The Economic Impact of Green City, Clean Waters: The First Five Years



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FINAL REPORT SUBMITTED TO:
Sustainable Business Network
2401 Walnut Street Suite 206
Philadelphia, PA 19103

FINAL REPORT SUBMITTED BY:
Econsult Solutions
1435 Walnut Street
Philadelphia, PA 19102

sbn
Sustainable Business Network
of Greater Philadelphia

GREEN STORMWATER INFRASTRUCTURE PARTNERS
REIMAGINING STORMWATER

ECONSULT SOLUTIONS
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EXECUTIVE SUMMARY

The purpose of this report is to articulate the local economic impact of *Green City, Clean Waters (GCCW),* an ambitious initiative of the Philadelphia Water Department that seeks to invest in green stormwater infrastructure (GSI) projects throughout the City of Philadelphia. *GCCW* fulfills federally established water quality requirements in ways that are simultaneously environmentally sustainable, positive for the local economy, and beneficial to neighborhoods throughout the City (see Table ES.1).

TABLE ES.1 – GREEN CITY, CLEAN WATERS' TRIPLE BOTTOM LINE BENEFITS

Economics	Environment	Equity
Green infrastructure provides a more affordable approach for Philadelphia and rate payers, circulates more dollars with the local business community and improves property values	Green infrastructure is less energy intensive than gray infrastructure, provides water and air quality improvements, enhances habitats, reduces the carbon footprint, provides an aggregate cooling effect and enhances adaptability and resiliency	Green infrastructure creates more neighborhood benefits and more accessible employment/business opportunities than gray infrastructure. Green infrastructure is being leveraged to make improvements to rec centers, play grounds and school yards. Green infrastructure enhances aesthetics and reduces blight

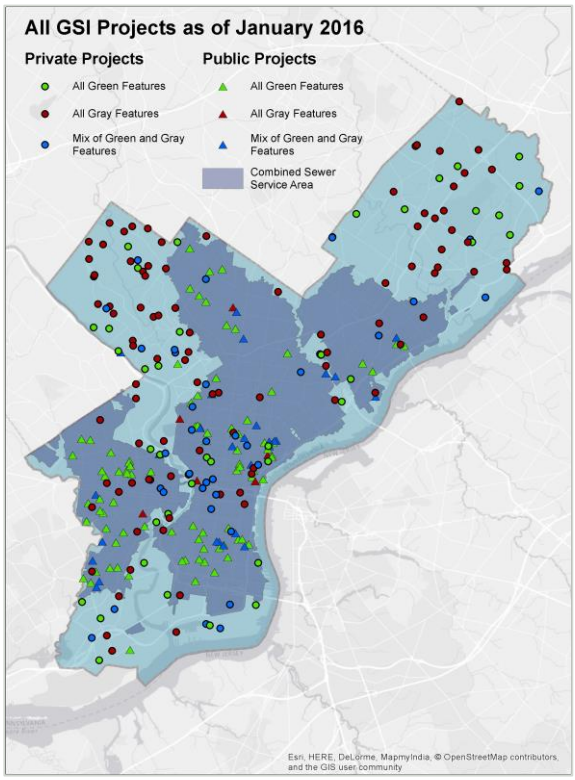
GCCW is currently in Year 5 of a 25-year program, so it is useful to both account for its successes to date and point to even greater impacts upon further implementation of efforts. This report reaches the following key findings:

Stormwater Management Regulations for Development have helped catalyze a best-in-class GSI industry cluster, with meaningful consequences for the local economy. The local GSI industry is believed to be experiencing double-digit annual growth, and conservatively represents annual economic impact of almost $60 million within the city of Philadelphia, supporting 430 local jobs and generating nearly $1 million in local tax revenues. Innovative solutions birthed by local vendors in response to GCCW have produced export opportunities for the benefit of the local economy and have established Philadelphia's status as a leader in stormwater management; positive media coverage, national awards, and emulation from such cities as New York City and Washington have followed.

GSI work boosts the local economy. Philadelphia Water has projected that it will invest approximately $1.2 billion in stormwater infrastructure projects over the life of *GCCW*, and is inducing additional private GSI projects through regulation and incentives. Conservatively, these investments will produce a $3.1 billion impact in the Philadelphia economy, supporting about 1,000 jobs per year and generating $2 million per year in local tax revenues for the entire 25-year period.

GSI projects advance social equity. GSI has proven superior to traditional gray infrastructure solutions in generating more accessible on-ramps for individuals to find employment opportunities and for businesses to find contract opportunities. Also, both GSI investments by Philadelphia Water and private GSI investments induced by regulation and incentives can be found in neighborhoods throughout Philadelphia (see Figure ES.1), and hence the benefits they confer at a very local level are enjoyed by a wide range of household income levels. Indeed, the majority of GSI projects (public and private) are located in relatively low-income neighborhoods (with very few in relatively high-income neighborhoods), with some becoming beloved amenities for communities even as they perform an important ecological function.

FIGURE ES.1 – GREEN AND GRAY STORMWATER INFRASTRUCTURE PROJECTS UNDER GREEN CITY, CLEAN WATERS[1]



GSI represents a neighborhood-level amenity that provides a wide range of quality of life benefits, stabilizing home values, growing the city's property tax base, and making possible more private investment throughout the city. GSI projects beautify areas, create active recreation opportunities in neighborhoods previously lacking such resources, reduce the negative effects of urban blight, and perform valuable ecological services that result in cleaner air and less flooding. These gains

[1] For more information on the distinction between green and gray stormwater mitigation features, please see section 3.1.

are enjoyed in neighborhoods throughout Philadelphia, and have resulted in increases in property values relative to houses not near GSI projects. It is estimated that proximity to a GSI feature produces a 10+ percent increase in house value, which means that the 496 GSI projects that have been completed to date have yielded an aggregate $1.3 billion increase in citywide property value, producing an annual increase of $18 million in property taxes for City government and for the School District of Philadelphia.

TABLE ES.2 – ESTIMATED AGGREGATE PROPERTY VALUE INCREASE AND PROPERTY TAX GAIN FROM PROPERTIES WITHIN A QUARTER-MILE OF GREEN STORMWATER INFRASTRUCTURE INVESTMENT

Aggregate Property Value	Estimated Property Value Gain from Proximity to GSI Investment	Aggregate Property Value Gain from Proximity to GSI Investment	Aggregate Annual Property Tax Increase from Proximity to GSI Investment
$13.8B	10.3%	$1.3B	$18.0M ($8.1M to City and $9.9M to School District)

Five years into an ambitious, daring, and innovative 25-year plan to address federal water quality requirements, *GCCW* has demonstrated present results and future potential. Its premise is to deal with stormwater on site and in a distributed fashion, using green infrastructure solutions, rather than move it to centralized locations and treating it in traditional gray infrastructure ways. But its promise is grander: to simultaneously pursue economic gain, environmental sustainability, and community benefit, and to not only orient public sector action in this way but to impel private sector participation to the same end. With greater convergence of public and private investment in neighborhoods throughout Philadelphia around high quality of life offerings that respect community and environment, this appears to be *GCCW*'s greatest legacy, which is to encourage a triple bottom line approach to water quality requirements that saves municipal government billions of dollars and in turn invests in desirable neighborhood amenities, creates local employment and economic opportunities, and generates economic impact for the Philadelphia economy and tax revenue gains for Philadelphia government.

ABOUT SBN AND THE GSI PARTNERS

The Sustainable Business Network (SBN) is a non-profit membership organization working to build a thriving, local, and sustainable economy in the Greater Philadelphia region. They are accomplishing this by growing and educating a broad base of local, independent businesses and educating policymakers and the public.

The Green Stormwater Infrastructure (GSI) Partners is a priority initiative of SBN working to advance the local GSI industry, innovation, and the local economy as it relates to GSI. Formed in 2012 in response to Philadelphia's ambitious and innovative stormwater management plan,

Green City, Clean Waters, the GSI Partners advocate for the greenest approaches to be facilitated and incentivized as much as possible, and for the public and private investment to remain as local as possible. Members include locally-owned engineering and landscape architecture firms; landscape design, build, and maintenance firms; and material suppliers whose services and products pertain to GSI.

SBN supports *Green City, Clean Waters* and its triple-bottom line approach, and through the GSI Partners, SBN is working to maximize the local economic, environmental, and social impact of the plan.

ABOUT ECONSULT SOLUTIONS INC. (ESI)

This report was produced by Econsult Solutions, Inc. (ESI). ESI is a Philadelphia-based economic consulting firm that provides businesses and public policy makers with economic consulting services in urban economics, real estate economics, transportation, public infrastructure, development, public policy and finance, community and neighborhood development, planning, as well as expert witness services for litigation support. Its principals are nationally recognized experts in urban development, real estate, government and public policy, planning, transportation, non-profit management, business strategy and administration, as well as litigation and commercial damages. Staff members have outstanding professional and academic credentials, including active positions at the university level, wide experience at the highest levels of the public policy process and extensive consulting experience.

1.0 PHILADELPHIA SETS A NEW COURSE AND THE NATION IS WATCHING

1.1 INTRODUCTION

The purpose of this report is to articulate the local economic impact of *Green City, Clean Waters. Green City, Clean Waters* is an ambitious initiative of the Philadelphia Water Department that seeks to invest in green stormwater infrastructure projects throughout the City of Philadelphia. In doing so, *Green City, Clean Waters* will fulfill federally established water quality requirements in ways that are simultaneously environmentally sustainable, positive for the local economy, and beneficial to neighborhoods throughout the City. *Green City, Clean Waters* is currently in Year 5 of a 25-year program, so it is useful to both account for its successes to date and point to even greater impacts upon further implementation of efforts. Specifically, this report will speak to the benefit to Philadelphia from cultivating a local green stormwater infrastructure industry cluster, the impact of the work on the local economy and on local real estate markets, and the quality of life gains that will be accrue to Philadelphia's neighborhoods.

1.2 ABOUT GREEN CITY, CLEAN WATERS

Green City, Clean Waters (*GCCW*) is the name given to the Combined Sewer Overflow Long Term Control Plan Update (CSO LTCPU), an initiative of the Philadelphia Water Department (Philadelphia Water) that responds to water quality goals set for Philadelphia as part of its consent decree with the United States Environmental Protection Agency and the Pennsylvania Department of Environmental Protection. GCCW will include $1.2 billion[2] in green stormwater infrastructure (GSI) and other investments, including an additional $260 million for stream restoration and wetland creation yielding 9,600 "greened" acres.[3] The objective of GCCW is to reduce combined sewer overflow (CSO) events in innovative ways that are more cost-effective, environmentally sustainable, and neighborhood-friendly than traditional methods. For more information of the regulations, billing structure, incentives and goals of *GCCW*, please see Appendix D.

1.3 THE IMPETUS

Historically, older cities like Philadelphia have managed stormwater runoff by using a combined sewer system that uses vast underground networks of pipes and pumps that carry both sewage and rainwater, treat it at a centralized treatment plant and release it back into bodies of water.

[2] $1.2 billion in 2011 dollars / $2.4 billion in total 2036 dollars
[3] Per *GCCW*: A greened acre manages at least the first inch of rainfall over that acre.

However, due to development and increased density the capacity of the system is regularly overwhelmed during wet weather events, causing a combination of sewage and stormwater to overflow untreated into rivers and streams. A combined sewer overflow (CSO), occurs when the capacity of the system is overwhelmed and a mix of raw sewage and stormwater is released into rivers and streams through combined sewer overflows (CSOs).

Specifically, increasingly stringent water quality regulations at the federal (US EPA) and state (PA DEP) levels have necessitated that Philadelphia take action to reduce the number of CSO events.[4]

Federal and state regulatory bodies are setting increasingly stringent water quality requirements. These requirements are typically met through traditional "gray infrastructure" methods that would be prohibitively expensive, energy-intensive, and disruptive to neighborhoods. Below-ground solutions are complex, involving vast networks of pipes and devices to capture, store, and treat stormwater. Furthermore, much of Philadelphia's gray infrastructure is over 100 years old, making repair and expansion efforts even more costly. All told, it is estimated that $8 billion to $10 billion in gray infrastructure investment would be needed to comply.[5] This is cost-prohibitive for the City: federal policies concerning affordability constrain Philadelphia Water from raising water rates and therefore place a ceiling on capital spending in any given year. Therefore, any response to federal and state requirements involving traditional gray infrastructure methods will not only be extremely expensive but would have to be implemented over a period of several years, delaying the City's ability to be compliant.

1.4 THE ALTERNATIVE

Philadelphia Water proposes instead to handle stormwater treatment in a distributed manner, using a variety of "green stormwater infrastructure" (GSI) techniques installed throughout the city. Also known as low impact development (LID), GSI represents water-soil-plant systems that intercept stormwater, infiltrate a portion of it into the ground, evaporate a portion of it into the air, and in some cases release a portion of it slowly back into the sewer system recreating the natural water cycle in a dense urban area.[6] This approach promises greater local benefits in the form of desired amenities, positive health outcomes, energy savings, and economic opportunities.

In 2011, Philadelphia Water signed a consent agreement with the US EPA to implement *GCCW* over the next 25 years as an alternative approach to satisfying water quality requirements. Philadelphia Water is currently 5 years into the 25-year plan to meet water quality requirements through green stormwater infrastructure principles and investments. This paradigm shift – from

[4] The Environmental Protection Agency's Combined Sewer Overflow (CSO) Control Policy establishes a national approach for controlling discharges from CSOs to bodies of waters through the National Pollutant Discharge Elimination System (NPDES) permit program. The CSO Control Policy mandates that CSO permittees should develop long term CSO control plans which evaluate alternatives for attaining compliance with the Clean Water Act. The Pennsylvania Department of Environmental Protection developed a policy in response to "improve and preserve the purity of the waters of the Commonwealth through the adequate permitting and control of CSOs." This policy describes the actions that will be taken if permit conditions are violated.

[5] Luntz, Taryn. "City's 'All Green' Stormwater Plan Raises Eyebrows at EPA." The New York Times. December 24, 2009.

[6] Philadelphia Water Department. 'Green Stormwater Infrastructure.' January 22, 2016.

traditional stormwater infrastructure systems to innovative GSI solutions – will begin to contribute to water quality improvements immediately, while a large tunnel project would not reduce CSOs until it was completed. Alternatively, above-ground investments using GSI serve to not only support incremental improvements to water quality over time, but also create additional environmental and social benefits. This above ground investment will enhance the urban environment and add value to properties throughout the city.

FORBES

SMART COMMUNITIES WILL BUILD GREEN INFRASTRUCTURE

"At the municipal level, the pioneer operating on a grand scale is the city of Philadelphia."

1.5 A PARADIGM SHIFT IN WATER QUALITY CONTROL

Fundamentally, GCCW represents a paradigm shift in water quality control, from utilizing complex, expensive, and energy-intensive gray infrastructure methods below ground to dealing with stormwater to treating stormwater above ground and on site and thereby reducing (or in some cases eliminating entirely) the amount of stormwater that enters into the City's sewer collection system. As such, it is governed by the following guiding principles:[7]

1. Thinking of stormwater as a resource to be used for good where it falls, rather than a problem to be dealt with by moving it away and treating it elsewhere.

2. Being strategic and cost-effective in the maintenance and upgrading of one of the nation's oldest water infrastructure systems.

3. Activating regulatory partners, the public sector and business community, as well as advocacy groups and local citizenry to come together on strategies that simultaneously achieve economic, environmental, and equity objectives.

FIGURE 1.1: AN EXAMPLE OF A STORMWATER TUNNEL BEING CONSTRUCTED IN PORTLAND, MAINE & THE PHILADELPHIA



City of Portland, Maine. "Baxter Boulevard"



© LRSLA Studio, Inc.

[7] "Green City Clean Waters: The City of Philadelphia's Program for Combined Sewer Overflow Control." Philadelphia Water Department. Amended June 1, 2011.

1.6 IN PURSUIT OF TRIPLE BOTTOM LINE ACTIVITIES

GCCW is reflective of a broader movement, at both the national and local levels, towards "triple bottom line" activities that simultaneously achieve multiple objectives (see Table 1.1). This innovative approach to stormwater management is being followed carefully by other municipalities and serves as a blueprint for similar work in New York City, Washington, DC, Buffalo, NY and Kansas City. If successful in fulfilling these aims, *GCCW* will serve as the gold standard for cities across the country, fundamentally shifting the way urban stormwater is managed throughout the country, and build on Philadelphia's long-standing leadership position in municipal water management.

TABLE 1.1 – GREEN CITY, CLEAN WATERS' TRIPLE BOTTOM LINE BENEFITS

Economics	Environment	Equity
Green infrastructure is more cost-efficient than gray infrastructure and circulates more dollars with the local business community	Green infrastructure is less energy intensive than gray infrastructure	Green infrastructure creates more neighborhood benefits and more accessible employment/business opportunities than gray infrastructure
The impact of the investment is immediate rather than long term; with the potential to be more cost effective than gray and more sustainable in the long run. Less disruptive to residential neighborhoods and commercial corridors Greater local capture of economic activity, supporting local jobs and generating local tax revenues The development of a best-in-class GSI industry cluster	Gray infrastructure… Is more energy-intensive Can aggravate flooding Does not produce better air quality	Green infrastructure… Represents desirable amenities in residential neighborhoods Creates easier on-ramps for employment and business opportunities commercial corridors Greater local capture of economic activity, supporting local jobs and generating local tax revenues The development of a best-in-class GSI industry cluster

1.7 NATIONAL INTEREST IN GREEN CITY, CLEAN WATERS

The City of Philadelphia has long been a leader in municipal water management, and the implementation of *GCCW* has reaffirmed this status, drawn national attention and accolades (see Table 1.2), and afforded Philadelphia influence as an innovator and convener on stormwater management. This is hugely important for Philadelphia, both from a reputational standpoint (Philadelphia is seen as a leader and trend-setter on vital municipal issues) and for producing intellectual capital that can be exported to other cities (Philadelphia firms are seen as go-to vendors for a variety of products and services needed in other parts of the country).

TABLE 1.3 – SELECTED LIST OF HONORS AND ACTIVITIES CATALYZED BY *GREEN CITY, CLEAN WATERS*

Honor/Activity (Year)	Description
US Water Prize (2012)	Presented by the Clean Water America Alliance
Sustainability Award (2012)	Presented by the Pennsylvania Horticultural Society
Environmental Communications Award (2014)	Presented by the American Academy of Environmental Engineers and Scientists
Emerald City Rating (2011)	The only city profiled by the Natural Resources Defense Council undertaking all six recommended actions related to GSI investment

AWARD: FROM THE NATURAL RESOURCES DEFENSE COUNCIL

In November 2011, the Natural Resources Defense Council ranked cities working to employ green stormwater infrastructure to reduce combined sewer overflows. Philadelphia was the first city to meet all six of the review criteria. In order to meet the criteria, cities were required to have a vision linked with a long-term green infrastructure plan, prioritization of infrastructure investments, a strong retention standard for stormwater reduction or management of runoff from impervious surfaces, incentives for residential and commercial property owners to install green infrastructure, and lastly a long-term, dedicated funding source to support green infrastructure investment.
Source: NRDC

WASHINGTON D.C. PURSUES HYBRID APPROACH

Washington D.C. is managing stormwater through a hybrid approach, inspired by Philadelphia. In 2005, the Washington D.C. signed a consent decree with the Environmental Protection Agency (EPA). Philadelphia signed a consent decree with the EPA in June 2011. After the EPA permitted Philadelphia to move forward with Green Stormwater Infrastructure, Washington requested a modification of its 2005 plan to a "hybrid" system that includes both the new tunnel network and new green infrastructure. That would allow the city to avoid building some of the tunnels, reducing the cost of compliance.

Source: Inside D.C.'s Massive Tunnel Project, Brian Clark Howard, National Geoprahpic, July 5th, 2014

1.8 REPORT OVERVIEW

Given the import of what *GCCW* represents for Philadelphia and as a national model, it is appropriate to take stock, five years into a 25-year effort, of its performance and benefits. The purpose of this report is to express the local economic impact of *GCCW* during its first five years of operation, and to discuss where it has been successful in achieving its intended economic, environmental, and equity aims. The report begins with a description of the local GSI business cluster that *GCCW* has helped grow (Section 2). The report then describes three sets of gains produced by *GCCW*: impacts to the local economy and tax base from the economic activity catalyzed by *GCCW* (Section 3), impacts to neighborhood residential real estate markets from the addition of GSI features (Section 4) and quality of life benefits to households throughout Philadelphia (Section 5). The report concludes with a summary of these gains and their implications for highlighting the success of *GCCW* (Section 6)

GSI PARTNER PROFILE: SHIFT DESIGN



SHIFT_DESIGN is a Philadelphia-based company that designs and manufactures sustainable products and places for modern, outdoor living. They are focused on local manufacturing. SHIFT_DESIGN has developed two products in response n response to increased interest in GSI catalyzed by GCCW. These products are unique because they are developed and produced in Philadelphia and are being exported to other states, primarily California.

Fairmount Living Tiles

SHIFT_DESIGN has a DIY green roof kit for homeowners called "Fairmount Living Tiles". The tile kit contains four aluminum trays that come flat-packed with up-cycled LaColombe coffee bean bag soil container. Local labor is used to assemble the kits.

Downspout Planters

SHIFT_DESIGN is creating downspout planters in conjunction with PWD's Rain Check Program. These stylish planters will enable homeowners a means to manage Stormwater.

The presence of thriving manufacturers and technical service based firms enhances Philadelphia's economic environment and ensure that the City remains on the cutting edge of GSI innovation.



2.0 IMPLICATIONS ON THE LOCAL ECONOMY OF GROWING A BEST-IN-CLASS GREEN STORMWATER INFRASTRUCTURE INDUSTRY CLUSTER

2.1 SECTION OVERVIEW

This is the first of four sections articulating anticipated benefits from *Green City, Clean Waters* and evaluating the extent to which these benefits

have materialized or will materialize. Through regulation, investment, and incentives, Philadelphia Water has created an economic landscape that encourages the development of a local industry cluster of green stormwater infrastructure firms that provide best-in-class products, services, solutions, and developments. This has the effect of actualizing the triple bottom line potential of GCCW in Philadelphia, of providing accessible on-ramps for employment and business opportunities, including for traditionally disadvantaged communities, and of creating opportunities for local firms to gain business in other parts of the country. This section will endeavor to describe the composition and growth of this industry cluster, quantify its economic footprint within Philadelphia, and evaluate the extent to which the promises of export and of economic inclusion have been fulfilled.

2.2 MAINTAINING A DIVERSE ECONOMY THAT FOSTERS INNOVATION

Manufacturing jobs have provided Philadelphia residents with family-supporting wages for the last century. However, like other metropolitan areas, the City has shifted away from goods-producing industries and has become more dependent on service-providing sectors.[8] Unfortunately, the manufacturing industry in Philadelphia no longer supports the jobs or revenue for the City that it once did. Between 2007 and 2012, the industry has seen a 12.8 percent decline in total firms, a 20.4 percent decline in total employees, and a 12 percent decline in annual sales within the Philadelphia region.[9] While the decline of a once thriving industry means a loss of manufacturing specific jobs, the City has seen tremendous growth of existing firms and creation of new jobs within other industries. The City was committed to supporting and sustaining local manufacturing businesses. However, in order to keep up with global economic forces, Philadelphia has cultivated new industries to compensate for sectors that are experiencing stagnation or becoming obsolete. In fact, the Bureau of Labor Statistics' Quarterly Census of Employment and Wages shows that the combined job growth in health services and professional and business services has helped offset the losses in the manufacturing industry over the last ten years. The growth of annual revenues of the GSIP firms from 2013 to 2014 represents the City's dedication and new dependence on this growing industry.

While there is growing consensus on what constitutes GSI, the work transcends traditional industry classifications, making it difficult to calculate the size of the GSI industry in Philadelphia. One useful proxy of the size – and rapid growth – of the GSI industry in Philadelphia is SBN's GSI Partners. Through the GSI Partners, SBN is working to grow the local GSI industry and advance innovation by ensuring incentives for green approaches. Members include locally-based architecture, engineering, and landscape architecture firms; landscape design, build, maintenance firms; and material suppliers whose services and products pertain to GSI.

[8] Perrins, Gerald and Diane Nilsen. "Industry shifts over the decade put Philadelphia on a new road to job growth" Monthly Labor Review . April 2010, Vol. 133 Issue 4

[9] U.S Census, Statistics of U.S. Businesses Annual Data 2007, 2012

GSI Partners is growing in membership, and the partner firms are growing as well. These firms revenues totaled more than $146.8 million 2014, an increase of 14 percent from 2013 (see Table 2.1).[10]

TABLE 2.1 – REVENUE GROWTH OF GSI PARTNERS FIRMS WITHIN THE CITY OF PHILADELPHIA

2014 Revenue	2013 Revenue	Revenue Increase	% Increase
$146,796,900	$128,959,000	$17,837,900	13.8%

Source: Econsult Solutions (2016), GSI Partners (2016)

GSI Partners firm operation's growth has a significant impact across the City. By supporting jobs and businesses in the area, GSI Partners firm operations have a significant economic impact on the City of Philadelphia in three ways:

1. The direct footprint of GSI Partners firms. Revenue growth and the percent increase in growth are shown in Table 2.1.

2. GSI Partner's firm operations require direct procurement of various goods and services, a portion of which take place within the city. These local expenditures have a ripple effect on the economy. Expenditures on goods and services cause suppliers of those goods and services to increase production to meet the demand as well as acquire additional goods and services from their suppliers, who themselves will do the same. The additional output, employment, and earnings beyond the activity at GSI Partners firms is known as the **indirect impact**.

3. GSI Partners firms directly employ hundreds of full- and part-time workers, a portion of whom live within the City. The wages and salaries provide these people with additional spending power. Some of that spending power is exercised within the region, supporting local providers of various goods and services (e.g., food, entertainment, housing, retail, and transportation). This additional output, employment, and earnings beyond the activity at GSI Partners firms is known as the **induced impact.**

ESI then constructed an economic impact model using multiplier data provided by IMPLAN, an industry standard input-output modeling software program, to estimate the scale and composition of spillover impacts generated by activity associated with GSI related industries in Philadelphia. Operations associated with the Philadelphia's Green Stormwater Infrastructure Projects account for $35 million of total annual revenues for the 60 GSIP firms. The estimated local operations of GSI partner firms generate an annual economic impact of $57 million, supporting 430 direct, indirect, and induced jobs and $27 million in annual labor income within the City of Philadelphia. More details on the methodology can be found in Appendix A.

[10] Please see Appendix A for details on the Impact of GSI Partners Impact.

TABLE 2.2– ESTIMATED ANNUAL ECONOMIC IMPACT OF GREEN STORMWATER INFRASTRUCTURE WORK PERFORMED BY FIRMS WITHIN THE CITY OF PHILADELPHIA

Impact Type	City of Philadelphia($M)
Direct Output ($M)	$35
Indirect & Induced Output ($M)	$22
Total Output ($M)	**$57**
Employment Supported	**430**
Labor Income Supported ($M)	**$27**

Source: Econsult Solutions (2016), GSI Partners (2016), IMPLAN (2013)

The ongoing operations of GSIP firms, coupled with spending from local residents and employees generate annual tax revenues to the City of Philadelphia government. The associated tax revenues come from personal income and wages, sales, and business taxes. In total, the City of Philadelphia gains nearly $860,000 in tax revenue each year as a result of GSI Partners firm operations (see Table 2.3).

TABLE 2.3 – ESTIMATED ANNUAL FISCAL IMPACT OF GREEN STORMWATER INFRASTRUCTURE WORK PERFORMED BY GSI PARTNERS FIRMS WITHIN THE CITY OF PHILADELPHIA

Tax Type	City of Philadelphia
Income	$580,000
Sales	$109,000
Business	$170,600
Total	**$859,000**

Source: Econsult Solutions (2016), GSI Partners (2016), IMPLAN (2013)

It is important to note that these results are simply the impact of the operations of these 60 GSI Partners firms, rather than the overall impact of the GSI industry within Philadelphia, which is much greater. Additionally, these impacts are projected to grow significantly over the next several years as local GSI firms grow in tandem with the demand for GSI work within the City.

2.3 THE BENEFITS OF BEING FIRST

In addition to regulation, investment and incentives generating GSI work in Philadelphia, *Green City Clean Waters* is also creating a best-in-class GSI industry cluster whose early work and innovations is producing vendors primed for work outside of Philadelphia. As other cities look to the City of Philadelphia government as a national model for municipal stormwater management, they are also taking note of the innovative solutions being implemented by a growing sector of manufacturers of GSI products and providers of GSI services.

There are two pivotal aspects of the perception gain for Philadelphia in being first and foremost in green stormwater infrastructure. First is the reputational enhancement to the city itself, as a place of innovation and triple bottom line solutions. Second are the export opportunities for Philadelphia vendors and service providers to do business outside of Philadelphia and thus support additional employment and tax base in Philadelphia. Both of these gains can be seen in vivid ways in the recent successes of three local companies providing innovative solutions in the GSI space (see insets). In all three cases, the private sector has responded to regulation-driven opportunities. There is now an economic incentive to deal with stormwater through green stormwater infrastructure methods – with innovative solutions given the new rules of the marketplace.

GSI PARTNER PROFILE: ROOFMEADOW

Roofmeadow is an award-winning green roof civil engineering and design firm specializing in elegant and inventive designs. The advent of Green Cities Clean Waters encouraged the enhancement of Roofmeadow storm water modeling capabilities. Over the course of a year and a half, the firm conducted runs using Philadelphia rainfall data sets to truth-test hypotheses and calibrate their Drain Mod model. Consequently, the firm continues to collaborate with key academic researchers who are developing the science and engineering foundations for this approach. Ongoing communications between industry and academics tend to provide fruitful and often unexpected results. As Roofmeadow's portfolio of Washington DC projects expands, the firm expects to leverage their modeling capabilities. The District offers partial credit for SMPs that cannot fully comply with the local storm water regulations.



Photograph © Albert Vecerka / Esto for Roofmeadow

Tucked between two buildings, Cira Green, Philadelphia's first elevated public park and blue-green roof, prevents six million gallons of storm water from discharging to the sewer while serving up fabulous skyline views.

2.4 A DIVERSITY OF OPPORTUNITIES

Another hugely important consequence of GCCW is that it is superior to the traditional gray infrastructure approach in generating on-ramps for individuals to find employment opportunities and businesses to find contract opportunities. Gray stormwater projects are typically bid on by multinational engineering firms. Submitting a bid on a large government contract requires significant investments in time and labor and it can be difficult for small, local firms to win projects like these. Green infrastructure projects are typically smaller and the bidding process is less capital intensive. It has also led to a vibrant support network of advocacy groups, technical assistance providers, and other non-profits.

The traditional gray infrastructure solution to meeting Philadelphia's CSO goals would potentially result in a sewage tunnel under the City costing into the billions of dollars. This type of large infrastructure project would likely go to a large, international construction firm. The employment impact would not necessarily be as localized and the gains from the contract would also circulate largely outside the city.[11]

In contrast, GSI work creates more, smaller opportunities that can represent contract and employment opportunities for local firms and residents. The City's procurement process requires compliance with City policies concerning the use of minority and women owned businesses. And, much of the labor input for GSI work is entry level in skill set (e.g. landscaping and restoration activities) but with advancement opportunity for living wage levels and beyond. Indeed, there is significant intersection with the aims and actions of the City's current programming around youth violence reduction, truancy prevention, and ex-offender re-entry.

GSI PARTNER PROFILE: VIRIDIAN LANDSCAPES

Viridian Landscapes is a landscape architecture firm that designs living landscapes to capture stormwater and reintroduce it back into the natural hydrological cycle. Germantown Friends School's new Science Classroom Building and Courtyard serves as an outstanding example of Green Stormwater Infrastructure. Through the use of raingardens, bioswales, green roofs, cisterns, and pervious paving, almost 90% of the new building and site's run off is collected and allowed to infiltrate into the ground instead of piped off site. Due to the PWD Green City Clean Waters program, Viridian finds their services being brought back to the region rather than concentrated in out of town work.



[11] Stratus Consulting, A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds.

"Green Stormwater Infrastructure projects are typically smaller than gray infrastructure projects with less onerous contract bidding requirements. These projects provide more opportunities for small businesses to participate as the prime contractor or as a subcontractor. The Green City Clean Waters Program has increased the number of public and private contracts that my firm is able to bid on." Lou Rodriguez, Rodriguez Consulting

The *GCCW* program is supported by a growing network of advocacy groups, technical assistance providers, and other non-profits promoting GSI education and training. These groups include the Overbrook Environmental Education Center, Jastech and PowerCorpsPHL. Soak it Up! is an innovative grant program managed by the Pennsylvania Environmental Council in partnership with the Philadelphia Industrial Development Corporation. Grants are provided to civic groups to help maintain the beauty and functionality of green stormwater infrastructure.

GSI PARTNER PROFILE: POWER CORPS

Power Corps is an AmeriCorps program designed to support the City of Philadelphia's youth violence prevention and workforce development initiatives. They annually enroll 100 individuals, ages 18-26 in a 9 month program that includes 6 months of full-time service as AmeriCorps membership and 3 months of intensive job placement support. The program encourages environmental stewardship, while building career opportunities for Philadelphia's youth.

Their goal is to strengthen communities by maintaining and enhancing public spaces and breaking down barriers to employment for Philadelphia's young adults. Power Corps provides training and service. Corps members gain technical and transferable skills, work experience, and support transitioning to the demands of the 21st century economy. Their service work helps to build the city's green infrastructure, making Philadelphia healthier, safer, and stronger.

Team "Blue Magic" supports the Green Stormwater Infrastructure Maintenance Team. This group of young men and women has done an outstanding job of maintaining the green in Philadelphia. In just over 10 weeks on the job, they have collected over 9,385 lbs. of trash and street litter (over 4 tons), 3,124 lbs. of leaves and organic debris and 2,138 lbs of construction materials from green stormwater infrastructure (GSI) across the city. These achievements are the result of over 430 hours of hard work, completing over 326 work orders for PWD.[12]

[12]"A Shout-Out to PowerCorpsPHL," Department of Philadelphia Watersheds Blog. July 21, 2014.

GSI PARTNER PROFILE: THE OVERBROOK ENVIRONMENTAL CENTER

In 2015, the Overbrook Environmental Education Center facilitated a 15-week Green Stormwater Infrastructure and Aesthetic Maintenance course to Philadelphia High School students. This course emphasized stormwater best management practices as directed in *GCCW*.

Eligible program participants are students enrolled in Career Technical Education schools and have an expressed interest in science, technology, engineering and/or math. After successfully completing the program's Green Streets Design and GSI Maintenance coursework, students participate in a 6-week paid in-field training, of which, thirty percent of last year's cohorts are now making a livable wage, employed as Green Stormwater Maintenance Apprentices.



3.0 SCALE AND DISTRIBUTION OF INVESTMENT THROUGHOUT

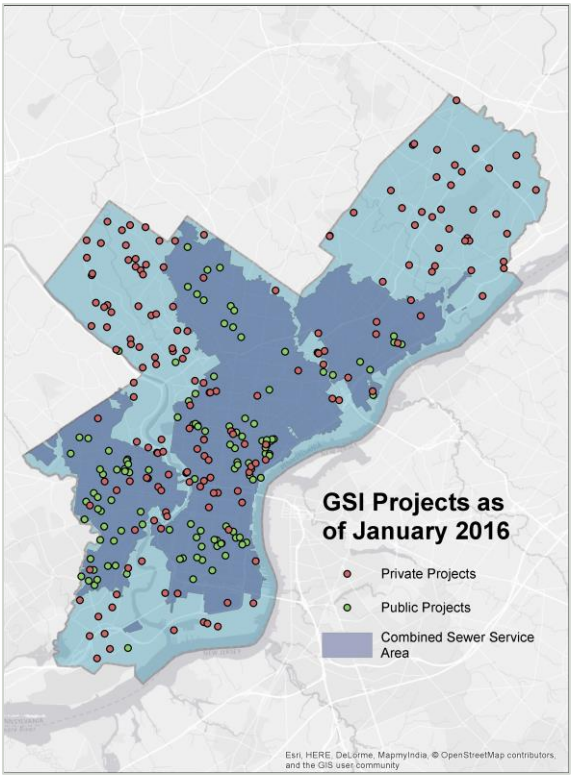
PHILADELPHIA

3.1 SECTION OVERVIEW

Another important characteristic of *Green City, Clean Waters* is that it has represented and will continue to represent significant investment all throughout Philadelphia. There are 125 constructed public projects and 172 constructed private projects. These projects can be found in practically every major neighborhood in Philadelphia's combined sewer area. This section shows where those investments have taken place and what their overall impact has been on the Philadelphia economy and on Philadelphia tax bases.

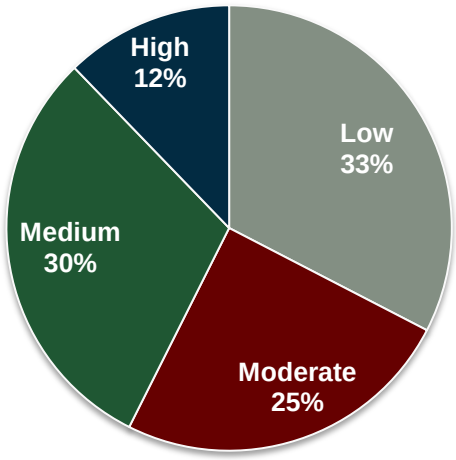
These public investments, and the overall framework of regulations and incentives created by Philadelphia Water, have many spillover benefits to the city as a whole. Private expenditures tend to cluster in Center City and major commercial corridors, because those are locations where the lot sizes and the underlying economics warrant major infrastructure investment; however, even these dollars have been distributed all throughout Philadelphia.

FIGURE 3.1 –PUBLIC AND PRIVATE STORMWATER INFRASTRUCTURE PROJECTS UNDER GREEN CITY, CLEAN WATERS



Note: This map includes GSI features that have been planned but not constructed. There are125 public projects and 172 private projects completed to date.

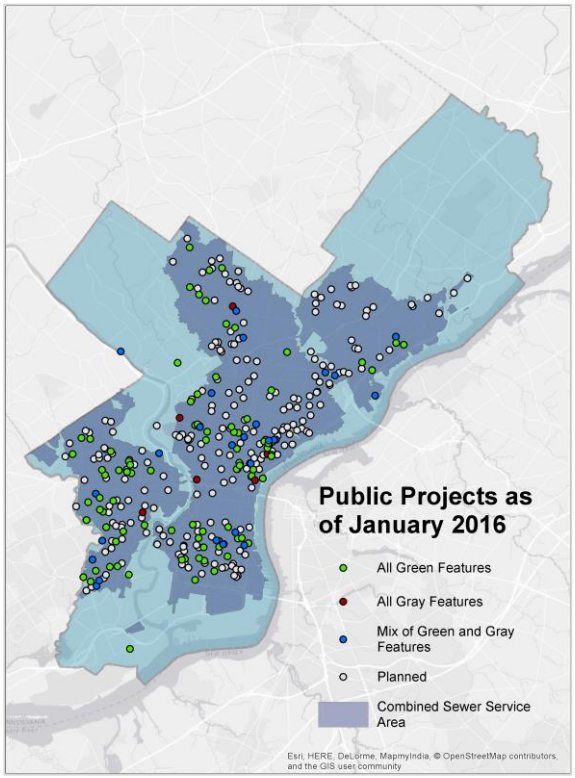
FIGURE 3.2 – DISTRIBUTION OF CENSUS BLOCK GROUPS WITH A GSI PROJECT BY MEDIAN INCOME LEVEL



3.2 PUBLIC GSI PROJECTS

As noted above, public GSI projects are part of a $1.2 billion[13] investment commitment in Philadelphia by Philadelphia Water. As this section demonstrates, these investments span a large geographic footprint reaching into neighborhoods through Philadelphia and therefore providing ecological as well as economic and social benefit to residents of every walk of life.

FIGURE 3.3 –PUBLIC STORMWATER INFRASTRUCTURE PROJECTS UNDER GREEN CITY, CLEAN WATERS



The location of public projects is chosen in large part to achieve the most and best water quality solutions at the lowest financial cost and civic disturbance. Philadelphia Water aims to distribute GSI throughout the portion of the city that contains combined sewer system; which is about 65 percent of the city and covers the densest urban areas. There are 125 public GSI projects built and these projects include 474 features to mitigate stormwater. There are 238 public projects that are in the planning phase but have not been constructed. Table 3.1 lists the most common features. Projects are located in the most opportune areas but will be found in each and every neighborhood within the CSS area. [14]

These projects can be found throughout the city. In fact, some have become beloved amenities for communities, even as they perform an important ecological function. Figure 3.3 shows the distribution of public GSI projects by the median household income of the Census block group in which they are located. It is notable that the majority of public GSI projects are located in relatively low-income neighborhoods, and very few are located in relatively high-income neighborhoods.

Controlling stormwater can be done with a combination of green and gray features. Green features include pervious paving, green roofs, rain gardens, stormwater bumpouts, stormwater planters, stormwater tree trenches, stormwater wetlands and swales. Gray features are subsurface features including subsurface basins, cisterns, rain barrels, and underground holding tanks. Tables 3.1 and 3.2 include the count of the various green and gray features in planned and constructed projects.

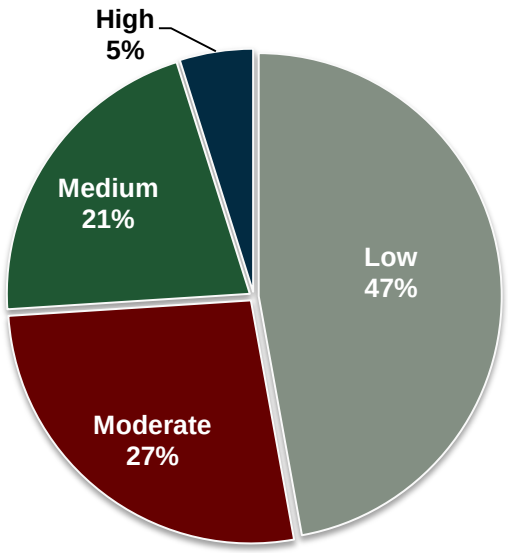
[13] $1.2 billion in 2011 dollars / $2.4 billion in total 2036 dollars

[14] This map includes projects from 2006. The projects from 2006 were completed on a demonstration basis and contribute to overall compliance.

TABLE 3.1 – ALL FEATURES OF PUBLIC PROJECTS (MULTIPLE FEATURES PER PROJECT)

Feature Type	Planned	Constructed	Total
Stormwater Bumpout	140	17	157
Depaving	5	0	5
Green Gutter	1	0	1
Green Roof	0	1	1
Pervious Paving	47	10	57
Stormwater Planter	143	49	192
Rain Garden	117	54	171
Stormwater Tree	10	86	96
Swale	35	6	41
Stormwater Tree Trench	491	194	685
Gray Feature	221	57	278
Total Features	**1,210**	**474**	**1,684**
Total Public Projects	**238**	**125**	**363**

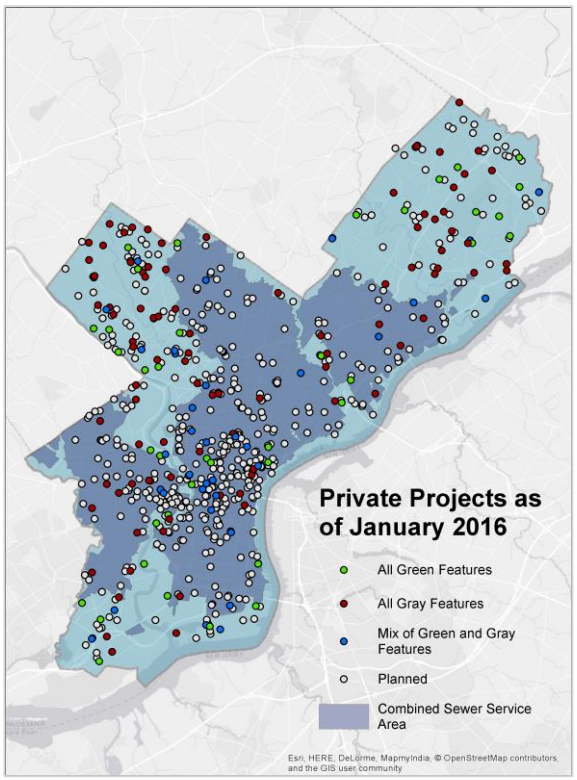
FIGURE 3.4 – DISTRIBUTION OF CENSUS BLOCK GROUPS WITH A PUBLIC GSI PROJECT BY MEDIAN INCOME LEVEL



3.3 PRIVATE GSI PROJECTS

In addition to public GSI projects, Philadelphia Water's stormwater regulations create a responsibility for the private sector to make its own investments in stormwater management. Specifically, earth disturbances of greater than 15,000 square feet now require some on-site stormwater management solution to manage stormwater at a minimum of 1.5 inches. As is articulated more in Section 4, this creates an opportunity for builders to incorporate green features into their product, something that the marketplace is beginning to value in ways that can produce profit opportunities for developers.

FIGURE 3.5 - PRIVATE STORMWATER INFRASTRUCTURE PROJECTS UNDER GREEN CITY, CLEAN WATERS



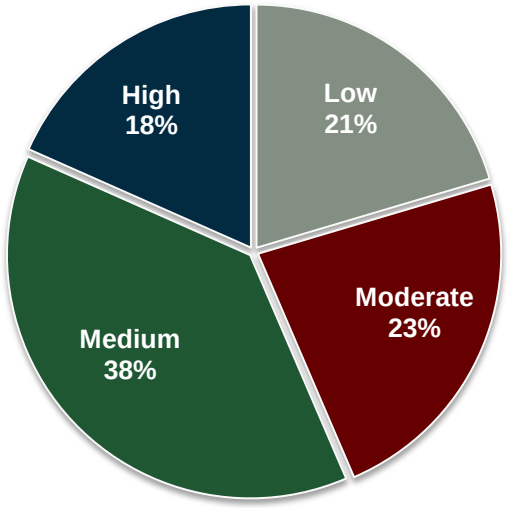
There are 172 private projects comprised of 409 features to mitigate stormwater. There are 502 private projects that are in the planning phase but have not been constructed. Private GSI projects occur where development is happening, which results in a concentration of private investment in Center City and popular commercial corridors, as well as other areas that are just starting to see development interest. Figure 3.4 reflects these clusters of private GSI investment. These rapidly growing areas are made more environmentally sustainable. These areas tend to include a wide range of household income levels, all of which are then benefitting from the presence of these investments.

Importantly, private GSI projects occur wherever development is happening, and while there are concentrations of development in Center City and edge areas, development is in fact occurring all throughout the city and therefore private GSI projects are similarly spread out. This means some are located in areas outside of the city's combined sewer area, where public GSI projects are located, and so they are further distributing the spillover economic and quality of life benefits throughout the city.[15]

Despite the fact that private GSI projects by definition are located where new development is subject to regulations requiring such investments, it is important to note that, as with public GSI projects, many private GSI projects are located in relatively low-income neighborhoods, and very few are located in relatively high-income neighborhoods. The average income level of the Census block groups where private GSI projects are located is $35,000, which is about the median household income in Philadelphia. Please see Figure 3.6 for a distribution of census block groups with a private GSI by median income level.

[15] This map includes projects from 2006. Private projects help Philadelphia meet compliance goals.

FIGURE 3.6 - DISTRIBUTION OF CENSUS BLOCK GROUPS WITH A PRIVATE GSI PROJECT BY MEDIAN INCOME LEVEL



The cost of installing GSI on private projects depends on a number of factors including, the size of the feature, the type of GSI feature, and the features of the site. The cost of installing GSI on private projects is not currently tracked. As such, it is impossible to estimate the aggregate investment in Philadelphia represented by these projects. However, their size and geographic distribution suggest a magnitude that could rival that which is being projected for public GSI. To be conservative, it is assumed that aggregate private investment will be equivalent to half the total value of public investment, or $600 million. Hence, public and private GSI investment will total at least $1.8 billion over the 25-year period starting in 2011.This is a conservative estimate.

TABLE 3.2 - ALL FEATURES OF PRIVATE PROJECTS
(MULTIPLE FEATURES PER PROJECT)

Feature Type	Planned	Constructed	Total
Bio-infiltration	119	39	158
Bio-retention	286	56	342
Green Roof	189	31	220
Porous Pavement	24	10	34
Surface Detention Basin	68	21	89
Surface Infiltration Basin	155	10	165
Gray Feature	850	242	1092
Total	**1,691**	**409**	**2,100**
Total Private Projects	**502**	**172**	**674**

PRIVATE PROJECT PROFILE: 2.0 UNIVERSITY PLACE

2.0 University Place is the forefront of green building design in Philadelphia. The over 90,000 square foot, Class A structure is completely eco-friendly, earning a Platinum Pre-Certification rating from the U.S. Green Building Council's L.E.E.D. (Leadership in Energy and Environmental Design) program – the highest standard for environmentally sustainable construction. Storm water is managed through an extensive modular green roof system composed of soil media and drought-tolerant vegetation.



3.4 PROJECTED ECONOMIC IMPACT

The overall economic impact of these future private and public investments is quantifiable. The estimated $1.8 billion in spending over the next twenty-five years was entered into the IMPLAN input-output model to estimate the total economic impact. The investments will lead to a total expenditure impact of $3.0 billion within the City, supporting about 1000 jobs each year[16] and approximately $1.5 billion in total labor income (see Table 3.3).

[16] The annual employment impact represents an average per year over the estimated 25-year period rather than a precise yearly impact. Construction spending and job demand is likely to fluctuate during varying phases of the project and will likely not stay constant over the three year period.

TABLE 3.3 – TOTAL ECONOMIC IMPACT OF GREEN CITY CLEAN WATERS STORMWATER INFRASTRUCTURE CAPITAL INVESTMENTS WITHIN THE CITY OF PHILADELPHIA OVER THE NEXT 25 YEARS

Impact Type	Public Investment	Private Investment	Total Investment	Annualized Impact
Direct Output ($M)	$1,200	$600	$1,800	$72
Indirect & Induced Output ($M)	$840	$418	$1,254	$50
Total Output ($M)	**$2,036**	**$1,018**	**$3,054**	**$122**
Employment Supported (Job-Years)	**15,656**	**7,828**	**23,484**	**940**
Labor Income Supported ($M)	**$1,020**	**$510**	**$1,530**	**$60**

Source: Econsult Solutions (2015), GSI Partners (2015), IMPLAN (2013)

The direct, indirect, and induced economic impacts generate tax revenues to the City of Philadelphia. The associated tax revenues come from the personal income or wages, sales, and business taxes directly and indirectly associated with the new developments. In aggregate, the City of Philadelphia will gain an additional $48 million of additional tax revenue over the next 25 years, or about $2 million per year during that time (see Table 3.4).

TABLE 3.4 – TOTAL FISCAL IMPACT OF GREEN CITY CLEAN WATERS STORMWATER INFRASTRUCTURE CAPITAL INVESTMENTS WITHIN THE CITY OF PHILADELPHIA OVER THE NEXT 25 YEARS

Tax Type ($M)	Public Investment	Private Investment	Total Investment	Annualized Impact
Income	$23	$11	$34	$1.3
Sales	$4	$2	$6	$0.2
Business	$6	$3	$9	$0.4
Total	**$32**	**$16**	**$48**	**$1.9**

Source: Econsult Solutions (2015), GSI Partners (2015), IMPLAN (2013), Philadelphia Department of Revenue (2012)

4.0 LOCAL REAL ESTATE MARKET IMPACTS

4.1 SECTION OVERVIEW

An important benefit of green stormwater infrastructure, as opposed to traditional gray infrastructure, is that it produces tangible quality of life benefits to households. GSI projects beautify areas, create active recreation opportunities in neighborhoods previously lacking such resources, and perform invaluable ecological services that result in cleaner air and less flooding.

Basic real estate economics states that when positive features are added to a place, demand for that place as a residential location increases, which produces one or both of the following outcomes: an increase in housing values and/or an increase in housing supply. Both of these outcomes are essential for the health of individual neighborhoods and the vitality of the city as a whole: an increase in housing values means more wealth for homeowners and more tax revenues for the City and the School District of Philadelphia, and an increase in housing supply means more investment in Philadelphia neighborhoods and more choices for prospective residents. To be sure, the specter of displacement of long-time low-income residents through higher property tax bills is ever present, but it should not necessarily prevent public policies that result in the introduction of attractive amenities that improve quality of life and render important ecological services in otherwise disinvested neighborhoods.

The purpose of this section is to summarize analytical work currently being performed by Econsult Solutions, Inc. as part of a US Environmental Protection Agency grant to explore the property value impact of GSI projects in neighborhoods throughout Philadelphia. In other words, one of the important benefits of Green City, Clean Waters is that it has produced household wealth for private property owners as well as an increase in the property tax base from which both the City and School District derive a significant proportion of their operating revenues.

4.2 RESIDENTIAL PROPERTY VALUE IMPACT

The impact of the spillover benefits of green stormwater infrastructure on property values can be estimated using an economic technique known as a hedonic regression model. Hedonic regression models have been used to estimate the positive impacts of improved water quality, open space, neighborhood greening as well as the negative impacts of being located in close proximity to landfills, toxic waste sites, and power plants.[17]

This analysis only uses GSI projects that had been built by March 2014. The full dataset that has been used previously in this report includes projects completed in 2015, however, the home sales data used to measure the impact the GSI features have on home value, is from early 2014.

The impact of stormwater infrastructure likely differs based on who installed the infrastructure (public vs private) and the distance to the investments. The analysis controlled for being located close to a green stormwater investment by including a dummy variable that indicates whether the property is within a quarter mile of green public project and a variable that indicates whether the project is within an eighth mile of green private investment. The analysis also controlled for whether the public project occurred at a park, school, or recreation center. In these ways, the different ways in which stormwater infrastructure investments can be seen as beneficial to an immediate area could be teased out.

Our results indicate that green stormwater investments have had a positive impact on local communities. The variables that describe the impact of stormwater infrastructure are statistically significant and have the expected sign (positive). Being located within a quarter mile of public project that did not occur at park, school or rec center has a positive impact on nearby residential property values of 12.7 percent, while being located near a public project that occurred at a park, school or rec center is 11.5 percent. The larger impact from being located near a public project that did not occur at park, school or recreation center is likely due to the fact that these projects are adding green features to a neighborhood that otherwise did not have much in the way of green. Nevertheless, it is notable that public projects have such a significant impact in neighborhoods that already have some green amenities.

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[17] The basic premise of a hedonic pricing model is that the price of good is related to the characteristics of the good. For example, the price of a house is related to the size of the house, the number of bedrooms, the size of the lot, the distance of the house to downtown, etc. The hedonic regression model allows us to estimate the price that an individual is willing to pay for various characteristics. In this case, we can include variables that indicate whether or not a house is located in close proximity to stormwater infrastructure investments.
The hedonic regression is as follows:

$$\ln(price) = \beta X + \alpha Census + \gamma Neighborhood + \delta private + \eta public + \zeta time$$

Where:

ln(price) is the price of the house
X are variables that describe the characteristics of the house
Census describe the Census tract that the house is located in
Neighborhood describes the Neighborhood that the house is located in
Private describes the private stormwater investments located nearby the property.
Public describes the public stormwater investments located nearby the property.
Time controls for the year the property was sold.

Being located near a private investment increases nearby residential property values by 1.7 percent. The smaller impact of private investment is likely due to the fact that these investment occur on private property and may not be visible to nearby properties, so they are still rendering an ecological function but their outward visibility is limited. Overall, it is estimated that the average residential property value impact of being located close to a green stormwater infrastructure investment is 10.3 percent. In other words, all else being equal, an identical house is worth 10.3 percent more if it is located near a green stormwater infrastructure investment, compared to not being located near the investment. To state this finding at an individual homeowner's level, an otherwise $100,000 house is worth over $110,000 if it is proximate to a green stormwater infrastructure investment.

TABLE 4.1 – ESTIMATED PROPERTY VALUE IMPACT ON PROPERTIES WITHIN A QUARTER-MILE OF GREEN STORMWATER INFRASTRUCTURE INVESTMENT

Public GSI Project in a Park/Rec/School Facility	Public GSI Project (Not in a Park/Rec/School Facility)	Private GSI Project	All GSI Projects
11.5%	12.7%	1.7%	10.3%

The results of the regression analysis can be used to estimate the aggregate impact that the stormwater infrastructure investments have had on the property values. The market values of properties that are located within a quarter mile of public infrastructure investment is $13.8 billion and the $1.3 billion of that value can be attributable to being located near a green stormwater investment. In other, words, those properties would be worth $1.3 billion less if it was not for the green stormwater investments. Assuming accurate and annually updated property value assessments (which is now true, on account of the City's recently implemented Actual Value Initiative), increased property values generate $8.1 million in additional tax revenue for the City each year and another $9.9 million per year for the School District of Philadelphia. These tax revenue gains will accrue annually, and the amounts will increase over time as additional projects are completed.

TABLE 4.2 – ESTIMATED AGGREGATE PROPERTY VALUE INCREASE AND PROPERTY TAX GAIN FROM PROPERTIES WITHIN A QUARTER-MILE OF GREEN STORMWATER INFRASTRUCTURE INVESTMENT

Aggregate Property Value	Estimated Property Value Gain from Proximity to GSI Investment	Aggregate Property Value Gain from Proximity to GSI Investment	Aggregate Annual Property Tax Increase from Proximity to GSI Investment
$13.8B	10.3%	$1.3B	$18.0M ($8.1M to City and $9.9M to School District)

4.3 COMMERCIAL PROPERTY VALUE IMPACT

Green infrastructure has impacts beyond residential neighborhoods. It can help commercial property owners in a multitude of ways, including higher rents and property values, increased retail sales, energy savings, reduced maintenance costs, reduced utility bills, and improved safety, health, and job satisfaction for office employees. A study by the National Resources Defense Council found that the cumulative value of the benefits can total in the millions of dollars for an individual property over a 40 years.[18]

A number of other studies have found that green infrastructure related landscaping can increase commercial office rents by 7 percent[19] and apartment rents by approximately 5 percent.[20] A study in New York City found that apartment buildings with a green roof enjoyed a rental premium of 16 percent compared to apartment buildings without a green roof, after controlling for other factors that impact rental rates.[21] To the extent that green infrastructure contributes to LEED certification, the green infrastructure investment can lead to increased property value, rents, and occupancy rates. After controlling for build age and other characteristics, LEED certification can increase occupancy rates by 8 percent.[22]

Retailers can also benefit from green infrastructure investments. Research has found that people are willing to spend more, visit more frequently, or travel farther to shop in areas with attractive landscaping, tree cover, or green streets.[23]

Commercial property owners can also benefit from stormwater fee credits and other incentives. Property owners that install green infrastructure that manages runoff from 1.23-inch storm event can achieve up to an 80 percent discount on the property's stormwater bill. Grants from PWD, such as the SMIP program, can help offset the cost of installing green stormwater infrastructure on commercial properties. Philadelphia also offers a green roof tax credit. The credit covers 25 percent of the green roof installation costs, up to $100,000, and is applied against the applicant's Business Income and Receipts Tax obligation for the year the roof is installed.

[18] Natural Resource Defense Council. "The Green Edge: How Commercial Property in Green Infrastructure Creates Value." 2013.
[19] Laverne, R.J., and K. Winson-Geideman.. "Influence of Trees and Landscaping on Rental Rates at Office Buildings", Journal of Arboriculture. 29(5): 281–289. 2003.
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[22] Fuerst, F., and P. McAllister. "An Investigation of the Effect of EcoLabeling on Office Occupancy Rates." Journal of Sustainable Real Estate 1(1): 49–64. 2009.
[23] Wolf, K.L. "Business District Streetscapes, Trees, and Consumer Response." Journal of Forestry 103(8): 396-400. 2005.

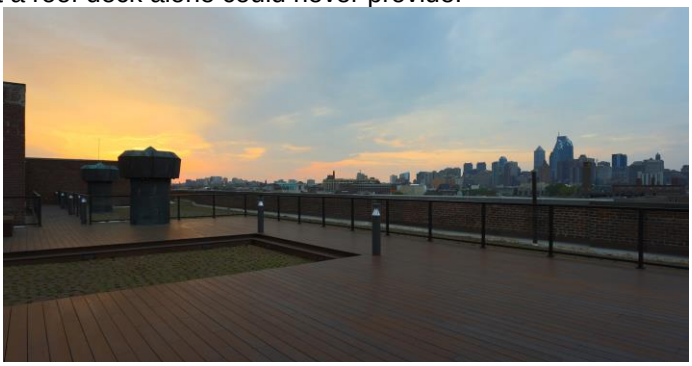
4.4 A PARADIGM SHIFT IN DEVELOPMENT IN PHILADELPHIA

Philadelphia Water's innovative approach to stormwater management is beginning to produce a paradigm shift within the development community in Philadelphia. Regulations designed to require or incentivize positive environmental solutions had typically been seen as an added cost burden for developers, affecting their returns and in some cases rendering a project infeasible. In other words, when viewed solely as an increase in project costs, environmental regulations were thought of as producing a lower return on investment on a project that in some cases caused an otherwise attractive project to not be pursued.

Developers understand that if a product can be made more attractive to end users, it can be marketed and priced accordingly, increasing developer returns and in some cases making a previously infeasible project feasible (see Figures 4.1 and 4.2 on the right). In other words, if the environmental regulations are taken as given from a cost standpoint (and/or innovation causes the cost differential to be slim to non-existent), and their presence encourages features that enable higher revenues to be derived from a project, then far from reducing the number of projects that are feasible, they could make otherwise infeasible projects attractive to pursue.

GSI PARTNER PROFILE: E-BUILT

E-BUILT was contracted to build a 14,000 square foot green roof / inset roof deck and a storm water management system by Alterra Properties for **their Wharton Street Lofts project**.
This project manages an impressive 100% of Stormwater on site. The 100% absorption is achieved through several features. E-BUILT has incorporated a large green roof, a rain garden in the center of parking lot, two subsurface infiltration beds at the entry and exit of the parking lot, additional landscaping and street trees.
This combination of features enhanced infiltration on site but the GSI feature that catches the greatest attention of existing and prospective residents is the green roof. The green roof enhances the aesthetic of the property and the marketability of the project. Residents are willing to pay slightly more because of the dramatic increase in useable outdoor space and greenery.
A chef who lives in the building has developed a roof top vegetable garden on the roof. The roof is routinely used for social functions and fund raisers for local schools like Jackson Elementary. The green roof helps to keep the roof area cool so that these functions can be held on mid-summer days when a typical urban rooftop would be sweltering. The green roof surrounding the inset roof deck also provides an aesthetic that a roof deck alone could never provide.



Consumers have not fully shifted to a new way of thinking about development. Developers therefore currently work hard to keep the cost of including green features to a minimum, as they do with all costs, because consumers do not always recognize the value that green building adds. Green City Clean Waters is helping consumers recognize this value. And, over time the market place is adjusting: more and more consumers are valuing and demanding green features, and more and more developers are featuring them in their projects. This shift in the development community – from seeing stormwater regulations requirements as a cost burden that drags down project feasibility to an opportunity to create an enhancement that can improve project feasibility and create amenity space for tenants or owners – may prove to be one of the lasting contributions of GCCW. This shift encourages a marketplace that is already heading in this direction and produces a development environment in which triple bottom line thinking is pursued more regularly, with positive implications for the local economy, the environment, and livable communities.

FIGURE 4.1 – ILLUSTRATIVE EXAMPLE OF HOW ADDED COSTS MAKE A DEVELOPMENT PROJECT LESS FEASIBLE

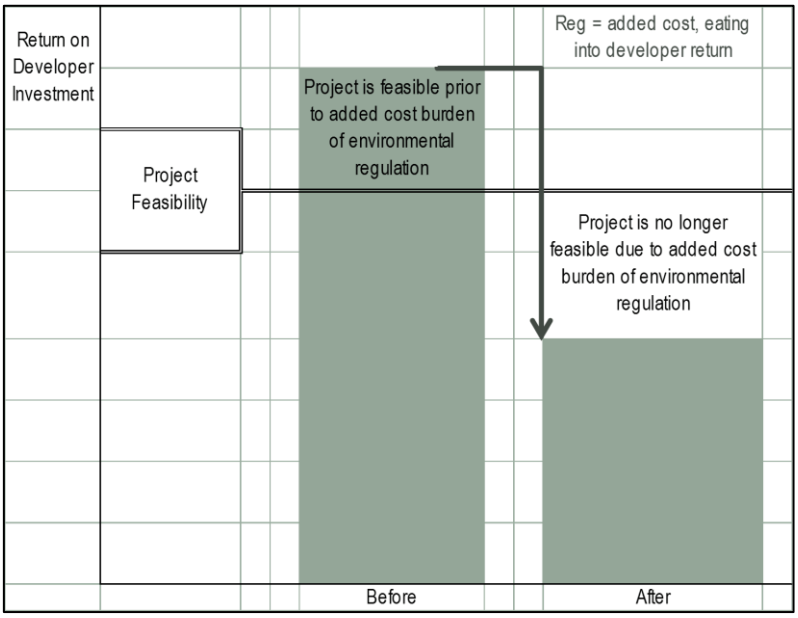
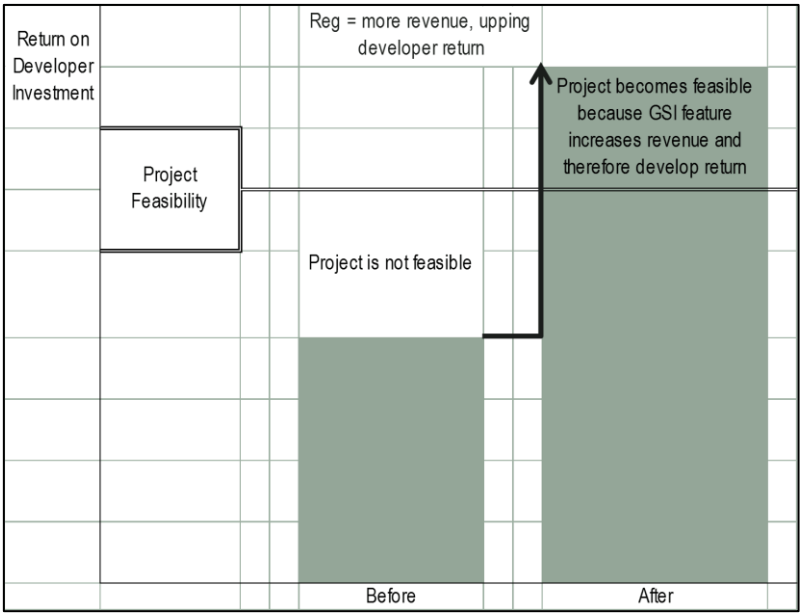


FIGURE 4.2- ILLUSTRATIVE EXAMPLE OF HOW ADDED REVENUES MAKE A DEVELOPMENT PROJECT MORE FEASIBLE



5.0 NEIGHBORHOOD-LEVEL QUALITY OF LIFE BENEFITS FROM GREEN STORMWATER INFRASTRUCTURE PROJECTS

5.1 SECTION OVERVIEW

Beyond the economic impacts quantified in the previous three sections are a number of important quality of life benefits that accrue to

households throughout Philadelphia from *Green City, Clean Waters*, including the following categories tracked by Philadelphia Water: Heat Stress Related Premature Fatalities Avoided, Water Quality and Aquatic Habitat Enhancement, Wetlands Enhancement and Creation, Energy Use and Related Changes in Carbon and other emissions, Air Quality Pollutant Removal from Added Vegetation and Construction and Maintenance Related Disruption Impacts. In many ways, it is these benefits that are most clearly evident and are of most importance to Philadelphia residents, and indeed these benefits were on the forefront of Philadelphia Water's consideration as it envisioned and then implemented *GCCW*.

5.2 GAINS FROM ACTIVE RECREATION

As noted in Section 3, both public and private GSI projects can be found in neighborhoods throughout Philadelphia. Many of these GSI projects include an active recreation component. A 2010 study by Econsult Corporation for PennFuture found that 44,000 households representing 98,000 people are not within close walking distance of an active recreation site.[24]

Given the growing obesity problem in Philadelphia,[25] and the increasing cost it is imposing on City government and on the local health, social services, and insurance sectors, this aspect of *GCCW* is of utmost importance. Indeed, the City has set goals to meet the demand associated with active recreation sites, so *GCCW* helps accomplish those goals.[26]

5.3 POSITIVE HEALTH OUTCOMES FROM GREENING INITIATIVES

In addition to encouraging active recreation, the mere presence of greened sites can have a meaningful effect on people's physical, emotional, and mental health.

Many psychologists and doctors have published numerous research papers that have made the connection between access to green space and positive health outcomes. Michigan psychologist Stephen Kaplan theorizes that nature, much like sleep, can refurbish and rejuvenate our brains. A 2009 study, conducted by a group of professors from Oberlin and University of Illinois at Urbana-Champaign, found that people who took a 15-minute stroll through the woods had a more positive mood than those who walked through the urban streets. Similar results were found in a 2012 study written by a group of researchers, which showed positive mood changes in individuals with major depressive disorder (MDD). A study by Gregory Bratman from Stanford also suggests positive health results after a 90-minute walk through the woods. The study indicated that people had less rumination and showed fewer neural activities in the portion of the brain that is associated with sadness. Bratman theorizes that reasonable investment in green space could improve the overall metal state of a city. The presence of GSI projects in neighborhoods therefore represents a hugely important asset for Philadelphia households, and the distribution of these

[24] "The Potential Economic, Environmental, Health and Quality of Life Benefits of a Fully Connected Waterfront Greenway in Philadelphia." Citizens for Pennsylvania's Future. Econsult Solutions. September 21, 2010.
[25] "America Watches as Philadelphia Battles Obesity." Governing: The States and Localities. August 2013.
[26] "Green2015 An Action Plan for the First 500 Acres." PennPraxis for Philadelphia Parks and Recreation. December 2010.

projects all throughout Philadelphia is a fulfillment of the desired outcome of *GCCW* to reach otherwise underserved populations with desired quality of life amenities.

Charles C. Branas, PhD, Professor of Epidemiology at the University of Pennsylvania, has published numerous research papers making the connection between access to green space and positive health outcomes. These studies suggest that, irrespective of the positive gains accrued from active recreation, green space reduces cognitive fatigue, promotes emotional recovery, and mitigates against the negative influence of stressors in urban environments on one's mood and anxiety levels.

The presence of GSI projects in neighborhoods therefore represents a hugely important asset for Philadelphia households, and the distribution of these projects all throughout Philadelphia is a fulfillment of the desired outcome of *GCCW* to reach otherwise underserved populations with desired quality of life amenities.

The presence of green sites can also increase physical activity levels ultimately impacting ones psychological health. In a study conducted by Dr. Jules Pretty it was found that pleasant scenery while exercising produced a significantly greater positive effect on self–esteem and psychological well-being.[27] This was tested by having individuals workout facing screens that exhibited different features such as pleasant rural and urban scenes as well as rural and urban unpleasant scenes. From these findings Dr. Pretty and his colleagues were able to conclude that green exercise has important public and environmental health consequences. There is a positive effect on blood pressure and overall cardiovascular health and mental health. Such increases in health would then lead to economic benefits because it would cost less to treat individuals if their health increased.

5.4 AESTHETIC ENHANCEMENTS, BLIGHT REMOVAL, AND CRIME REDUCTION

Dr. Branas' research also explores the role of greening projects in minimizing the negative effects of urban blight. His work has preliminarily found statistically significant improvements in crime levels upon the introduction of green space in urban settings. This research supports the "broken windows" theory of urban decay, which posits that vacancy, abandonment, and blight not only provide refuge for criminal activity but also visually symbolize the absence of care and supervision in ways that encourage additional criminal activity.[28] Greened sites such as those produced by *GCCW*, on the other hand, can be a powerful counter-symbol of aesthetic beauty and active maintenance. Indeed, two studies involving random introductions of green vegetation at public housing sites demonstrated meaningful reductions in violence and criminal activity.

[27] Barton, Griffin, Pretty. "Exercise-, Nature- and Socially Interactive-Based Initiatives Improve Mood and Self-esteem in the Clinical Population. Royal Society for Public Health, 2011.
[28] Branas, et al. "A Difference-in-Differences Analysis of Health, Safety, and Greening Vacant Urban Space. American Journal of Epidemiology. July 18, 2011.

Dr. Michelle Kondo is researching the link between GSI and Public Safety. Her research suggests that GSI installation may be a deterrent to the possession and manufacture of illegal drugs in public spaces.[29]

5.5 ECOLOGICAL SERVICES RENDERED BY GREENED SITES

Of course, an important function of *GCCW* is water treatment. And, as noted, dealing with stormwater above ground and on site, as opposed to below ground and away from sites, is significantly more cost-effective. The more vegetated types of GSI investments render additional ecological services, particularly as it relates to air quality, the cost avoidance of sick days, health care costs associated with asthma and heat attacks as well as soil erosion. Literature assembled by Econsult Corporation for a study on the ecological benefits of riverfront greenways in Philadelphia suggests that on a per acre basis, introductions of green space render the equivalent of $10.5 million/year in environmental benefit, whether measured by the replacement cost of purchasing those services in the marketplace or the value assigned by affected households.

There are many other benefits of the *Green City, Clean Waters* Program that are manifesting but are not considered in this report, including the following categories tracked by Philadelphia Water: Heat Stress Related Premature Fatalities Avoided, Water Quality and Aquatic Habitat Enhancement, Wetlands Enhancement and Creation, Energy Use and Related Changes in Carbon and other emissions, Air Quality Pollutant Removal from Added Vegetation and Construction and Maintenance Related Disruption Impacts.

6.0 CONCLUSION

Five years into an ambitious, daring, and innovative 25-year plan to address federal water quality requirements, *Green City Clean Waters* has demonstrated present results and future potential. Its premise, as captured in its consent order with EPA and PA DEP, is to deal with stormwater on site and in a distributed fashion, using green infrastructure solutions, rather than move it to centralized locations and treating it in traditional gray infrastructure ways. But its promise is grander: to pursue a triple bottom line of economic gain, environmental sustainability, and community benefit, and even greater than that to influence the entire marketplace of public and private participants towards triple bottom line solutions.

By the numbers, *GCCW* has proven to be an economic success, as articulated in this report. To begin with, *GCCW* is potentially saving the City billions of dollars over the 25-year period, by

[29] Kondo, Michelle et al. "The Impact of Green Stormwater Infrastructure Installation on Surrounding Health and Safety." American Journal of Public Health. Vol 105. No. 3. March 2015.

dealing with stormwater on-site using green infrastructure solutions that invest in neighborhoods throughout the city, rather than through traditional gray infrastructure projects that are highly disruptive for residential communities and commercial corridors.

Conservatively, the GSI industry in Philadelphia (as proxied by the member firms of SBN's GSI Partners) represents at least $146.8 million in annual revenues, and in turn has an annual economic impact of $57 million, supporting 430 additional jobs and generating $860,000 in tax revenues for the City of Philadelphia. It is also an industry that is growing in size (GSI Partners' firms have in the aggregate seen double-digit annual growth) and importance (GSI firms are providing innovative products and services that serve GSI needs here in Philadelphia and also create export opportunities to other localities around the country).

These economic gains are shared across individuals and firms throughout the city. Traditional gray infrastructure solutions tend to be large-scale engineering projects that can be fulfilled only by large and often non-local multinational firms. In contrast, green infrastructure solutions create accessible employment on-ramps for all levels of experience in multiple sectors and economic participation by local and minority-owned firms. *GCCW* has also supported and in turn been supported by a growing ecosystem of training and advocacy groups such as PowerCorpsPHL, and the Overbrook Environmental Center.

Public GSI investments made because of *GCCW*, and accompanying private GSI investments catalyzed by local regulations and incentives, represent an additional boost to the local economy. Public and private GSI investments will have a $3 billion impact on the Philadelphia economy, supporting about 940 jobs per year and generating an aggregate $48 million in tax revenues for Philadelphia government.

These investments have proven to not only produce economic gains for the city as a whole but also ecological, aesthetic, recreational, and social gains in neighborhoods throughout the city. A spatial analysis recently conducted by Econsult Solutions, Inc. found that homes within a quarter-mile of a public GSI project saw a 10.3 percent increase in value as a result of proximity to the amenity, supporting the contention that these projects are seen as beneficial to residential neighborhoods. In the aggregate, this represents a 10.3 percent increase in residential house values. Public GSI investments are therefore creating household wealth for homeowners throughout the city, which in turn stabilizes and expands the City's property tax base, resulting in $18.0 million more per year in property tax revenues to support municipal services and public education.

Furthermore, and importantly for a city as large and diverse as Philadelphia is, these public GSI investments can be found throughout the city's combined watershed, meaning that the benefits they accrue at a very localized level – blight remediation, the aesthetic and recreational benefits of green space, and the ecological services they render – are being enjoyed by Philadelphians from all walks of life. With greater convergence of public and private investment in neighborhoods throughout Philadelphia around high quality of life offerings that respect community and environment, this may be *Green City Clean Waters'* greatest legacy, which is to encourage a triple bottom line approach to water quality requirements that saves municipal government billions of dollars and in turn invests in desirable neighborhood amenities, creates local employment and economic opportunities, and generates economic impact for the Philadelphia economy and tax revenue gains for Philadelphia government.

APPENDIX A: IMPACT OF GSI PARTNER CALCULATIONS

The survey results of GSI Partners firms in Philadelphia were used to quantify these direct, indirect, and induced impacts. Based on a review of those firms which did and did not complete the survey, it can be reasonably assumed that the 16 GSI Partners firms that did not report revenue amounts can have revenue amounts extrapolated for them based on those 44 GSI Partners firms that did report revenue amounts. Three adjustments were made to the revenue totals provided by the survey respondents.

1. First, the six firms who filled out the survey but did not provide revenue amounts were accounted for.[30] By categorizing each of these firms into specific industries, ESI was able to estimate annual revenues and employment using industry standards of the other 44 firms.

2. Next, the ten firms who did not fill out the survey were accounted for by adjusting the aggregate revenue and employment upwards by 120 percent,[31] non-specific to industry. This suggests aggregate annual revenues of $189 million and 1,600 employees in total among all 60 GSI Partners firms.

3. Lastly, the aggregate annual revenue for 2014 was adjusted downward based on the portion of revenue that is estimated to come from Green Stormwater Infrastructure projects. This percentage was provided by all of the survey respondents and was 33.3% on average. However, these figures varied by firm. In general, larger firms generated less of their overall revenue from GSI projects while smaller firms estimated that over 80% of their revenues in 2014 came from GSI projects. In total, revenues associated with the Philadelphia's Green Stormwater Infrastructure Projects account for $35 million, approximately 20%, of the total annual revenues for the 60 GSI Partners firms.

ESI then constructed an economic impact model using multiplier data provided by IMPLAN, an industry standard input-output modeling software program, to estimate the scale and composition of spillover impacts generated by activity associated with GSI related industries in Philadelphia. Operations associated with the Philadelphia's Green Stormwater Infrastructure Projects account for $35 million of total annual revenues for the 60 GSIP firms. The estimated local operations of GSI partner firms generate an annual economic impact of $57 million, supporting 430 direct, indirect, and induced jobs and $27 million in annual labor income within the City of Philadelphia.

[30] Firms who did not provide employment totals were also accounted for in this process.
[31] 60/50 = 120 percent.

APPENDIX B: INPUT OUTPUT MODELING METHODOLOGY

Overview

Economic impact estimates are generated by utilizing input-output models to translate an initial amount of direct economic activity into the total amount of economic activity that it supports, which includes multiple waves of spillover impacts generated by spending on goods and services and by spending of labor income by employees. This section summarizes the methodologies and tools used to construct, use, and interpret the input-output models needed to estimate this project's economic impact.

Input-Output Model Theory

In an inter-connected economy, every dollar spent generates two spillover impacts:

- First, some amount of the proportion of that expenditure that goes to the purchase of goods and services gets circulated back into an economy when those goods and services are purchased from local vendors. This represents what is called the "indirect effect," and reflects the fact that local purchases of goods and services support local vendors, who in turn require additional purchasing with their own set of vendors.

- Second, some amount of the proportion of that expenditure that goes to labor income gets circulated back into an economy when those employees spend some of their earnings on various goods and services. This represents what is called the "induced effect," and reflects the fact that some of those goods and services will be purchased from local vendors, further stimulating a local economy.

The role of input-output models is to determine the linkages across industries in order to model out the magnitude and composition of spillover impact to all industries of a dollar spent in any one industry. Thus, the total economic impact is the sum of its own direct economic footprint plus the indirect and induced effects generated by that direct footprint.

Input-Output Model Mechanics

To model the impacts resulting from the direct expenditures Econsult Solutions, Inc. developed a customized economic impact model using the IMPLAN input/output modeling system. IMPLAN represents an industry standard approach to assess the economic and job creation impacts of economic development projects, the creation of new businesses, and public policy changes.

IMPLAN is one of several popular choices for regional input-output modeling. Each system has its own nuances in establishing proper location coefficients. IMPLAN uses a location quotient to determine its regional purchase coefficient (RPC). This represents the proportion of demand for a good that is filled locally; this assessment helps determine the multiplier for the localized region. Additionally, IMPLAN also accounts for inter-institutional transfers (e.g. firms to households, households to the government) through its Social Account Matrix (SAM) multipliers. IMPLAN

takes the multipliers and divides them into 440 industry categories in accordance to the North American Industrial Classification System (NAICS) codes.

These economic impacts in turn produce one-time or ongoing increases in various tax bases, which yield temporary or permanent increases in various tax revenues. To estimate these increases, Econsult Solutions, Inc. created a fiscal impact model to translate total economic impacts into their commensurate tax revenue gains.

Employment and Wages Supported

IMPLAN estimates the direct jobs employed by the project or activity being modeled. These estimated direct jobs will be displayed in the report unless the number of jobs is known beforehand by the project's owner, and if provided, will be noted in the body of the report. The project/activity expenditures also support induced and indirect jobs. These are jobs not directly employed by the project, but instead are employees who work for the project's vendors and employees who work at businesses frequented by those employees directly employed by the project. We report the total jobs supported by the project, therefore all direct, indirect, and induced jobs. These jobs are a mix of full-time and part-time jobs.

IMPLAN generates job estimates based on the term job-years, or how many jobs will be supported each year. For instance, if a construction project takes two years, and IMPLAN estimates there are 100 employees, or more correctly "job-years" supported, over two years, that represents 50 jobs each year. The 50 jobs represent the annualized number of jobs supported by the construction project. The job can be the same each year such as the coffee barista serving the directly employed construction workers or different if in the first year of the project a welder is needed and in the second year of the project an electrician is required.

The total income is for all direct, indirect and induced jobs. It includes proprietor income, wages, and all benefits. Since many projects/events require the employment sourced from multiple industries, the average wages paid will be different per industry. Therefore, it is not correct to divide the total labor income and divide it by the total job-years to derive an average employee compensation estimate.

APPENDIX C: ADDITIONAL INFORMATION ON PHILADELPHIA'S GREENED ACRES GOALS

The City is working to transform 9,500 impervious acres into green acres. Vacant land presents a unique opportunity for stormwater management. There are over 40,000 vacant parcels of land in the City. An estimated 5,000 to 6,000 acres within the combined sewer system drainage will become greened during the 25 year program, given the rate of redevelopment. The City's updated stormwater regulations adopted in January, 2006, require every development/redevelopment project initiated within the City limits with an area of disturbance greater than 15,000 square feet must manage the first inch and a half of runoff from the site. As new development over 15,000 square feet takes place, there will be an increase in the number of greened acres.

Another policy-related tool that will result in Greened Acres is the Parcel Based Billing Initiative. Rather than charging properties based on their water meter(s), the Philadelphia Water Department charges non-residential properties based on the ratio of impervious surface area to gross property area. Properties with a higher ratio will be charged more, and properties that reduce the amount of impervious surface will be credited.

There are two rates that apply to a property are the gross area fee. This fee applies to the entire site and cannot be adjusted. The gross area rate is $0.590 per 500 square feet. The impervious area fee can be adjusted if impervious area is reduced. The impervious area rates is $4.746 per 500 square feet.

The City has adopted two grant programs to create incentives for green Stormwater infrastructure. The Stormwater Management Incentives Program Grant (SMIP) program provides grants directly to non-residential property owners who want to construct Stormwater retrofit projects. The Greened Acre Retrofit Program (GARP) provides grants to contractors, companies or project aggregators who can build large-scale Stormwater retrofit projects across multiple properties. GSI projects reduce Stormwater charges and private property owners who include GSI features may be eligible for credits against future stormwater charges. In addition to the grant programs, the City has made a green roof tax credit available to business owners constructing an addition to their roof. The applicant may claim a credit against the Business Privilege Tax of twenty-five percent of all costs incurred to construct the Green Roof not to exceed $100,000.

APPENDIX D: REGULATIONS, BILLING STRUCTURE, & INCENTIVES THAT ARE GREENING ACRES

GCCW is the broad effort to encourage public and private triple bottom line solutions for stormwater management through capital investment, regulation, and incentives. Through these mechanisms, private entities are compelled, guided, and resourced towards actions that simultaneously produce positive economic outcomes, pursue environmental sustainability, and advance social equity aims. This is a momentous paradigm shift, for the public sector to not only practice a triple bottom line to stormwater management but to encourage private investment in stormwater management through regulation, with incentives encouraging the greenest approaches.

As part of *GCCW*, Philadelphia Water is working with other City agencies in order to help reduce the costs associated with green infrastructure. This includes working with the Parks and Recreation department to install green stormwater infrastructure during renovations and working with the Streets Department to install green stormwater infrastructure during road construction projects. Philadelphia Water has also worked with non-City agencies, such as SEPTA, to encourage the installation of green stormwater infrastructure on SEPTA property. These partnerships have helped Philadelphia Water reduce the cost of installing green stormwater infrastructure and has allowed for the leveraging of additional funding.

TABLE 1.2 –PHILADELPHIA WATER DEPARTMENT GREENED ACRE GOALS

Year	Greened Acres	Square Miles	% Impervious Cover Runoff Removed
5	750	1	3%
10	2,100	3	8%
15	3,800	6	14%
20	6,400	10	23%
25	9,600	15	34%

The City is working to manage the stormwater from 9,600 impervious acres into greened acres. Vacant land presents a unique opportunity for stormwater management. There are over 40,000 vacant parcels of land in the City. An estimated 5,000 to 6,000 acres within the combined sewer system drainage will become greened during the 25 year program, given the rate of redevelopment. The City's updated stormwater regulations adopted in January, 2006, require every development/redevelopment project initiated within the City limits with an area of disturbance greater than 15,000 square feet must manage the first inch and a half of runoff from the site. As new development over 15,000 square feet takes place, there will be an increase in the number of greened acres.

Another policy-related tool that is resulting in Greened Acres is the Parcel Based Billing Initiative. Rather than charging properties based on their water meter(s), Philadelphia Water charges all properties a stormwater fee proportional to their lot size and impervious surface; single family

residential is a flat rate based on the average Philadelphia home, whereas non-single-family-residential fees vary from property to property based on the ratio of impervious surface area to gross property area. Properties with a higher ratio will be charged more, and properties that reduce the amount of impervious surface will be credited.[32] There are two rates that apply to a property: the gross area fee and the impervious area fee. This gross area fee applies to the entire site and cannot be adjusted. The gross area rate is $0.59 per 500 square feet. The impervious area fee can be adjusted if impervious area is reduced. The impervious area rate is $4.746 per 500 square feet.

To support property owners to reduce their impervious surface, and therefore their stormwater fees, PWD offers two grant programs: SMIP and GARP. The Stormwater Management Incentives Program Grant (SMIP) program provides grants directly to non-residential property owners who want to construct Stormwater retrofit projects. The Greened Acre Retrofit Program (GARP) provides grants to contractors, companies or project aggregators who can build large-scale stormwater retrofit projects across multiple properties. In addition to the grant programs, the City has made a green roof tax credit available to business owners retrofitting their roof. The applicant may claim a credit against the Business Privilege Tax of fifty percent of all costs incurred to construct the Green Roof not to exceed $100,000.[33]

[32] "Policy and Regulations," Philadelphia Water Department. 2016.
[33] "Green Roof Tax Credit," Philadelphia Industrial Development Corporation.