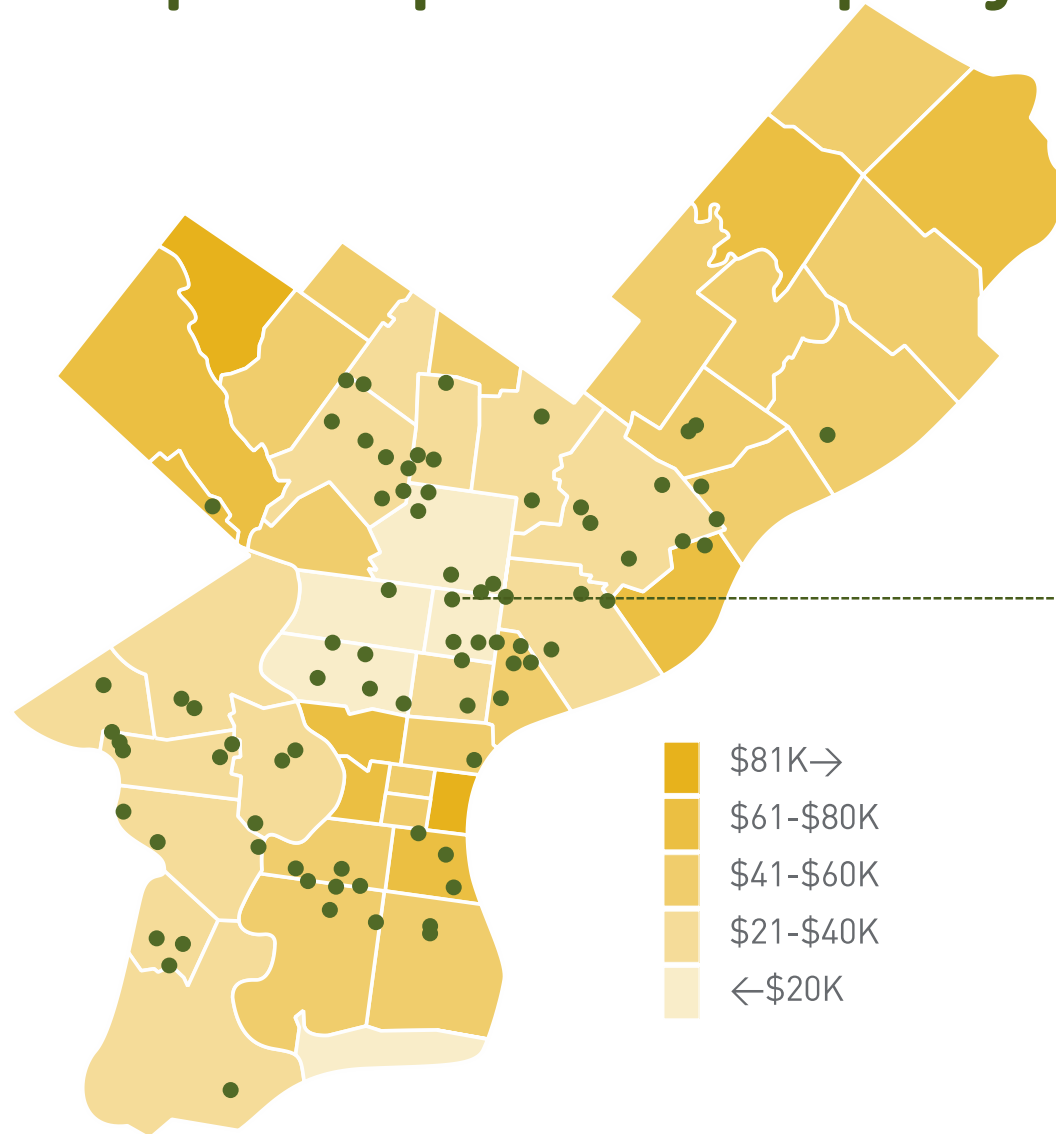
- Prior research has found that:
 - Individuals who get 90+ minutes of moderate or strenuous physical activity per week have significant health benefits
 - 33 percent of Philadelphians exercise above that threshold (DVRPC, 2015)
 - 41 percent of that physical activity occurs in parks and other public open spaces (Graefe et al., 2009)
- Calculated the working-age population that lives with 1/4 mile of an open-space project (170,000)
- Applied existing research on the avoided health care costs and lost productivity (Pratt et al., 2000; Chenoweth 2005)
- We assume that 50% of open space recreation among this population occurs at GSI open space sites



Where are public open space GSI projects?

85

public open
space projects
Completed/planned
to date



**65% located
in low- and moderate
income census blocks**

Total Health-Related Cost Savings

Annual
Total
Savings

Savings Type	Open Space (1/4 Mile)
Direct Medical Cost Savings	\$8.9 million
Indirect Medical Cost Savings	\$26.6 million
Direct Workers' Comp Savings	\$0.1 million
Indirect Workers' Comp Savings	\$0.5 million
Lost Productivity	\$14.1 million
Total	\$50.1 million

Benefits of Physical Activity on Open Space

Annual Per-Household Recreation Benefit of Open Space

Recreational Benefit per Household (2019\$)

\$450

Recreational Benefit per Household Credited to GSI Open Space Sites

\$225

Total Households within ¼ mile of sites

101,009

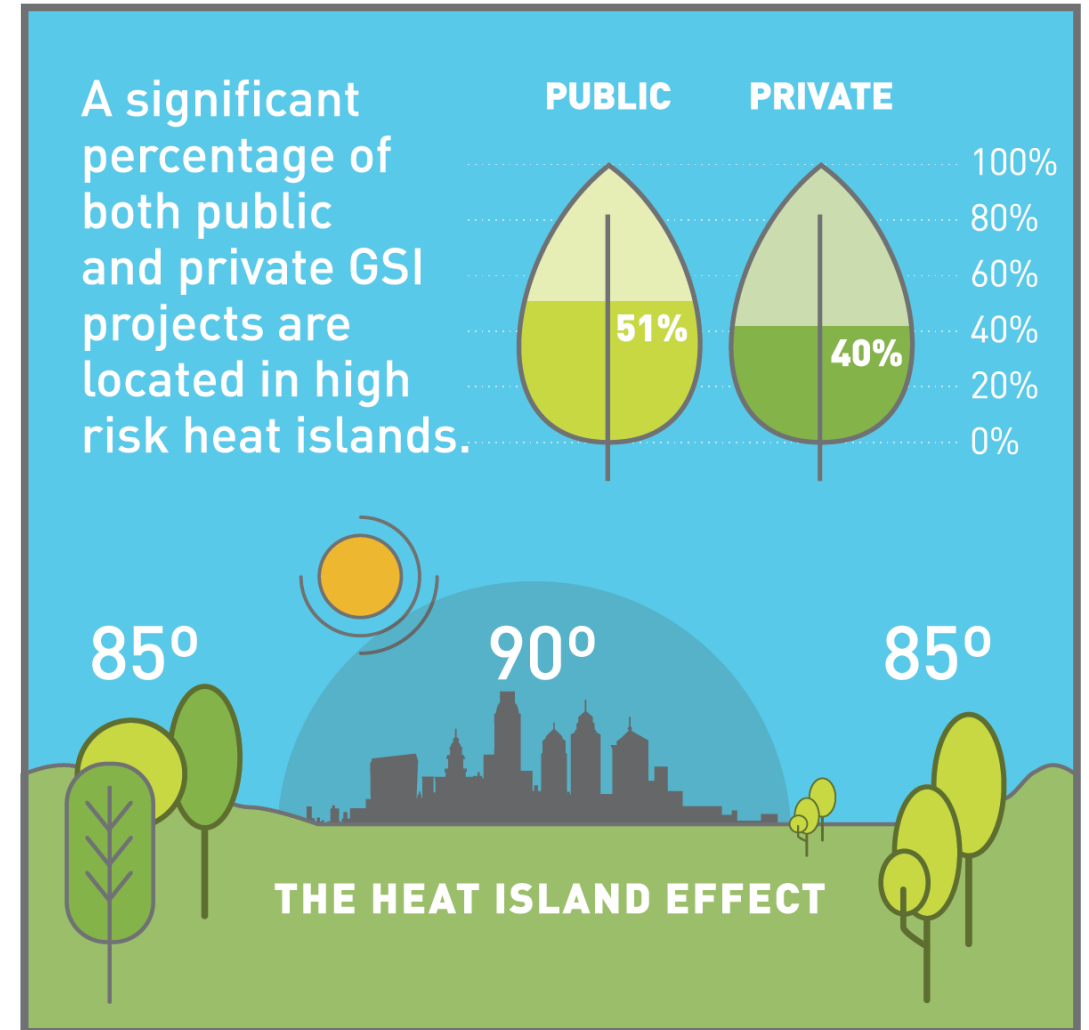
Aggregate Benefit

\$22.7 million

The Environmental Impact of GCCW

Urban Heat Islands

- Heat islands are urban areas where temperatures are significantly warmer than surrounding rural areas. The primary cause of heat islands is a lack of vegetated land surfaces (EPA, 2019)
- Research has demonstrated GSI projects reduce surface temperatures in urban areas and mitigate heat islands (Scientific American, 2018)



The Environmental Impact of GCCW

Negative Impacts of Heat Islands

Environmental:

- Increased energy consumption
- Elevated air pollution
- Elevated greenhouse gas emissions
- Impaired water facilities leading to stress and fatalities for aquatic life (EPA, 2019)

Human Health Impacts:

- Respiratory difficulties
- Heat cramps and exhaustion
- Non-fatal heat-stroke
- Heat-related mortality (EPA, 2019)

Heat Islands and Equity

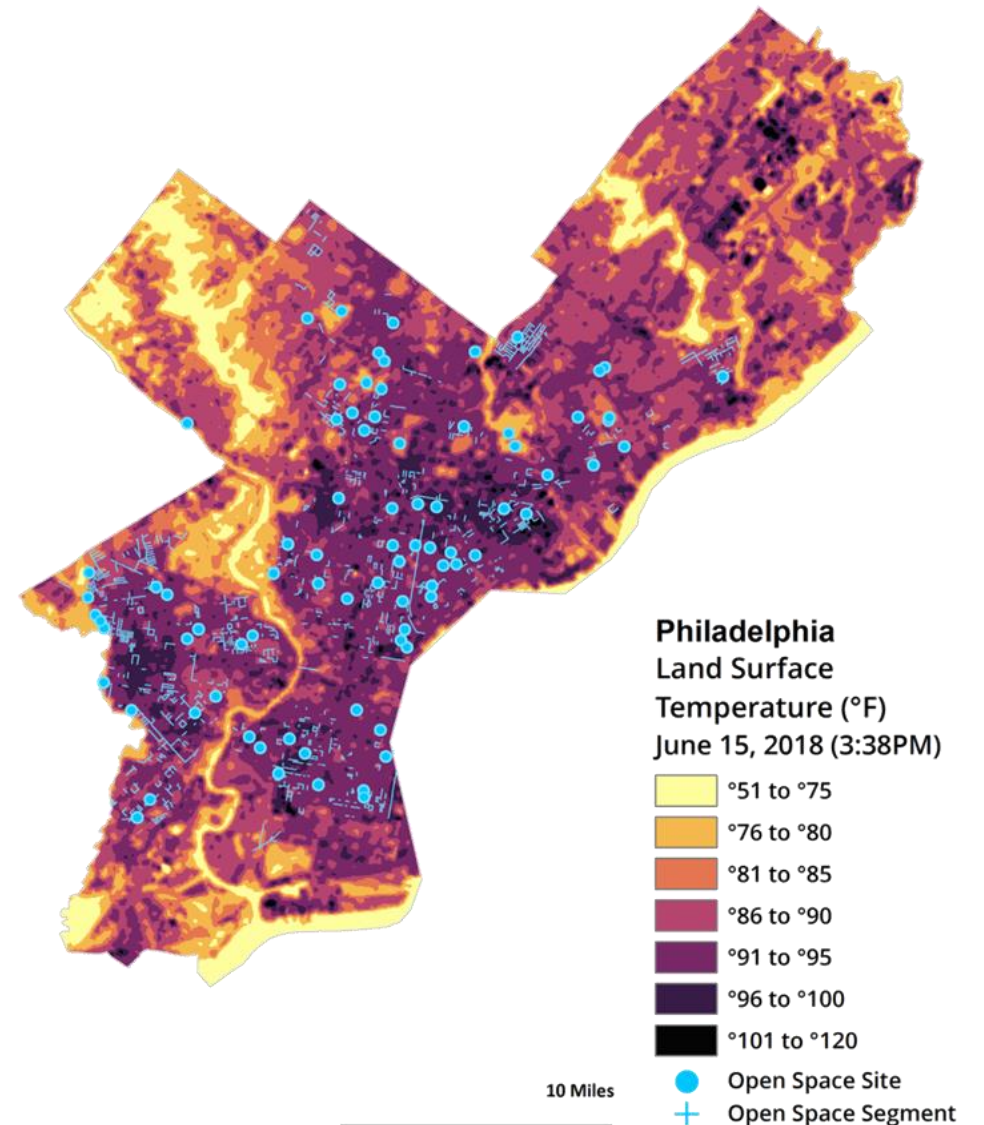


Public projects

- 51% are located in high-risk heat islands
- 3% are located in extreme-risk heat islands

Private projects

- 40% are located in high-risk heat islands
- 6% are located in extreme-risk heat islands



GSI in Practice: Nicetown East Park

- In 2016, PWD broke ground on a \$78 million, multi-year project to add a stormwater basin, upgrade water tanks, and improve general facilities
- Through a partnership with the Parks and Recreation department, stormwater basin improvements created and improved existing recreation opportunities at the site
- The project also includes the transformation of an abandoned water basin to a natural environmental habitat
- Within ¼ mile of the project, we found:
 - 4.4 percent crime reduction from 2011 to 2018
 - Estimated localized health cost benefit of \$800,000 annually for working age population



Photo Courtesy of Philadelphia Water Department

Conclusion

Major Findings

- The total annual economic impact of SBN's GSI partners is **\$89M**
- There are an estimated 4,354 fewer crimes that occurred in Philadelphia in 2018 due to GSI projects, this is a **\$337 million annual benefit** to Philadelphia
- **65%** of public open space projects are located in low- or moderate-income communities
- The health-related cost savings of GSI projects due to recreation access is **\$50.1 million annually**
- Recreational benefit of GSI open space sites is **\$22.7 million annually**
- **51%** of public GSI projects and **40%** of private GSI projects are located in high-risk heat islands



Additional Benefits of GSI

- Flood mitigation
- Water pollution reduction
- Air pollution reduction



Thank you to EConsult Solutions Inc. (ESI)
for conducting this research on our behalf