Assessment of Ohio Stormwater Management
for the Stormwater Incentives in Lake Erie Basin Project

Written by the Consensus Building Institute
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I. Executive Summary

This assessment report summarizes the results of interviews with 18 stormwater professionals in Ohio. It synthesizes the themes from their interviews, focusing especially on what is working well now in Ohio related to stormwater management and where there is room for improvement. The results of this document will be used to guide the Stormwater Incentives in Lake Erie Basin Project, a three-year collaborative research project that is just getting underway.

II. Introduction, Background and Methods

Background on Previous Needs Assessments Ohio stormwater professionals have identified their needs in numerous evaluations and assessments in the past few years, describing what they think would improve stormwater management practices in their region.[1] In a recent Ohio Coastal Training Program (CTP) assessment of local official training needs, 85% of respondents and 100% of city and village engineers indicated they were interested in receiving training and technical assistance on stormwater management. Stormwater professionals identified the need for dialogue among local and state governments, design guidance and training for stormwater professionals and decision makers, and quantitative data on innovative BMPs. Past participants in Ohio Coastal Training Program workshops have requested design manuals and training or a certification program including research results, case studies, cost analysis, site visits, and consistent state guidance. A majority of respondents to the 2011 Ohio Stormwater Conference evaluation expressed interest in training on low impact development (86%), including practices such as bioretention (90%), constructed wetlands (82%), and pervious pavement (82%). Nearly all respondents indicated they were interested in training on the water quality performance (95%), and design and sizing (88%) of stormwater systems. Sixty-three percent (63%) requested that training include local examples and 44% requested model ordinances and resolutions. At a 2010 stormwater design workshop for engineers, participants identified regulations, including water quantity control requirements and conventional zoning, as a top barrier to implementation of new approaches.

Of Ohio stormwater professionals responding to a 2011 survey on climate training and information needs in the Great Lakes region, half to two thirds of participants said they do not feel well informed on ways to prepare for the impacts of climate change (50%), they need more

[1] These needs assessments include the Training and Technical Assistance to Inform Land Use Planning and Protect Water Quality in Ohio's Lake Erie Watershed – A Front End Evaluation of Local Official Needs, the 2008 Northeast Ohio Stormwater Conference Program Evaluation Summary, the 2009 Workshop Evaluation Summary of workshops sponsored by the Northeast Ohio Storm Water Training Council, the NOAA Great Lake Climate Needs Assessment (Lake Erie Watershed Respondents), and numerous focus groups in which Ohio stormwater professionals provided input that helped shape design of training programs.

information about the regional impacts of climate change (67%), they need more information about climate change impacts on stormwater infrastructure in order to effectively do their jobs (60%), and they desire information on economic costs and benefits of climate change impacts and adaptation strategies (70%).

Overview of the Current Project: In response to the many types of information and support stormwater managers in Ohio have asked for, a group of researchers led by staff at Chagrin River Watershed Partners, Old Woman Creek National Estuarine Research Reserve, and the Ohio Department of Natural Resources (ODNR) sought and received funding for a three-year project in which participants will develop science-based policy and tools that promote the use of stormwater practices that minimize the impact of stormwater on Ohio's coastal communities and Lake Erie. Municipal and consulting engineers, stormwater utilities, developers, regulators, and watershed organizations will collaborate with the project team to generate credible, and locally verified performance information for innovative stormwater systems. Based on these results, the team will develop credits and incentives to encourage the use of the most effective systems. The project is called Stormwater Incentives in the Lake Erie Basin.

This Needs Assessment: As this project got underway in late 2011, project leaders decided they wanted to talk confidentially with local stormwater professionals about current challenges and opportunities to be sure the project is relevant to current needs and to gather information on how the project might provide truly useful results.

This report summarizes the findings from a series of confidential interviews carried out in December 2011 and January 2012 about the state of stormwater management today in coastal Ohio. Ona Ferguson of the Consensus Building Institute, who is part of the Project Team, did the interviews and subsequent analysis with support from Heather Elmer of Old Woman Creek National Estuarine Research Reserve.

Eighteen people were interviewed for this assessment. Others were invited to participate in the interviews but either did not respond to interviewer requests or had scheduling conflicts. Interviewees included stormwater program and utility managers, developers, architects, engineers working in both the public and private sector, state regulators, superintendents of public works and transportation, and county park and soil and water conservation districts. The group was selected to provide a wide range of different perspectives on the current state of stormwater management in Ohio and opportunities for moving forward, with a special emphasis on individuals who were invited to participate in the three-year research project as members of the project's Collaborative Learning Group. Interviews took between 30-60 minutes, and were carried out via phone. The list of interviewees is included in Appendix A. Participants were asked to speak honestly and were told that responses would not be attributed to specific individuals. The conversations were loosely guided by an interview protocol, which can be found in Appendix B.

This report captures the findings from these interviews. It is meant to reflect the range of interviewee perspectives and ideas. Statements have not been fact checked for accuracy. This document captures interviewees' concerns, suggestions and ideas, highlighting those heard numerous times and across types of perspective. It is not intended to be comprehensive, but rather to highlight key issues that arose across interviews and to be a useful summary of interviewee input. A glossary of stormwater terminology can be found in Appendix C.

The issues and concerns identified in this assessment largely echo those identified in the previous needs assessments described above, while also providing some additional nuance and detail. The assessment confirmed that the three-year project, as proposed, should address many current barriers to stormwater management in Ohio.

III. Defining Successful Stormwater Management

Interviewees began by describing the components they consider part of successful stormwater management. *Successful stormwater management, as explained by interviewees*:

- Begins with a regional or city-level planning approach first, then focuses in on site planning, design and implementation.
- Is a systems approach and includes consideration of the wider watershed, not just an individual site or parking lot.
- Requires good communication among and the combined expertise of those people and groups making stormwater-related decisions.
- Means real comfort among landowners, architects/designers, developers, and permitters with both the causes of stormwater pollution and the practices that can address those concerns.
- Balances all development project goals well including budget, design, environment and safety.
- Begins with addressing stormwater needs and opportunities early in site design.
- Mimics nature.
- Mimics pre-development or pre-agricultural hydrology.
- Reduces flooding.
- Addresses both water quality (producing clean effluent) and quantity (retaining water, infiltrating on site).
- Slows and improves the quality of any runoff.
- Treats water at the source.
- Disconnects hard surfaces and reduces impervious surfaces.
- Uses small best management practices (BMPs such as bioswales, pervious pavement and bioretention) instead of end of pipe basins, increasing on-site infiltration.
- Is cost effective.
- Meets the landowner's development goals.
- Prevents impacts downstream.

IV. Current Stormwater Management Successes in Coastal Ohio

We asked interviewees what is working well right now in Ohio related to stormwater management, whether incentives, programs or regulations encourage good action, and for examples of projects where stormwater has been managed "right." Their responses are grouped here by theme, and it is worth noting that most people could not quickly come up with examples of projects that "got stormwater management right."

Certain Communities are Leading. People noted that there are some Ohio communities that are taking a lead on stormwater management, notably large metropolitan areas.

Stormwater Utility Structure is Effective. Stormwater utilities are funding BMPs and other cutting edge stormwater projects. People said Soil and Water Conservation Districts are helping move stormwater management practices forward.

Gradual Adoption of New Approaches. Pervious pavers, constructed gravel wetlands and other BMPs are being included in some projects, and these projects are slowly showing the stormwater community in Ohio how to design, install and manage such approaches. Where installed, these BMPs are starting to allow for more infiltration on site than is found with more common stormwater management approaches.

Some Giving Credits for LID. At least one County (Lucas)'s stormwater utility is crediting projects for addressing water quality and LID.

There Is Regional Leadership. Northeast Ohio was described by many interviewees as being advanced on LID and BMP adoption as compared with other regions of the state. The Northeast District of Ohio EPA was mentioned multiple times as supporting LID approaches to stormwater management and helping lead the way.

Regulatory Requirements and Local Codes Are Becoming Stronger. NPDES Phase II requirements are causing communities to require more stringent stormwater practices and, largely but not exclusively tied to those requirements, community codes on stormwater management are getting more strict and requiring higher performance.

Bioretention Is Starting to Be Accepted. Acceptance of bioretention is variable across the region. It is accepted in some communities, but in other communities there are concerns that they might lead to basement flooding and about how the systems function in clay soils.

Watershed General Permits Are Beginning to Require Infiltration. The Darby Watershed General Permit includes infiltration requirements in its post-construction language. This watershed-scale approach is new for Ohio, and this watershed is leading the way.

Trainings Are Available. There are some good trainings available to raise awareness of stormwater management issues and approaches. The Coastal Training Program's efforts were noted by multiple people as effective, though someone mentioned they are limited by funding constraints. It was noted that the Ohio Stormwater Association also intends to begin to offer trainings and that the Northeast Ohio Stormwater Training Council convened by the Ohio EPA and regional partners provides a range of training for stormwater program managers.

Stormwater Community Collaboration. Many noted that the stormwater management community has becoming increasingly collaborative in the last three years or so. They said that spirit is growing, and with it comes some (positive) peer pressure among stormwater managers to use better practices, as people share information about good projects and discuss the successes and challenges of different projects. People noted especially efforts by the Ohio Stormwater Association, watershed groups, and Chagrin River Watershed Partners.

Developers are Building Compact Developments. An increasing number of subdivisions are being designed for conservation and compact development, which helps to protect Ohio's wetlands.

ODNR Stormwater Manual is Trusted. People said that most municipal engineers trust the ODNR stormwater manual, so it should be regularly updated to include any effective new practices.

Financial and Marketing Incentives for Using BMPs. Firms that choose innovative stormwater BMPs such as rain gardens or bioretention in place of traditional practices have found that these practices improve the appearance of individual lots and make them desirable. This means there is no more "last lot to sell" with an unsightly detention basin right beside it. Often sites with BMPs are the first to sell, which creates a financial incentive for developers and designers to use BMPs. In addition, interviewees described free publicity in the form of news reporting on successful projects (such as publicity around LEED certification or other green activities).

Champions Achieve BMP Adoption. When a project manages stormwater in the best possible way, people said there is often a champion behind the project who is focused on stormwater. This could be a designer, developer, landowner or municipal official who raises the issue of stormwater and shepherds it all the way through the project.

Other Successes Noted by Interviewees:

- There has been some stream restoration to recreate floodplains in urban areas.
- There are some federal funds available for stormwater public works projects, and a state alternative stormwater infrastructure loan program.
- There has been a reduction in impact from development on streams and on downstream owners.
- Pervious pavements can work well on public roads and will require homeowner acceptance to be installed on private roads.
- The stormwater credit manual for the Northeast Ohio Regional Sewer District will likely give credit for BMPs in utility rates once the program is active.

V. What Could Be Working Better and Suggestions

We asked interviewees to share their thoughts on what could be working better and what they see as the most significant barriers to effective stormwater management in Ohio. Interviewees described the following concerns and issues. When naming challenges, people sometimes offered ideas of how to address them, which are listed here as suggestions for improving stormwater management. Those suggestions that are intended to be addressed during the project have been noted with an asterix.

Behavior Change is Difficult. One theme across interviews was the difficulty of changing behaviors and practices when there are so many individuals and organizations taking site-specific action on stormwater. People talked about different methods for changing behavior including education, incentives, peer pressure, examples, and regulations and discussed the pros and cons of trying to inspire or push people to adopt new practices.

Balancing Among Stakeholders and Goals. We heard that one challenge for many stormwater professionals is figuring out how to best provide value to the landowner, the public, shareholders and people downstream. There are difficult decisions to be made about who will bear what costs and who will reap the benefits. Stormwater professionals must also balance project goals including budget, design, environment and safety.

Concerns about Costs and Maintenance. Cost concerns prevent people from trying new stormwater management approaches. Several people asked for cost data in rural settings. Several noted that stormwater management is sometimes seen as an unfunded mandate. People noted that some engineers and others are concerned that BMPs need maintenance (for example, porous pavements need to be cleaned twice a year), and that long-term maintenance costs more than maintenance of non-LID stormwater management approaches. However, other interviewees noted that all stormwater management systems need maintenance.

> Suggestion: Gather cost data under real conditions over time. * [This project will address this in a limited fashion.]

> Suggestion: Quantify the benefits of keeping soils and land in a natural condition.

> Suggestion: Quantify the benefits of non-structural post construction BMPs.*

Newness Causes Discomfort. People described a fear of what can seem like exotic solutions and a desire to keep using approaches that are "the way we've always done it." Some communities are still focused on the pipe and pond approach, especially rural communities.

> Suggestion: Communities that want to encourage LID should feature demonstration sites on their land, showing they believe these approaches work and will invest accordingly while also showing them in the real world.*

Few Incentives to Change. Almost to a person, interviewees said they are not aware of any formal programs or incentives to support adoption of effective stormwater approaches. They also expressed concern that stormwater regulations might negatively affect economic development for a community.

> Suggestion: Create programs and incentives and credits for stormwater runoff volume reduction for contracts and operations to encourage new stormwater approaches.*

> Suggestion: Collect data on how much volume credit to give for different BMPs, so communities can decrease detention requirements for sites with significant infiltration.*

Limited Resources Prevent Exploration. Many communities have limited staff time to focus on stormwater, and so fall back on to tried and true practices rather than taking extra time to research additional opportunities and approaches.

Distrust of BMP Effectiveness. Many interviewees said they need to know more about BMPs to start using them. People wanted to know how well the BMPs work in terms of infiltration, especially in clay soils and under Ohio's cold winter conditions. Several mentioned that it is important to know that infiltration from BMPs will not flood resident basements.

> Suggestion: Gather performance data on BMPs in Ohio, especially on pervious pavement (ideally side by side with impervious pavement).*

Limited Understanding, Awareness and Citizen Concern. The problem of stormwater is largely invisible to regular citizens. They do not see the problem with current stormwater management practices and do not understand the reason for the requirements. People think of stormwater as an engineering problem rather than seeing it as a quality of life issue in which good stormwater management protects our homes and communities and is the right thing to do.

Suggestion: Show the extent to which LID practices decrease flooding (a significant resident concern related to stormwater), then residents would start supporting LID.*

Suggestion: Homeowners need to be educated not to undermine new systems, by doing things like ploughing over bioswales or salting driveways thereby inadvertently killing raingarden plants.

Suggestion: Focus on making stormwater a priority.

Suggestion: Consider quantifying the importance of the natural soils and condition of a site (ecosystem services) to help citizens understand the problems associated with poor stormwater management.

Suggestion: Communities should be proactive about stormwater management rather than being reactive to citizen complaints.

Regulations Inconsistent and Overlapping. People noted that some local codes require practices that may not be current best practices. Some require downspout connections to the sewer, while EPA regulations seek the opposite. Some require developers to clear an acre of woods to put in detention ponds, when keeping the land and soils in a natural condition might have the same end effect at less cost. Interviewees said both state and local regulations (including those of the Army Corps of Engineers, the Soil and Water Conservation Districts, EPA and communities) should be revised so there are consistent standards across the state. They described inequities among Ohio's EPA regional requirements, which influence how communities view Ohio Stormwater regulations. It is hard for communities to keep up with rule changes, and some are just now catching up to the requirements set five years ago. Others wonder whether there may soon be stormwater requirements for parcels smaller than an acre. Regulations should serve as guidance, and people said EPA should set the bar higher with a unified approach across the state in design methods and standards (for engineering practices and municipal oversight).

Suggestion: Numerous people said that Ohio needs an updated stormwater manual.*

Suggestion: Several people said that it would be good if there were additional technical assistance for local governments to help them draft good stormwater regulations.*

Suggestion: Ohio EPA should approach their stormwater work with uniformity and a collaborative spirit and be aware that the statewide approach is key in how communities perceive stormwater requirements.

Regulations Inflexible. Many people noted that they are unable to design BMPs because state regulations are too rigid. They said the ODNR approved list prevents them from innovating and adopting other, newer approaches. We also heard that communities are fearful of being creative due to the possibility of an EPA audit.

Suggestion: Find a way to approve creative piloting of new approaches that is not burdensome in terms of time and process.

Suggestion: Agency review of projects should include a review of the unique circumstances of each site (location in watershed, unique watershed qualities, etc.) to make approval decisions, rather than being one-size-fits all.

Retrofits Are Difficult to Address. People said that it is not yet clear how to encourage, inspire or require people who buy already developed (usually commercial) sites to retrofit the stormwater management approach. There is no requirement for owners to retrofit properties. A couple of people noted that during slow economic times, people shift their attention to retrofits instead of focusing exclusively on new development.

Efforts are Not Yet Well Coordinated. Interviewees indicated there is room for more coordination and collaboration, and that while this has begun within the stormwater management community there is more to do to share lessons learned and create opportunities to work together to improve interconnected systems of education, management and regulation. There need to be more joint efforts to do what needs to get done, now that there is a shared understanding of what is needed. Someone suggested that the public probably cannot differentiate between the array of organizations working on stormwater in Ohio (including ODNR, Soil and Water Conservation Districts, the Northeast Ohio Areawide Coordinating Agency and others).

Suggestion: It would be more effective (as far as impact and efficiency with limited resources) if there were one overall plan guiding the direction of stormwater efforts in Ohio. It would be good to have an Ohio Water Environment Association or Federation (including government, regulated community, professionals, etc.) with a larger scope than that of the Ohio Stormwater Association to agree on problems, goals, approaches needed, informational needs, and then to pool resources to tackle particular problems in a logical sequence.

Trainings Are Too Broad. People noted that there are multiple available stormwater management trainings but that these often target too diverse an audience in a given session.

Suggestion: Design trainings about BMPs for more narrow audiences such as engineers, municipal officials or architects.*

Suggestion: Train architects through "Lunch And Learns" where trainers visit an architecture firm mid-day, provide lunch, and educate architects about a particular topic. Architects, who often set the vision for a site, could then become advocates for BMPs.

Suggestion: Educate realtors in basic watershed and stormwater principles so they understand BMPs when they see them.

Ineffective Wetland Protection. A couple of interviewees noted that stormwater management is linked with wetland management, and that protecting isolated wetlands and doing good stormwater management on small residential sites may not make a significant difference to wetlands and wildlife, especially in degraded watersheds.

Suggestion: One interviewee suggested considering the Ohio Wetlands Foundation's model of a bank of clustered high-quality wetlands that are professionally managed and for which developers could buy credits.

Misuse of Stormwater Rules. Several people noted that stormwater rules are sometimes used to prevent development rather than to enhance ecological objectives, which gives stormwater management a bad name.

Need Higher Standards for Practices. Several people said few contractors currently have a good handle on new approaches to stormwater management and that there ought to be higher standards for engineering practices and municipal oversight, though others noted exceptions to this.

Little Whole-Site Design. Interviewees said that even in the most advanced parts of the state where there may be several LID practices on a given site, there is generally not yet a site-wide conceptual approach to design effective stormwater management.

Agriculture Dwarfs Residential Development. Many people noted that residential development covers a small percentage of Ohio lands as compared with agriculture, and said that as long as parcels in agricultural use are exempt from zoning and stormwater regulations, there will continue to be substantial stormwater problems both due to runoff volume and pollutant loads. They indicated that managing stormwater through residential small-lot actions is an uphill battle in the face of current agricultural practices.

VI. Precipitation Patterns and Information Needs

Interviewees were asked whether the possibility of changing precipitation patterns has altered how they do their stormwater-related jobs, and whether there is other information they would like about precipitation in the future.

Most people said they are not concerned about this issue. They said that engineering standards are generally conservative enough to meet current and future needs. They design for the "middle of the road," using "common sense, with infiltration when possible," knowing that there will occasionally be significant storms that may cause problems. They said that they base their designs on rainwater atlases (such as NOAA's Midwest Atlas on Precipitation Values), which are good sources of data, and will continue to do so and so hope the atlases and other state agency sources will keep their recurrence interval storm charts and predictions updated. Interviewees said they are not discussing this topic much in their work. They expect that state agencies use the most current data, and are generally content with that.

Some interviewees indicated a desire to know more about predictions of rainfall frequency, storm intensity and duration in the next decade or two (i.e. what constitutes the 10 year or 100 year storm). A few noted that 2011's significant rainfall caused members of the public to ask them what is going on with rainfall and storms.

VII. Trustworthy Data Sources

We asked people to reflect on those data sources they most trust, considering what type of entities should gather data on BMP performance in Ohio if the goal is for the results to be useful and trustworthy. Most people said they most trust state-level government agencies. Noted in particular were Ohio Environmental Protection Agency (Ohio EPA), Ohio Department of

Transportation (ODOT), and the Ohio Department of Natural Resources (ODNR). Many also said they have high levels of trust in work done by federal government agencies like the National Oceanic and Atmospheric Administration (NOAA), US Geological Survey (USGS), and the Environmental Protection Agency (USEPA). One person said federal agencies are the least trustworthy, and a few others noted that there is some pubic mistrust of federal agencies and that their work feels somewhat distant. Soil and Water Conservation Districts are in general highly regarded.

Universities are also well-respected and trusted to do good research, and the University of New Hampshire Stormwater Center was mentioned repeatedly. The American Society of Civil Engineers was suggested as a good source of data. There was some support and some concern about non-profits linked to the reputations of the organizations and their charge. People noted that the purpose driving the research is important, and they have to believe research is being done to answer a question, not to prove or support a pre-determined outcome. Some noted that non-profits have the advantage of being outside of politics compared to other groups. Many interviewees mentioned that they are very comfortable with the Chagrin River Watershed Partners and expect that their projects will be well done.

Several people mentioned that it is imperative that engineers be involved in any stormwater project, especially if engineers are one of the intended audiences for the research results. People said that involving contractors in this effort would show whether it is truly possible to install BMPs, get them approved and keep costs low. And one person mentioned that it would be great to have contractors and installers involved in any demonstration site, as they would be able to describe concretely how a particular BMP works on the ground. Finally, someone mentioned that it would be nice to have coordinated or standardized data collection systems so that different stormwater data sets can be compared.

VIII. Acceptable Geographic Range

What is the geographic range within which any projects should be carried out for the results to be most useful to the people we spoke with?

People said they want data collected in a real, not controlled, setting. Their preference is for data to be collected in their own watersheds, northern Ohio, Cleveland, Toledo. The closer to home the better, as people said that there are some who will discount data from other places. Someone mentioned that having demonstration sites in a 50-80 mile radius would be good because then they could easily visit the sites. Interviewees said they would like data from their watersheds and other similar places with swampy areas, clay soils, lots of agricultural land, flat ground, and winter conditions with salt. If data is collected further afield, that is acceptable as long as it is made clear which conditions are similar to those in coastal Ohio and which are different. People expressed a desire for data collected in places with similar soil types, climate, and conditions. Some said data from neighboring states could be helpful. Others noted that data from further away could even be helpful as long as the natural system in which the data was gathered was clearly described so researchers could appropriately determine what lessons could be translated for use in Ohio.

IX. Recommendations for the Three-Year Research Project

"*If [this project] can create natural [stormwater management] systems that are relatively inexpensive and that can enhance the look of a site, that would be perfect."* - Interviewee

In addition to the suggestions offered to address particular concerns and challenges above, interviewees had some comments and suggestions regarding the Stormwater Incentives in Lake Erie Basin project more generally. First, many interviewees considered various ways to change practices that are carried out by thousands of people, noting such a goal is necessarily challenging. They considered ideas about altering incentives, increasing peer pressure, providing examples of real sites, aligning regulations, improving and deepening education efforts, and other suggestions noted above. They then added the following:

- Consider engaging farm service organizations in this project, as the agricultural community needs to learn about stormwater management.
- Provide high quality technical assistance and incentives in order to have a significant impact on stormwater management at this stage.
- Any tools or models produced from this effort should not be too intricate if they are to be used by a diverse audience. For example, most municipal engineers use TR55, so EPA's SWMM model, which uses dynamic hydraulic modeling, might seem daunting
- Good stormwater management would be of great value to the region because it could help decrease Harmful Algal Blooms (HABs) in Lake Erie. Harmful Algal Bloom result from excess loading of phosphorus and nitrogen, nutrients commonly found in animal and human waste that can enter streams and Lake Erie through agricultural and residential lawn runoff, improperly functioning septic systems, combined sewer overflows, or through erosion of nutrient-rich soil.
- The Ohio stormwater community needs design parameters or criteria around the use of natural infiltration. There should be a way to quantify the value of keeping a site in a natural condition, versus clearing it. People would like a formula for letting water run through a natural area so they can show that letting stormwater run through the back lot will serve the same purpose as putting it in a pipe to a basin.
- The collaborative nature of this project means it has built in checks and balances that encourage those we interviewed to trust project results.

Appendix A: People Interviewed

Dan Bogoevski, Stormwater Program Coordinator, Ohio EPA, Northeast District Office

Justin Czekaj, Municipal Engineer, City of Aurora

Eric Dodrill, Highway Superintendent, Perkins Township

Alexander B. Etchill, Associate Engineer Surveyor, John Hancock and Associates, Inc.

Ken Fortney, Drainage Manager, Erie County Engineers Office

Lynette Hablitzel, Stormwater Coordinator, Ohio EPA, Northwest District Office

John Hancock, President, John Hancock and Associates

Keith McClintock, Deputy Director, Geauga Metroparks

Tim Miller, Director, Lake County Stormwater Management Department

Jay Moseley, Hydrologist and Stormwater Engineer, URS

Todd Roth, Director of Engineering Services, City of Sandusky

William Sanderson, Vice President of Joint Ventures, Forest City Land Group

Greg Schmid, Architect, Poulos + Schmid Design Group

Leonardo Sferra, Site Development Project Manager, GPD Group

Carmella Shale, District Director / Engineer, Geauga Soil & Water Conservation District

Harry Stark, Assistant Director of Public Service, City of Wadsworth and Chair, Ohio Stormwater Association

Rachel Webb, Watershed Team Leader, Northeast Ohio Regional Sewer District

Paul Wilkerson, Construction Supervisor / Civil Engineer, Summit Metroparks

Appendix B: Interview Protocol

The following list of questions was used as an interview guide.

1. YOU
    a. What is your name, affiliation and title?
    b. What is your role and expertise related to stormwater management?

2. EFFECTIVE STORMWATER MANAGEMENT: How would you define effective stormwater management, looking at everything from site design, to different treatment processes, to BMPs? (technical)

3. THINGS WORKING WELL
    a. What is working well in Ohio right now related to stormwater management?
    b. Can you give me an example of a project where they really got it right? Why do you think that project worked so well?
    c. What existing programs or incentives seem to be encouraging/facilitating effective stormwater approaches?
    d. Do state and local regulations in your region encourage developers and/or municipalities to incorporate effective stormwater management approaches? Why or why not?

4. ROOM FOR IMPROVEMENT
    a. What could be working better? Follow up as needed: If there were one thing you could change, what would it be?
    b. What are the most significant barriers to more effective stormwater management in Ohio?

5. PRECIPITATION PATTERNS
    a. How has all the talk about climate change and the possibility of changing precipitation patterns affected how you approach your job or your projects?
    b. Can you think of any information on precipitation or precipitation patterns that, if available, might help you address future projects?

6. RESULTS: What kinds of results and information would you most trust?
    a. For example, would you feel comfortable with data collected by a federal agency?
    b. Information collected elsewhere for similar ecosystems under similar climatic or geography conditions
    c. Does it need to be generated specifically from and for Ohio?

7. Is there anything I should know about the different organizations and individuals involved in stormwater in the Great Lakes region?

8. Do you have suggestions for who should be involved in or engaged in this initiative?

Appendix C: Glossary

Glossary sources can be found on page 15.

Atlas 14 - Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 3.0, G. M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley, NOAA, National Weather Service, Silver Spring, Maryland, 2006. NOAA Atlas 14 contains precipitation frequency estimates with associated confidence limits for the United States and is accompanied by additional information such as temporal distributions and seasonality. The Atlas is intended as the official documentation of precipitation frequency estimates and associated information for the United States. It includes discussion of the development methodology and intermediate results. The Atlas supercedes precipitation frequency estimates contained in past NOAA publications including Technical Paper No. 40, NWS HYDRO-35 and Technical Paper No. 49. The updates are based on more recent and extended data sets, currently accepted statistical approaches, and improved spatial interpolation and mapping techniques.

BMP – Best Management Practice Best Management Practice (BMP): Techniques used to lessen the environmental impacts of land use. These techniques may involve structures, vegetation, or altering construction operations.

Green Infrastructure refers to natural systems that capture, cleanse and reduce stormwater runoff using plants, soils and microbes. On the regional scale, green infrastructure consists of the interconnected network of open spaces and natural areas (such as forested areas, floodplains and wetlands) that improve water quality while providing recreational opportunities, wildlife habitat, air quality and urban heat island benefits, and other community benefits. At the site scale, green infrastructure consists of site-specific management practices (such as interconnected natural areas) that are designed to maintain natural hydrologic functions by absorbing and infiltrating precipitation where it falls.

Infiltration: The gradual downward flow of water from the surface through soil to groundwater.

Low-Impact Development (LID) is a stormwater management approach that seeks to manage runoff using distributed and decentralized micro-scale controls. LID's goal is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source. Instead of conveying and treating stormwater solely in large end-of-pipe facilities located at the bottom of drainage areas, LID addresses stormwater through small-scale landscape practices and design approaches that preserve natural drainage features and patterns. Several elements of LID—such as preserving natural drainage and landscape features—fit into the Green Infrastructure approach described below.

NPDES Phase II - In December 1999, the United States Environmental Protection Agency promulgated the Stormwater Phase II Rule expanding the National Pollutant Discharge Elimination (NPDES) stormwater program. The Phase II Rule extends coverage of the NPDES stormwater program to operators of *small* MS4s (Municipal Separate Storm Sewer System), located in urbanized areas that serve populations of less than 100,000. The Rule requires Phase II communities to develop stormwater management programs that: Reduce the discharge of pollutants to the *maximum extent practicable (MEP)*; protect water quality; and satisfy the appropriate water quality requirements of the Clean Water Act.

Porous Pavement: An alternative to conventional pavement whereby runoff is diverted through a porous asphalt layer and into an underground stone reservoir. The stored runoff then gradually infiltrates into the subsoil or an underdrain system.

Post Construction Stormwater Management Practices: Those practices designed for the treatment of stormwater pollutants and effects of runoff after construction is completed.

Recurrence interval: Also known as the return period, it is the average period between precipitation events or flood events of a certain size based on the records and statistics.

Storm Water Management Model (SWMM) - The EPA Storm Water Management Model (SWMM) is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. http://www.epa.gov/athens/wwqtsc/html/swmm.html

Stormwater Treatment: The removal of pollutants from urban runoff and improvement of water quality, accomplished largely by deposition and utilizing the benefits of natural processes.

TR-55, Urban Hydrology for Small Watersheds Technical Release 55 (TR-55) presents simplified procedures to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes required for floodwater reservoirs. These procedures are applicable in small watersheds, especially urbanizing watersheds, in the United States.

Water Quality Volume: The extended detention volume captured for the purposes of treating pollutants and protecting stream stability downstream. This volume is prescribed by the Ohio EPA Construction General Permit.

Glossary Sources:

- Low-Impact Development Design Strategies An Integrated Design Approach Prepared by: Prince George.s County, Maryland Department of Environmental, Resources Programs and Planning Division, June 1999
- USEPA http://water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm
- Ohio Rainwater and Land Development: Ohio's Standards for Stormwater Management, Land Development, and Urban Stream Protection, Third Edition 2006 Prepared by: John Mathews Ohio Department of Natural Resources, Division of Soil and Water Conservation
- Stormwater Phase II Final Rule An Overview. United States Environmental Protection Agency Office of Water (4203) EPA 833-F-00-001 January 2000 (revised December 2005) Fact Sheet 1.0 http://www.epa.gov/npdes/pubs/fact1-0.pdf
- USDA Natural Resources Conservation Service http://www.hydrocad.net/tr-55.htm
- NOAA Atlas 14 Precipitation-Frequency Atlas of the United States Volume 2 Version 3.0: Delaware, District of Columbia, Illinois, Indiana, Kentucky, Maryland, New Jersey, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia, Geoffrey M. Bonnin, Deborah Martin, Bingzhang Lin, Tye Parzybok, Michael Yekta, David Riley. U.S. Department of Commerce, National Oceanic and Atmospheric Administration National Weather Service Silver Spring, Maryland, 2004, revised 2006. http://www.nws.noaa.gov/oh/hdsc/PF_documents/Atlas14_Volume2.pdf
- United States EPA Website - Stormwater Management Model (SWMM) Version 5.0.022 with Low Impact Development (LID) Controls. http://www.epa.gov/nrmrl/wswrd/wq/models/swmm/