Sustainable Development Workshop
Midterm Presentation

In Partnership with Rockland County Water Task Force

Pervious Pavement for Enhanced Aquifer Recharge

Zoe Berg
David Bigio
Katie Homa
Emily Lau
Tara Mohtadi
Jennifer Olson

How does Permeable Pavement work?

Workshop Purpose

The Workshop in Sustainable Development is the undergraduate senior capstone class at Columbia University for the Sustainable Development Major and Special Concentration.

The course is designed to give Columbia University students an opportunity to work with outside clients in the field of sustainability. Students select a project proposal and work with the client to create a concrete plan for the semester.

This course enables students to apply the skills they have acquired in the classroom to real-world problems. At the end of the semester, the students give a final presentation for the class and for the client.

Our Team






Zoe Berg, Barnard College 2018. Environmental Policy Major. Project Manager.

David Bigio, CC 2017. Sustainable Development Major.

Katie Homa, CC 2017. Sustainable Development Major.

Emily Lau, CC 2017. English Major, Sustainable Development Concentration.

Tara Mohtadi, CC 2017. Sustainable Development Major.

Jennifer Olson, CC 2017. Earth Science Major, Sustainable Development Concentration.

Client Introduction

Patricie Drake: Rockland County Water Task Force Coordinator
We are working to inform Rockland County's future decisions on the location, design, and management of permeable pavement, a Green Infrastructure (GI) practice that enhances aquifer recharge by capturing stormwater runoff.

Our Client's Main Concerns:

- Water quality and quantity in Rockland County
- Design, implementation, and maintenance techniques of permeable pavement
- Potential site locations for installation of permeable pavement
- Regulatory and policy considerations dealing with permeable pavement (and alternative GI)
- Potential sources of funding for GI initiatives

Project Schedule

Task	Date
Work Plan	Sept. 13
Literature Review	Sept. 20
Permitting/Regulation	Sept. 29
Site Criteria Checklist	Oct. 6
Funding Sources	Oct. 13
Pratt Field Visit	Oct. 21
Midterm Presentation	Nov. 1

Task	Date
Report Planning	Nov. 3
Finalize Permitting Study	Nov. 3
First Draft of Report	Nov. 15
Second Draft of Report	Nov. 22
Finalize Report and Presentation	Dec. 1
Final Presentation (Columbia)	Dec. 9
Final Presentation (Rockland)	Dec. 15

Defining the Problem

- Water in Rockland County
  - Fractured bedrock aquifers supply ⅓ of the region's drinking water
  - Peak demand in summer months
- In recent years, population growth and low annual rainfall rates in Rockland have put significant pressure on water supply
  - Water shortages, depleted aquifers
- Impervious surfaces prevent aquifer recharge
  - Increases peak storm flows
  - Contaminates nearby water sources

Objective Declaration

A preliminary feasibility study of permeable pavement use in Rockland County, encompassing:

- A site criteria checklist for evaluating optimal pervious pavement sites
- An overview of the regulatory framework and required permits
- A report on costs and potential funding sources

Methodology and Approach

- **Site criteria checklist**
  - Consulting industry experts, conducting independent research
  - Criteria categorization and prioritization
  - Site visit and tour of Pratt Institute

- **Regulatory framework & permits**
  - Primary research (consultation with Jennifer Zunino)
  - Secondary research (literature review)
    - Peer-reviewed, independent scientific studies on permeable pavement
    - NYSDEC Stormwater permits and Stormwater Management Manuals

- **Cost overview and funding sources**
  - Federal funding opportunities
  - State funding opportunities

Pratt Institute Site Visit

October 21, 2016

Jaime Stein

Director of M.S. Program in Sustainable Environmental Systems

Site Visit Takeaways

Successes:

- Combined different GI practices (bioswales, pavers, etc.)
- Using university resources (faculty and student research)
- Inclusive planning for drainage shed (buildings, sidewalks, etc.)

Failures:

- Lack of maintenance (erosion, clogging, etc.)
- Non-meticulous construction practices
- Grants for private GI installation are available but often poorly administered

Pratt Institute

Combining GI practices: permeable pavement, permeable paver trenches, and rain gardens

Site Criteria Checklist

- Categories: soil, topography, watershed, runoff, setback, land use and management, and weather
- Description and explanation of individual criteria
- The more criteria a site meets, the more suitable it is for permeable pavement installation

Rockland County
2016 Permeable Pavement: Site Criteria Checklist

Categories	Criteria (and sources)	Does the site meet the criteria?
Soil	Is the soil infiltration rate at least 7 mm/hr (ideally 13 mm/hr) 1.2 meters (or more) below bottom of stone reservoir? *(EPA) (DOT)*	☐
	Is the minimum infiltration rate 1.3 cm/hr at 0.9 m below the bottom of the stone reservoir? *(EPA) (DOT)*	☐
	Does the site avoid areas with high soil subgrade compaction? *(Minnesota Stormwater Manual)*	☐
	Does the site avoid areas with heavy clay soils? *(Duluth Lake Superior Streams)*	☐
	Is the soil subgrade as flat as possible, i.e. less than 1%? *(Minnesota Stormwater Manual)*	☐
	Does the site avoid areas with loose fine particles? *(Bean)*	☐
Topography	Is the surface slope greater than 1% but less than 5%? *(EPA) (DOT) (Minnesota Stormwater Manual)*	☐
Watershed	Is the bottom of the reservoir layer at least 1.2 meters above the seasonally high water table or the top of the bedrock? *(EPA) (DOT) (Minnesota Stormwater Manual)*	☐
	Is the watershed between 0.1 and 4.1 ha? *(Kenneth Young et al.)*	☐
	Does the site avoid stormwater "hotspots" with high pollutant	☐

Permits and Regulations

- Additional permitting necessary for permeable pavements vs. impervious pavement:
  - **SPDES General Permit for Stormwater Discharges: Construction Activity (GP-0-15-002)**
    - SPDES: State Pollutant Discharge Elimination System. Permit written and regulated by NYS Dept of Environmental Conservation.
    - The permit applies to permeable pavement (PP) projects because of PP "potential for contribution to a violation of a water quality standard."

References: Jennifer Zunino and DEC

Permits and Regulations (continued)

Process of Submitting Proposal for Permeable Pavement Installation:

1. Develop Stormwater Pollution Prevention Plan (SWPPP) to NYS DEC, Bureau of Water Permits in accordance with General Permit for Stormwater Discharges from Construction Activity
2. Submit completed Notice of Intent (NOI) to DEC
3. Along with permit, submit signed Municipal Separate Storm Sewer Systems (MS4) and Stormwater Pollution Prevention Plan (SWPPP) Acceptance Form along with NOI
4. Project review pursuant to the State Environmental Quality Review Act (SEQRA)
5. During construction the owner/operator must use the Blue Book to ensure Erosion and Sediment Controls are accounted for

Check out the DEC's "Construction Stormwater Toolbox" for more detailed information

http://www.dec.ny.gov/chemical/8694.html

Potential Federal Funding Sources:

- US EPA-Clean Water State Revolving Fund (CWSRF)
  $1.4 billion available
  - Monies loaned at below market rates
  - Deadline for NYState is generally in March
- DEC-Clean Water Act, Section 604(b) Funding Awards
  - Funding through the Hudson Valley Regional Council
  - Next Request For Applications in 2018
  - Up to $300,000 per region available

Potential State Funding Sources:

- New York State (NYS) Environmental Facilities Corporation
  - Green Innovation Grant Program
    - $10 million available
    - Municipal, inter-municipal, state, or interstate agencies are eligible
    - Covers 90% of cost
  - Integrated Solutions Construction Grant Program
    - 50% of cost is covered
    - $5 million limit on EFC grants awarded to individual municipalities over five year period
  - Climate Smart Communities (part of the Environmental Protection Fund)
    - Required local match of 50% of funding
    - Up to $500,000 for community certification-identify, analyze and prioritize effects of climate hazards to pinpoint areas that require targeting of staff and funding
    - Up to $10.5 million for adaptation and mitigation program-stormwater runoff and construction of natural resiliency measures

Environmental Education Grants

US EPA-Environmental Education Local Grants Program

- Up to $91,000 available per project
- Covers 75% of project funding
- Focuses on projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques

Additional interventions

The inclusion of the following green infrastructures can promote the success of permeable pavement:

- Rain gardens
- Trenches
- Bio-swales
- Infiltration basins

Conclusions

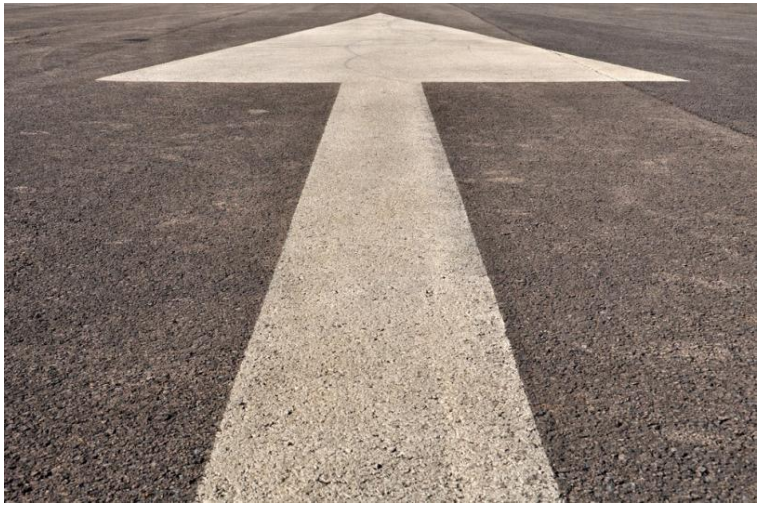
- Stormwater management practices can aid Rockland County in aquifer recharge
- Permeable pavement can successfully assist with aquifer recharge, but there are obstacles and caveats that must be considered prior to installation.
  - Site selection is key
  - Maintenance is important for continued effectiveness
- In addition to general building regulations for impervious pavement, pervious pavement requires additional permitting
  - Don't have to worry so much about runoff reduction rates
  - But must consider stormwater discharges
- Funding: Pursue a combination of federal, state, and local grants
  - Explore grant opportunities in education, engineering, stormwater management, and climate preparedness

Next Steps

- Cost estimates
- Research other GI alternatives
- Formal written report on November 3rd
- Final presentation on December 9th to Columbia community
- Final presentation on December 15th in Rockland with client, Rockland Task Force, and Rockland community

Questions Going Forward:

- Optimal sites for installation
  - History of sites (avoid brownfields/other environmental risks)
  - Funding available/funding required
- Access to competent engineers and contractors (contractors from Netherlands were recommended by Jaime Stein)
- Format of final deliverables and intended audience (ex: formal report for stakeholders, pamphlet for community members)



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Questions?