

Water Resources Collaborative: Building Resilience with Green Stormwater Infrastructure

Thursday, March 11, 2021

2:00 pm – 4:00 pm

Microsoft Teams

Welcome & Introductions

TJ Cawley, Morrisville - Water Resources Collaborative Co-Chair

Wendy Jacobs, Durham and Steve Rao, Morrisville - Smart Growth Collaborative Co-Chairs

A Path to Resilience: Green Stormwater Infrastructure in the Piedmont Region, Kate Ancaya, Living Roofs, Inc, and Joshua Robinson, Robinson Design Engineers

Joshua

- Green roofs can store the first inch of rainfall, meet the goal of GSI of capturing rainfall as soon as it hits the surface
- Urban context provides space challenges; green roofs are an innovative solution
- Green roof downspouts help capture rainwater where it falls and slow the water down. This is especially helpful during heavy rain events
- Gray stormwater infrastructure - use traditional hydrology models that are mathematically predictable and quantifiable. Through Sea Grant funding, they were able to quantify impacts of peak flow reduction on green roofs

Kate

- We need to design to address more than one problem- extreme heat/ heat island effect, biodiversity, habitat, stormwater improvement, etc. (co-benefits)
- We think of green roofs thought of as a “nice to have” rather than a “need to have”
- Biosolar roofs- solar and green roof combinations; green keeps roofs at ambient temperature which helps solar perform better
- Economic, social, ecological benefits
 - Economic: reduction in heating/ cooling costs, reduction in cost to replace roofs every 20-25 years, increases property values
 - Environmental: Reduce stormwater runoff (erosion, pollution)
 - Also provides habitat for birds, butterflies, and other insects
 - Social/ qualitative- views and access to nature improve productivity
- Many different types of green roofs
 - Green gardens/ accessible roofs- amenity for hospitals, universities, businesses and other buildings utilized by many people
 - Fully vegetated- mainly for stormwater control, less expensive

Resource: [Green Roof and Wall Policy in North America](#)

Presentation Q&A

- **Reuben Moore, Raleigh-** Didn't see any pictures of people on an amenity green roof like a grassy lawn. Does it work well for people to walk on the grass?
 - Learned the hard way from another project that it becomes muddy in high use areas
 - Vegetation when it is walked on gets impacted- incorporate hardscape areas instead
- **Nancy Daley, Wake County-** Maintenance costs of green roofs?
 - When designed well, green roofs require low maintenance. No maintenance during winter. In spring, turn on irrigation system and have someone come out 1-2 times per month, once system is fully grown in, and do periodic weeding
 - Fully vegetated systems with low maintenance plants are lower maintenance
 - Design is key! Maintenance can be costly/laborious if not designed properly.
 - Should not have to go back and revegetate every year
- **Wendy Jacobs-** Where can you find data of cost/ benefit analysis? When we are making decisions in local government, we have to look at short term vs. long term vs. payback costs. Heating/ cooling, runoff, etc.
 - Greenroofs.org
 - Gsa.gov- dedicated website/ portion of website just to vegetated roofs.
- **James Misciagno-** Have you seen much demand for vegetable gardens, herbs on green roofs at restaurants?
 - Some, not as much as you would think but sometimes they incorporate planter/ containerized gardens in addition to a traditional green roof
 - NYC has examples of full farms on rooftops. Here in NC (at least in Asheville area where LRI is based)) there is so much land for farming, its smaller scale
- **James-** Many local gov'ts have permitting fees. If fees can be waived as incentive, it may be worth the cost to install – do you see this happening?
 - A tactic could be to streamline permitting process for projects with green roofs
- **Allison Platt-** Green roofs on historic buildings- issues with loading?
 - Yes, this is an issue. First step is to estimate the load, might have to do additional structural support to install a green roof
 - Views from the street can impact historical façade of the building
 - Expensive to restore buildings, retrofitting can be challenging
 - Consider age of existing water-proofing membrane on the roof - might make sense to re-waterproof before installing a green roof
 - Can be a higher up-front cost on historic buildings
- **Cordis Yates-Thompson-** Can you drain water from a parking lot onto a green roof at grade on an underground building?
 - Kate- May need Pre-treatment before interfacing with the vegetation
 - Joshua- Research has provided insight into different layers and materials: drainage materials, soil, edging, types of plants, etc. More options now than

there used to be. Sounds like a fun engineering problem. Could be designed, maybe not a one-size-fits all scenario

From the chat:

- **Chris, ECWA-** What is our local government's (Durham's) best source for recommended ordinance language changes to make our ordinances (stormwater, UDO) more friendly to green roofs?
 - Maya- WI Sea Grant developed a workbook you can use to self-audit your codes and ordinances for whether they permit, encourage, or are neutral on GSI types
 - Kate- See the Green Roofs Healthy Cities document. Sometimes cities have this built in and folks just are not aware of it
 - Wendy- Changes have been made in Durham to allow for LID. Should consider building incentives into the ordinance, also would be important to know if you could get credit for Jordan Lake Rules, Neuse Rules, etc.
 - Joshua- Since it is a somewhat less well understood technology, need to be able to monetize benefits easily for engineers, clients, etc. Stormwater credit trading programs are also promising and a growing trend. These are great incentives for institutions who have a lot of roof and need the extra funds to do projects
 - Kate- The reasons that people install green roofs really come down to economics and stormwater benefits

- **Trevor Clements-** Why do you think there isn't more use of green roofs in the Piedmont of NC? Why aren't more developers incorporating them with their designs?
 - Kate- We are seeing an increase. Need to be doing a better job of educating others about the options and opportunity.
 - When company was started, had to learn the hard way to design green roofs that thrive in southern climate (not the same as other places because of heat, etc.). Older green roofs in the Piedmont followed the model of the Pacific Northwest, Europe – have to go back and restore these old projects.
 - Any building system needs to be maintained; green roofs are the same
 - Can design a system for any project, any budget- not one size fits all
 - Nancy Daly: Thank you, this further addressed my question on maintenance. It sounds like some of the misinformation is based upon incorrect applications in our ecoregion.

- **Beth Schrader-** Could you recommend a resource for the combined green roof / solar PV? In a coastal community subject to frequent hurricanes, we are also concerned with energy resilience
 - Kate- have not actually done one of these projects yet. One prospective project on hold since the pandemic. Some ballasted systems online (resource: Zinko). Kate can follow up via e-mail.

- **Rich Gannon-** Curious about the sizable difference in estimated % runoff reduction benefits you listed b/t two green roofs, the Asheville apartments vs the other. Can you address the design differences?

- Joshua- biggest difference is depth of the planting media. Soil depth, slope of the roof, drainage media all make a difference too. Also, one was a dual-media system- included more granular drainage media beneath soil – helpful for intense rainfall.

Contact information: Kate- kate@livingroofsinc.com ; Joshua- jr@robinsondesignengineers.com

Outstanding questions:

Cordis Yates-Thompson: Can you explain how the green walls work?

Sarah Johnson: Do you think there is value in distinguishing between green infrastructure vs. green stormwater infrastructure?

Mike Dupree: Have you researched the nutrient levels of the runoff? Have you incorporated polymers to absorb and hold water? Have you combined green roofs with rainwater harvesting for reuse?

Open Discussion in Breakout Rooms - Guiding Questions:

- 1) *At what scale should cities and counties be implementing green infrastructure to meet peak flow mitigation, water quality/nutrient reduction, and other goals?*
- 2) *How do these various goals we may have for a project shape whether we implement green or gray infrastructure projects? When considering the two, how should we prioritize the costs and benefits (monetized or not) of green and gray infrastructure projects?*
- 3) *How can Piedmont communities incentivize wider green roof and other GSI adoption in the public sector? Since funding often seems to be the limiting factor, what funding sources do you see public-sector organizations using to implement these projects besides grants?*
- 4) *How can Piedmont communities incentivize wider green roof and other GSI adoption by private developers, especially if there is not a regulatory driver?*

Emily's group

- **Q3**—hard for staff-level personell in the public sector to advocate for specific tactics; other political drivers are more likely to come from NGOs; planners are told that decisions like this are for the engineers (there is a siloing of public service); some local governments have alternatives analysis; some local government small divisions would need to have a coalition of planners and others to support including solutions like green roofs in their projects—many good examples like curb bump outs and bioretention; training would also be helpful for staff—NC State has done presentations on maitenance and construction on green infrastructure for local government staff...this can increase familiarity and acceptance among staff;
- **Q4**—private sector is likely driven by regulatory drivers and least-cost; designers also have trouble recommending less tride and true methods; a lot of interest, but it does

come down to money driving decisions; businesses like the public recognition that GSI can provide...especially if it is beautiful and functional

Hannah's group

- **At what scale should cities and counties be implementing green infrastructure to meet peak flow mitigation, water quality/nutrient reduction, and other goals?**
 - There is a parallel with road construction as it relates to real estate. Developers required to have 3/10 of an acre tree conservation area. Could do this with green roofs- If you built a certain size roof, a certain percentage must have a green roof treatment. Specify maximum peak flow. Drainage area is important to consider.
 - Incentivization: Credits- could help achieve more than just the minimum.
 - Partnerships: City could find funding source- if you include this in your design, we will contribute \$ to the project.
 - Thinking of the project design from the beginning
- **How do the goals, costs and benefits of projects affect whether we implement green or gray infrastructure in a given situation?**
 - Roadway projects do have green infrastructure implemented
 - Who will maintain the project? This is a cost we do not have a great handle on yet. Need to coordinate with DOT or city to come up with maintenance plan
 - Change in traditional project framework- some guidelines/ requirements can work against us in working towards goals. Need more room to document co-benefits and be flexible. Example- implementing bioretention in a historical district near a road. Each has own sets of requirements that makes it more challenging

Lindsay's group

- Cities are going to have to look at different ways to treat stormwater - at all scales and at the departmental scale. Not just large-scale projects manipulating larger areas. Widespread distributed impacts are detrimental and widespread distributed solutions can be effective. There are small options everywhere (even taking away concrete).
- Treat it at the source - I.e. small rain garden that is stormwater control and helps with beautification. Retrofitting things also has a huge benefit.
- Limiting factor – no Environmental Consent Decree? Is not common in the Southeast. no regulatory stick that is forcing people to embrace this type of planning (a barrier).
- New grant opportunity - FEMA BRIC - Building Resilient Infrastructure and Communities (integrating nature-based solutions with infra. projects) - just released last year.
- Buy down credits for developers (similar to what James from Apex mentioned)
- Environmental Impact Bonds or Green Infrastructure Bonds (Atlanta/DC) credit-based programs sometimes not perfect, at times you may get penalized for trees).

T.J. Cawley's group

- **Scale question:** Avg 30-35% nutrient reduction goals for Durham. Lots of nutrients are coming from older developments. Concentrate on retrofits. Generally, before 2000 it was pipe it to the ditch. New standards appear to be adequate going forward for new development.
- **Funding** should be directed closest to source of severe erosion and in Durham that appears to be the older areas. High % of impervious area is point source. Legacy nutrients and issue in Durham, former agricultural phosphorous being eroded into streams causing nutrient problems.
- **Incentivize** more affluent neighborhoods to implement practices to reduce their stormwater fees since they generally have more impervious area and they are more likely to apply fertilizer. In lower income neighborhoods Durham would like to be able to provide 100% reimbursement-where they cannot afford. Downspout disconnections are an easy one.
- Stormwater retrofits would be preferred to be green infrastructure.
- Most municipalities measure as part of peak water demand how much is for irrigation for outside use. This could encourage rainwater harvesting

Wendy Jacobs' group

- How to approach it as a watershed rather than individual governments? Disconnect between soil & water districts and cities. Important to share information. Looking at land conservation as a way to improve stormwater. Can only implement what is in the ordinance, elected officials have a role to play with regards to developers and re-zoning. How do we incentivize developers through the process, and incentivize the use of some of these green infrastructure techniques?
 - Potential solution: Designate a portion of stormwater impact fees and stormwater utility fees to fund or subsidize green infrastructure retrofit projects.

Steve Rao's group (Rick Savage report out)

- Raleigh acquiring land to protect Falls Lake watershed is a good example of green infrastructure writ large. Small scale GSI can help influence the larger scale; look at multiple scales to make sure you are solving the problem. Local level is critical to getting things done, this is where the action is. Carolina Wetlands Association is using nature-based solutions to solve flooding problems – see their white paper about incentivizing wetland restoration. When you do not have authority to create an ordinance, you use what works.

Patrick's group

- Education is necessary - for everyone developers, engineers, architects, everyone. The industry has certain products/people that it uses even though there are a lot of other options. Making sure to value the co-benefits so that it is not just viewed as a "cool building thing"

- Hertford has a lot of flooding problems with flooding in a park. Looking at building a retaining wall and building wetlands outside of that wall, with public walkway on top of retaining wall. It was an industrial site - maybe why it hadn't been delineated as wetlands prior.
- Don't know of any green roofs in Apex
- Chapel Hill has one downtown on top of a hotel – AC Marriot, installed by Kate Ancaya's company. It wasn't originally planned and therefore is a very lightweight system since it wasn't designed to hold a green roof.
- Upcoming big redevelopment efforts in downtown could be explored
- Check out Durham County Library – new green roof - a sloped roof and that means much more and different engineering. It was a pre-vegetated install.
- What are the problems with getting people to install them? It seems like the educational aspect is important for designers and engineers - sometimes it seems like anything involving plants is too tough to deal with for some.
- It seems it is just different and that stumps people. Unless you have a client who is asking for it.
- If you don't have policy with incentives for it, it is difficult.
- How about architects? Some just don't know about it. It's new and they need education. Sometimes the trade industry runs things because they get it in their hands or on their lists so to speak.
- They cost more up front but the ROI comes eventually. It depends on what they value.
- Is there a density tipping point, say for more urban areas - probably.
- Developers don't always realize the other benefits. They sometimes think it is just a special option. They don't think about stormwater or cooling benefits.

Rich's group

- Summary thought: what are the drivers? Bob Deaton made a good point that the visibility of the project speaks to the drivers. High visibility, better likelihood of doing the project. How to incentivize in the private sector: need to be better about selling the co-benefits of stormwater control.
- Scale – every scale, large and small. Even down to micro scale; homeowners, community centers, developers.
- Goals/costs/benefits influence whether do GI – Amy: always down to the C/B, dollars.
- Bob Deaton: visibility b/c relates to both cost and scale. Visibility has a lot of value, hits other drivers. Marketing drives it.
- How to get wider implementation in the public sector? Amy: every project, early on in design, evaluate whether feasible, like 25% design. Review multiple options.
- How to get wider implementation in the private sector? Brian Byfield: Need do better job selling comparative cost.

Input on Future Topics: *What training topics related to green infrastructure, flooding, resilience, etc. would you benefit from that TJCOG could provide in the next year? Weigh in here:* [Water Resources Collaborative Feedback Form](#)

Next Meeting will be Thursday, June 10th!