Appendix 3. Presentation Session Notes

April 21 and April 22 Systems: Cross Sector, Scale and Time Presenters		
Name	**Organization**	**Presentation Title**
Angela Larsen	Alliance for the Great Lakes	Planning Strategies that Achieve Implementation of Policies, Projects and Programs
Charles Frederick	Kent State University	The Design Studio as Experiment: KSU/CAED Graduate Landscape Architecture Program and the Speculation of Urban Futures
John Hazlett	Williams Creek Consulting	Taking it to the Streets: Consolidated Green Infrastructure Case Study
Kyle Dreyfuss-Wells	NEORSD	Grey and Green: Addressing Legacy Infrastructure and Water Quality Impacts in NE Ohio (preliminary title)
Katie Hall	Great Lakes Commons	Systems Thinking Approach to Water Management and Stewardship
Abe Bruckman	City of Mentor	Restoring Forgotten and Overlooked Sub-Watersheds
Michael Cook	Advanced Drainage Systems, Inc.	Combining Gray with Green Infrastructure for Triple Bottom Line Stormwater Success
Shaun O'Rourke	Trust for Public Land	Green Infrastructure and Creative Placemaking: Linking climate justice, environmental performance, and community engagement
Patekka Pope-Bannister	Toledo Water Resources	Municipal Water Management in Toledo (preliminary title)

Presentation Summaries

Angela Larsen, *Alliance for the Great Lakes*

- Major problem: stressed and aging water infrastructure, infrastructure, Increase in severe storms, erosion, trash, overflows
- Strategy/Solution 1: connected corridors of land and water- map possible greenways and blue-ways
- Strategy 2: empowering local stakeholders with information and tools
- Partnered with nine Great Lakes cities to help them adapt.
- Case study: Michigan City, Indiana watershed area
- Indian trail creek watershed, multi-departmental team operating at various scales (watershed, utility)
- Goals: Water quality, water quantity and recreation. Goals matter. Depend on the place and the people
- Climate impacts, -Impact: measured in traditional ways (dollars, number of stakeholders)
- Also measured in capacities
- Targeted strategies that would be catalysts for future action, reduce effects of climate change
    - Site scale demonstration projects (earth moving)
    - Wabash Street
    - Zoning concerns—recommended updates to zoning code; riparian setbacks; storm water controls
    - Land acquisition control
    - Streetscape project in downtown redevelopment zone. Code had gaps that didn't protect marina district. Lake Michigan Gateway Redevelopment promoted a lot of impervious development. Many Zoning Concerns. Suggested overlay impact zone with specific permit process. Any

development should comply with certain site design requirements. What is the impact? Build capacity

Charles Frederick, *Graduate Landscape Architecture Program, Kent State University, Foundations Studio, Walworth Run*

- Start of semester: excited about the experiments ahead
- Landscapes are connected to places
- Program: 3 years
- Studio 1: Sketching, rendering, computer work
- Studio 2: Working with community partners
    - Case study: working to fill open areas in Warren, OH. Rethinking vacancy
    - Case study: redevelopment of Pattison Park in East Cleveland. Helped clean up park with community's help, "one park can save a neighborhood", concepts presented, community goes out and starts changing the park.
- Studio 3: Systems/infrastructure focusing on water. Experimental Projects
    - Protecting Kingsbury Run Opportunity Corridor in Cleveland
    - Moving mud, visiting dredge site. Rethinking dredge design, inspired by Dutch design, various ecosystems, landform texturing
    - Beachwood fire station placement
    - Redistributing sediment with Port of Cleveland
        - Landform texturing

-End of semester: tired but happy

John Hazlett

Williams Creek Consulting

- Case study: consolidated green infrastructure project at Butler University
- Butler: five miles north of downtown Indianapolis; adjacent to two rivers; lots of impervious surfaces; strong sustainability plan—trying to become climate neutral by 2040
- Sunset Avenue streetscape project
    - Front door of campus
    - Was up for resurfacing. Indianapolis passed a complete streets policy
    - Project goals: bike lanes, mass transit connections, branding, green infrastructure, new LED streetlights
    - Native plant material

-Lessons learned:

- Leverage your funding—use green infrastructure to avoid costly traditional features- grey alternative was 3.1 million
- In house maintenance requirements—develop your own manual for people who are going to maintain the improvements

Construction site stabilization—neighboring construction site sediment clogged permeable pavers.

Kyle Dreyfuss-Wells

Northeast Ohio Regional Sewer District

-Problem: fixing combined sewers and managing stormwater

-NEO Regional Sewer District:

- Owns three wastewater treatment plants—Westerly, Easterly, Southerly
- 355 square miles, sanitary and regional stormwater services, 61 member communities
- Political subdivision separate from city and county

-History of region:

- When cities spread out, they piped tributaries

- Combined sewer overflow—wastewater and stormwater are intentionally in the same pipe

-Project Clean Lake—combined sewer overflows

- Construction of deep tunnels is backbone of solution
- Green infrastructure
    - West Side Market parking lot redevelopment: retrofitting with green infrastructure 2.6 MG controlled annually.

-Regional Stormwater Management Program—funded by new impervious surface fee

- Doan Brook Bank Stabilization
- Highland Park Golf Course stream restoration
- Lots of construction
- Impervious Surface Fee—based on amount of impervious surface on individual lots
    - All impervious surface in the region has been digitized
    - Series of credits to reduce the fee

Katie Hall

Great Lakes Commons/ University of Wisconsin-Milwaukee

-Why systems thinking? Water management is very complicated

- Social ecological system—conservation, equity, etc.

-How? Two step process:

- Gather knowledge
    - Held a water conference, Water City 3.0, made list of ideas
    - 2-yr initiatives, 10-yr vision, multi-sector collab.
    - Bicycles with "water cycle" engages residents at bars, street parties, etc.
    - Water- story map, Great lakes commons, Vent, communicate, transdisciplinary knowledge generation.
- Decide where you're going to intervene in the system
    - Worked with 8 schools
    - Water school for children and adults. First time seeing Lake Michigan for many children, parents did not know water cycle
    - Water festival
    - Kids water innovation center
    - Teaching children to swim – partnered with YMCA (considering other ways of "knowing" water)
    - Great Lakes Water Walk—coordinate with other Great Lakes cities-walk around watershed
    - Create spaces for collaboration

-Conclusions:

- Create more opportunities, like this conference

Abe Bruckman, *City of Mentor*

- Lake country watershed projects in Mentor, Ohio
- 3 main watersheds in Mentor, and sub watershed in district (Ward Creek), 10 sq. mi. & Mentor Marsh
- City is 29 Sq. miles, 3.8 mil budget
- Sedimentation and algal blooms present in Lake Erie from watersheds
- Mentor Marsh-complex coastal estuary system
- Wildwood cultural center project under construction= educational benefit
- Marina project under construction 24000sq ft. $540,000, by ODNR: surface water improvement, pervious pavers, bioswales
- Marsh is degraded challenges: fires, public health and safety issue (over $1 mil spent fire-fighting) habitat degradation, salinity
- Dominated by Phragmites (invasive)
- Pelee point in Canada great example.

- Many people come to mentor to bird watch- watershed management and recreation, used as economic revenue generator to justify project.
- Great Lakes Mall- take stormwater and do combo of permeable pavers and cistern work to capture building and parking lot water. All of the water went into one pipe that drained to city park, causing flooding.
- Acquired city property for neighborhood watershed work.

Michael J. Cook, *Advanced Drainage Systems*

- View from the construction side.
- OWEA Executive Board Member
- "Nature's BMP"- Photo of Wetland, creates habitat
- We do a good job designing sites, but there are a lot of factors that influence design after it leaves your desk. Owner's budget, community, dry weather periods, installation integrity, trash and human abuse, invasive species, NE OH weather.
- Invasive species reduces volume capacity.
- Snow Loading and Grit, when plows go out at 3AM then bioswales are not considered.
- Permeable pavers have grit from snow and water flow- oak and maple trees clog voids.
- When we look to climate change there are other factors that come in- greater storm events, increased temperatures, population growth, extended periods of dry weather, can our designs handle climate change? How do we make GI climate resilient? How to we ensure design service life? MAINTENANCE just as important as design.
- Ksat, soil depth, internal water storage zone, root depth of plants, bowl storage depth, hydraulic loading.
- Can retrofit existing bioretention, can increase depth of permeable pavement.
- Owner education, O&M education, understanding real O&M Costs, winter & snow conditions, using climate modeling, performance specs & holding contractor accountable to performance.
- Stormtech chambers that go into aggregate base to capture volume. Captures sediment as well, water quality improvements associated with these.

Shaun O'Rourke, *Trust for Public Land, GI Director*

- How can we engage underserved areas in urban areas?

  - Program called Climate Smart Cities. Big data with community scale impact.
- Climate justice and equity is a major component.
- Resiliency in various communities mean different things. For wealthy communities it's about bike paths, for poorer communities it is trying to prepare for acute events.
- Heat is one of the major issues they're looking at. Projected 10X increase in heat related deaths by 2057.
- "Trees grow on money" – wealthy neighborhoods most TC
- CONNECT, ABSORB, COOL, PROTECT- each has a GIS modeling component
- CONNECT- Home to school and work
- COOL- UHI modeling
- ABSORB- How do we treat water as it falls
- PROTECT- Edge inundation, threat of storms and sea level rise
- Bringing funding to help at no cost. City partnership helping identify and supply data. Identify key research questions. Finance team helps figure out innovative financing measures. Analysis and planning is only as good as projects that come from it. They package data from cities, don't create data. Allows cities to analyze data. Tool works at parcel level and has query function to find places to solve multiple problems at once.

- Green Alleys in LA. Collection of 7 alleys to create network. They hope to set up template for communities.

Patekka Pope Bannister, *Toledo Chief of Water Resources*

- 1951-2012 found 3 degree F increase in temperatures
- Growing season increase of 35 days.
- Road green infrastructure, rain garden initiative, porous pavement alleys.
- GI in neighborhood- 25% homeowners, people living there wanted something different than owners of houses. Median income $25,384, below avg in Toledo
- 66-.5 acre lots project
- Park project at park close to river, boat launch, sees a lot of tourism for birding, USEPA coastal cities grant, restored 0.2 ac of habitat.
- GI in areas without curb and gutters to reduce nuisance flooding. Curb and gutter is expensive. Storm-water utility money and grant from EPA were used for bioswales in the residential areas.
- Collins park solar field, 250kw system at WTP.
- Maumee River Watershed- Service area for water goes up into Michigan and several areas outside of Toledo. 2014 Algae bloom "Do not drink advisory". 500,000 households discontinue use of drinking water until they deemed safe. They realized they needed to update testing method.
- Now: exceed Ohio EPA protocol- test every other day and sample every day. They needed to look at emergency operating plan. They needed to expand staff. Trained staff in FEMA NIMS system. Have community dashboard to allow people to check water quality on their own. They realized communication was a problem. They now have an intake buoy sends real time data.

Q&A: 1A

Identifying emergent practices: What are most interesting/important & innovative/emergent practices and research to address climate change you heard about? Are any of these practices bridging across water professionals to city planners or to research scientists?

- John—LEED on steroids. Some think that LEED isn't enough. Living building challenge—net zero water, waste, etc. Living community challenge—buildings whose systems feed each other, share systems and strategies
- Follow up question for John—is the living building challenge a model goal or something you're actually pursuing?
  - John—unlike LEED, there's a lot of free resources you get for registering your project
- Kyle—simply the fact that planners, water people are talking with each other. There are a lot of conservations on the national level. The land use practices are what produce the water quality impact. Anywhere we can build GI into infrastructure and act as storage is good. Concept of redundancy/redundant landscapes—not everything that's good is innovative
- Angela—we can use social network analysis and governance theory to think through local networks. Who are the anchors? It's important to figure out whom you are trying to reach and spend time with. There may be other players that are better at reaching political players, decision makers. Regional org like alliance is often not the best messenger, they can't reach city council. Partner with universities to embed research into facilitation program. Figure out if you're effective in facilitation.
- Follow up question for Kyle—within the sewer district, are you starting to see anyone reacting to the intense, new rainfall that we're seeing?
  - Kyle—the program went through five years of litigation, which really improved people's understanding of the problem. Local communities knew very little about stormwater management before the lawsuit. Example: downspout disconnection. We're very behind on climate change because not all of our mayors even believe in climate change. Thinks communities are starting to understand

- Follow up question for Kyle—can you tell us more about the litigation?
    - Kyle—the litigation was about the sewer district's authority to charge a fee for controlling waste water. Ohio Supreme Court found that sewer district had this authority in Ohio Revised Code. Very specific to Ohio. Tax v. fee question didn't come in because the court found that it was a charge.

Identifying emergent practices: What are most interesting/important & innovative/emergent practices and research to address climate change you heard about? Are any of these practices bridging across water professionals to city planners or to research scientists?

- Mentor uses some of ADS's products for their design. Mike works a lot with commercial owners, what about the commercial component? The design service life needs to be ensured. Mentor worked with Chagrin River watershed to get grant for project. Working in small community need to do a lot of outreach to people who might not see the need for projects.
- City of Solon- someone moves in and they don't realize the need to maintain. Companies have new owners come in and they don't maintain pervious parking lots. How do others address these maintenance barriers and education as projects change hands? City has had to take on maintenance.
- Doesn't the city want to start taking on this maintenance?
- Burden has been shifted from private commercial back to city. They have a lot of other issues they have to deal with. Solon does have maintenance agreements so they have had to change language.
- Mentor trying to formalize. Great Lakes mall has agreement, need to explain long term benefits of proper maintenance. Need to educate contractor – if their piece of practices compromises function then they have to fix it.
- Most communities have an MS4 program, if the development is over an acre they have to put in stormwater feature. Some companies don't maintain BMP. Home associations don't understand responsibilities and residents don't maintain. They do a lot of education and home associations so they know their responsibilities. They need to know this is the law to maintain it. There is a mechanism in place that
- What are best practices for integrating education into process? Any of these community based projects… need ongoing educational piece for kids and communities at large. Do any include schools?
- Patekka pointed out there was residential outreach program. Mentor doesn't have educational piece in place. They have homeowners waiting for million dollar project and they feel isolated while they wait. Need some intermediate work.
- Spirited citizenship, for children to understand. School field trips should come to projects and see how they change over time. Teach how these ecosystem projects change over time. To make these things as learning projects we need educations
- TPL- non-traditional community groups are best champion. The community groups engage kids and the parents then become involved. Church groups, "Friends of" groups. Identifying community champion so key to get children involved and the community.
- What made projects in Toledo low maintenance. Put in buffalo grass they could mow. Put in gravel mix they could park on. Have 3-4 options: flower plants, tree, grass for low maintenance, gives residents buy in to maintain.
- Indianapolis rolled out credit program for GI from stormwater program fee. If schools incorporate GI into education they get credit off stormwater bill. The maintenance provides green collar jobs. Columbus is certifying people for GI maintenance. Residents got certificate of maintenance and now city has workforce. Work with reentry program. Gary is doing the same thing.
- Angela- innovative public private partnerships, wrap into package puts design and engineers on the hook for some of long-term maintenance.
- How long of time span does TPL have to communities?

- If they are doing full decision support tool. 18 months to develop tool and working with the city. Host the tool for 2 years with regular data updates. Then work with city to host their own tool. Implementation they hope to go on forever.
- NOAA grant in Cleveland and Sandusky, decision support tool "light". PDF maps, peer to peer sharing opportunity to identify neighborhoods.

Identifying Challenges: In what ways is the current status of research or practice limited by sector, by scale or by short vs. long term perspectives? How does this pose challenges or reduce to our capacity to respond to climate-induced disruptions and vulnerabilities?

- Not believing in climate change diminishes the ability to respond to it as an issue.
- Uncertainties we're dealing with in climate change are also a great challenge, what is the future scenario and impact?
- Behavioral changes- consequences of actions, adjustment of actions, change how household is run, not turning on sink, challenge to overcome.
- KYLE- About the next site- next development project has to be better than the last. I don't want to debate anyone on climate change. Focus on how is the next site going to handle its water in its confines. Zoning code.
- Angela L- don't start talking about challenges- talk about assets. Inclusive community dialogue. MI City mayor does not believe in climate change, not allowed to mention it. GL said no problem we just want demonstration program to be implemented we don't need to talk about climate change. Now Michigan City is changing zoning to protect waterway. They know assets and they want to protect them.
- Beyond the question of uncertainty- uncertainty in system performance. Don't know how those systems are going to perform with events in the future- measure co-benefits and other technology. Water orgs are risk adverse- but how do you balance with innovation and not knowing how systems are going to respond. Haven't seen GI systems perform in these situations.
- EPA is risk adverse as well.
- Pace of change is happening at faster pace than we can adapt to.

Mentor is largest city in states smallest county. Watershed transcends jurisdictional boundaries. To assemble teams for watershed requires communities to work together. Communities are siloed from other communities. Need to work beyond boundaries.
TPL found tool important, but best result is getting everyone around the table allows critical connections to occur. Process of engagement has been really instructive. New Orleans Phase 2 of tool- investments are not in New Orleans, they are upstream and need to talk to folks at statehouse. Need to think of hydrologic systems and not jurisdiction by jurisdiction.
Neighboring city has very different practice and the neighborhoods on border are having issues.

Identifying assets: What assets to respond to climate change exist within the current status of research or practice? What bridges across sectors, scale or time could be made to improve adaptive planning and management responses?

- Frontline soldier: sustainable solutions make sense, but they have to be cost effective. Proof is in data and pictures. We have to go there and stay there. (She lives with conservatives who believe science is hokey). We need to be the marketers and move forward, baby steps, in implementation. When she goes to Youngstown they don't believe they have any problem- it is good to be supplied with real data to influence change.

- Huge transformation in aging: elders considered an asset. Not liabilities, assets. Grey to green organization. Reach out to senior centers.
- Spiritual issues as well and reaching out to faith communities to use as asset. Interfaith issue.
- Infrastructure aging and population aging and needing renewal.

- What else was significant that you heard about?

Sean what are the projects you're doing in Cleveland today?
TPL Team is working with NEORSD to prioritize GI investments. Projects evolving in Akron Toledo and Sandusky. Playhouse Square. Relationship with Sewer district has been major point of focus

What else was significant that you heard about?

- When will the region act on making dredge land near airport publicly accessible space?
- Jim White- north of airport, so security issues crossing active runway. Designed and built to handle contaminated sediments from Cuyahoga River. Half needs to be stored professionally, need to cap it off- 40 yr. cycle- if it were made a park 6,000 ft. of property, CDF planning for next life (after remediated).
- Tomorrow at 8:30 he will be discussing further. They are discussing turning part of CDF into nursery to support CLE tree planting goals and Holden arboretum reforestation goals and riparian corridors. They want to grow native trees, not street trees. 7-8 acres for trees.
- Buffalo is kicking our butt. We need to connect the emerald necklace.
- Jim White- Problem when we use lakefront as landfill and then cover with airport, walled off area, founded as port city, but has a bad relationship with lake, maritime activity is barreling Cavaliers in commerce for city. People need to respect the fact we're a maritime city and a lot of money comes in. Some of material was harvested and used for land bank material on Monday- restored library parking lot in Glenville.

April 21, Session 1B: Decision Support & Feedback Loops, Bonda Board Room (253)		
Name	**Organization**	**Presentation Title**
Gary Hunter	NASA Glenn Research Center	Smart Sensor Technology for Environmental Monitoring Applications
Duane Verner	Argonne National Lab	Using Climate Data to Inform Critical Infrastructure Resilience
Marcus Quigley	OptiRTC	Continuous Monitoring and Adaptive Control (CMAC) of Stormwater Infrastructure
Samar Khoury	EPA (OCHP)/ASPPH	Extreme Precipitation from Climate Change, CSOs and Diarrheal Disease in Children
Simon Belisle	Great Lakes and St. Lawrence Cities Initiative	Climate-Ready Infrastructure and Strategic Sites Protocol (CRISSP): A Simplified Municipal Adaptation Tool
Amy Samples	Michigan Sea Grant	Best Practices for Increasing Resilience at Marinas and Harbors
Ebie Holst	Splashlink	A Web-based Tools for Water Solutions and Funding: Splashlink (preliminary title)
Robert Coville & Thomas Taggart	Davey Tree	i-Tree Hydro: A First-Order Hydrologic Model for Land-Use Decision Making
Benjamin Clark	Cleveland State University	Engaging Citizens to Reduce Costs & Improve Water Quality—Pilot Project in Detroit, MI
John Hoornbeek	Kent State University	Addressing Harmful Algal Blooms in Lake Erie: Policy Instruments for Reducing Nutrient Loads to Lake Erie from Cities and Rural

1) Gary Hunter, *Smart Censor technology for Environmental Monitoring Applications.*

- Sensor platforms and smart sensor systems.
- Lick and stick hardware
- Wireless sensors and nodes
- Environmental modeling of 2 types
- Harsh environmental systems using silicon processing to make sensors. Resistors, platforms and hardware can be reorganized to use for almost anything. And the approach then is you start off with the silicon processing approach to make things in bulk. Make them small and smart. Starting with these base platforms.
- Meet the needs of the application. 3 Electrode cell. Can easily measure from that. Get high oxygen sensor. Start with platform, use necessary materials.
- Chemical sensor family tree. Resistors, Schotky models, etc.
- Not only the sensor itself but the hardware. Lick and stick technology. Sensor communication, processor. That's what makes it smart. Included within sensor structure.
- Core Microsystems technology. Control sensor Processing. Wirelessly transmitted data – hydrocarbons etc. *Selectively measuring* hydrogen, hydrocarbons. Trying to understand the world. Multiple sensor and parameters. This work began because of aeronautics application. Cargo bay of aircraft. That happened because those detectors were successful at finding pathogens. They could be found a found by us.
- Chemical species that would look at the products of a fire to the FAA. Start with a particular detection, bring them together to better understand the environment to get the basic core center.
- Move towards a handheld unit and built-in self-check. Water quality monitoring – whole-field approach. Parameters feeding the data in. Where would we try to use this information?
- Multiple sites for regional protection. Working electrochemical cells. Can also work in air and aqueous suppliers.

- Particulate fluid monitoring. Look at species and morphology; combine those two. BOD pH alliance. Biological species do you not in your water supply. The idea that you would want to look at.
- Expand notably what you are trying to measure. Whatever hardware should be supplied. Wireless nodes form a better connection. Farm runoff or pollution and changes in local property. Looking at the water supply, it's a whole field problem. Look at the other environmental parameters and combined the two. Doing good work – concentrated on changed sensor for individual applications. Adopt sense of system to this environment. Selective sensors for that application.
- Understand pattern recognition. Move towards regional monitoring to check centralized location and a number of different locations. An approach for smart censors systems.

2) Duane Verner, *Argonne National Lab*, Using Climate Data to Inform Critical Infrastructure Resilience

- Global security science center in Aron. RISC. Focus on lots of sectors. Dept. energy, defense, homeland security, etc.
- Climate Change Adaptation challenge. What they learned and what planning means in terms of climate science. Lake 90s, Euclid Bus Corridor – Healthline. Define inputs from FTA. Working detailed studies and projected traffic. Went to NC – highway project work. Worked through Wall street bonded project for traffic projections.
- Public private partnerships. Detailed, regimented process for the planning process to fund plan design and build
- **Work is being done as though Climate is static**. Other than sea rise – most people ignore. Designs are continuing as though those are not changing. Climate is changing – storms are increasing, temp going up. Still designing like its static. Design guidelines are not addressing the change in climate.
- Really need routinely available data. Not routinely, but need translators to make science data adapted into information for engineers. Lack of framework for adaptation planning. For the most part its fairly nonexistent for adaptation planning. There's a gap. Climate science center. Even right behind the planning. Still hard to get data from science models. Most have a hard time understanding the data. This is for atmospheric science and ecosystem science rather than for engineers and planners.
- Part of the solution is the downscale of climate data. Downscale to COMMUNITY level. Not always necessary, depending on goals, but really local level output level climate model. There are many things which impact the weather. Unique microclimates that the regional climate models allow you to understand using boundary conditions, etc.
- Some work is in New England. (Argonne)
- Asking about heat waves. Know it's getting warmer, but how hot? And what does this mean for out systems? More intense precipitation. Irene was a wakeup for Vermont.
- What do you do with that information? How do you inform your planning and design process? Engineers say they need a number. 4 ft. radius or 6 ft. radius? How hot is it going to be? You can design them for the desert, but those are very different technologies. How do you downscale this climate model for engineers?
- Look at temp from climate model to current electric infrastructure. Made assumption that infrastructure is static. What happens if you add a 105 heat wave to the electric structure? Power decreases. Transmission decreases. Demand increases. Add that together and you get Brown out Blackout conditions.
- No one is planning from this. Becomes international because we a drawing power from Canada. If the system is not adapted, where can we draw power from?
- Too late to build new transmission lines overnight. This data is not being factored into the 20 30 40 year plans for these companies. We are behind the curve. What about the precipitation? Getting more extreme. Blue map this morning. More precipitation, more severe. Climate model to hydrological model to understand your region.

- Civil engineers use IDF curves. NRC made changes after Fukushima – what are the flood risks around the country. Looked into the future. Inform what they are doing with their campuses. Same with Dept. of defense with military installations to understand and handle flood risks using hydrological models.
- Cities should be using a similar approach. Guidance document for the dept. of defense. They asked them to create guidance document for military based planning. (Small city) which could be applied to a small city. They are similar structures. Does the project need to be based on global? Regional? What kind of climate data? They still do not recommend a city planner and engineer take this document and work off of it – communicate with the professionals in the area to get proper model and ensure they are implemented properly.
- Downscale data is the cream of the crop with climate data. Arrgonne has been doing this work for years. Combining these concerns with the climate scientists is pretty new. What are all the parts going into something like this?
- Within city, university, can we answer these stakeholder questions.

3) Samar Khourey, *Office of Children's Health, EPA,* Extreme Precipitation from Climate Change, CSOs and Diarrheal Disease in Children

- Combined sewer overflows, climate change, and diarrheal disease in children in Milwaukee, WI
- CSOs – consist of one pipe with both kinds of water. Separate consist of two pipes. Animation here of CSO conditions.
- When these things happen, poop happens. Climate change exacerbates extreme precipitation.
- National Climate Assessment Report from 2014 – increase in percent change of very heavy precipitation. New England, 74%, and the Midwest by 45%. Climate change is going to lead to more severe and frequent rainfall. It will become 10-40% stronger, and CSO 50-120% frequency. Climate is related to health. More than half of the disease outbreaks have followed heavy storms. Increased acute diarrhea following intense rainfall.
- Climate Change increasing at unprecedented rate. Past can no longer predict the future and we must act accordingly.
- Great lakes are 40 million people in terms of water for different reasons. Over a trillion gallons of water is discharged during CSO events. Data collection in progress. Data helped to figure out associations and correlations.
- Downloaded NOAA data on temp, precipitation, and wind. Then detailed reports from the sewer district to determine the overflows, the rate of precipitation, and rates of overflow into different water bodies. Then got health department on diarrhea in children.
- Looked at overflow events and volume discharge per year. Is there a difference on precipitation on days when there is an event or not an event? Findings were significant. CSO or SSO. Trying to determine what can be predictor. CSO triggering threshold was from 2-2.5 inches. Risk of CSO with 2 inches. Statistical significance of CSO events on days with 2 inches and less.
- Waterborne diseases in Children under 5. Shigellosis is responsible for 50% of the diseases. The rest were much less. Is there a difference in monthly disease occurrence in relation to CSO events? Month following and the month of events. Mean total disease incidence of month of or month following was 13. 6. Without considering the temporal lag, the outcome was insignificant.
- Next steps – incorporate GIS. Water quality indicator not a perfect one. Disease is under reported, and Health Data! Health data is a huge challenge to figure out pathogen-based diseases. Must have money or people in high places.
- Early warning systems would be beneficial to alert for health risks.
- Increase green infrastructure in grey infrastructure. Cradle to grave – think of storm water as a resource.
- Education and research training is always a large component.

- Understanding the relationship between climate and health. Some people still think of climate change as not impacting them, but it is. Not just the polar bears. Storm water can cause a negative impact in the case of CSOs. Whether you believe in climate change or not, it's real.

4) Simon Belisle, *Great Lakes and St. Lawrence Cities Initiative,* Climate-Ready Infrastructure and Strategic Sites Protocol (CRISSP): A Simplified Municipal Adaptation Tool

- Grown to 122 cities over 17 million people. Work with a lot of cities, mayors, high-level staff in planning, environment, etc. Clear as we heard this morning that everything happens at the city level. If there is an overflow and a flood, the first call is to the city. Working on GHGs and monitoring the diversion.
- Problem facing in smaller municipalities – felt they had a lack of reliable data or a lack of translation of data and also the municipalities had limited financial bases to devote to identifying and assessing vulnerability. The challenge was to figure it out and make it as easy and simple as possible while still being comprehensive. CRISSP – *Climate-Ready Infrastructure and Strategic Sites Protocol*, which created an expedited methodology to identify infrastructure weaknesses. Gary Indiana was the pilot site. Many partners.
- Was first only looking at rain. But recent wind only even made the group to create changes in their protocol. Simple: list of questions carefully crafted about one infrastructure in the city. Want to make it as simple as possible. 12 pages. Not short list, but cheaper than a consultant. Based on existing data. As data increases, the strategy will improve.
- Cannot downscale data as much as many municipalities would like, but things are always improving. Lower costs, which means most places could work these changes from within. Some have used this to justify or understand why a full assessment isn't necessary. Part of project was the guide, the matrix, and the white paper. Trying to make as much as they can happen – working on the group. Guide is owner's manual. 70 pages. Maybe too long for a sales pitch but worth going through.
- Matrix
- List of vulnerability assessment questions a municipality needs to ask itself, comprehensive, identifies data needs, touches on various aspects of risk management and works in conjunction with the Guide.
- Using library for shelter, to keep the guide, highest from the lake. Then they found out they had no back up power. Need that. One thing to create through this is to identify risk and then have you ask yourself the right question if you have a problem.
- White paper – for research requirements for grant program. Link to matrix, focus on methodology.
- How to use CRISSP? Become a member. Establish scope. Establish team, assign data-gathering roles. Use matrix to answer questions and establish vulnerability. Take actions to ensure sustainability. Understand and now what the data sources are. There are more and more – constantly expanding. Need team leader. Need organization. Got two departments, which never speak using this kind of attack to a problem.
- Learned: Data management may not be always accessible, used sensitive infrastructure, sensitive to strategic, Integration in existing plans, staff champion needed, be flexible, interdependencies and cascading effects.

5) Marcus Whitney, Monitoring *and Improving Infrastructure Performance with Adaptive Control*

- Unique company – much work funded by the EPA. Tech start up. Focus on stormwater. Climate change in the great lakes.
- Stormwater and green infrastructure monitoring – overview, continuous monitoring, examples and case studies.
- Etc.
- First – continuous monitoring – what does it mean? Getting information from infrastructure into context in minute-by-minute performance. Water quality and quantity. What do they do? They put sensors in to the field – using lightweight connection to cloud on Microsoft platform. Interactive.

- In Milwaukee – groundwater sensors to calculate in real time the volume of runoff, precipitation amounts. Etc.
- All comes seamlessly as part of collecting the data. No software, no servers, all in the cloud. Interact with live data all in real time. Summarize events. No need to do event separation to put data in context – water quality, hydrology, etc. of a watershed. Live imagery along with the data.
- Store all the data on 5-min. basis. Any 5-minute basis for any area. Continuous sensor data. Minute by minute storm runoff data. Ambient air temp. Ambient rainfall. Over 100 facilities. 20,000 data streams being processed. Small solar panel, data logger, etc., very light data collection unit. Cell connected, off grid. Some include control. TSS censor – new piece of equipment. One event – first flush.
- Single event has more TSS measurements – more discreet real time measurements than his entire career.
- 10 measurements an hour – solar. Dissolved nitrate concentration with nitrate sensor. Rainfall. Etc. Nitrate levels. Rainfall and storage, TSS and Nitrate, TSS and nitrate, conductivity (increases with road salt use). Big data comes to environmental applications.
- Can take all data and summarize it in a simple metric and then give them real time data.
- Make all this data available for public via website, would summarize metrics for municipalities
- Control:
- Not just for humans. Data is mostly for machines. In addition to direct monitoring – take control of the facility with the cloud. On minute-by-minute basis. Complete control of the hydrograph.
- Running models to think about the performance. ***Depends on how the events unfold***. How minute by minute how the facilities change. With complete control of the hydrograph you can figure out how long you need to act in.
- What the hydrograph should look like. In Maryland – existing dry pond in 88. Rebuilding ponds by dragging out dry ponds and making them wet ponds. These are very expensive eco-services though. Mostly getting enormous holes drilled in the group. Added about 12-inch valve. Lightweight communications box. Create an active storage volume.
- Facility interprets the forecast and determines what will happen and what it should do. For instance, if a large rain event is coming on, the facility can store the water in the pond for 24 hours before release. Dry retention ponds.
- Large facilities. Discharges at the lowest rate possible in Washington County, Oregon. It is always trying to downsize and perform less work. As a result, there are curves by taking control of the facility. TSS data – taking control of this facility, that facility performed better than before.
- 7 Systems in LA – EPA headquarters or in Portland or Washington, etc. real time in those to try to handle stormwater overflow.
- Every stormwater facility was not built as it should have intended because of lack of modeling. Should employ, adapt, redesign, etc. over and over to build resistant systems.

<u>Session 2B: Presenter Notes</u>

1) Amy Samples, *GL Marinas; Climate Toolkit, Best Practices for Increasing Resilience at Marinas and Harbors***,** *Michigan Sea Grant Program*

- 2014 Project – lessons learned. Increasing resilience of harbors.
- Gap in stakeholder groups. Approach with idea to take climate science and translate it to the user group – harbor and marina operators. Industry – pollutants going into the lake and waterways.
- Stakeholder group challenges – environmental conditions, fluctuating water levels. Increased storm frequency. Policy and budget. Most were built 50-80-100 years ago – now deteriorating. No longer reliable. Needs improvements. Issue avoidance. Tough issue.
- Too much information or denial of climate change – also a focus on day-to-day operations is something to be considered.
- Funding from GLISA for project. Assist with sector specific problem identification, decision making, planning related to climate change adaptation.

- Cynical – so without proper delivery, changes are not made. They consider a wide range of information and possibilities.
- Clean Marina Classroom develops training material for marina and harbor operators. Important to bring conversations, which are business savvy – economics are important to business owners. Great Lakes Clean Marina.
- Started with needs assessment. Resources were a need for climate. Clarified needs with stakeholders. Identified current tools and necessary still needed tools. Did workshops, webinars to see on the right track. Online training tools.
- Section 1: Potential risks and impacts background
    - Fluctuating water levels. Storm frequency and intensities and temperature changes.
    - Updating marinas is expensive. Resources and tools provided by Sea Grant.
    - BMP – infrastructure is changing, rapid deterioration cycle. Investing in long term adaptations. Adjustable floating dock. Dredging is expensive. Marine Corp used to fund this but now less so.
- Section 2: Infrastructure
- Section 3:
- Section 4: Planning and Financing
- Beta Testing: good feedback from the business owners. Great framing
- Framing is important. The relevant parties are concerned with day-to-day operations. Operational risk: storm damage. Such as hurricane Sandy and the impacts. Many businesses unprepared. Risks: costs of adaptation. Costs will increase.
- Local Decision Makers
- Needed to involve year round staff, who plan for these concerns and help maintain the harbor.
- Challenges and Lessons Learned: to provide outreach, start with trust and access. Advice from industry peers is relevant and very important. Accounting for uncertainty and personal bias against climate change. Focusing on resilience for a range of conditions was the successful approach along with access to the science.
- Outcome: provided operators with useful information and vernacular. Project has urged the organization to think about planning support. Support is key. Need people in all industries in order to plan properly. Implementation is dependent upon cooperation.
- Sustainable Small Harbors Project
- Purpose: Identify tasks.

2) Ebie Holst, *Water Industry/Economic Development*

- Great Lakes – opportunities at this conference.
- Given the amount of fresh water relative to the rest of the world that the future is secure. False. Increase in population, etc. means thriving, but only if we plan for it.
- Major issues which require action. Chance will cause many risks to appear and likely come true. Attracting opportunities, identifying risks.
- Attracting opportunities.
- Many water dependent economies and industries. Such as textiles, mining, oil and gas. These industries could benefit from being in our region. Not just because of drought but because drought causes regulation shifts which hurt industries. Bringing industries, many risks appear when we are not in control of regulations for water. Are we protecting them appropriately?
- Flint. Bringing attention to our area. Not starting with Flint. Other states around the great lakes began since the river caught fire. Also Milwaukee some population had no water.
- Also issues with governance. Toledo with shut down of water resources because of algal blooms. Much work to do on that. This is a system. Significant issues to consider. Uses, releasing water back to watersheds, and infrastructure issues as well. Significant energy pipelines going through the area. Systematic fashion for controlling issues coming up.
- Have made much progress on the Cuyahoga from where it was in the twentieth century to now. We must export our expertise to the world. We are still industrial and have a huge reliance on water.

- These same issues are emerging around the world. India, China. Export of manufacturing from the US has caused these issues elsewhere. Increasing manufacturing is causing huge issues with water resources.
- Flint: infrastructure issue among other things. Expertise – testing on water samples. Has come up as a crisis of now that needs to be addressed. But in the other parts of the world this is a common issue. China. Acute crisis for contamination. Non-potable water is what comes out of the taps in 4 star hotels. Chronic issue in places like India and China. Dead fish are common to see. Also tremendous infrastructure for responding where as these countries do not.
- Interesting opportunities in the great lakes. Opportunities to help connect the dots.
- Splash-link discussion and walk through.
- Projects being financed seeking groups to provide research information to provide content for private sector businesses as well. Bringing water resources to one site. Funding aligning to the market demand. Seeking to provide that over time. Databases of providers. Stormwater expertise. Collaborate with a company. Can find some players with that expertise. Keeping track of where the problems are become easier with Splashlink. Updated daily.

3) **Robert Coville & Tom,** *I-Tree Modeling*

- Part of tools to provide services. Generated with partnerships including the Davey Institute. Simply a model to look at how land cover changes are effecting water quantity and quality.
- How is tree cover going to affect water flow and quality? Helps provide a first assessment of these changes and what impact they will have. Provides data, solutions for different scenario. See groups working together to solve these issues.
- Model.
- First order, process-based model. Trying to change the curve number models that cities have to adhere to. Benefits to typical hydrology model. Better estimate to impact of green infrastructure. Complex model. Lots of inputs (13+). Generate runoff. Inputs. 5 land-cover classes. Model can be calibrated for watershed alliances and impacts of watersheds. Can use observed data. Model will run hundreds of times with all parameters. Calibration. Different parameter sets give different outcomes.
- Outputs: Predicted streamflow. Yearly, monthly, daily graphs. Hourly time-series and export options. Water quality outputs – same bar graphs for quantity and quality. Use EPA NURP data. Pollution output – total mass. Concentration in time series. Increasing impervious cover increases runoff. Green infrastructure solutions require a lot of different angles.
- I-tree hydro applied – Itreetools.org for more information. Highlight project in Mass. Tree cover was modeled in 2008, deforestation from Asian longhorn beetle. Then tree reforestation model was set in. The reforestation had less tree cover, but the reforestation was designed to cover impervious surfaces. Deforestation = increased runoff, but reforestation helped overland runoff by design. Workshop Sept. 25th in New Orleans. Adding green infrastructure type to the land options. Rain gardens, tree pits, porous pavement, and rain barrels to the model. Easier to apply monetary impact of changes.
- Question: Does this include the sewer system? Combined sewers? Need apples to apples to apply something like this to city planning.
- Answer: Harder to run model generally when taking all of these into considerations. However, there are simple models too. This is more accessible. May need technical knowledge for urban landscape. Easier than TR55 model. More appropriate. TR55 is too simplistic for most applications. Some outputs will allow you to take many of the interactions of green infrastructure and apply it to the Swim model. Don't have to calibrate the model – this can be run in an hour. Can use some of the outputs and apply them to a more complex model. Good for overland stuff and advocacy tool for more in depth modeling.
- Question: Does this deal with complexity of trees? Species, age, season, etc.?
- Answer: To some extent. Working with EPA to get (what)… to make it more complex to help determine which species may be the best to apply to the model and then use for this kind of system.

4) Ben Clark, *WQ Monitoring; Technology Cities, Director of Environmental Finance Center*

- Tools that cities are using to help citizens give feedback on community issues. Pilot project. Needs more finance and assistance. 311 systems – compliment to 911 for non-emergency problems. This has saved a lot of money. Cities are starting to realize this data they are collecting with 311 can create a database to help communities. The data could be accessible to community members to see what problems are appearing today. As 311 evolved, along with smart phones, these have gotten easier to handle. In some instances, it can cost $5/call. If you have a smart phone, there is now an app for some of these cities to gather information in the cities and geocodes that. Working with See Click Fix. Works with Detroit. 311 can be $30,000 per year. Accessible to larger cities. City tool to see what requests are coming in from the city. Ex. Illegal dumping – problematic issue related to water quality. Not only descriptions are available, citizens can also upload pictures to show the city employees.
- Helps city become more proactive. Can be seen on a map. Shows # of issues at top. Can search for types of request. Can see intensity of problems. There is certainly an issue in one particular area – can increase rounds in that area where intensity is high. Professionals are not GIS technicians. Cannot do mapping or data analysis. Tools being google fusion tables. Free tool to input data sets. Can change parameters, heat map, etc. Engage citizens to report. Mayor and Council of Cleveland has 311 and online format like this, but no one is aware of it. Mayor and Council are failing at this. Non-technical tool. Free, easily available, easy to use. If employee of city. If you are a community group, sometimes these are available – such as in Chicago.
- Google fusion table allows data to be inputted. Boston uses same as Chicago. Work with a lot of difference cities curating this data. Rich way to understand what is going on in cities.
- Pilot project to help community get more involved to improve water quality. Giving people instructions to deal with catch basins. Not that you have to do it, but shows you that you can do it. Help yourself and your neighbors rather than waiting 3 months since resources may not be available. Helps engage technology to activate the community.

5) **John Hoornbeek,** *HAB Policy Tools*

Policy Tools for Water Pollution Control: Addressing Nutrient Enrichment & Harmful Algal Blooms in Lake Erie.

- Pulled data together about what policy tools are being used to address algal blooms along with several programs to handle nutrient loads around the US. How to enable Lake Erie to not have algal blooms?
- Spoke with federal and state environmental officials to assist with the project along with extensive funding from a variety of groups and institutions. Preliminary findings to implement policy tools to address nutrient loads. Share information on policy tools and strategies to address nutrients. Tools can be used in the future to reduce algal blooms.
- Approaching finished project.
- Preliminary findings: (Please do not share)
- Background points: massive bloom in 2011. More every year in Western Basin. Major one in 2014. Others labeled harmful and that one produce microcystins. Another just last year. Seeing in Lake Erie – increasing frequency of problem including environmental and health risks. Not the only place dealing with this. Temperature increases over the summer have caused increase in these blooms over time. Prediction – may see these in other parts of the world and they will increase over time.
- Lake Erie – pollutant of concern is phosphorous although nitrogen is also an issue. Mostly agricultural but also found in urban areas as well. Hoping work can contribute to solve issue. Predominance in Western basin of Lake Erie – water is shallower. Algal blooms extend into the central basin of the lake. Most western basin main area although they end up moving towards the center of the lake.
- Basins touch 36 counties in Ohio Lake Erie basin. Some are wholly contained in the basin. Partial counties are difficult to analyze. What are we doing now to help these counties in state and federal level to reduce nutrient load.
- Purposes: understand current nutrient loads. Understand what others are doing to handle these loads. Compare what we see here with what we see in other parts of the country. Can apply to basin to reduce loads.

- Data collection: information is publically available. Permits from the Ohio EPA website. Inquiring to officials about spending and management efforts to deal with nutrient loads. Screened 32 water basin programs around the country to ascertain to how they handle nutrients and what they have learned and what lessons they can share. 3 basin wide programs that identified ambient … and systematic efforts…
- Number of efforts underway but not systematically handing the results. Some have improvement in recent years.
- Regulatory controls, money being spent, organizational strategies.
- Wastewater treatment plans are required to get NPDES permits. Permitting the flow of wastewater to surface waters. Counted permits 1150 permits in Lake Erie basin. 102 were major – discharge 1 million gallons per day or more to the waters of the US. Or they produce loads that are a danger to the water body.
- The rest are minors and don't meet those conditions. Looked at effluent and monitoring requirements. Looked at treatment works that produce wastewater from cities and sewage from showers, sinks, toilets, etc.
- Final effluent limits and nutrient treatment 60% have nutrient limits of some kind. Major have more nutrient limits. 102 of major, 56 were publically owned treatment works. 98% have effluent limits for phosphorous. Almost 20% had average monthly concentration of 1 mg/liter. Average from IJC for the great lakes wastewater treatment plants that are majors. Several also below.
- Stormwater. 7-8000 stormwater outfalls in basin. Both CSO and SSO permits. Ag permits. 12 CAFOS in Lake Erie basin. Additional 113 permits in place for ODOA. Oversight not covered with federal regulation but may cause quality problems. Distressed watershed rules created recently.
- Spending a lot of money. Federal and state funds.
- Management tools. 10 agencies. Everyone is playing in this game but not all playing the same game. Other programs. Chesapeake Bay, PA, Tampa bay, common institutional programs. Many policy tools that could be used. More stringent requirements for CAFO. Identified standards for receiving bodies. State fertilizer requirements. Fund nutrient reduction strategies. Multiple regulatory tools in place. Not all comprehensive. Millions being spent, but algal still issue. Is money the right solution? Other basins taking other solutions. Many other policy tools we could use being utilized in other places. Done much since Toledo shut down but not necessarily good strategy. Obviously not sufficient.

Emergent Practices (1B):

(Notetaker note: *Would put in questions, but we think the wrong questions were asked. So…. Here's what we got!)*

Samar Khourey: Theme points for better and quicker feedback loops.

- Julie M Barrett O'Neill: Buffalo water district. Very grateful. Couple things as a practitioner – lands between planning and wastewater treatment on climate model to link to flood management and swim modeling for their mechanisms. Also how all of those – the question of which if E coli is their trigger. Is there another sensor for the pathogens we should be looking at? The best use is RTC and better infrastructure. On their challenge side of that – how to have the capacity to use this data within this field and use it fluently is going to be a huge culture change – green infrastructure was difficult.
- Duane Verner: Education, design standards, etc. all have to work to be able to bridal all of this information. All of these terabytes what do you do with it. They were even struggling.
- Marcus Quigley: When people get the data, they don't arrive at the hypothesis that people should even have the data, they should just get involved when you find yourself in a situational you cannot solve without the data. In reality, the best way to use these services and monitoring data: you are brought into the loop when you need to know. You don't need people to just sit and watch the data because no one wants to do that. If you go to bed and you haven't heard from your systems, you know it's working. No one should have to watch data.

- Julie M. Barrett O'Neill: She cannot even work from home, so for them to just peel something off and then use data to do a job is a huge massive shift.
- Gary Hunter: distributing intelligence. Local system to control is sensors and its data - provide user standard information when they want it and how they want it. The attempt is to have a distributed intelligent system that isn't overwhelming. It's smart enough. Trillion-sensor world. It's a conference. The idea is that the amount of information that is going to exist is overwhelming but it needs to be locally intelligible. The idea must be the information is the way you want to have it.
- What does this really well? Cars – they have worked to become interfaces for the user. They check everything all at once and you don' t know what it means when your check engine light comes on – could be anything. You need to take it to a professional. That's the same idea for this with the sensors and the big data. People don't want a detailed diagnostic like the mechanic, that's the same as with this information.
- Dr. Sudhir Kshirsagar: Sensors. The biggest challenge is to secure the system and have strong cyber security. Want to keep it secure but smart sensor needs open doors. It is a necessity and the data is just sitting there. Need it in a secure manner – that's an integration challenge.
- Concern with technology overall. Does it free up time to focus on things? Want to spend years working on spreadsheets? No. Technology has pushed us that way. Of the belief that people have better things to do with their time.

Emergent practices (2B):

- Concept of watershed utility – watershed trust. Innovative concept. This grew out of Mississippi nutrient dialogues. Perennial questions – people making concept papers. What is a concept watershed trust? Aggregating stormwater, wastewater utility. In a watershed (more regionally conceptualized). Nature conservancy. Fund or trust to target investments that are not covered by current programs. Fluid means different things to different people. Trying to bridge gap and find new paradigms.
- Stormwater utility does – charge for resurfaces – equitable distribution. Pay less – basic premise. Idea at larger scale with multiple services that are not part of the programmatic regular. Hear term watershed trust – not utility.
- Mechanism in software is something that is widespread but is not known to the public.
- Use in a compliance environment. Want to plant trees but can't use for compliance because…how do you regulate a tree? Want to see good work come to maturation for a lot of us.
- So many tools sustain, becomes white noise. Dealing with reg. environment. Usually out to market, here to learn. Really happy to be here. Sponge cities – China's trying to be more sustainable because of flooding. Seeing US – we are impactful and NGOs are making a difference. Opposite in China – no access, so they don't see the value. Water is blocked off. Problem is critical here, dire in china. Hope they start listening to things they get from the West. Don't know if they can rebound the way we have because they are moving so fast. See in the news, tip of iceberg. No regulations in place. Government has to make the change but so far not happening.
- How do you regulate trees? For storm water fees?
- No, based on swim modeling for compliance. Making sure there are good modeling tools to determine what trees are doing in the landscape.
- Dealing with that right now with water quality trading – how do you model that benefit to use it for compliance. Concurring this is a challenge. Allowing flexible options to come into place for compliance but not tools to know how to take action and what affect it will have.
- Don't know a lot about swim model. Who manages those and how do you incorporate conversation?
- It comes from the EPA general compliance tools. Have to argue to use something different. Proprietary companies that allow easy access and applicability. Getting data sets and ensuring high quality information. Most don't have the inputs you have. Hard surfaces but very aggregated data that has to apply for compliance.

- Implement changes. In order to utilize sustainable alternatives, need to ground proof that. The EPA understands limits. What can be but at the end of the day you cannot use sustain to move.

Identification of challenges (1B).

- Simon: It is an evolution. Can a municipality use what the machines are producing as accurate? Or do you have to double-check everything? A spike – does that require double-checking?
- Verner: When you look at premise of TMDL program, it seems like a reasonable thing to do because anything else is expensive. Finding that to be ultimately a challenge. Much potential, but problems of inability to act. The CSO program requires you to perform record keeping, but many don't because of expenses and lack of reliance. If you cannot afford to comply, that is a defense. Cost is a reasonable roadblock. It is pretty disruptive if you can afford to do things in such high resolution that politician heads are spinning.
- If you take a look at our economy – monitoring, control, feedback, >>> if takes a while to get that up and running – regulatory agencies may be that over a function of time that there are many things that will just – the technology becomes available and then the agency moves in the direction towards optimization. If there is a way to upkeep public health, the technology if it exists should be utilized. May have feedback associated with it…
- Moderator: One thing mentioned about CSOs is the best available technology is a requirement by the EPA.
- Julie M. Barrett O'Neill: Also lawyer – practicable is an important term. On regulatory piece – you have CSO compliance – has a model – precipitation year predicts when there will be a CSO - no field monitoring. By introducing the question of the typical year to determine what climate change will cause. Just finding the typical year is difficult. Exciting to see, and meeting clean water goal would be amazing but it's the institutional, cultural, and regulatory pieces that are hard to get to fit.
- Verner: Doing own thing in year 2. Want to know in year 5. City at the end of their complete separation – beginning period to determine if all the money they spent put them into compliance. No new technologies – outcome is the results. That's what's measured. Spend a ton in Philly but don't meet water quality of the Delaware river. Is it a good thing? Clean water act doesn't care.
- Samar Khourey: 50-year model doesn't include climate change and it should. Cost – should be a paradigm shift and include the externalities that's where we should be headed.

Identifying challenges (2B)

- Tom Denbow: Capture: algae problem giving money to water utilities. Increasing treatment plans but not connected to land use. Big loans for infrastructure costs but stipulating expanded growth without controls. No regenerative design. Water strategies are critical. Land use practices should be included in this climate change context. Not sure they have been linked
- Julie: Smartgrowth analysis required. Trying to introduce green infrastructure. In NY state revolving funds applied here. They are dealing with Smartgrowth requirements and possibly resiliency analysis.
- Professor: Those funds that provide infrastructure. Management side gets forgotten. Sustainable source of revenue to analyze data is very important - shouldn't have to rely on consultants to analyze data because it's expensive. Understand the human capital for technology.
- Edie: Challenges: We see there is no channel for escalating some of the findings. There's no standard practice of benchmarking. Ability to then do more complex modeling based on data and learning from pilot studies – no data infrastructures to provide it. Regulations? Provide it
- Think with research, there is no research to find out where research is needed. There are great institutions and they are not aligning with where those hot spots are and where issues are continuing to arise to send money there.
- John Hoornbeek: Central mechanism for finding out what's going on. Escalating findings and channel for determining impacts and aligning that baseline of data with where research is needed.

- Sweater lady: State – Toledo is set on water quality agreement, local water quality want to have them declared to have similar regulations as Chesapeake Bay and none are being implemented. Interested to see what Maryland dose with the other folks. Spotlight of Maumee river. 13 permits. Michigan counted over 130 in Maumee river basin. 3 States. Getting public sector on same page is a challenge.
- Julie: As for research trying to bridge things. Research – fellowship in government at university to build bridges between capacity and need. Institutional barriers between schools, different culture. Some are more user-friendly with a user environment. Many can't apply these things. Timing issue. Sometimes students wouldn't work out and it would have to go into private sector. Beauty of pure research and trying to solve a problem quickly. Practitioner level and research partners. Some real obstacles in having academic partners. Consultants don't always have good relationships too.
- Drivers are just sometimes different to find funding and then funding isn't always application. Communication issue.
- Victoria Pebbles: Model out there called collaborative model – run three of them. Phragmites, bring scientists together to look at genomes. What is the latest science and how can it be applied? Group of scientists can blow that out. Model can be used by regions, and anyone can do this. Collaborative model journal article for long term engagement to bring that to management. No communication. Some are and some aren't. There's an opportunity.

Identifying assets (1 B)

- Presenter 1: National climate assessment and toolkit is a good start, but after playing around in those for the 5-step process are pretty heavy. Good place to start with future decision making
- Moderator: …nothing.
- Last present: Folks have a device that can tell you your BAC. Technology is coming a very long way and should be applied accordingly.
- Dr. Sudhir Kshirsagar: The police department are using the ones for phones – BAC monitor. If the EPA requires it, other devices are going to come on the market. Can transport to maintain data. They are all actually consumers' world the user ….money…slowly …

Identifying Assets (2B)

- Purse: Green infrastructure has to be considered an asset. Has to be evaluated as asset management by sewage department. Green infrastructure is an asset to the system. The last question, we are failing in monitoring and applying systems to make an impact. Biggest fear is they will put in infrastructure and not have data that says this is working. Universities have been good and bad; she is a consultant. Data has to come from because people believe the universities and have the science basis. Private entities have reasons. Need data.
- Tom Denbow: retrofit wetlands. Erie basin. Asset – transport mechanism for the pollutant load. Need folks' attention.

What else significant? (1B)

- Verner: Climate change stuff is always very fascinating. So complex. Did work for EPA – past doesn't predict the future. But there's actually a good signal from the past. The change – the 1% events are what people focus on but the rest of the distribution is incredibly complex. There are places like Portland Oregon where the storms are reducing, but others are increasing. Thinking of green infrastructure – if the high frequency events are going down you may see other horrible things happening in incidences, but it is so complex, what do you do with this information.
- Moderator: Doesn't call it climate change but calls it ***climate chaos.***
- Verner: Simple message is hard enough – people getting sick things getting worse.
- Moderator: most vulnerable effected first. Don't have to call it climate change or focus on complexities, but can say heat or asthma – this is what happening when you add the climatic stressors or non-climatic stressors – not intended consequences from non-action. Take health impact to see what climate change does to it. Mold in homes, exposure to pathogens, etc.

- Verner: People ***are more capable of understanding the complexities***. Should emphasize the negative
- Moderator: Think ***doom and gloom makes people think they can adapt***. But it is happening now and it's affecting everyone, especially the vulnerable – but think on an individual level. Community etc.
- Julie: prepare for what is going around. Engineers? Struck moving into this field. Engineers bears and manages risk in civil environment. Having that license creates a level of responsibility that people who don't have that stamp don't understand. Must understand the responsibility of engineers and asking them to control something that is uncontrollable. Getting them to stamp green infrastructure. Used to controlling all variables for public health. Will be difficult and not sure schools are preparing engineers to handle these problems.
- Kshirsagar: new people coming in have a problem. The things they are being taught have nothing to do with climate change, it's just not being taught. This is a big issue. ***They are being given antiquated lessons which don't adapt to the changes we are seeing.*** These are very bright people, they will get there, but that's the biggest challenge, ***how do we get this into engineering schools and put the stamp on it***? That's the biggest challenge.
- Verner: Starting discussions now but almost like we're too late. How long does it take to implement a new design manual for culverts in Ohio?

April 21, Session 1C: Adaptive Capacity, Sweet Seminar Room (241)		
Name	**Organization**	**Presentation Title**
Anthony Body	NEORSD	Workforce Development (preliminary title)
Joel Bingham	EnviroScience, Inc./University of Akron	A Conceptual Framework for Restoration Performance Assessment
Katie Rousseau & Malcolm Mossman	American Rivers	When a Bandaid's Not Enough: Implementing Stormwater Utilities in the Great Lakes Basin
Sammis White	University of Wisconsin-Milwaukee	The Milwaukee Water Technology Cluster
Scott Hardy	Ohio Sea Grant	Coastal Storm Hazards in Northeast Ohio: A Case Study of Community Vulnerability and Resilience
Samuel Molnar	Great Lakes Commission	Climate Ready Great Lakes Cities: Lessons, Tools, and Critical Future Steps
Richard Norton	University of Michigan	Managing Great Lakes Shorelands for More Resilient Communities
James White	Cleveland-Cuyahoga Port Authority	Sediment Choreography For Cleveland Harbor
Todd Danielson	Avon Lake Regional Water	Preparing for the Worst: How One Water Utility is Becoming More Resilient to Combat Extreme Weather
Matt Schmidt	Trust for Public Land	Project Clean Lake Community Investment Plan: Creating an Framework for Neighborhood Investment and Sustainability Education

Joel Bingham- *Enviroscience, Inc*

- Stream restoration, degrading
- Initial – something's wrong can be fixed/Goals and funding
- Intermediate – human induces alteration
- Target – Nature and time/Environment

Katie Rosseau- *American Rivers*

- Bluestem
- Storm water utility toolkit
- Messaging/Engagement plan: 3 parts/Customizable Documents
- Americanrivers.org/stormwaterutility

Sammis B. White, *University of Wisconsin-Milwaukee*

- Milwaukee Water technology cluster
- The water council and Econ. Dev. (TWC) /Global water center
- Water Tech Cluster – companies, researchers, non-profits, entrepreneur

Scott Hardy, *Ohio Sea Grant Extension*

- Storm Hazards in NEO: Analyzing Community vulnerability
- Areas that are target of storm water problems
- Measure future precipitation
- Storm Hazards Vulnerability Index
- Social Vulnerability/Socioeconomic
- Environmental Vulnerability/

- Resilience indicator/In creation/ understanding of hazards, resources, collaborations
- How to link the ecological restoration to community value/How do we want it to look like in 20 years.
- Get invested interest from people of the community. Take pride of it
- Being in close proximity of things, in order to educate the people an on hands approach is needed
- Goals with restoration can be a million different things, community is one.
- Other values that they don't know about. Aesthetics
- Science leads more to quantifications; community people are needed to establish the real goals.
- Floodings are not that bad. Use the floodplains because that why they are there for
- Floods damage, but are good. Rejuvenate the landscape. Not a bad thing.

Samuel Molnar, *Climate Ready Great Lakes Cities*

- Adaptations of great lakes cities should not be prescriptive: cities are too unique in nuances and vulnerabilities
- Adaptation should be across organizations, requires "adaptation mindset"
- Adaptation should happen justly, not "equally": should target most vulnerable pieces of the urban landscape. Can be done through, calculated risk, procedural justice, and distributive justice
- -Information mediates planning process to ensure that resources are allocated to most vulnerable parts of urban landscape; also avoids maladaptation
- Climate impacts Vulnerability Index: tool and process that cities can use for procedural justice, GIS-based index used for planning/evaluating, focus on people in cities.
    - 4 facets of vulnerability: physical: uses aster satellite
    - Built environment vulnerability: housing stock and type, # units/building, access to AC, HVAC, Ozone, 311 data for infrastructure problems
        - Personal vulnerability: where are most young, old, highest asthma and hypertension rates in a city? Helps target marketing.
    - Socioeconomic vulnerability: where are most poor/minority?
        1-100 index of vulnerability
- IT can be used by all!

- 2) Great Lakes Coastal Dynamics: coastal hazards
    - Unique attributes of GL that make them different to manage
    - Local governance has a key role in managing but they're not doing much!
    - Creating planning-based methodology that communities can use
- Great lakes are not tidal, dynamics are different.
    - Public trust Doctrine: was adopted from ocean coastal setting, thus the ordinary high water mark is different/harder to find without tides.
        - This affects public trust/private ownership boundaries
- Great lakes water levels vary by meters over decades, not inches. Climate change effects are unknown. Also impacts where things can be built like houses. Property owners will build hardened structures that can impact sand/coast for other people along shoreline.
- Management: Some national and state, but local units can be most impactful through zoning laws
- Created scenario planning with different futures and planning options.
- Future Conditions: varying storminess and standing water levels
- Development: buffers and setbacks

Richard Norton, *University of Michigan*

Jim White, *Port of Cleveland, Cuyahoga Port Authority*

"Sediment choreography"

- Huge impact on regional economy: harbor maintained by Army Corps of Engineers
- Sediment management is critical for regional economy
- Big struggle is adapting to changing weather patterns: more frequent peak precipitation, more erosion/sediment production, more sediment processing, more pollutants flushed into river.
- Cuyahoga River is expanding and modifying floodplain dynamics, less stable, lack of equilibrium
- Dredging: 200,000-250, 000 cubic yards/year. One CDF is a bird sanctuary.
- Port approach: systems-based environment. Changing how sediment is valued: as a commodity to be harvested.
- Sediment choreography: "dance with physics" instead of imposing will
- Have created a pre-planned system to capture marketable sediments.
- "Sluiceway" allows hard material to settle for harvest.

Todd Danielson, *Avon Lake Regional Water District*

Water Utility Adaptation

- To what should we plan? For the "worst" with flexibility
- Tool for water quality change detection
- Re-bedding 1/3 of filters to improve treatment ability
- PAC
- Increasing storage of finished water: +5 mil gallons
- Power: adding capacity for power generation, all "green"
- Wastewater collection: Lateral loan program to help pay for separation
    - Chemically augmented biological nutrient removal

Matt Schmidt, *Trust for Public Land*

- Land for People Services: gray infrastructure: 7 tunnel systems
    - Green infrastructure: create a quality park, trail within 10-minute walk of all homes
- Listening campaign: what's important, what are ongoing investment campaigns?
    - Identified "opportunity areas": based on land-use, topographic changes, neighborhoods: evaluated on 1-5 scale based on potential benefits to people, education, greenspace. Ranked neighborhoods based on impact that investment could have.
    - Projects along tunnel work: brings "identity"
- How does green infrastructure relate to gray infrastructure?
- How are they funding green spaces?
- All the payers in the communities. Those that are funded by the district because of fairness, have to focus on the infrastructure itself, and it has brought regional connectivity.

Questions

Identifying emergent practices

- Joel Bingham: Application of field tiles on inputs into streams, filters on the end of pipe, a retrofit. Also lots of farmers are getting more scientific on their application of fertilizers, putting only what the soil needs rather than a blanket.
- Along that line: drone applications for agriculture to do a variety of things.
- Citizen science projects, there are many but could be more. In regards to stream monitoring: Community members could be doing citizen science to assess stream phases that Joel referenced in his presentation.

Identifying Challenges

- Many state agencies, local government, other areas are still not able to admit that climate change is real. In many cities we are adapt to extreme weather, not climate change. Lack of accepting science is a major stumbling block.
- Tendency for looking at short-term, nothing further than next election cycle in making funding decisions, shortage of funding that can go over longer periods of time.
- Also alluded to this morning, silo culture of governance, we work in an environment where roles are passed back and forth but don't all come to the table.
- US EPA has started to accept integrated water management, but only on larger scale, not smaller. We don't have consent decree. Set up for large cities and not smaller areas
- There is a gap of tools and knowledge
- Basic zoning codes each community has own zoning, if you don't have larger scale consent decree, it becomes hodgepodge between communities in same watershed.
- Doing zoning codes takes awhile
- Enforcement of zoning codes
- Endurance of technology: slow to be accepted at Municipal level
- Tight budgets: risk of failure, community can't accept risk of failure without insurance guarantee
- When collaboration happens: network is closed, don't bring in private business, same network doing all planning
- Design approach is shifting how we are doing vulnerability: challenge is management and maintenance, once somewhere is restored.
- Adding, as an engineer, if I design something, should give the owner confidence of endurance, if not: the fault is on engineers. Thus engineers will be conservative in decisions

Who or what organizations are not engaged in learning?

- Many community decision makers are not up to speed on these issues, unless entire city is firing on all sides, hard to make these decisions. Small communities don't have enough decision makers who know what's going on.
- Leadership within engagement process: if there isn't an interest, it won't happen. If leaders don't push an issue, it won't happen.
- Business side: Venture capitalists should be brought in

Identifying assets

- Are we planning for a non-existent future or are we adjusting governance to account for a range of possible future scenarios?

What else was significant that you heard about?

Questions that Participants had for presenters:

- *Comment*: Presenters should talk about collaboration and embedding community values in practices:

- Anthony Body: The ultimate goal is to get interest in what the company is doing
- Joel Bingham: there are many ways to make "goals" in restoration practices, which usually focus on aesthetics: what are some other inherent values present in restoration practices? We need community folks to put in real goals. A couple would be, people have been looking at streams in the same way forever (condition A) changing perception is a huge benefit, and functional perception change goes along with that. I try to give the impression that flooding is not all that bad, utilizing flood plains is the goal- "we have a Cadillac in the garage we never drive." Areas like West Creek Reservation are not

being used. Space is not being utilized effectively. Would love to see some education in community and schools.

- Anthony Body: Growing up, going to different places like Cuyahoga Valley etc., we've moved away from that, we need an all hands on deck approach, many organizations need to approach from all sides.
- Question about the Ambassadors program to Anthony Body: where the ambassadors legit?

- Anthony: Absolutely, close proximity, part share with family and friends, allows transparency in community to those directly impacted.

Identifying Challenges (2C)

- Port of CLE faces a lot of challenges, educating people here.
- The quality of the settlements in the lake. Engineers come up with their own conclusions that the settlements are clean.
- Quality of their science vs. EPA.
- Compliance with the coastal zone management plan
- No new biochemical can be put in the lake was not addressed by the judges.
- One methodology but they need to rethink their model for the great lakes. How to do dredge material handling on the great lakes, because it's different and it's drinkable water. Unique circumstance in the great lakes.
- The court works by themselves. From the federal level we should be pushing for the court to
- The court took too long to review the plan, longer than it took to build the plan. A frustrating working environment.
- Collaboration is fun.
- Managed to move material into the market. · 3 million yards of material. Brought back into the city for urban renewal
- Partnership with the city of Cleveland

Questions for presenters (2C):

- Where insurance companies involved in constructions close to the lake?
    - They were self-insured. Rich people who want a house near the lake. If they want to live in the water, they are going to live in the water.
- Fixing the insurance system is a big part. FEMA tried but got a kickback
- Mayors who get elected by how dry they can keep the streets. They do the wrong thing.
- Try to get them good for the winter but ruined for the rest of the year.
- The more corrosive we put on the street the harder it gets to manage, so it's not easy to manage climate change.
- Areas that have more ice formation get more salt put on and more potholes later on.