



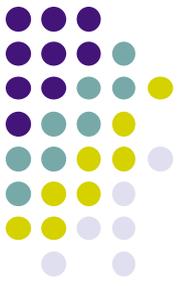
Multiple Benefits from Green Stormwater Infrastructure

human health & wellness

Kathleen Wolf, Ph.D.
Research Social Scientist

University of Washington (Seattle)
USDA Forest Service, Pacific NW Research Station

15th Annual New Partners for Smart Growth
Portland, OR :: February 2016



Industrial Age – city squalor



credit: BlendSpace



credit: blogs.isb.bj.edu.cn

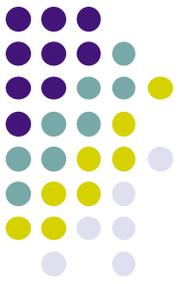




08/04/2005

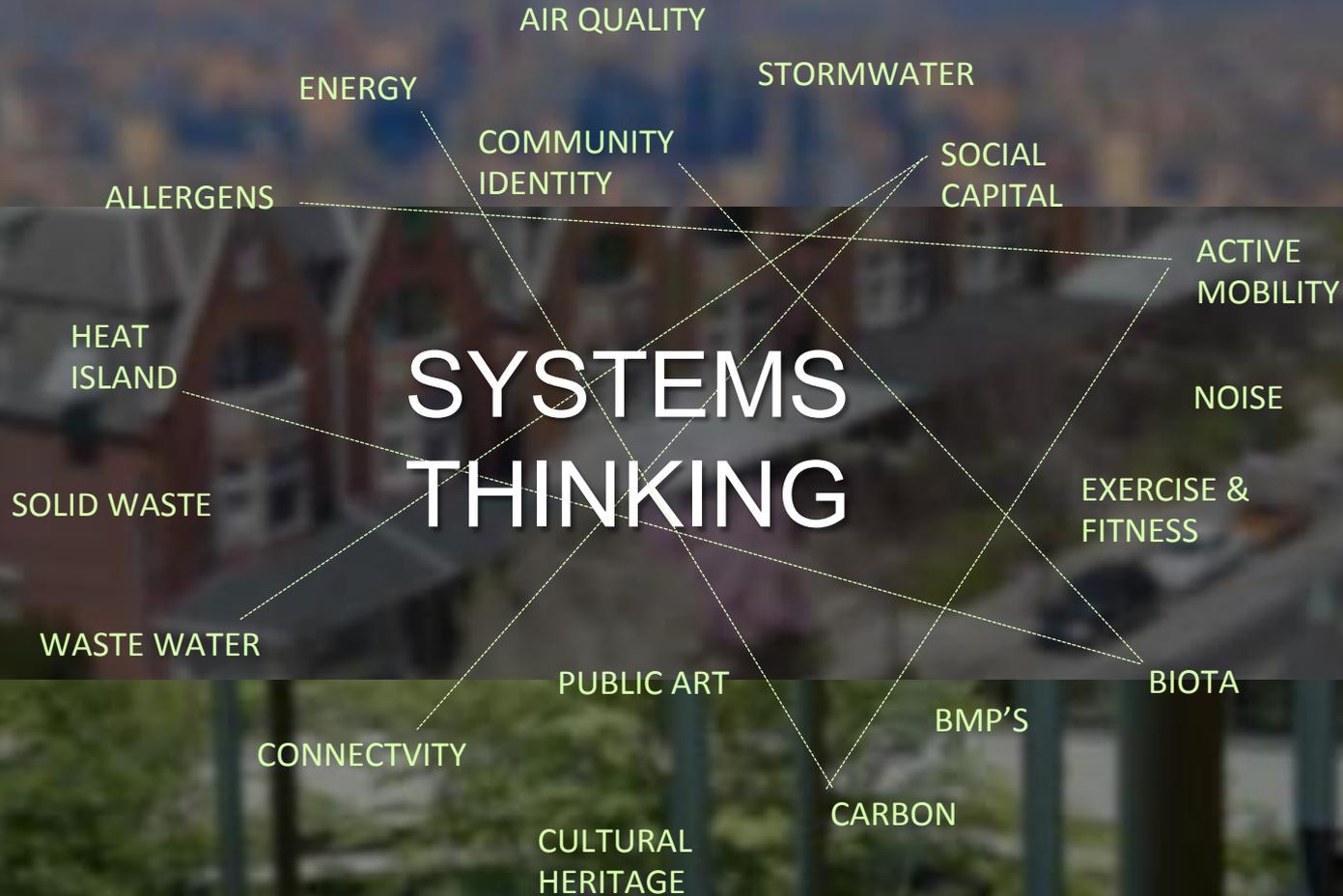
Sewers & Streets

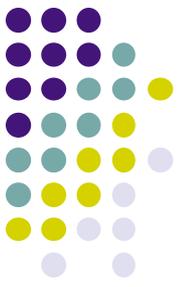
Urban Neighborhoods



credit: Kristine Cramer, King County, WA

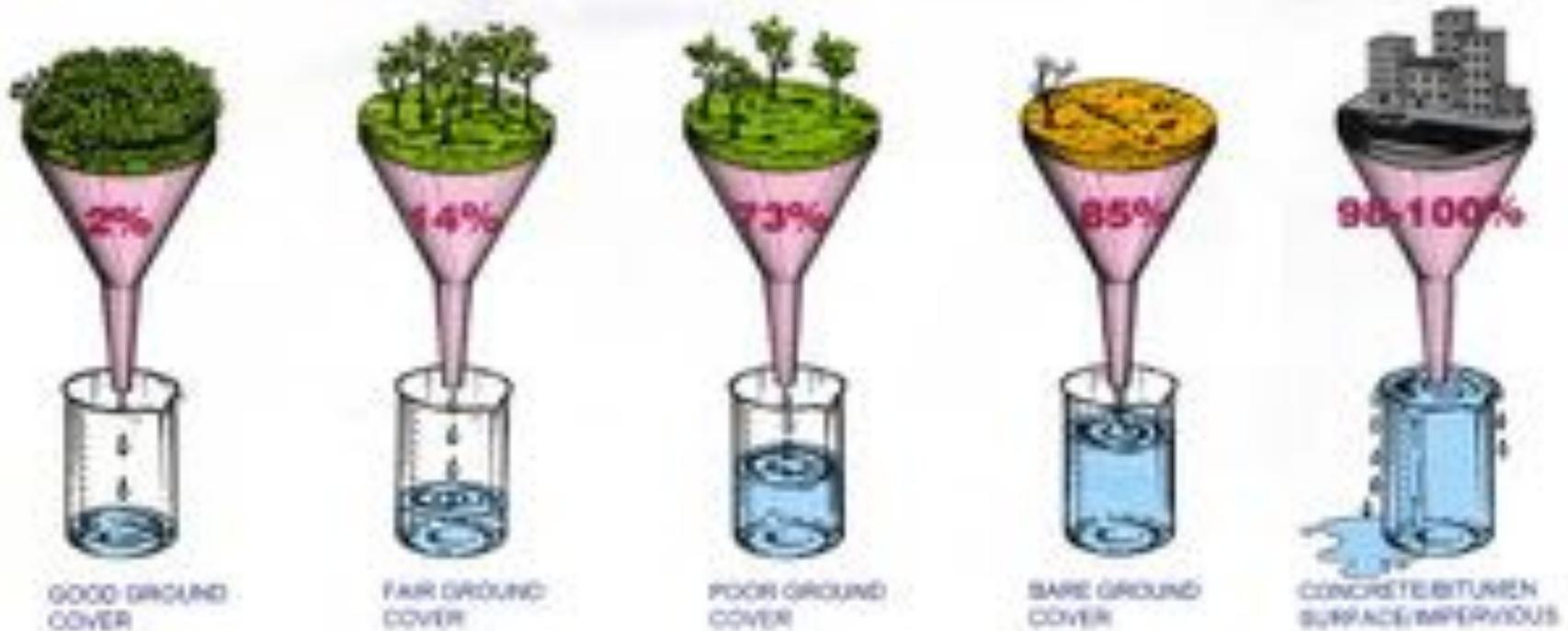
credit: American Planning Association





Trees & Stormwater Runoff

PERCENTAGE (%) OF SURFACE RUNOFF ON A VARIETY OF SURFACES



credit: City of State College, PA

Stormwater Management

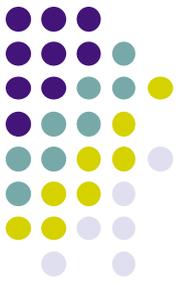


Pierce County WA, Chambers Creek Properties



Pierce County WA, Chambers Creek Properties - 4 year growth

Stormwater Management



Thornton Creek Water Quality Channel (Seattle, SvR Design)
1 hectare, treats runoff from 275 hectares





in cities

expensive land values
reduced public funds
increasing community needs
new parks??

SO
multi-tasking nature
creating co-benefits

GSI Tool

Bioretention



Rain Gardens



Stormwater Cisterns



Dispersion



Dry Well/
Infiltration
Trench



Biofiltration



GSI Tool

Permeable
Paving



Green Roofs



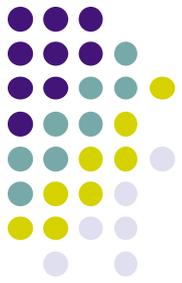
Depaving



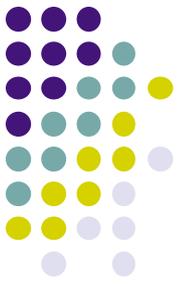
Tree Canopy



Compost &
Mulch

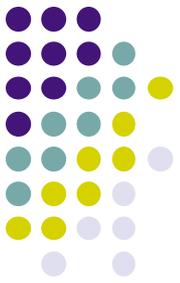


**green
stormwater
infrastructure
tools &
strategies**

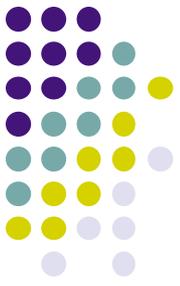


Tanner Springs Park

Portland OR



linked to active living network



**neighborhood
social cohesion**

**environmental
education &
social learning**



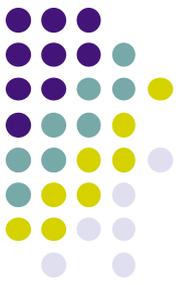
WHO health definition

*a state of complete
physical, mental, and social well-being
and not merely the absence
of disease or infirmity (1946)*

science & evidence re: environment
role of 'metro nature'?
not a panacea, but important!



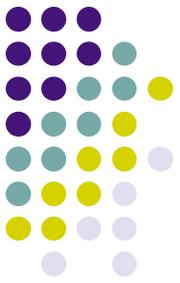
Determinants of Health



**in the
background**

**support
functions,
needs,
benefits,
ecosystem
services**





Green Cities: Good Health

www.greenhealth.washington.edu

Sponsors:

USDA Forest Service, U&CF Program

University of Washington

NGO partners

thanks!

to U of WA students:

Katrina Flora

Mary Ann Rozance

Sarah Krueger



research review & summaries

[Community Building](#)[Local Economics ▶](#)[Place Attachment & Meaning](#)[Crime & Fear ▶](#)[Safe Streets ▶](#)[Active Living ▶](#)[Reduced Risk](#)[Wellness & Physiology](#)[Healing & Therapy](#)[Mental Health & Function ▶](#)[Work & Learning](#)[Culture & Equity](#)[Lifecycle & Gender](#)

Local Economics

Trees in cities are not grown and managed for products that can be bought and sold on markets, but they do provide many intangible services and functions! This article serves two purposes. First, it introduces valuation methods that are used to convert intangible benefits to dollar sums.^{1,2} Then, it shows how nonmarket valuations can support local decision-making.

Fast Facts

- The presence of larger trees in yards and as street trees can add from 3% to 15% to home values throughout neighborhoods.
- Averaging the market effect of street trees on all house values across Portland, Oregon yields a total value of \$1.35 billion, potentially increasing annual property tax revenues \$15.3 million.⁹
- A study found 7% higher rental rates for commercial offices having high quality landscapes.¹⁴
- Shoppers claim that they will spend 9% to 12% more for goods and services in central business districts having high quality tree canopy.³⁴
- Shoppers indicate that they will travel greater distance and a longer time to visit a district having high quality trees, and spend more time there once they arrive.³⁴

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street trees boost market value of houses, providing tax revenue for communities





green stormwater
infrastructure

+ human health
co-benefits

King County, WA

Barton CSO Basin Then and Now

Development and the addition of impervious surfaces have changed the natural flow of stormwater.



1936

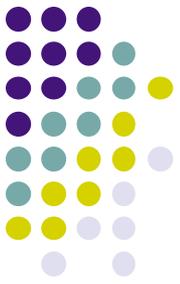


2010

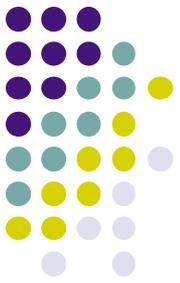
**on-going
land use
changes**

**= less
natural flow**

photo credits:
Kristine Cramer,
King County, WA



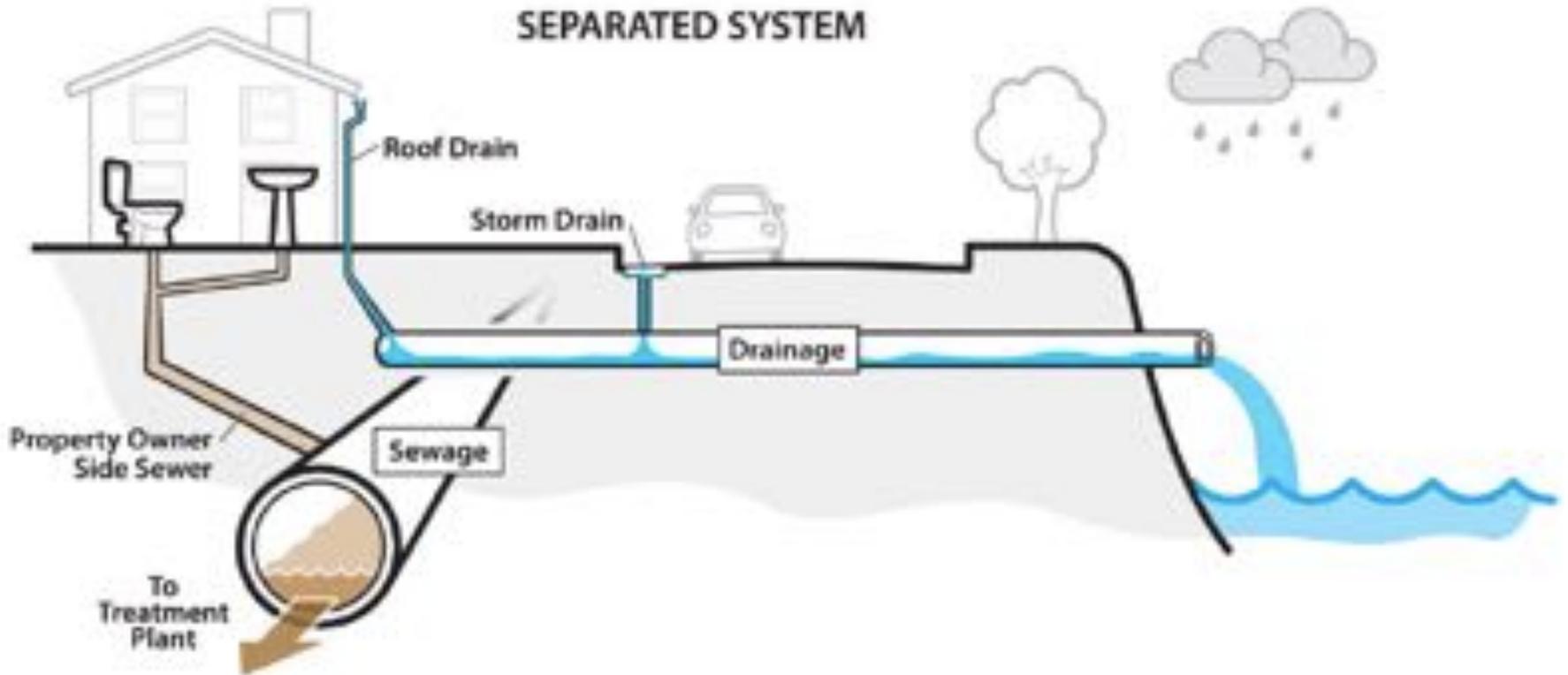
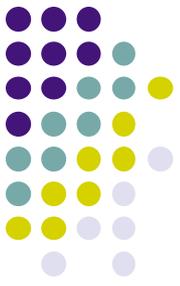
It seemed like a good idea!



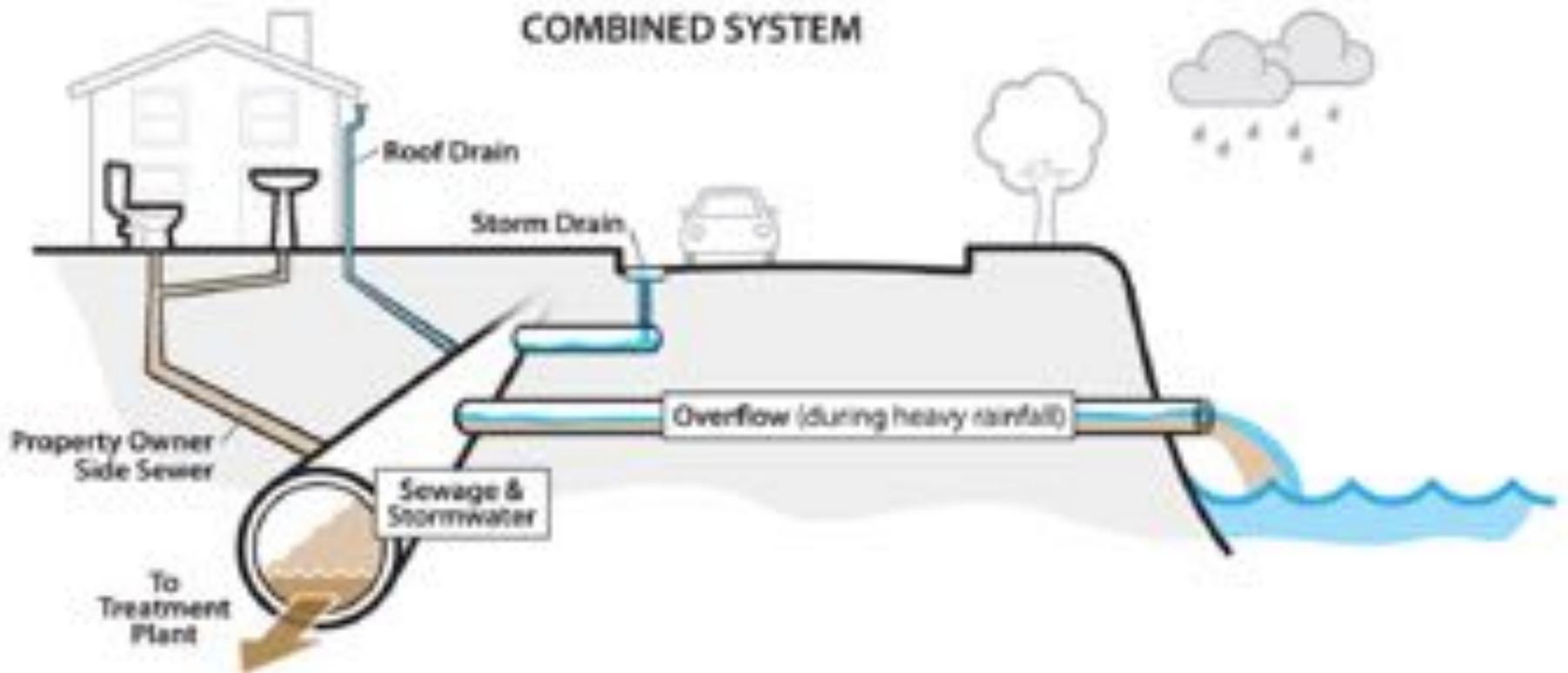
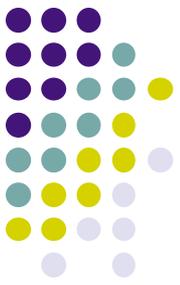
water quality?
extend the pipe!

photo credits:
Kristine Cramer, King County, WA

Separated Sewer System



Combined Sewer Systems



Urban Drainage

- City of Seattle sewer and stormwater drainage systems



Change & Water Quality

- King County/City of Seattle CSOs (> 120 combined sewer overflows in city)
- EPA consent decree
- approach – green stormwater infrastructure
- co-benefits?





study in design phase

stormwater reduction performance
health co-benefit
neighborhood scale



Stormwater Report, online April 2014 (search health)

co-benefit design opportunities



Community Building

Local Economics ▶

Place Attachment & Meaning

Crime & Fear ▶

Safe Streets ▶

Active Living ▶

Reduced Risk

Wellness & Physiology

Healing & Therapy

Mental Health & Function ▶

Work & Learning

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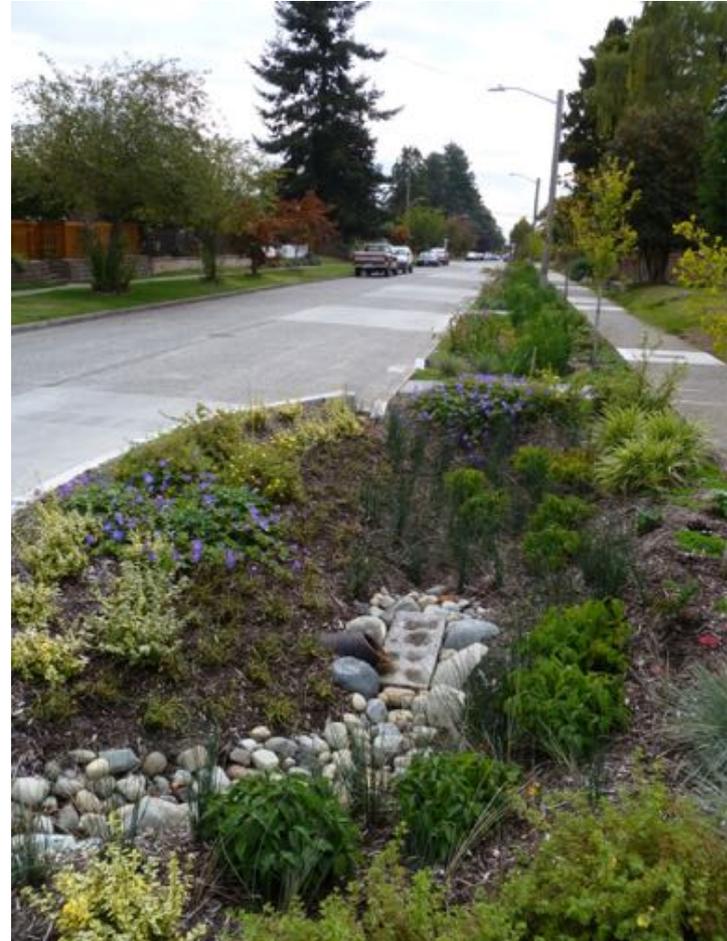
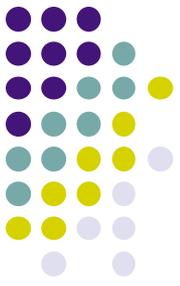
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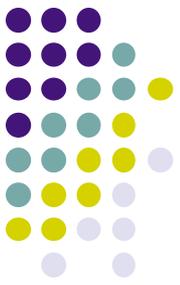


streets that work like the forest



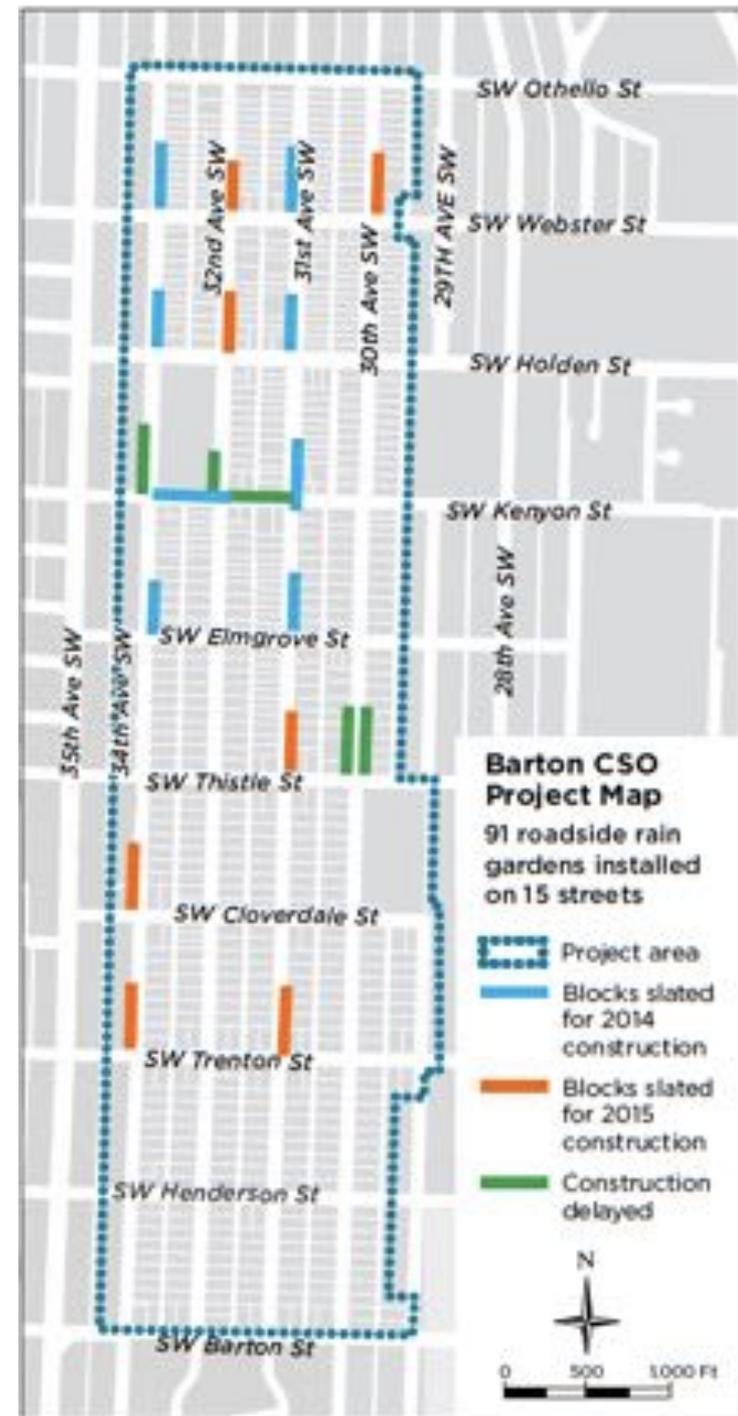
Analysis :: Surface Infiltration Potential

public &
private
lands

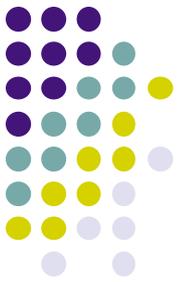


Study :: Health Outcomes

- neighborhood green stormwater infrastructure installation - 2017
- consent decree co-benefits
- pre/post analysis
- measures?
property value, physical activity, social capital, mental health, school performance



Equity in Action :: King County & City of Seattle



- **Key Recommendations:**
- Consider the needs of nearby residents and businesses, including Martin Court (transitional housing at the northeast corner of 4th Ave S. and S Michigan St.).
- Pursue partnership with Seattle Department of Transportation (SDOT) to improve the corners of 4th Ave S and S Michigan St.
- Thoroughly document and share information about equity determinants the project *will* impact – share successes.
- Increase vegetation in and around the project site.
- Employ strategies during construction and operation to reduce pollution.
- Create quality educational opportunities during design, construction and operation.
- Keep relocated businesses in Georgetown, if possible and desired by the business.
- Seek opportunities throughout project (design through operation) to provide job training.
- Engage and employ small-, minority-, and woman-owned businesses and consultants.
- If possible, pursue opportunities to support the creation of open or green space in the community.





Summary

- sanitary city (drains & pipes)
- sustainable city (socio-ecological systems)
- Green Cities: Good Health
- green stormwater infrastructure
- potential health & wellness co-benefits
- King County/City of Seattle research
case study
- scalable to other U.S. cities with GSI



Human Dimensions of Urban Forestry and Urban Greening

featuring research on peoples' perceptions and behaviors regarding nature in cities

Green Cities: Good Health

human health & well-being research

Projects Director
Kathleen L. Wolf, Ph.D.



What's New?

Nature and Consumer Environments
Research about how the urban forest influences business district visitors.

Trees and Transportation
Studies on the value of having quality landscapes in urban roadsides.

Civic Ecology
Studies of human behaviors and benefits when people are active in the environment.

Policy and Planning
Integrating urban greening science with community change.

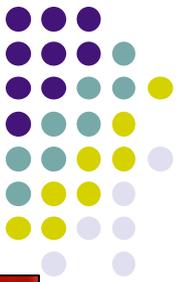
Urban Forestry and Human Benefits
More resources, studies and links . . .

Sponsors



www.naturewithin.info

well, maybe not



early 1960s – raw sewage plumes in Puget Sound

1958-sewage treatment plant approved; 1965-in operation

photo credits:
Kristine Cramer, King County, WA