Urban Stormwater Working Group (USWG)

August 11th, 2020 2:00 – 3:00 pm

In attendance: Eliana Brown, Illinois Extension; Kate Gardiner, Illinois Extension; Layne Knoche, Illinois Extension; Brian Rennecker, Illinois Department of Agriculture; Christine Davis, Illinois EPA; Holly Hudson, CMAP; Lisa Merrifield, Illinois Extension; Allison Neubauer, Illinois-Indiana Sea Grant; Jennifer Jones, Illinois Extension; Justin Keller, Metropolitan Planning Council; Mary Beth Falsey, DuPage County; Mary Mitros, DuPage County; Reid Christianson, University of Illinois; Steve Brendel, Madison County; Tyler Carpenter, Greater Egypt Regional Planning; Stephen McCracken, The Conservation Foundation; Donna Twickler, Sierra Club; and Zuhdi Aljobeh, Valparaiso University

Summary

Welcome and Member Updates

Eliana welcomed everyone to the meeting and provided the opportunity for members to share updates.

Selected LIDs Implementation and Modeling - *Research Findings Dr. Zuhdi Aljobeh, Valparaiso University*

The EPA reported that many US waterbodies are impaired and do not meet minimum water quality standards. A main source of the impairment is stormwater. Rain gardens are a popular stormwater treatment technique but lose their ability to filter nutrients over time and can even contribute nutrients.

Studies have shown that rain garden filtration can be enhanced with iron. And while the rain gardens will eventually use up the iron and resort back to releasing nutrients, the researchers found out that it takes a long time to exhaust the iron shavings in the sand layer.

The researchers constructed two model gardens to compare effluent phosphorus levels between conventional rain gardens and those with an iron-enhanced sand layer. The gardens, one conventional and one with an iron-enhanced sand layer, were set in plastic boxes with 12-inch layers of gravel, sand, and a compost-sand mixture. The researchers simulated two hours of rain to each garden and collected influent and effluent samples to test for total dissolved phosphorus.

He then showed the results over nine tests and compared the Total P and SRP retention of the iron-enhanced rain garden with that of the Control rain garden. His results showed that the iron-enhanced rain garden consistently retained more phosphorus than the control rain garden.

Future research on the optimum rain garden mix design (sand, compost, mulch, and iron), how nitrogen can be addressed, and long-term performance and modeling of nutrient retention.

Calumet Stormwater Collaborative Green Infrastructure Baseline Inventory - *Justin Keller, Metropolitan Planning Council*

Justin provided an overview of the Calumet Stormwater Collaborative (CSC) and its Green Infrastructure (GI) Baseline Inventory project. The CSC is a cross-sector group of stakeholders that work to improve coordination across the area, which has high susceptibility to flooding. One of the CSC foundational activities is to establish a baseline inventory of existing GI.

During Phase I of the project, the CSC confirmed the need for and feasibility of a GI Baseline Inventory. The group worked completed a literature review of similar efforts, advisory committee meetings and survey, interviews with municipal actors, and both CSC and workgroup meetings. For Phase II, the CSC will convene data providers, collect existing data, contact main Calumet-region engineering firms, conduct direct outreach, and build the dataset.

The inventory's primary functions/uses would be to assess the location, performance, and maintenance status of existing GI and, in the long-term, to strategically plan and guide investments in new GI that will have the greatest impact. Primary users would be regional planning agencies, CSC member agencies, and other actors in collaboration with municipalities and other units of local government, as well as funders and researchers in the long-term. The inventory will take the form of a dataset with GIS capabilities and will be focused on the Calumet region, though it can be expanded over time.

Discussion and Next Steps
The next meeting is Tuesday, September 8th at 2pm. The Tracking Subgroup will meet in a few weeks. Look for a Doodle Poll. To be added to the Tracking Subgroup, please email Eliana at brown12@Illinois.edu.

Meeting Minutes

Welcome and Member Updates
Eliana welcomed everyone to the meeting and offered the option to share updates.

Selected LIDs Implementation and Modeling Research Findings – *Dr. Zuhdi Aljobeh, Valparaiso University*
Dr. Zuhdi Aljobeh is an Associate Professor in Civil and Environmental Engineering at Valparaiso University, which is located in Valparaiso, Indiana. He presented on his research on enhanced rain gardens.

According to the EPA National Water Quality Inventory Report to Congress (August 2017), 70% of lakes, reservoirs, and ponds; 78% of bays and estuaries; and 55% of rivers and streams assessed in the US are impaired by pollution and do not meet the minimum water quality standards. Impairment is caused by unacceptable levels of nutrients, metals, and bacteria in the water and the leading source is stormwater runoff. Common stormwater pollutants include nutrients (nitrogen and phosphorus), metals (cadmium, copper, lead, and zinc), polycyclic aromatic hydrocarbons (PAHs), salt, bacteria, and heat/temperature variation.

Impairment is determined by the concentrations of excess nutrients and can lead to dead zones and the death of wildlife. Excessive phosphorus loads can cause eutrophication where phosphorus is the limiting growth nutrient.

The amount of phosphorus in stormwater runoff varies based on land use, however the average concentration in urban stormwater runoff is 0.27mg/L for Total P and 0.12mg/L for Dissolved P. Most conventional stormwater treatment practices provide filtration (solids), infiltration (solids and some

nutrient removal), sedimentation (solids), and biological and chemical treatment (organics P and some dissolved nutrient removal).

Rain gardens are a popular stormwater treatment technique. They retain solids, dissolved metals, and oils/greases. However, long-term use results in release of nutrients from plants and other organic matter and some rain gardens exported as high as 100% more phosphorus than they received. Measured influent dissolved P was 0.13mg/L but effluent was as high as 0.50mg/L. Can rain gardens be used effectively to reduce dissolved phosphorus? Yes, they can.

Iron-enhanced rain gardens use layers of compost-amended sand, iron-enhanced sand, and a gravel subbase and underdrain above the natural soil. For this research project, we focused on the second sand layer, which we mixed with iron shavings that were donated from a company in Chicago. The iron reacts with the phosphorus to create iron phosphates. And while the rain gardens will eventually use up the iron and resort back to releasing nutrients, we found out that it takes a long time to exhaust the iron shavings in the sand layer.

For some background on iron-enhanced sand filtration, sand column studies using steel wool found that 5% steel wool by mass was the optimum amount and retained greater than 90% of dissolved P. In contrast, 2% steel wool retained about 50% of the dissolved P.

The researchers constructed two side-by-side rain gardens in conjunction with the City of Valparaiso and Central Elementary School - one with an iron-modified sand layer and one without. Underdrains connected to nearby stormwater catch basins to monitor the outputs.

While the gardens looked nice as landscape features, they did not function as rain gardens. Due to incorrect construction by the landscape contractor, no infiltration of stormwater runoff was observed, and poor-quality soil was used instead of sand. Since the planted gardens did not work, the researchers decided to build their own rain gardens in plastic boxes. The researchers constructed model gardens in plastic boxes with 12-inch layers of gravel, sand, and compost and sand mixture. Two model gardens were constructed - one conventional and one with the iron-enhanced sand layer (5% by weight) - to compare effluent phosphorus levels between the gardens.

The researchers simulated rain with shower heads and a hose for a rain duration of two hours and supplied water at approximately 0.12L/s to each garden. The students collected 1L of influent over the two hours and 15mL effluent samples collected for every 50L of effluent from each garden. They then analyzed them in the environmental laboratory to test for total dissolved phosphorus. They used the ascorbic acid method, where the acid reacts with phosphorus and turns blue. Spectrophotometer determines concentration by refraction of blue mixture. The influent Total P average was 0.54mg/L with a standard deviation of 0.06mg/L. Influent Phosphate (dissolved P) average was 0.50mg/L with a standard deviation of 0.04mg/L.

He then showed the results over nine tests and compared the Total P and SRP retention of the IESF rain garden with that of the Control rain garden. His results showed that the IESF rain garden consistently retained more phosphorus than the control rain garden.

Future research on the optimum rain garden mix design (sand, compost, mulch, and iron), how nitrogen can be addressed, and long-term performance and modeling of nutrient retention.

Questions/Discussion:

Holly Hudson: I'm interested in learning more about your research as you continue, especially more on phosphorus and nitrogen removal.

Zuhdi Aljobeh: We learned about the importance of quality control during construction. Without the correct materials, the garden will not function as a rain garden.

Reid Christianson: Are there design standards for residential rain gardens in the state?

Zuhdi Aljobeh: There are guidelines for the best management practice, but no official standards. That's why landscapers tend to focus on the dimensions rather than the media. There is an EPA calculator to find out the size based on the impervious surfaces.

Holly Hudson: The Illinois Urban Manual might cover rain gardens or bioretention design principles.

Calumet Stormwater Collaborative Green Infrastructure Baseline Inventory - *Justin Keller, Metropolitan Planning Council*

Justin is the current facilitator of the Calumet Stormwater Collaborative (CSC) and the group has been working on the Green Infrastructure (GI) Baseline Inventory.

The CSC is a cross-sector group of stakeholders that work to improve coordination across the area. Members include municipalities, government agencies, nonprofits, conservation groups, landowners, and more. They work to improve knowledge, technology, and financial resources to minimize the negative impacts of stormwater in the Calumet region of Illinois. Justin showed a map of the Calumet area with the risk of urban flooding, showing it has high susceptibility to flooding. Chicagoans use the non-emergency police line 311 to report flooding. Lots of calls in the far south side and near O'Hare airport.

One fundamental challenge to managing stormwater in any geography is coordinating among various government units, agencies, and regional and local organizations. The three-year workplan is a consensus-based plan with mutually reinforcing activities and coordinated collective efforts.

The CSC fundamental goals are a significant reduction in non-overbank flooding, to increase municipal capacity and reduce fragmentation across Calumet government actors, for gray and green infrastructure to maintain its designed performance over time, and to make data-driven decision-making more prevalent in stormwater management planning. Foundational activities are to establish baselines of existing GI, non-overbank flooding, and municipal capacity in stormwater management, as well as to develop and begin to execute systems to provide relevant training and strengthen management systems to bolster GI implementation and maintenance. Today, he will focus on establishing a baseline of existing GI.

Phase I of the GI Baseline consisted of a literature review of similar efforts (in Milwaukee, DC, DuPage County), advisory committee meetings (Jan. – June 2019) and survey, interviews with municipal actors, and CSC and workgroup meetings. During Phase I, CSC determined there was a need for the GI Baseline and that it is feasible. Its primary functions and uses would be to assess the location, performance, and maintenance status of existing GI near-term and in the long-term to strategically plan and guide

investments in new GI that will have the greatest impact. Primary users in the near-term would be CMAP, MWRD, CDOT, IDOT, IDNR, IEPA, and other regional planning agencies, plus MPC, CSC member agencies, and other actors in collaboration with municipalities and other unite of local government. In the long-term, primary users would include the above plus funders, researchers, etc. The CSC considered a few options for the form this GI Baseline could take, including a dataset, such as a GIS layer; a web-based map with suite of relevant data layers (e.g. FEMA floodplains, combined sewer areas); or a custom-built application with analytic functionality. Ultimately, the dataset option was chosen. Target geography is the Calumet region communities along the far south side of Chicago and south suburbs. It is a pilot project that can be expanded over time.

GI Baseline Phase II steps are convening data providers, collecting existing data, contacting main Calumet-region engineering firms, conducting direct outreach, and building the dataset. Detroit created a stormwater hub with a map of over 200 projects tracking total acres managed and millions of gallons managed annually.

Questions/Discussion:

Eliana Brown: Reid, I know you have some experience with this in the Chesapeake Bay. Do you have any advice for us?

Reid: It was awesome that Justin noted the cooperation with a statewide effort which are not mutually exclusive. Thinking about the detail required for something local vs statewide, there are definitely options to aggregate up because details on a statewide level aren't needed (for reporting like for the Illinois NLRS). Categories might be where, when, how much, and what, which are needed for scale.

Eliana Brown: It was interesting that you asked the consulting firms. Are there a certain number of consulting firms doing GI throughout the state? Or is it that well integrated into most consulting firms that it would be unwieldly?

Reid: One thing that has been on my radar for why something is being tracked is new development or retrofits. For new development, GI can be integrated, but all the elements may not be tracked. For example, there might be a maintenance agreement with an HOA who is doing their own tracking. New development is also not exactly comparable to the 1980-1996 baseline because its comparing to something that wasn't there before. Retrofits would be more of a one-off by adding a new practice in one location, which might be easier to flag than a suite of practices in a relatively large development.

Holly Hudson: I think its certainly worth exploring because consulting firms can be the gateway by knowing where they have worked. It's an interesting question and in some ways I think it may be limited to a subset of engineering firms.

Eliana Brown: Should we set up time for the Tracking Subcommittee to talk about this, rather than waiting until next month? Would those in the Tracking Subcommittee want to meet?

Reid Christianson: That would be a good idea, how complete is this list expected to be? Even on the ag tracking side, you do as good as you can, but with data sources available, you might only be capturing a fraction of what is available. Will the approach be to grab what we can and add more later or try to get everything now?

Eliana Brown: You taught me to do the former, so that would be my answer.

Reid Christianson: For the former, there are a lot of data sources out there. If we wanted, we could make some assumptions about the bigger picture based on the smaller subset of data. Having this for the next Illinois NLRS Biennial Report would be a huge win.

Eliana Brown: Chris or Trevor, do you have any guidance for us on what the IL EPA would have in mind?

Chris Davis: Everything, of course. I wonder if the group could get together and determine what is reasonable with what we know vs. what we are hoping to get. Perhaps this inventory could be used to help watershed groups make decisions about selecting GI.

Eliana Brown: That's a great idea. Perhaps it we can start with a foundational effort that captures a starting point and is flexible so it can be built upon.

Chris Davis: Yes, that's what I would like.

Lisa Merrifield: We are just applying for this grant; we don't know if we will get it yet. I do think it would be interesting to get the Tracking Subgroup together to flesh it out.

Reid Christianson: When we do meet next, we could probably start to line up those data sources and bring any data we have right now in line and plan out how that subset might be used as a road sign or a guide for any other asks/data sources in the future.

Lisa Merrifield: That's a good point, Reid. It's a good idea to have our ducks in a row going into any funding opportunity.

Eliana Brown: It sounds like getting the tracking group together would be a good idea. If anyone is not on the Tracking Subgroup who would like to be, just shoot me an email at brown12@illinois.edu. Thank you to Justin and everyone for being on the call.

Discussion and Next Steps

The next meeting is Tuesday, September 8th at 2pm. If you would like to be added to the Tracking Subgroup, please email Eliana at brown12@Illinois.edu.