GREEN CITY, CLEAN WATERS:
The Philadelphia Story

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PHILADELPHIA, PENNSYLVANIA

Population:
1,526,000 (2010)

Land Area:
350 sq. km (135 Sq. Mi.)

Annual Rainfall:
107 cm (42 inches)

Median Income:
$37,090 (USD, 2008)

Persons Below Poverty Level:
23.8% (2008)

PHILADELPHIA WATER DEPARTMENT
A Sustainable Utility in Support of a Sustainable City

- **Drinking Water**
  (1.73 million customers in Philadelphia, Bucks, Montgomery and Delaware Counties)
- **Wastewater**
  (2.22 million customers in Philadelphia, Bucks, Montgomery and Delaware Counties)
- **Stormwater**
  (Philadelphia City/County only)
- **New integrated approach for water and resource management**

Choosing the Right Approach,
Benefits and Metrics

The Plan

- The Green City, Clean Waters plan will lay the foundation for a sustainable Philadelphia by
  - greening our neighborhoods,
  - restoring our waterfronts,
  - improving our outdoor recreation spaces, and
 - enhancing our quality of life.

Choosing the Right Investment with
Limited Funding

Triple Bottom Line Benefits

- PWD undertook a Triple Bottom Line (TBL) analysis of the environmental, social, and economic benefits of the program.
- Expands upon the traditional financial reporting framework
  - Assess the impact of green stormwater infrastructure investment beyond water quality benefit

Supplemental Documentation
Volume 2
Triple Bottom Line Analysis
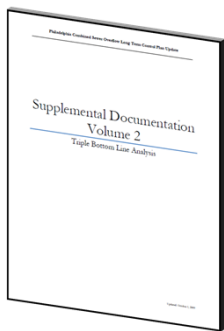
Triple Bottom Line Analysis

- The Triple Bottom Line Analysis focused on two alternatives:
  - A 50% Green Infrastructure Based Program
    - Managing the 1st inch of runoff on impervious cover
  - Traditional Tunnel Based Program
    - Four water bodies – therefore, four tunnels

Triple Bottom Line Benefits

Economic/Environmental/Social Benefits

  Jobs

  Recreation

  Property Values

  Avoided Heat Related Fatalities

  Avoided Premature Deaths

  Avoided Asthma Attacks

  Avoided Missed Days of School / Work

  Avoided/Absorbed Carbon Dioxide Emissions

  Water Quality and Habitat Improvements

The Green plan is the best choice because...

- A **$390 million increase to the property value of homes** near parks and green areas (2-5% increase per home)
- On average, **250 employed in Green Jobs each year**
- When the trees are fully grown, improved air quality will:
  - Avoid many **premature deaths** and **asthma attacks**
  - Reduce days of **work loss** or school **absence**
  - **Result in 1.5B pounds of CO_2 emissions** avoided or absorbed
    - The equivalent of removing close to 3,400 vehicles from Philadelphia's roadways each year

A Green Infrastructure based approach was best for Philadelphia

ALIGNING MAJOR PLANNING & POLICY INITIATIVES

GRENWORKS PHILADELPHIA

Energy

Environment

Equity

Economy

Engagement

202,000 Philadelphia residents do not have a public green space within 1/2 mile (10-minute walk) of their home

Green2015

Opportunity Sites

- 183 acres of PPR land that is either 90% impervious or underused
- 1,365 acres of schoolyards, many of which are largely paved
- 1,043 acres of publicly owned vacant land

Meeting Regulatory Requirements

2009 LTCPU Submittal → 2011 CONSENT ORDER & AGREEMENT - PADEP

Consent Order & Agreement
- Pollutant Mass Approach
- Stream/Wetland restoration removed
- $200M additional funds
- 25 yr program
- $1.2Billion (present value)
- more than 34% 'Greening'
- Approximately 12 'Deliverables'

| June 1, 2011 | 25-year Program | June 1, 2036 |
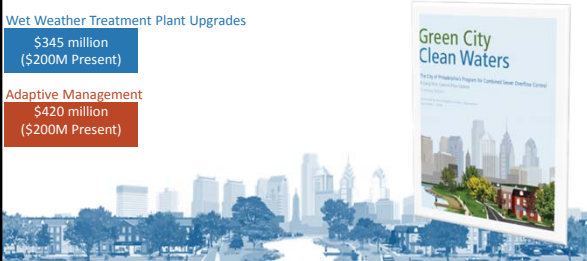
GREEN CITY, CLEAN WATERS

Green Stormwater Infrastructure

$1.67 billion ($800M Present)

Wet Weather Treatment Plant Upgrades

$345 million ($200M Present)

Adaptive Management

$420 million ($200M Present)

Green City Clean Waters

Water Quality Based Effluent Limit (WQBEL)

Metric	Units	Baseline value	Cumulative amount as of Year 25 (2036)
NE / SW / SE WPCP upgrade: Design & Construction	Percent complete	0	100%
Miles of interceptor lined	Miles	0	14.5
Overflow Reduction Volume	Million Gallons per year	0	7,960
Equivalent Mass Capture TSS / BOD / Fecal Coliform	Percent	62%	85%
Total Greened Acres	Greened Acres	0	9,564

COA Deliverables

Deliverable Name	Deliverable Date
Implementation and Adaptive Management Plan	December 1, 2011
Green Infrastructure Maintenance Manual Development Process Plan	June 1, 2012
Comprehensive Monitoring Plan	December 1, 2012
Facility Concept Plan for NE WPCP	June 1, 2013
Facility Concept Plan for SE WPCP	June 1, 2013
Facility Concept Plan for SW WPCP	June 1, 2013
Updated Nine Minimum Controls Report	June 1, 2013
Tributary Water Quality Model – Bacteria	June 1, 2013
Tributary Water Quality Model - Dissolved Oxygen	June 1, 2014
Green Infrastructure Maintenance Manual - First Edition	June 1, 2014
Tidal Waters Water Quality Model - Bacteria	June 1, 2015
Tidal Waters Water Quality Model - Dissolved Oxygen	June 1, 2015

Implementation and Adaptive Management Plan

Delivery: December 1, 2011

Metric: All

A strategy for the first years of Implementation

- Adaptive Management
- Capital Projects Planning
- Policy and Streamlining
- Operations and Maintenance
- Program Monitoring
- Public Outreach

Comprehensive Monitoring Plan

Delivery: December 1, 2012

Metric: Greened Acres

Monitoring, Modeling and Inspections

Natural Environment Monitoring

- Tidal
- Tributary
- Groundwater
- Rainfall

Sewer System Monitoring

- Sewer System Flows
- CSO Discharge
- Model Outputs

Green Infrastructure Performance

- Soil and Vegetation
- Underground Infrastructure
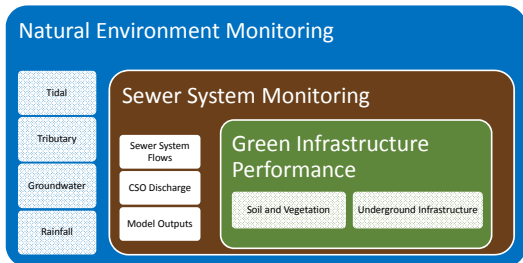
Facility Concept Plans for Plant Expansion

Delivery: June 1, 2013

Metric: Overflow Reduction

Increase wet weather treatment capacity to over 1.4 billion gallons per day

215 MGD
- Increase wet weather capacity using secondary bypass

60 MGD
- Increase secondary treatment capacity

50 MGD
- Increase in secondary treatment capacity

Water Quality Modeling

Delivery: 2013-2015

Metric: Progress Evaluation Tool

Assess the program and evaluate alternative implementation options

Tookany/Tacony-Frankford	Cobbs Creek	Delaware River	Schuylkill River

Bacteria

Dissolved Oxygen

Green Infrastructure Maintenance Manual

Delivery: June 1, 2014

Metric: Greened Acres

Defining maintenance activities, frequency and efficiencies for long-term success of each type of green stormwater infrastructure

STORMWATER TREE TRENCH: Maintenance Responsibilities

TOTAL GREENED ACRE METRIC

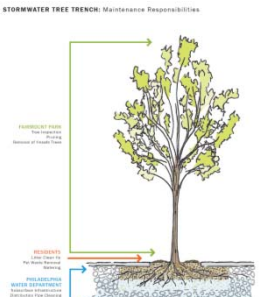25-year target = 9,564 greened acres

5-year target = 744 greened acres

Metric	Units	Year 0	Year 5	Year 10	Year 15	Year 20	Year 25
Total Greened Acres	Greened Acres	0	744	2,148	3,812	6,424	9,564
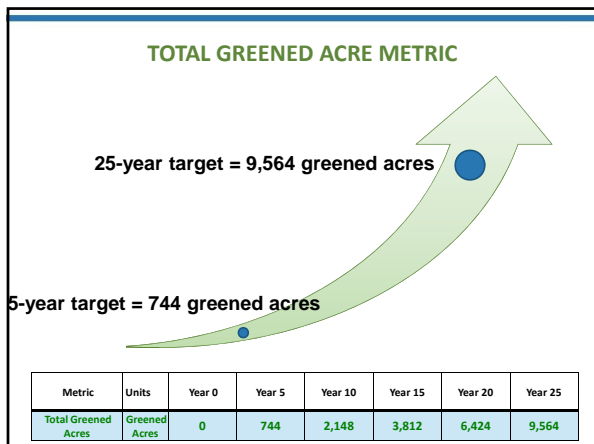
WHAT IS A GREENED ACRE?

Greened Acre: acre of impervious cover that is retrofitted to utilize *green stormwater infrastructure* which manages stormwater using source controls such as infiltration, evaporation, transpiration, decentralized storage and reuse.

GA = IC * Wd

- **IC** is the impervious cover utilizing green stormwater infrastructure (acres). This quantity can include the area of the stormwater management feature itself, as well as the area that drains to it.
- **Wd** is the depth of water over the impervious surface that can be physically stored in the facility (inches). Green stormwater infrastructure designs will be aimed at controlling **at least 1.0 inch of runoff, and up to 1.5 inches of runoff, unless otherwise deemed feasible by engineering design.**
- One Greened Acre is equivalent to one inch of managed stormwater from one acre of drainage area or 27,158 gallons of managed stormwater.

Implementation

9,564+ IMPERVIOUS ACRES CONVERTED TO "GREENED ACRES"

- **Public/Public Works:** innovative Green Programs to invest in green stormwater infrastructure / standardizing on city projects
- **Private:** enforce strong stormwater regulations on development and create stormwater billing structure that rewards good practices

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NEW INITIATIVES
First Five Years

- PWD Facilities
- Green Streets
- Green Campus Initiatives
- Green Schools and Schoolyards
- Greening of Publicly owned Parking Facilities
- Vacant Lands
- Green Homes

www.pennconnects.upenn.edu/find_a_project/by_category/landscape/shoemaker_green_images.php

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DEMONSTRATION PHASE
Initial focus on Green Streets and Open Space

Columbus Square Stormwater Planters

Liberty Lands Park

Cliveden Park

PENNVEST STATE REVOLVING FUND (SRF) Low Interest Loan

- $30M PennVest loan

- 5 phases between 2009 and 2012

- 93 Sites - over 200 Blocks

- 80+ Greened Acres are completed

- Prep for spending $40M per year

Green Stormwater Infrastructure Project Map

GREEN STREETS DESIGN MANUAL

- Collaboration between:
  - Mayor's Office of Transportation & Utilities
  - Philadelphia Water Dept
  - Streets Dept
- Provide standard details for green stormwater infrastructure design
- Revise and define City review process and policies

GREEN STREETS
Evolving Implementation

- Increasing in size and scope

- Changing policies create new partners and funding potential

- Partners starting to take the lead on requesting stormwater management in their projects

STORMWATER MANAGEMENT ENHANCEMENT DISTRICTS (SMEDS)

- Maximizing Green Acres in clustered areas → 50+ GA at a time

- Alternatives analysis for integrated implementation

- Potential leveraging of limited funding

- Innovative collaboration

- Centralize stormwater management facilities

PHILADELPHIA STORMWATER REGULATIONS

**Impacts New Development & Re-development with earth disturbance exceeding 15,000 square feet:**

- Water Quality
- Channel
- Flood Control

Meets the definition of a greened acre and manage the first inch of stormwater.

Opportunity to leverage private development.

Since enacting the 2006 regulations:
- PWD has **approved 436** Stormwater Management Plans
- **57% (248)** of these projects are located in the CSO area

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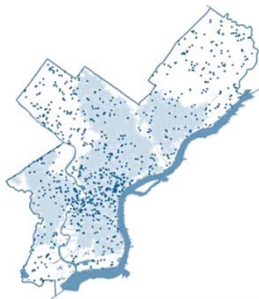
PARCEL-BASED STORMWATER BILLING
Financial incentive for better stormwater management

- Shift from a meter-based charge for stormwater to a parcel-based stormwater charge
- Credit system available for managing stormwater
- Top 500 impacted parcels in the combined sewered area make up 12.3% of total impervious area
- Rewards Urban Development

Gross Area = 24,000	Existing Charge = $ 4,700
Impervious Area = 24,000	New Charge = $ 120

Gross Area = 600,000	Existing Charge = $ 400
Impervious Area = 500,000	New Charge = $ 2,500

PUBLIC OUTREACH AND PARTICIPATION

Philadelphia Water Department

Watersheds Blog

Green City, Clean Waters Website
www.phillywatersheds.org

Share / Save

Low Impact Design Challenge

Fairmount Waterworks
Interpretive Center

*Green City, Clean
Waters* Advisory
Committee

Green City, Clean Waters **Documentary Video Series**

Green Tours

The Flower Show

The Philadelphia Inquirer

Breaking ground
with a $1.6 billion
plan to tame water

A green plan to embrace any deluge

Social Media: Facebook

Ribbon-cuttings and project specific events

**GSI Interactive Tours,
Podcasts & Maps**

ALIGNING RESOURCES AND CREATING PARTNERSHIPS

The Big Green Block

New Kensington CAPA School

Norris St Stormwater Trees and Mural

PWD Stormwater Tree Trenches

Improvements at Shissler Recreation Center

Images courtesy of PHS

GREEN CITY, CLEAN WATERS

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Office of Watersheds

www.phillywatersheds.org