



Image credit: Danya Henninger,
Imaginedigital

Markets, Policies & Tools for Green Infrastructure

Research Team & Project

- EPA-funded research grant to study GI implementation in Philadelphia
- Team: urban planners, real estate market and policy analysts, landscape architects
 - Faculty: D. Hsu, J. Landis, T. Daniels, S. Wachter
 - Students and Staff: H. Hu, T.C. Lim, E. Harrington, E. Hosek, B. Leopold, P. Amos, D. Karp
 - Consultants: Azavea, AKRF, PEC, OLIN
- Objective: To enable citizens and owners to invest in green infrastructure in Philadelphia

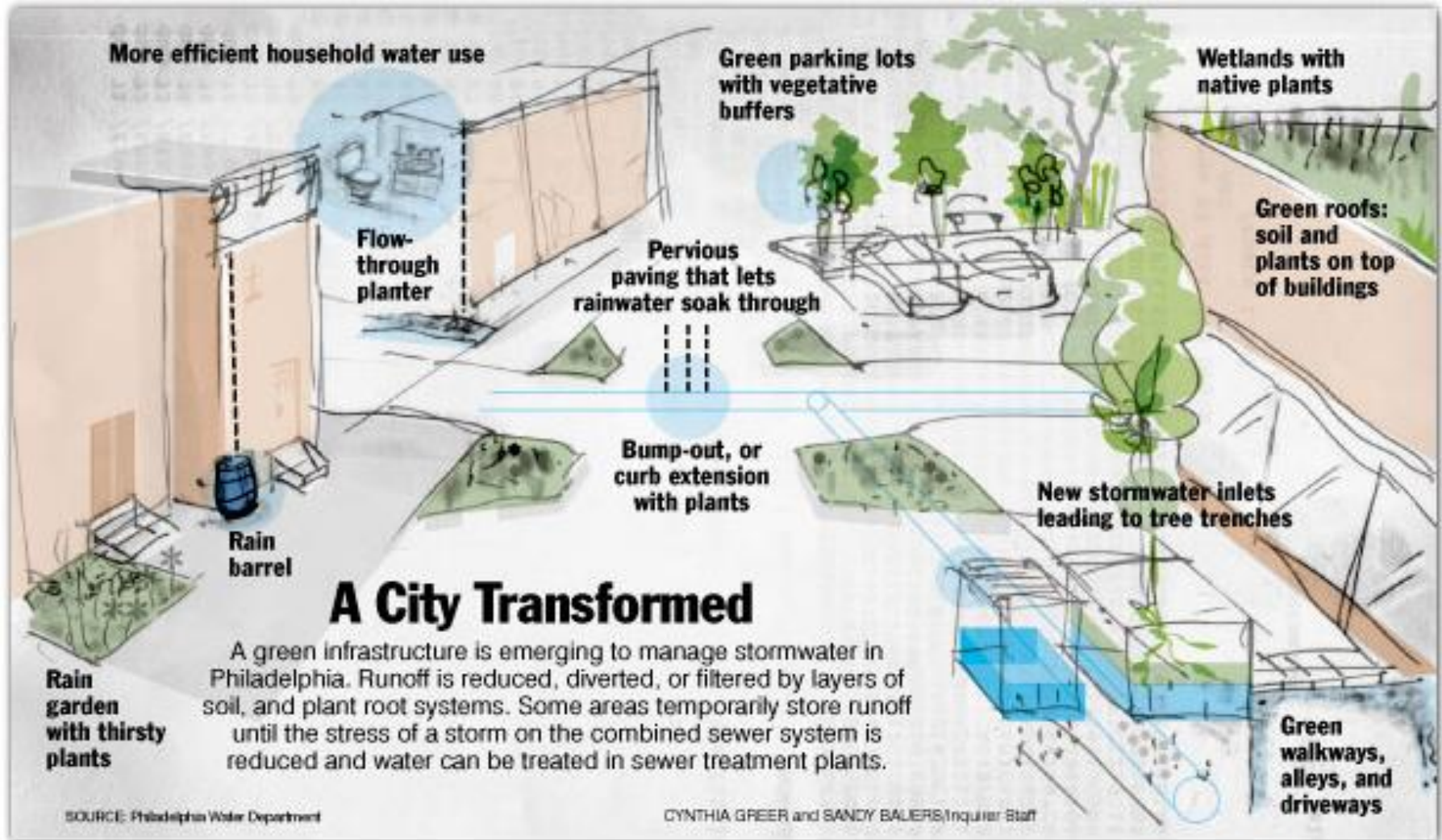
U.S. Stormwater Policy

- National CSO Control Policy of 1994
 - Expedited compliance with the U.S. CWA
 - Water quality measured for uses:
 - swimming, aquatic life, industry and agriculture
 - Criteria are numerical and narrative
 - Anti-degradation policy
- Control discharges from CSOs
 - NPDES permitting process
 - authorization necessary to discharge to waterways
- Wet Weather Quality Act of 2000

“Green City, Clean Waters Plan”

- Philadelphia is not the first, but the biggest post-industrial city, to pursue controlling stormwater runoff almost entirely with green infrastructure.
- Approximately \$2 billion plan.
- Result of a 2011 consent order and agreement (COA) with PA Department of Environmental Protection
 - Reduce CSO volumes
 - Pollutant removal
 - Proof of concept
 - Adaptive management
 - 34.5%+ greening of the city

Green Infrastructure in Philadelphia





Southeast Philadelphia (10th & Moyamensing), photo by Andrew Dobshinsky

Math Problem

- COA / LTCP requires 10,000 greened acres by 2035
 - cost of GA in right-of-way: \$50-400k
 - cost of GA through SMIP grants: \$82k
 - [cost of GA through GARP program: ~\$90k]
 - plus historic re-development rate: 0.5%
- Q: How much can PWD pay to meet target?
- A: If cost of GA declines smoothly to 2035:

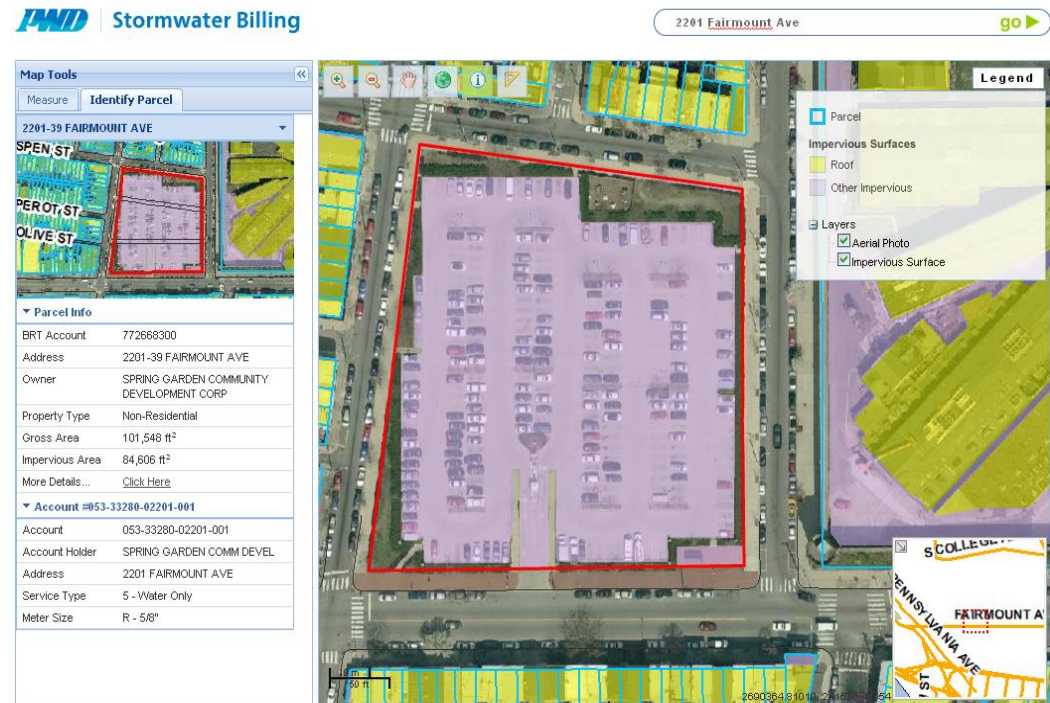
Cost	10%	20%	30%	40%	50%	60%	70%	80%	90%
Year	2020	2024	2026	2028	2030	2031	2032	2034	2035

Policies and Tools

- Stormwater Development Regulations
 - 15,000 SF threshold for new and re-development triggers stormwater requirements
 - capture first inch
 - water quality, quantity, and channel protection
 - goal is >10% of impervious cover over next 25 years
- Stormwater Management Incentives
 - credit for retrofitting properties with GI
- Green Acre Retrofit Program
 - targeted program to aggregate large sites
 - again offers credits for GI retrofit, site assembly

Area-Based Stormwater Billing

- Previously meter-based.
- Now:
 - Gross area charge: \$0.69 / 500 sf / month
 - Impervious cover: \$4.75 / 500 sf / month
- Substantial re-distribution of externality costs.



Please Note: The data on this site is to be used for stormwater billing purposes only. The Records Department's Mapping Unit maintains parcel maps. These maps contain the graphical depiction of the legal descriptions contained on deeds that are also processed by Records. The Streets Department's Survey Unit maintains maps that contain survey data and street plans.

Market Effects: Plus / Minus

- Competitive market for GI does not yet exist
 - ✓ Existing efforts are small scale (~100 GA)
 - ✓ Lack of information, awareness
 - ✓ Lack of financial / technical capital
 - ✓ High transaction costs (20-40% of cost)
- Supply of GA:
 - ✓ Costs decrease as experience grows
 - ✓ Costs decrease as market grows
 - ✓ Supply increases as stormwater charges go up
 - ✓ Costs increase as best sites go first

Social & Institutional Barriers

40 years of energy efficiency efforts show that significant market barriers exist to retrofitting buildings and properties!

Barrier	Policy response
Externalities / lack of incentives	Area-based stormwater fee ✓
	Redevelopment ordinance ✓
Lack of knowledge	Outreach to developers ✓
Lack of upfront capital	SMIP / GARP grants ✓
Matching people to programs	Alternative financing sources
	Targeted incentives / subsidies
	Site acquisition / aggregation

Markets Need Information

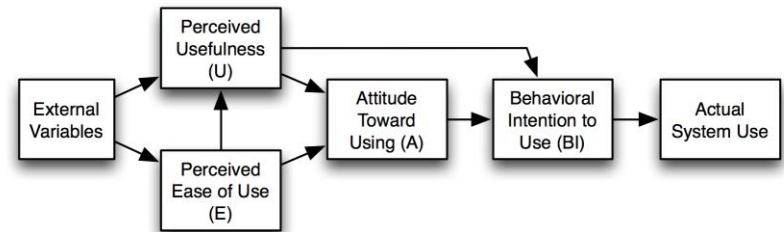
Daniel Kahneman:

- “we can be blind to the obvious and we are blind to our blindness”

Ajzen's Theory of Planned Behavior (TPB); technology acceptance model (TAM); “reasoned action”

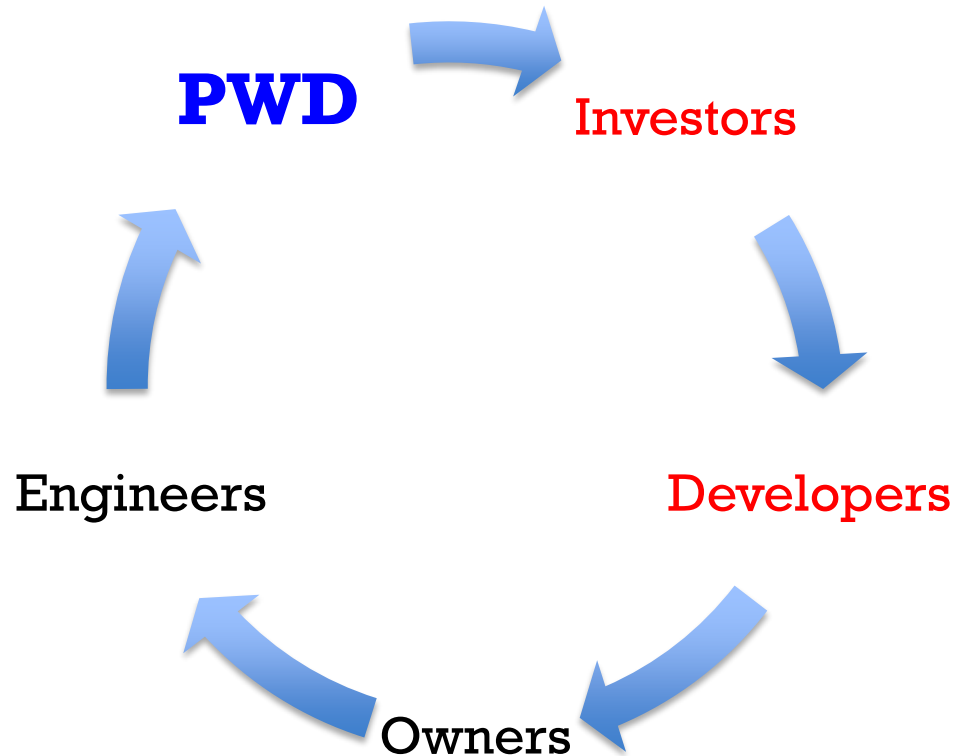


Daniel J. Simons and Christopher F. Chabris, “Gorillas in Our Midst: Sustained Inattentional Blindness for Dynamic Events.” *Perception* 28 (1999): 1059, 1070.



Wikimedia / Theory of Planned Behavior

Market Transaction Model



Web-Based Tools for Information

WHAT'S YOUR EXPERIAN CREDIT SCORE?

FIND OUT NOW FOR FREE WHEN YOU CHECK YOUR CREDIT REPORT FOR \$1

- ✓ Checking your own credit report will NOT lower your score
- ✓ A REAL credit report, with more information, like the one banks see
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#1 in dates, relationships and marriages

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Between ages: and

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musicians
pets
politics
rideshare
volunteers

housing
apts / housing
housing swap
housing wanted
office / commercial
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rooms / shared

jobs
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art / media / design
biotech / science
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Bankrate Home Rates Calculators Mobile

MORTGAGES BANK RATES CREDIT CARDS INSURANCE AUTO INVESTMENTS RETIREMENT FINANCIAL PLANNING

WELCOME TO BANKRATE

1. What are you looking for?

- ☐ Mortgage
- ☒ Refinance
- ☐ Auto Loans
- ☐ Home Equity
- ☐ Student Loans
- ☐ CD Rate
- ☐ Savings
- ☐ Credit Cards
- ☐ Checking
- ☐ Insurance

2. Select a product

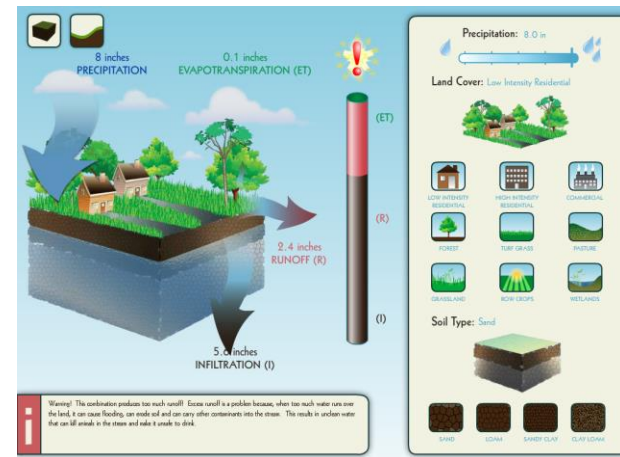
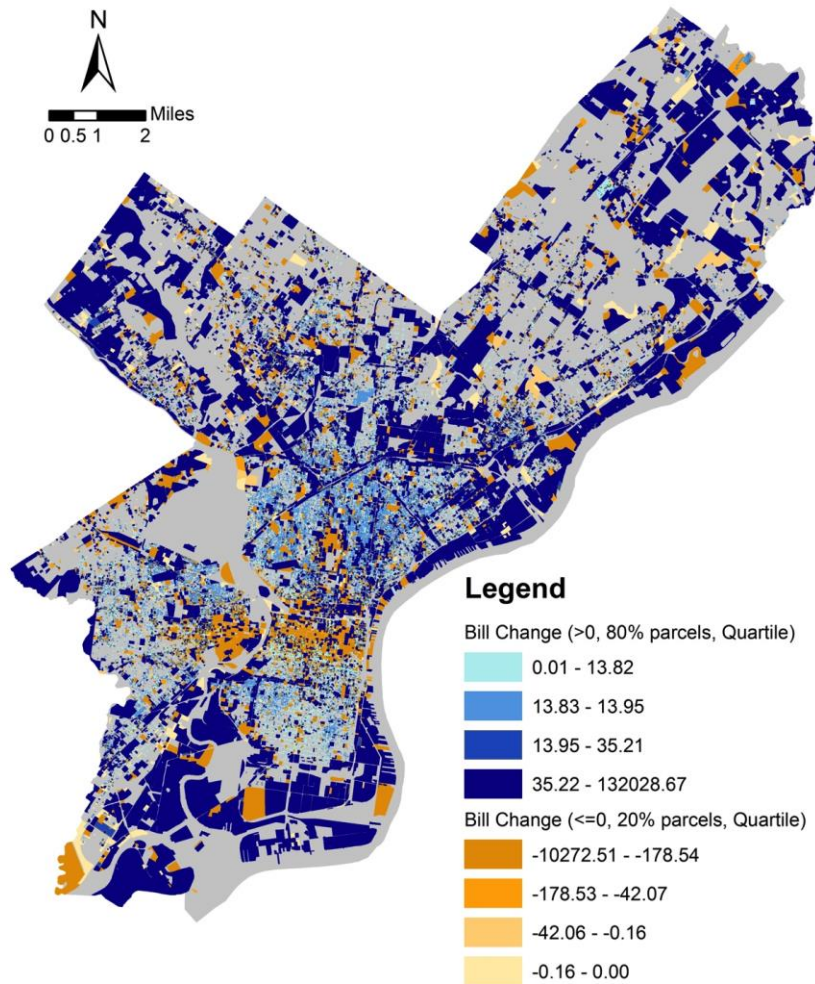
- ☒ 30 yr fixed refi
- ☐ 30 yr FHA mortgage refi
- ☐ 5/1 ARM refi (interest only)
- ☐ 15 yr fixed refi
- ☐ 5/1 ARM refi
- ☐ 7/1 ARM

COMPARE RATES

Product	Rate	Change	Last week
30 year fixed refi	4.08%	0.04	4.04%
15 year fixed refi	3.22%	0.06	3.16%
10 year fixed refi	3.27%	0.07	3.20%

VIEW RATES IN YOUR AREA Enter ZIP code

“Daylighting” Information for Action



Thank you!

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