Faculty of Design

2015

Co-Design for second-order effects and institutional Change: A case study in sustainability

Barba, Evan and Stewart, Audrey

Co-Design for Second-Order Effects and Institutional Change

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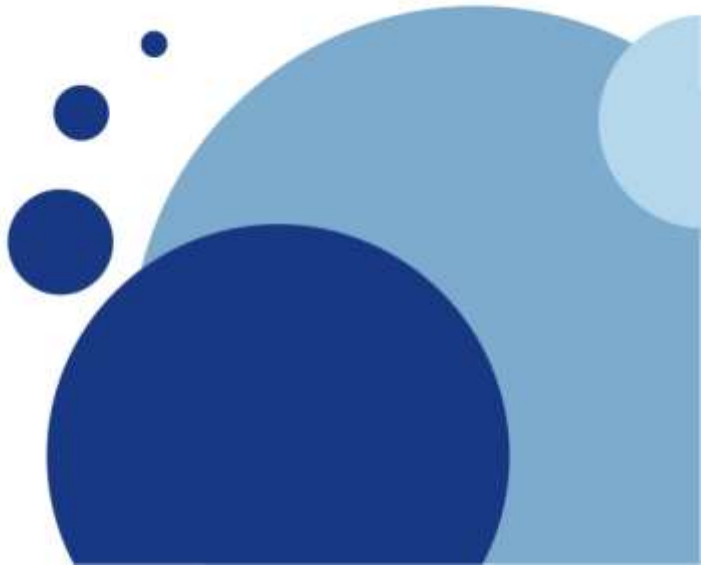
Communication, Culture and Technology Program

Georgetown University

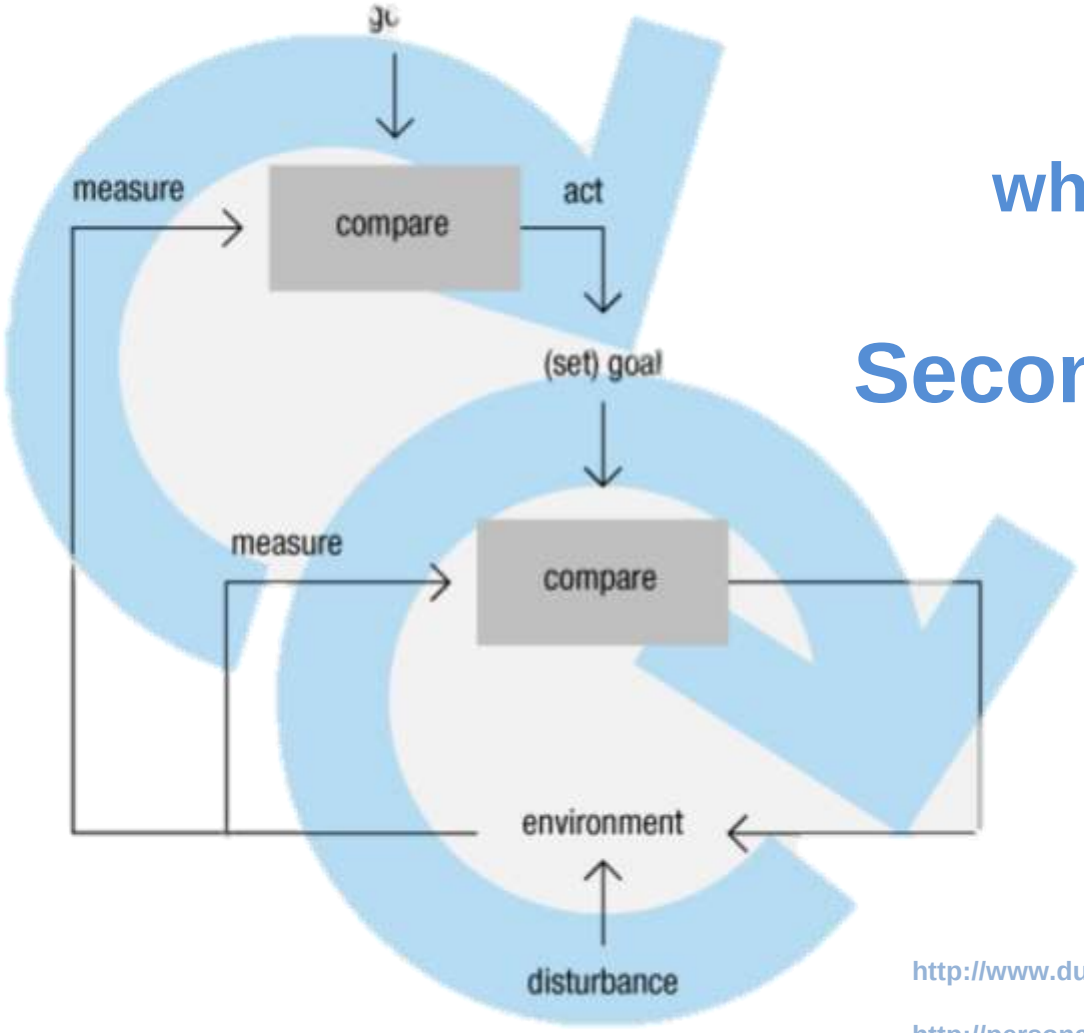


“Every action has consequences

and those consequences have consequences

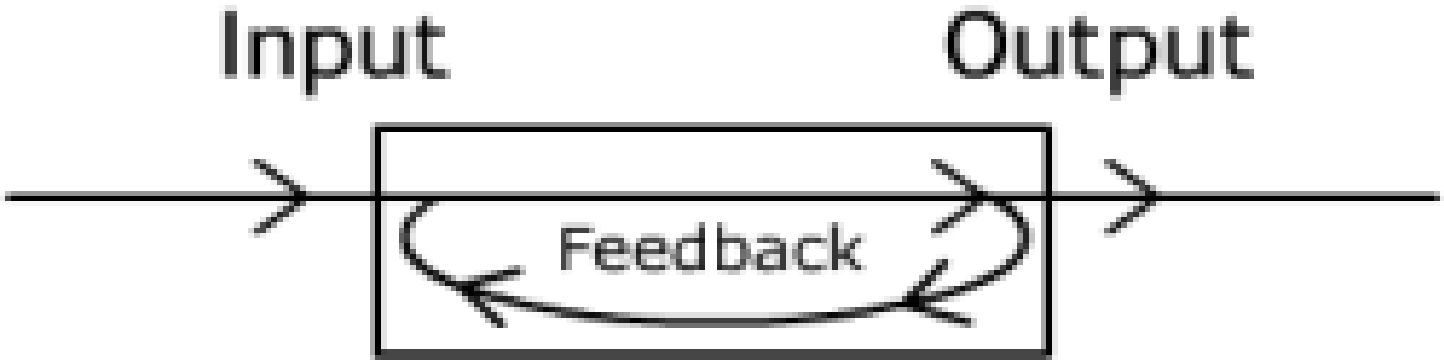
which are called

Second-Order Effects”

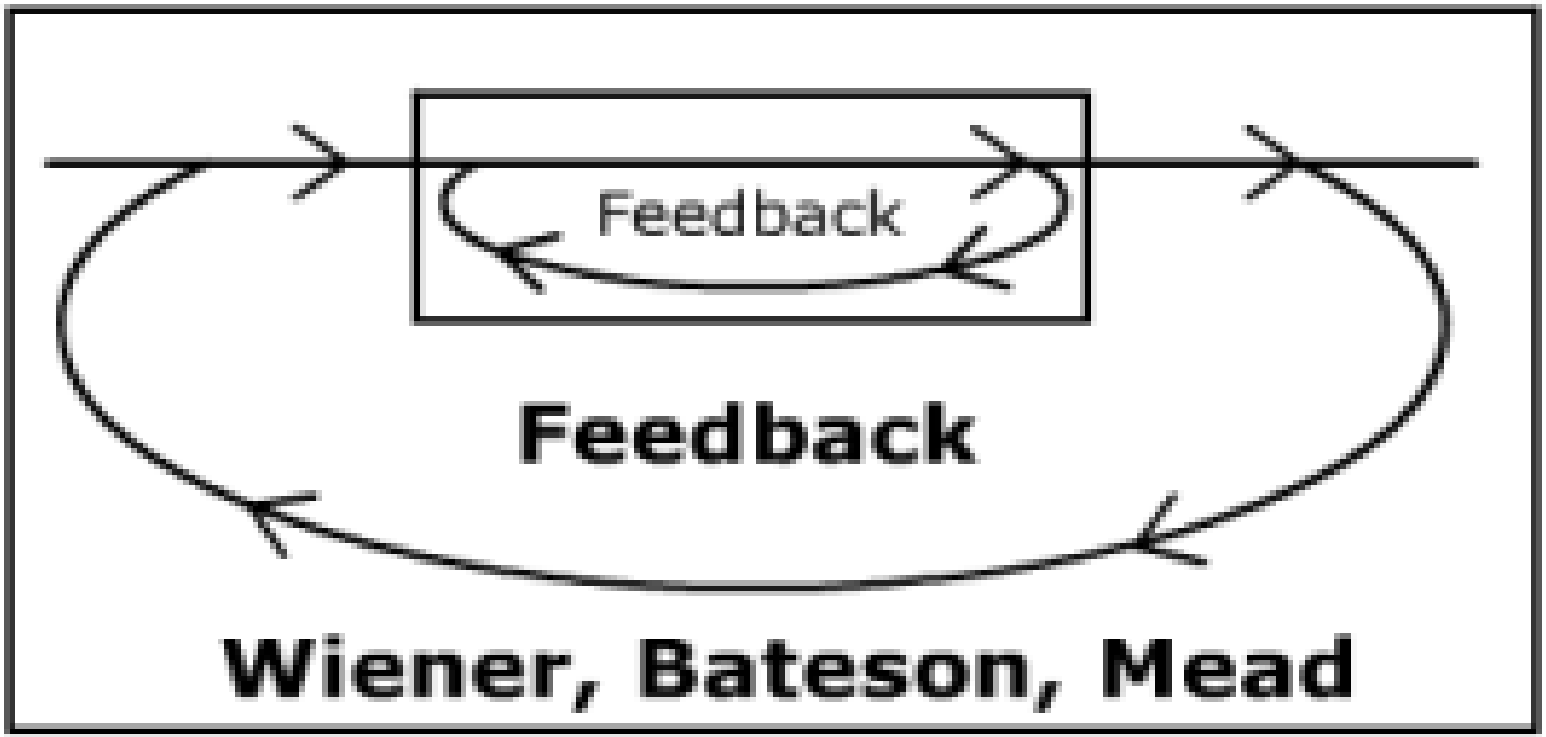


http://www.dubberly.com/articles/what-is-interaction.html

http://personalmba.com/second-order-effects/: Josh Kaufman quote



Engineer



Wiener, Bateson, Mead

- Weak Emergence

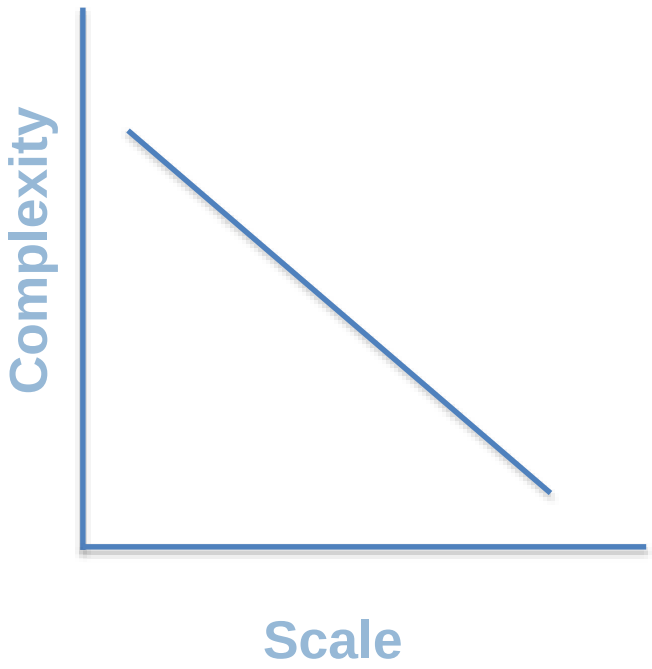
  “effects you did not anticipate”

  Indirect effects

- **Strong Emergence**

“connections between effects at different scales”

Emergent effects


Complexity
Scale

Goals at two scales

- Create a new course
  - Systems theory and design practice
  - Use campus as “living laboratory”
  - Authentic design experience
  - Support sustainability initiatives

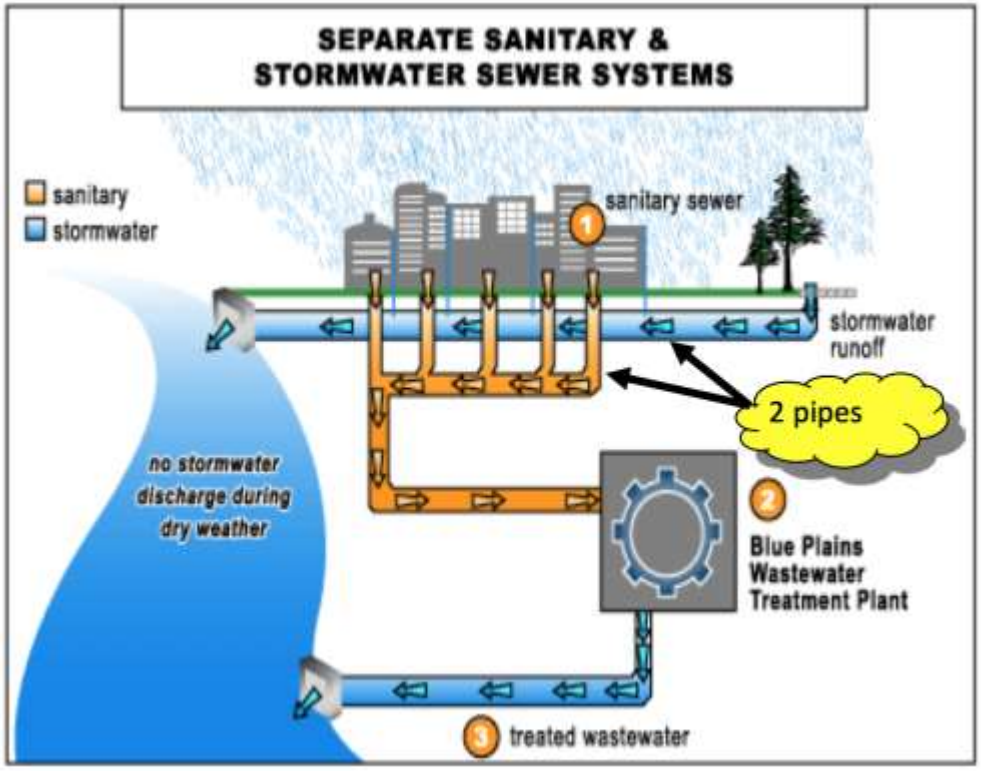
- Emergent Goal

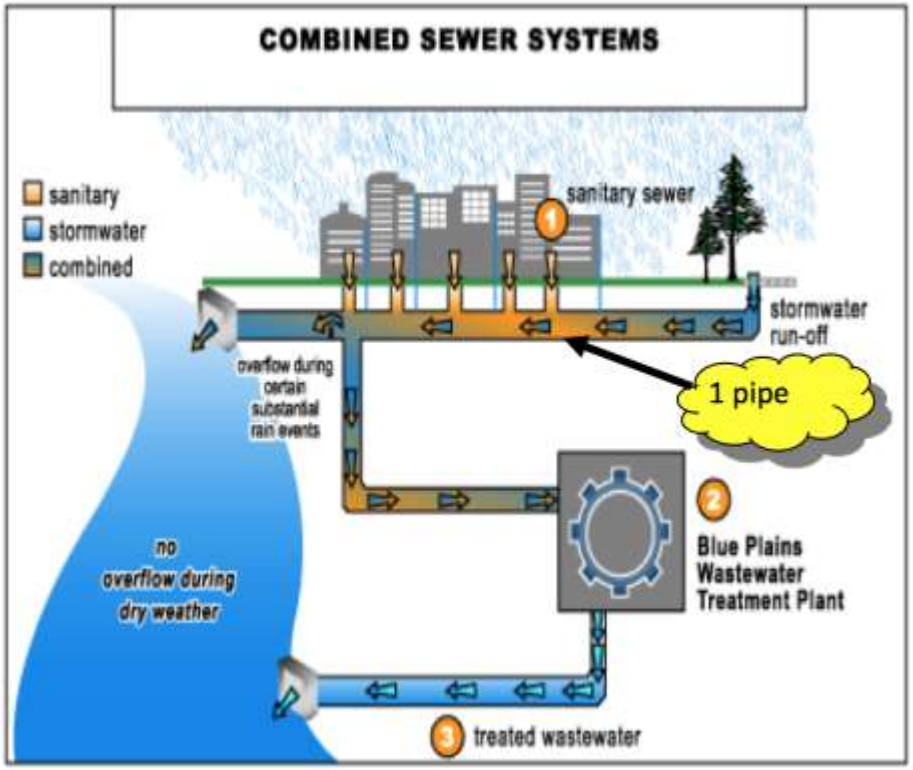
  Connect Institutions


Top Scale Goal: MOU


dc
dc clean
RIVERS
PROJECT
ect
BLEED
BLUE
WEAR
GRAY
THINK
GREEN

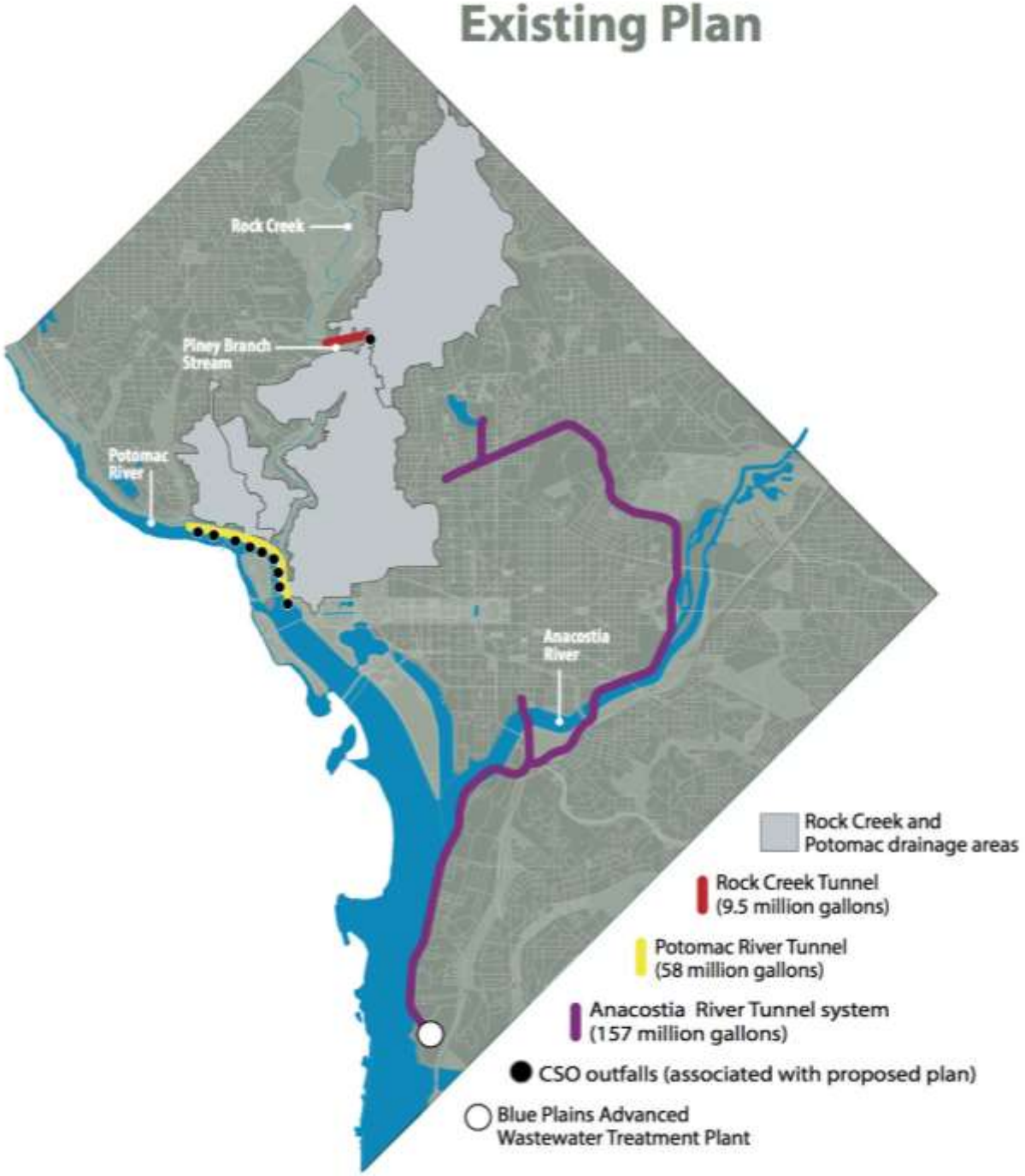
CAMPUS RAINWORKS CHALLENGE


SEPARATE SANITARY &
STORMWATER SEWER SYSTEMS
sanitary
stormwater
sanitary sewer
1
stormwater
runoff
2 pipes
no stormwater
discharge during
dry weather
2
Blue Plains
Wastewater
Treatment Plant
3
treated wastewater


COMBINED SEWER SYSTEMS
sanitary
stormwater
combined
sanitary sewer
1
stormwater
run-off
overflow during
certain
substantial
rain events
1 pipe
no
overflow during
dry weather
2
Blue Plains
Wastewater
Treatment Plant
3
treated wastewater


dc clean
RIVERS
PROJECT

Existing Plan




CANAL
ROAD

Georgetown University

Rainwater Capture at Lauinger Library *Site Overview*

SWIFT POTOMAC'S LOVELY DAUGHTER…

22,050
total gallons captured in 1.2" storm

1 HEALY LAWN

Rainfall from 1.2" storm: 3,400 gallons
Contributing Drainage Area: 4,600 sq. ft.

Site dynamics: highly compacted soil on central lawn causes rainwater runoff to pond in underutilized southeast corner. Existing plant life does little to retain rainfall, flooding the high-traffic library steps and causing significant erosion.

Rainwater Intervention:
BIORETENTION
(w/ PERMEABLE PAVEMENT)

2 LIBRARY ROOF

Rainfall from 1.2" storm: 650 gallons
Contributing Drainage Area: 880 sq. ft.

Site dynamics: ballast-filled flat roof overhang with central interior downspout located above the main entrance to Lauinger Library. Visible from 5th floor administrative offices and student study lounges.

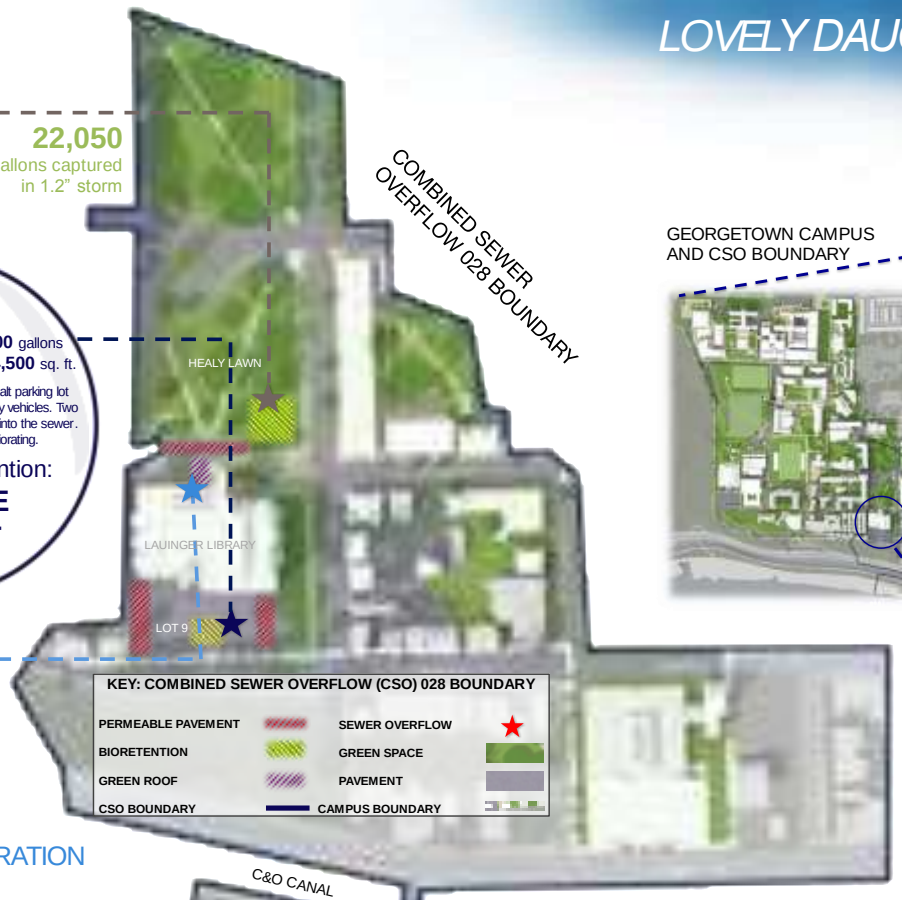
Rainwater Intervention:
GREEN ROOF

3 LOT NINE

Rainfall from 1.2" storm: 18,000 gallons
Contributing Drainage Area: 24,500 sq. ft.

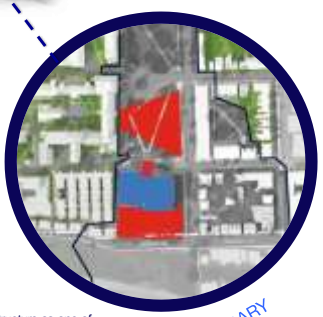
Site dynamics: impermeable asphalt parking lot used by university commuters and delivery vehicles. Two inlet drains divert rainwater runoff directly into the sewer. Current surface is degraded/deteriorating.

Rainwater Intervention:
PERMEABLE PAVEMENT
(w/ BIORETENTION)



COMBINED SEWER OVERFLOW 028 BOUNDARY

GEORGETOWN CAMPUS AND CSO BOUNDARY



LIBRARY AND MITIGATED CONTRIBUTING DRAINAGE AREAS

THREE-IN-ONE DEMONSTRATION SITE

EXISTING CONDITIONS

In 2014, the Potomac Conservancy identified Washington, DC's aging sewer infrastructure as one of the top three threats to the Potomac River, due to frequent combined sewer overflow events that release raw sewage pollution directly into the river during even moderate rain storms.

The local water authority, DC Water, has put forth an ambitious plan to mitigate this pollution in part through large-scale deployment of green infrastructure, which would provide triple-bottom-line sustainability benefits in priority combined sewer overflow (CSO) drainage areas.

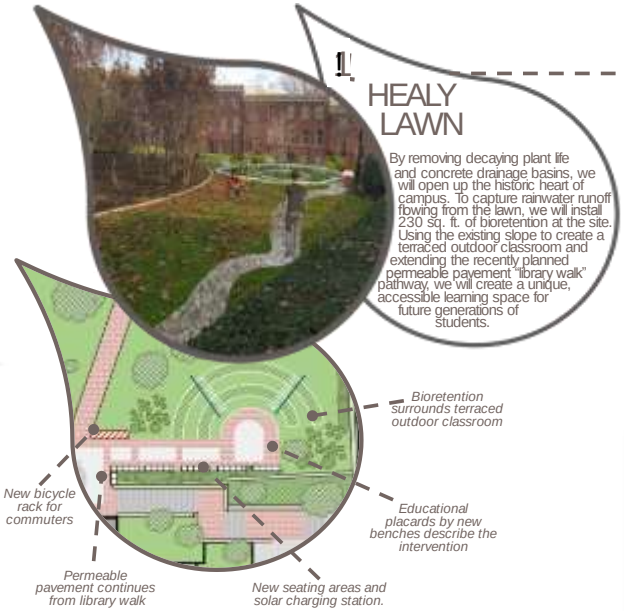
Georgetown University's campus comprises significant acreage within priority combined drainage areas, thus offering the potential to play a key role in reducing runoff and mitigating overflow events. Our design plan leverages GU's location within the combined sewer area and capitalizes on the heavily visited nature of our campus to offer a 3-in-1 demonstration site for green infrastructure in the nation's capital.

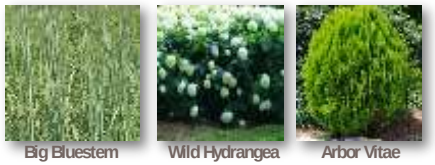
Georgetown University

Rainwater Capture at Lauinger Library *Site Detail*

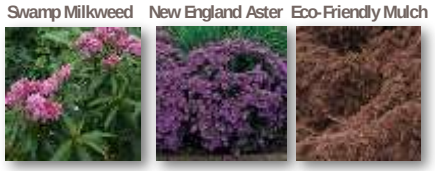
1 HEALY LAWN

By removing decaying plant life and concrete drainage basins, we will open up the historic heart of campus. To capture rainwater runoff flowing from the lawn, we will install 230 sq. ft. of bioretention at the site. Using the existing slope to create a terraced outdoor classroom and extending the recently planned permeable pavement "library walk" pathway, we will create a unique, accessible learning space for future generations of students.

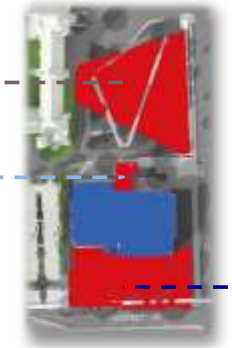




Bioretention Palette (Native Species)



All plants are native to the Mid-Atlantic; recommended by Fairfax County Dept. of Public Works and Environmental Services



Lush overhanging plants give a concrete cube new life and increase visibility from below

Vinyl stickers promote Georgetown's sustainable infrastructure and educate passersby about green roof

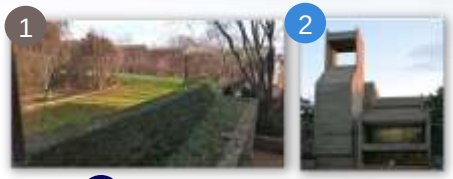
Student study lounge, library special collections, and library administration benefit from a new perspective

2. LIBRARY ROOF

This highly visible space is often criticized by students as "harsh" or "soulless." This flat roofed building has a ballast surface which allows rainwater to flow directly to the downspout and into the sewer. By removing the ballast and replacing it with a multi-layered green roof structure including overhanging plants, we wish to brighten up the academic hub of campus and create a study space that serves to educate at the same time. Students, library administrators, and those on the lawn below will instantly recognize this key part of our initiative.

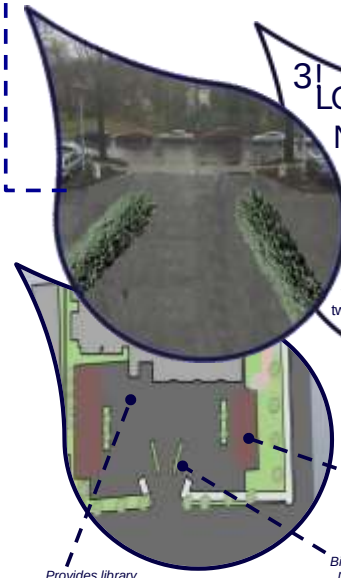
1 Million Visitors

Georgetown campus architects estimate that the central portion of historic main campus—including Healy Lawn, Lauinger Library, and Healy Hall—receive one million visitors each year. Tourists, faculty, staff, professors, and other scholars—from around the world—will have a chance to see what Georgetown University is doing to change the planet. In this prominent location, in the heart of our nation's capital, our demonstration sites will not only change the quality of the Potomac's waters, but also change the minds of all who see them.



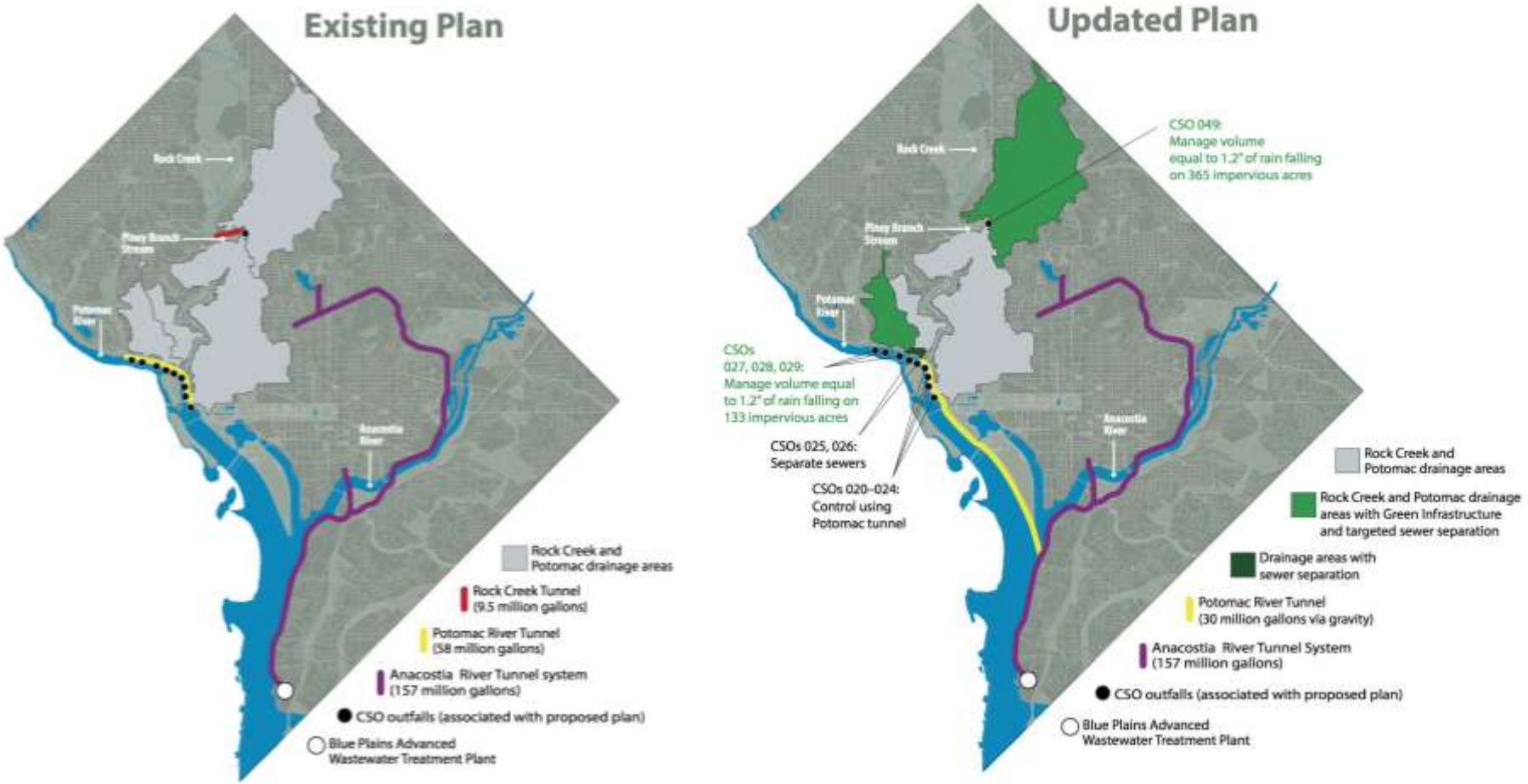
3 LOT NINE

This commuter lot is the last stop between campus runoff and the Potomac. By simply replacing the perimeter parking spaces with permeable asphalt pavement, we anticipate being able to collect 18,000 gallons of runoff during a 1.2" rainstorm. We will also add two bioretention strips where current concrete barricades stand.



Results

- Honorable Mention (3rd Place) in the Rainworks Challenge
- 9-month survey of CDAs and drainage system
- Green Roof to be installed 2017
- Modified Consent Decree for Long-Term Control Plan
- Ongoing talks re: MOU


Existing Plan
Rock Creek
Piney Branch Stream
Potomac River
Anacostia River
Rock Creek and Potomac drainage areas
Rock Creek Tunnel (9.5 million gallons)
Potomac River Tunnel (58 million gallons)
Anacostia River Tunnel system (157 million gallons)
CSO outfalls (associated with proposed plan)
Blue Plains Advanced Wastewater Treatment Plant
Updated Plan
CSO 049: Manage volume equal to 1.2" of rain falling on 365 impervious acres
CSOs 027, 028, 029: Manage volume equal to 1.2" of rain falling on 133 impervious acres
CSOs 025, 026: Separate sewers
CSOs 020–024: Control using Potomac tunnel
Rock Creek and Potomac drainage areas
Rock Creek and Potomac drainage areas with Green Infrastructure and targeted sewer separation
Drainage areas with sewer separation
Potomac River Tunnel (30 million gallons via gravity)
Anacostia River Tunnel System (157 million gallons)
CSO outfalls (associated with proposed plan)
Blue Plains Advanced Wastewater Treatment Plant

Takeaways

- Institutional time scales are longer
- Students have no sense of how change happens
- Student have no sense of what they are actually learning
- Sacrifice managing complexity at one scale for managing complexity at another

Questions