2013 State Nutrient Reduction Strategies Web Series

Wetlands Supplement: Incorporating Wetlands into Watershed Planning

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Instructors:

- **Cynthia Curtis,** U.S Environmental Protection Agency
- **KerryAnn Weaver,** U.S Environmental Protection Agency
- **Chad Fizzell,** Michigan Department of Environmental Quality
- **Siobhan Fennessy,** Kenyon College

Cynthia Curtis
Hello, everyone, and welcome to the fifteenth in our nutrient strategy series of webcasts. Today, we have Kerryann Weaver from US EPA, Chad Fizzell from Michigan DNR, and Siobhan Fennessy from Kenyon College. Michigan Department of Natural Resources and Environment --

Speaker
No, MDEQ, Department of Environmental Quality.

Cynthia Curtis
MDEQ, I apologize for that. All right. So, Chad, I apologize for that, but just real quick for everyone else tuning in, if you're having any technical difficulties, please type a note for me in the chat box up at the top of the screen, and I'll work with you to adjust any issues. Also, I want to hand this over to them as quickly as possible. If you have questions during their presentations, also use the chat box. They will be taking questions at the end of their presentation. And if you want to just see the whole slide, you'll notice at the top of your screen, you'll see a full-screen button. Just go ahead and hit that, and it will expand the PowerPoint to take up your full screen. So with that said, I'm going to hand it off to Kerryann.

Slide: Incorporating Wetlands into Watershed Planning: Wetlands Supplement to the Watershed Handbook

Kerryann Weaver
Thank you, Ms. Curtis. I appreciate the introduction. I just want to -- I'll introduce myself again. I'm Kerryann Weaver with the EPA in Region 5, Chicago's office. I'm in the Wetlands Branch in the Water Division, and I deal with public notice Section 404, Clean Water Act, Section 404 public notice review. I'm also responsible for reviewing Section 404 enforcement cases, and I do contract, wetland contract and grant management. I just want to thank everybody for attending. Since the supplement has been unveiled, it has been very well received. Obviously, this is good news to us. The supplement presents some fairly recent methodologies and tools which are based on a landscape approach. So we're hoping that presentations like this will help get the word out about the supplement and really reach its intended audience and be used and referenced frequently. So I'm going to spend my time really discussing the intent of the document and the content within the supplement. We feel that one of the most valuable pieces of the supplement is the case studies that we provide. So we are very lucky to have two individuals participating today that will be able to elaborate on their approaches. As Ms. Curtis introduced them, Chad Fizzell is from the Michigan Department of Environmental Quality, and Siobhan Fennessy is a professor at Kenyon College. Before I begin, I do want to recognize the contractor that worked on this project, PG Environmental, and a couple of Region 5 folks, Tom Davenport from the Nonpoint Source Program and Sue Ellston from the Wetlands Branch. We spent

a good chunk of time working through and refining the document before it was finally -- it finally hit the streets in February of this past year.

Slide: Watershed Handbook – 2008

So the document is to act as a supplement or an addendum to the EPA Watershed Planning Handbook that came out in 2008. Many of you are probably very familiar with the handbook, but for those of you who are not, the handbook is a guide to developing and implementing watershed plans to meet water quality standards and to protect water resources. The handbook itself has great value and discusses wetlands as a means to address water quality issues, but it's a rather broad discussion, and the supplement really attempts to expand on the discussion. So it is understood that watershed plans are effective tools for identifying and addressing water quality issues from both point and nonpoint source problems, but very few communities or groups were identifying wetland restoration priorities in their local watershed plans or their water quality improvement initiatives. So a barrier to this type of planning in the past is that there weren't tools or methods for assessing wetland function and condition that was able to guide restoration projects that supported specific watershed management goals. And these tools and approaches were not developed or were not well known. So this supplement is an attempt or an opportunity to present these approaches in an effort to help change the way communities and watershed groups look at their watersheds. This is an effort to try to support the inclusion of wetlands above and beyond the more broad goal of protecting wetlands anywhere in the landscape. In presenting these new tools and approaches, the supplement does draw on some key concepts in the handbook in order to begin this more detailed wetlands discussion.

Slide: Purpose

So the overall purpose of the document is to encourage the inclusion of wetland management into a watershed plan and planning, and to emphasize that wetlands play an important role in a healthy functioning of a watershed, and to reinforce that wetlands contribute to overall ecosystem health beyond what is described in the handbook. While the intent of the supplement is to share methodologies for considering and identifying wetland functions, using a landscape approach, it is also a way to encourage restoration, creation, and enhancement of wetland functions to help watershed groups achieve their watershed management plan goals and objectives. So again, a key element in the supplement is that it is promoting a landscape approach -- or a watershed approach, which is a more familiar term -- while supporting the planning processes that we have -- that are already outlined in the handbook. The document is intended for the same groups or organizations that use the watershed handbook, communities, local and state environmental agencies, basically groups that are formulating a plan and want to improve on their plan and are looking to address habitat loss, hydrologic alteration, and water quality impairments. Our goal was to make the supplement as user friendly as possible. We have broken it down into four chapters. We include four appendices, and we feel like this layout makes it useful and a quick reference and something similar to how the handbook lays out its information.

Slide: Region 5 Supplement

So the first chapter in the supplement lays out the purpose of the document, which I've kind of highlighted already, and provides a discussion on the importance and value of including or considering wetlands as part of a watershed plan. There is detailed discussion on wetland functions and values and specifically discussing functions in terms of floodwater storage, sediment retention, streamflow maintenance, nutrient transformation. So throughout the document, we provide sidebars which provide definitions which clarify what we felt were important terms or concepts necessary to understand as one considers this landscape approach to including wetlands into a watershed plan. For example, what is a landscape approach or a watershed approach, and providing definition on

functions -- wetland functions and wetland values. There's another sidebar which discusses climate change as we felt this was, like, an emerging topic that warranted discussion. The chapter also provides a brief discussion on the history of wetlands and wetland protection in the US and provides a small discussion on regulation of wetlands under Section 404 of the Clean Water Act and the role that federal agencies play. This is important if and when any work will be conducted in wetlands.

Slide: Wetland Basics

So our second chapter provides a basic wetland definition and discusses wetland type. It provides a pretty good visual representation of wetland types as they occur in the landscape. We present broad categories of riverine, lacustrine, and palustrine systems to provide a general understanding of the differences between a forested wetland, an emergent wetland, or a scrub/shrub wetland. The different wetland classification systems are also presented. The US Fish and Wildlife Service Cowardin classification system, which is used as part of the National Wetlands Inventory -- and those of you who don't know, the National Wetlands Inventory is a database of information on wetland location and type nationally. It's a very extensive wetland monitoring and mapping effort, and the Cowardin classification is used in that inventory. The HGM, or hydrogeomorphic method, is also presented. This is a US Army Corps of Engineer endeavor which classifies wetlands according to geomorphic setting, water source and transport, and hydrodynamics. The HGM was developed to begin to assess wetland function. We also talk about the National Wetland Inventory Plus. This is an effort by the US Fish and Wildlife Service to address the limitations in the HGM method and the Cowardin systems or the NWI system. Basically, they're trying to enhance the existing NWI data with HGM type descriptors, so talking about the wetlands landscape position, land form, and water flow path. The NWIPlus provides a consistent means of using NWI data to identify potential wetland functions, although its availability is not widespread. I don't want to go too much into this functional analysis because Chad is going to touch on that in his presentation. However, really laying out this basic wetland information is a good foundation for what is later explained in the case studies and is useful information for watershed practitioners or those who are involved with wetland planning -- or, excuse me, watershed planning that are not familiar with wetlands.

Slide: When to Include Wetlands in Watershed Plans

So Chapter 3 is where we start to begin that discussion of including -- when to include wetlands in watershed plans or watershed planning, and it outlines the basic watershed planning steps specified in the handbook. Four major components are planning, implementation, monitoring, and long-term management. Basically, in this section we want to emphasize that wetlands should be considered throughout each phase of the watershed planning process. Within the four major steps are nine essential elements that need to be included in every watershed plan when a goal is water quality improvement. They're highlighted in the graphic there. I don't know if it's -- it may not be very easy to see. But these elements are required to be addressed for projects receiving 319 funding, but these elements should be included in all watershed plans under any funding mechanism which considers managing water quality using a watershed approach. So in the initial planning stage, the importance of including wetlands when setting planning goals is stressed. Also, the importance of including wetlands in characterizing the watershed is also stressed. An example of a planning goal may be to increase wetland acreage in particular areas of the watershed to protect against downstream flooding or to restore or enhance a former existing wetlands near a degraded waterway to filter runoff from development in the upstream watershed. As a means of characterizing the watershed, the supplement highlights the use of GIS data, but the case studies actually provide a more in-depth discussion of the use of GIS data and how valuable it is as a starting point for identifying wetland restoration opportunities in the watershed. The supplement also highlights EPA's three-tiered assessment framework as a way to obtain information on the location and condition of wetlands in the

watershed. This is a three-level approach which starts simple, as a simple desk assessment, to the level-three approach which is a collection of more quantitative data.

The section on implementation considers how to include wetlands in implementation strategies and plans. Specifically, we talk about the use of reference wetlands to develop site plans, general information on wetland restoration, enhancement, and creation techniques, and site-specific design factors to consider when actually implementing a wetland project. Site selection is a critical design -- excuse me, a critical decision, and we stress that wetlands should be located basically where its functions and values are going to address specific watershed planning goals. Again, the case studies featured in the supplement consider some of these same landscape factors. We also discuss monitoring and long-term management and including wetlands in those processes and pretty much just to -- for monitoring to gauge a project progress or success in meeting planning goals and to ensure that restored wetlands are maintained to help improve water quality, water quantity, and habitat issues in perpetuity.

Slide: Case Studies

So the last chapter of the supplement highlights four case studies, one in Michigan, one in Ohio, one in Virginia, and another one in Utah. All case studies, they're rather similar. They strive to identify former or existing wetlands, using a landscape approach, and make efforts to prioritize those areas that may contribute to resolving watershed issues, such as altered hydrology, impaired water quality, or destruction or fragmentation of habitat. Chad will be presenting on the Michigan methodology, which is referred to as the Landscape-Level Wetland Functional Assessment, or the LLWFA, and their application of this functional analysis in the Paw Paw and Clinton River Watersheds. Siobhan will be present being the Ohio approach that's been focused in the Cuyahoga River Watershed in Ohio. The state of Virginia has developed an approach to identify wetlands suitable for wetland restoration, creation, and enhancement based on the functions and services they provide. The end product is a catalog which will help users select potential wetland mitigation sites under the Clean Water Act, Section 404 program. So they're hoping to expand this analysis to the entire state, and the methods here are, again, similar to the Michigan and Ohio approaches. The project in Utah is slightly different. It's an EPA study which intended to help managers envision future conditions of wetlands under varying management practices, basically forecasting and quantifying wetlands services and functions in order to understand different land use and water management decisions. The study was focused in Farmington Bay in the Great Salt Lake Basin and is aptly named the Alternative Futures Analysis, or the AFA. The modeled future scenarios were based on stated goals and objectives of watershed groups and various stakeholders and has assisted managers in making informed land and resource use decisions. Basically, all of the approaches highlighted in the supplement are straightforward, practical approaches that can be altered for use in other watersheds and states using similar national and state level datasets. They're all rooted in a landscape approach and develop methods for prioritizing where in the watershed restoration needs to occur to address specific watershed goals. It uses readily available GIS data and GIS-based evaluation models, and most of the projects are adaptable. Users can create it -- can cater it to their own watershed, include additional data and analyses, remove certain datasets, or alter the weights assigned to the different GIS data layers.

Slide: Appendices

The supplement includes four appendixes just as quick references or easy references. Appendix A is the federal programs and acts affecting wetlands in the United States. This is useful to understand, especially when a group, watershed group, does decide to implement a wetlands project. Appendix B provides information on GIS data sources that are out there and how they can obtain it, information on soils, precipitation, topography, geology, hydrology, and land use. Appendix C provides various

wetland and watershed assessment methodologies and categorizes them under the three-tiered assessment framework. For example, there's the Ohio Rapid Assessment Methodology, there's the California Rapid Assessment Methodology. It's really expansive inclusion of assessment methodologies. This is going to be very important in the planning phase of the watershed planning process, specifically when you're characterizing wetlands in the watershed. And then, Appendix D briefly highlights on restoration, creation, and enhancement techniques. This is kind of broad. Some of the techniques for each of the -- for restoration enhancement and creation may generally be the same, maybe plugging a ditch or bringing hydrology back on to the landscape. But the considerations that go into planning and implementing the techniques will vary in intensity and scale for each particular site.

Slide: Finding the Supplement

So the supplement can be found on these following websites. One is the EPA headquarters site, and one is the Region 5 site. I just want to make note that this supplement is not fully inclusive of all the potential ways to incorporate wetlands into a watershed planning process. We do highlight the four case studies, and we feel that this is just a valuable, easy-to-use resource. We try to provide a somewhat step-by-step approach, and we're trying to make it a good complement to the handbook. And the example case studies will help watershed groups or users of the document really see how wetlands can be identified to address water quality, quantity, and habitat issues. So with that, I am going to hand this off to Siobhan Fennessy to discuss the Ohio approach.

Slide: Planning Wetland Restoration at a Hierarchy of Scales

Siobhan Fennessy
I'm ready. Can you hear me? Hello?

Cynthia Curtis
Yes, we can.

Siobhan Fennessy
Okay, great. So I'll go ahead and get started, and first of all, I just want to thank Kerryann and Cynthia for the invitation to speak today and to talk about this project which actually took -- we did this project quite a long time ago. So I'm really thrilled that it's included in the supplement and sort of getting a rebirth or an additional injection of life because I really enjoyed working on this. I, again, now work at Kenyon College, but when I did this project, I worked at Ohio EPA. And we were working on piloting some approaches for taking landscape-level -- a landscape-level view of water quality and wetland restoration.

Slide: Wetland Values Accrue at the Watershed Scale

So let me see if I can make these slides work. So the problem we were working on at the time -- just a bit of background -- and this is an issue faced by, really, all resource agencies, so all of you on the line, I'm sure, think about these issues. We have still a lot of waterways in the country that do not meet basic water quality standards, and despite all the progress we've made with point sources, we still have quite a severe nonpoint source problem in many parts of the country. And nonpoint sources are estimated to account for at least 50 percent of the water quality impairment, if not much higher in many locations. So these nonpoint sources, these spatially disaggregated sources, really take a different kind of approach when thinking about improving water quality. So we started looking at watershed-based planning to restore these ecosystem-level processes and to begin to think about the broader landscape and not just look at wetland restoration or mitigation at the site-specific level. And we recognized at the time -- I should say we really started this project, I think, in 1996, so it's been a long time -- that the spatial distribution of wetlands in a watershed was important, and the spatial

distribution has a lot to do with the functions that wetlands provide on the landscape or the watershed scale.

Slide: Issues in Wetland Mitigation

We were also thinking at the time, and I know people still are, about issues in wetland mitigation. Because I worked at Ohio EPA, we talked a lot about where mitigation projects were going to happen and the kinds of issues that surrounded what was seen, particularly at the time, as some of the issues that were preventing mitigation wetlands from being very successful. So we took to heart some of the information that a study by the National Academy of Sciences had put forward, and in that they talked a lot about landscape-level issues that were not looking at landscape level -- sort of the landscape context for mitigation or restoration projects. And they said specifically that there was no preference for on-site, in-kind mitigation, that really the hydrological equivalents of that site should be considered, the hydrological equivalents of a mitigation site to replace wetland that had been permitted for 404 purposes, and that we had to be thinking on the landscape scale. And looking at sort of the historical distribution patterns of wetlands was one way to do that.

Slide: The Cuyahoga River Basin

So this is just a bit of background about how we started thinking about this project. We did work in the Cuyahoga River Watershed, and that is a watershed in Northeastern Ohio. It's kind of an interesting watershed because it changes direction. It's one of the few rivers in the world, I think, that does this. So it flows south and then does a dog leg -- I'm trying to use this pointer here -- does a dog leg and flows north into Lake Erie. It's a very, very heavily used watershed, has two big urban areas, Cleveland and Akron.

Slide: The Cuyahoga River Basin (2)

And because of its long history of industrial activity -- you can see here some photos of the harbor mouth, the river mouth -- it was designated as a Great Lakes Area of Concern as a mechanism to try to get funding and resources in to deal with some of this legacy of industrial pollution. The watershed itself, however, is about 800 square miles. It's three percent of the land area of Ohio, with about 16 percent of the population. So it has a very dense population, and the watershed has, you know, been modified by human activity as a result. We're lucky in Ohio that we have something called the Ohio Wetland Inventory. It's sort of the state-level version of the National Wetland Inventory, and so we have good wetland maps in the watershed that we could rely on, as well.

Slide: The Cuyahoga River Fires: Catalyst for Water Protection

The Cuyahoga is also famous -- I don't know -- probably a lot of you realize this, but I always think it's kind of interesting -- because it was one of the sort of -- I guess I should say it's infamous -- one of the catalysts for the environmental laws that we rely on in this country today. So like a lot of rivers in the US, through the early part of the 20th century, there were fires on the river. So this is a famous photo of the river actually burning from the accumulation of debris, oils, creosote, all kinds of stuff in the Cleveland area. And there was a large, large fire in 1969, and it got a lot of national attention. And it was really, as I like to say, one of the sparks for the sort of environmental movement to really take hold and ended up -- that movement ended up fostering the laws we have now, like the Clean Water Act. So it's kind of an interesting river historically, as well.

Slide: Development of a Site-Suitability Model for Restoration

So with all that in mind, the actual project I'm talking about today is to look at -- what we wanted to do was develop a site suitability model for wetland restoration. So where are the places in the watershed

that are suitable for wetland restoration projects to take place? As I said, this project started a long time ago, so it was really the early days of GIS. We weren't able, at that time, just to log in to the USGS website or the Ohio Inventory website and download files. At the time people were still digitizing the USGS quad sheets, so a lot of this project, sort of the background of it, was just developing the methods to put this dataset together, to knit together all these quad sheets, generate sort of in-house digital elevation model, the kinds of things now that are so routine with GIS. But what we wanted was a spatially explicit model to predict the suitability of wetland restoration for every location in that watershed. And the goal, then -- this addressed the goals, which was to avoid these sort of site-specific decisions about where to put wetland restorations and investigate how that spatial configuration of restoration sites, both restoration sites and existing wetlands, might influence the contribution of those to the watershed and its water quality. So we looked at a lot of things. Some of these I've mentioned. The hydrogeologic setting of that specific location, that has a lot to do with water flows in and out of a location, it's geomorphology, and, of course, the land use in the watershed.

Slide: Restoration Site-Suitability Model: Two-Phase Approach

We really took a two-phase approach in this. One, the first site -- or the first phase, rather, was to identify the total population of sites that are suitable for restoration. So we wanted to develop criteria or environmental indicators that would identify the total population of sites that could support a wetland, wetland restoration projects, and those -- select those sites in particular where the chances of restoration success would be high or that would have a high likelihood of success. The second phase, then, was -- we thought of it kind of as a filter. Once we identify all the potential sites for wetland restoration and sort of rank their potential for success, then where are those sites -- how can we filter out the sites and identify them, identify those that would contribute most to water quality improvement downstream or contribute to the water resource integrity, if you want to think about it that way, of the watershed? And so those were the sort of two steps we took, and I'll talk about a little bit quickly about how we did that.

Slide: Suitability Modeling: A Multi-Criteria Evaluation Using GIS

One thing we did is look at, as you might imagine, the landscape criteria, and we called these sort of the first -- well, they're all landscape criteria, but in the first instance, we look at the local characters, sort of the site-specific characteristics of a place. And I should say also, because of the way data were available or the forms in which data were available at the time, this is a raster-based GIS model. And so we looked at the site-specific characteristics, the local characters, those that really define wetlands. What kind of soil is there? What kind of saturation? How much water availability is there at that particular location? What's the land use/land cover there? And what's the topography at that site? That allows us to identify whether or not that particular location can support a wetland or not in this restoration scheme. Then we looked at what we call the neighborhood character, or the more broader landscape characters, and this is a way to look at or to characterize wetland function. What would be the function of those wetlands? How could they contribute to downstream water quality? And so in that case, we looked at things like the overland flow distance, the flow distance between a potential wetland site and a perennial stream channel, the closest perennial stream channel. That's a way to link what the wetland is doing with downstream water quality. We looked at stream order and whether or not headwater streams may be more valuable in terms of integrating wetland restoration as buffers between, say, agricultural land use and stream channels. And we looked at in-stream water quality, so what is the -- in that sub-watershed, if we sort of broke the watershed apart into little sub-watersheds, what -- how well are the stream channels in that sub-watershed meeting water quality standards? Are they attaining water quality standards or not? And if they're not, if there are some documented water quality issues in that little sub-watershed, that might be a location where restoration projects would be better suited or would do more good downstream.

Slide: Cuyahoga Watershed: Land Use as a Constraint

So land use was a constraint because there are some places where wetland restorations just can't be placed. So this just shows a map of the watershed with -- the pink areas are urban land uses, so you can see Cleveland at the top of the watershed near Lake Erie, Akron down in the southwestern part of the watershed. And then you'll see here all kinds of wetland categories, if you look at the key on the left, and that is the categories of wetlands that are identified by the Ohio Wetland Inventory. So this is just sort of land use pattern that we have in this site. The upper dog leg part of the watershed over here in Geauga County is very agricultural and suffers a lot from those kind of nonpoint issues.

Slide: Cuyahoga Watershed: Urban Land Use

Okay. So this shows the urban land uses sort of pulled out, and it shows -- this is, I guess, the biggest constraint. One thing we did say when we were doing this is that if it's an urban land use pixel, there's no way we can have a wetland restoration project. So those were eliminated from the project initially. And so we recognize that there are constraints that you just can't get around in working within a watershed.

Slide: Suitability Modeling: Multi-Criteria Evaluation Using GIS

So the first step then, as I mentioned, was to identify all the suitable sites in the watershed. Where are they located? What's the total population of sites that we can identify for wetland restoration? And so we used what we called an effectiveness matrix to extract all these suitable sites, and this is just sort of GIS jargon, sort of lining up the characteristics of each watershed location to see if it meets the specific criteria that we would need for a wetland restoration project to go -- to be located at that site. And so these, again, based on land use, urban land uses, open water, and things like roads and railroads were excluded. Hydric soils and soils with hydric inclusions were included. That was the basis for wetland restoration. If it did not have a hydric soil, we did not consider it suitable. We developed a saturation index that calculated the sort of relative levels of saturation of a given location as a way to -- as a way to determine whether hydrology might be suitable. And we used a digital elevation model to look at the topography of these -- the topography of each area.

Slide: Cuyahoga Watershed: Hydric Soils

Hydric soils, as I mentioned, were sort of a starting point for wetland restoration, and this just shows the distribution of hydric soils in the watershed. Like many places in the US, a lot of these had been drained and converted to agricultural land use and, increasingly in the Cuyahoga Watershed, as in a lot of watersheds nationally, now are being converted into suburban land uses. And so this is a map of what would be, I guess, considered the historical base of wetlands in the watershed. But again, a lot of these had been drained prior to the start of this project.

Slide: Suitability Modeling: Multi-Criteria Evaluation Using GIS

Okay. So then the second phase of the project was to look at the filters, to develop the filters that we could use to identify which -- if we had this total population of wetland sites that we've identified that are suitable for restoration, which of those would do the most good for water quality downstream? And so this is what we called a priority matrix, and this is sort of summarizing the criteria that we used to give priority to some sites over others. And so, again, we looked at stream order, if it's on a high stream order or a low stream order, a given location; the overland flow length, which I'll talk about in a minute, but that's basically, again, the distance between a location and an adjacent stream channel; the saturation index, what does that site as an index or a measure of wetland hydrology and hydrological connectivity; and then we used the stream condition in the sub-watershed, so how much of the stream water quality standards are being attained. If we have a lot of stream miles within a sub-

watershed that are not in attainment, that would make that area a higher priority for restoration. We used a lot of expert opinion in this piece of the project in order to build these matrices, and so we asked resident experts their views on which of these variables should be weighted more highly in selecting sites that would give the most water quality sort of boom for the buck over others. And so we put this together in a sort of matrix, and the overall restoration potential of a specific location, then, would be the effectiveness of that site, the ability of it to support a wetland times this priority selection process that we went through. And I should say I have a paper on this that details all this stuff. If anybody is interested, feel free to contact me and I can send that on. I just have a few more slides to show you.

Slide: Will the Hydrology Work? A Topographic Saturation Index

The hydrology was obviously crucial because that is the basis for all wetland functions, and it's also the measure by which wetlands connect with other aquatic resources. And so we used our digital elevation model to do this sort of flow accumulation. I'm not going to go into the details of this here, but this is sort of a standard way of looking at flow accumulation across the landscape as a function of slope.

Slide: Flow Path Analysis: Hydrologic Distance

And so this is what you get, this sort of flow path analysis. The blue cells here are a stream channel in this raster-based GIS, and then the flow path would be the flow from a potential wetland site -- say, above here, above this flow path -- that would then move into this channel. And so we see the distance that that water would have to flow to enter the channel, and that gave us some sense of the connectivity, then, of a potential restoration site with the stream network. And we felt like that was an important way to judge hydrological connectivity, as I mentioned.

Slide: Cuyahoga Watershed: Wetland Restoration Model

And this finally, then, is the model itself. And we did three permutations of this. This shows the restoration potential. I'm not going to show the other two. But this is sort of the base model that shows the spatial distribution of the potential restoration sites, and these are ranked by categories. The categories are here, and they are categories of wetland suitability. And this is just a class, a set of classes that we identified on a scale from zero to 100, and these were established based on partitioning the range of scores that we got through this matrix of suitability that we developed. And so we have sites that score from zero to 15, those are considered to have no restoration potential; 15 to 30 have low; then we have a group of fair potential; a group of good potential sites scoring between 45 and 60; and then a very broad top class which scored between 60 to 100, which reflects the very strict definition of this class, so not a lot of sites actually made it into that category. And you can see here in the map, then, this sort of distribution of potential restoration sites and scaled by this suitability, both for restoration and also for those restoration sites that would offer the most water quality benefits.

And so this is sort of what the spatial distribution, then, of those restoration projects would look like. Our hope was that people in the watershed would use this -- and they have done so to some extent -- as a means to start implementing, through mitigation projects or just restoration programs, wetland restoration projects on the ground.

Slide: Restoration Site-Suitability Model: Two-Phase Approach

And so this is the last slide. I've kind of talked about this, so I won't take any much -- any more time because I know Chad has a presentation, as well. But just, again, this two-phased approach that we had, and this was meant as a model approach that we hoped other watersheds might adopt and plan

for their watershed. It has a lot of flexibility in it because if water quality improvement, for example, was not your goal, the filters could be set up to maximize some other objective that might allow other concerns to be addressed, such as biodiversity, fish habitat, those kinds of things. Okay. So with that, I'll turn it over to Chad.

Slide: Wetlands and Watershed Planning in Michigan: Landscape Level Wetland Functional Assessment

Chad Fizzell
Okay. Can everyone hear me?

Siobhan Fennessy
I can.

Chad Fizzell
Okay. That's a good sign. So I'm going to go ahead and pull up our next slide here. Again, thank you to --

Cynthia Curtis
Siobhan, if you -- let's see. I'm not hearing Chad yet coming over on the mic.

Chad Fizzell
Can you hear me now? Can anyone hear me?

Siobhan Fennessy
Can you hear me still?

Cynthia Curtis
I can. Are others able to hear Chad okay?

Siobhan Fennessy
Yes, I can. I'm going to mute my microphone, though.

Cynthia Curtis
Okay. Sounds good.

Chad Fizzell
Yep, looks like everybody can hear, for the most part here. So I'm going to go ahead and get started. I'm getting a little bit of an echo on the line here, so I apologize. So thank you again to EPA. I appreciate the opportunity to speak in this webinar here. We've been working on our level one landscape-level assessment of wetlands for about the last five years. My background is I work for the Department of Environmental Quality in the Wetlands Unit. We actually have 404 assumption here in Michigan, so we actually administer the national program at the state level. My role is as a GIS wetlands specialist and to essentially coordinate the landscape-level activities at a program level.

Slide: Why Do We Care About Wetlands? Why Protect and Restore Wetlands?

So I'm not going to bore this crowd with reasons to care about wetlands, but essentially, in Michigan, we have for a long time identified wetland loss, historic wetland loss, as an underlying driver of nonpoint source water quality problems in the state. And about five or six years ago, we interfaced with the 319 watershed planning program in the state and included Landscape-Level Wetland Functional Assessment in the state RFP so that watershed groups applying for watershed planning

money could have that analysis completed as part of their plan and could get funding for that. We do the entire process in-house here at the DEQ, with myself and one other GIS analyst.

Slide: How Wetlands Work

So obviously, from a functional standpoint, again this is probably fairly basic level, but it's a good slide to illustrate, at a GIS landscape level, what we're trying to get at. Obviously, you know, wetlands are not only the sources of streams and headwater positions, but also buffers and filters for streams. If you have a through-flow type wetland, as in this example, you get stream energy into the wetland. It dissipates the stream energy, sediment and nutrients fall out, and the water flows out more or less cleaner from a surface water quality standpoint. They're obviously great for habitat, you know, and then pathogen control and sources of groundwater, many times.

Slide: Flood Water Storage Natures Sponges

So essentially, what we were looking to do was apply some basic landscape-level inventory techniques and attempt to take a stab at wetland function across the board statewide, or what wetlands were performing what functions at particularly high levels. And we actually adopted a process from US Fish and Wildlife Service in the Northeast region. A staffer by the name of Ralph Tiner, who some of you may have heard of, developed this process of using the HGM method with NWI to get at some basic wetland functions. And I'll get into that in just a bit.

Slide: Percentage of Wetland Acreage Lost, 1780s–1980s

Just a quick map of wetland loss by state. In Michigan, we typically go with the 50 percent loss number. The quantities you typically hear are we originally had 11 million acres of wetland pre-settlement. We're now down to more like 5.5. We recently completed some status and trends reports that put that number more at 6.5 million acres of wetland in the state, so a little less than half.

Slide: Michigan's Wetland Losses Not Uniform

But in Michigan in particular, given the geographic diversity of the state with the Upper Peninsula and the Lower Peninsula, there's really no uniformity to that wetland loss.

Slide: Upper Peninsula: Pre-Settlement Wetlands

And that can be expressed fairly easily visually through some of these maps. Now, as Siobhan alluded to, our basis for pre-settlement wetland locations was our hydric soils data. So what you're seeing here for the UP is essentially a reproduction of the hydric soils in the Upper Peninsula.

Slide: Upper Peninsula: Approximate Areas of Wetland Loss

And where this gets more interesting is where you overlay our current wetland inventories with that pre-settlement wetland inventory. So in this slide, you're seeing that pre-settlement wetland inventory in red, current wetland inventory in green, so everything that's showing up red on this map would be areas that we would have more or less identified as wetland loss.

Slide: Northern Lower Peninsula: Pre-Settlement Wetlands

And you can see it's not quite as widespread as when we start to move south into the Lower Peninsula. This is, again, our pre-settlement wetland coverage for the Northern Lower

Slide: Northern Lower Peninsula: Approximate Areas of Wetland Loss

and then overlaid with our current pre-settlement, in red, to show loss.

Slide: Southern Lower Peninsula: Pre-Settlement Wetlands

Now, this map takes a much more startling turn when we look at the Lower Peninsula. Once again, we see our pre-settlement wetland inventory based off hydric soils, but then turn that red and overlay it with our current wetland inventories

Slide: Southern Lower Peninsula: Approximate Areas of Wetland Loss

to identify wetland loss. And that image is typically fairly startling for watershed groups and environmental officials, alike. So given that particular situation, we've really focused our landscape-level assessment efforts on the Southern Lower Peninsula, and I'll get into a little bit later what watersheds we've actually done this analysis for.

Slide: Wetland Loss = Functions Loss

So what does all this wetland loss mean? This is really what we're driving at with this process. So if you've lost 35,000 acres of wetland in the Thornapple River Watershed, what does that mean in terms of lost floodwater storage and sediment retention and streamflow to your surface water? So the LLWFA is really a method to express the functional loss of that quantified acreage loss.

Slide: 3 Step Process for Watershed Planning

So again, this is going to look very similar to what Siobhan presented. We've sort of boiled this down to a three-step process, which it sounds like the first two are very similar to what they did in the Cuyahoga. Essentially, the first step is to enhance our existing and our historic wetland data. So referring back to Kerryann's presentation, we chose to go with the NWIPlus methodology, which is utilizing our state and national wetland inventories and that hydrogeomorphic light information to get essentially an HGM light look at each of our wetlands within the NWI. So again, we're looking at water flow direction, landscape position, and land form as our three HGM type descriptors, and I'll explain those in a bit more detail as I move forward. The second step in our efforts is to prioritize. Using GIS, we can prioritize and cookie cutter this information up in a multitude of ways, whether or not you want to see wetland loss by sub-watershed, by municipality, by parcel, so on and so forth. Once all this information is entered into the GIS, it becomes very easy to prioritize and cut it up in any imaginable way given the needs of group that we're working with. And then the third step is to utilize these results, and, for me, we think probably ultimately, getting restoration or enhancement done on the ground through this process, and we've had a lot of success in doing that in the last five years.

Slide: Step 1: Enhancing NWI for Landscape-Level Wetland Functional Assessment

So again, we talk about step one being enhancement. Again, we're essentially talking about three HGM type descriptors here. If you look at this map, we are truly trying to draw a distinct relationship between -- oh, there's my arrow -- a distinct relationship between our surface water and our wetlands. So one of the major things we really focus on is the connections that are map surface water maintained between wetlands, from wetlands to other surface water, so on and so forth. We use the national hydrography dataset for this, and we can gain all kinds of information when you start to combine the two datasets. We're looking for wetlands that are in a headwater position because, again, those may have differing functions from wetlands that are actually within stream corridor, versus something where you have, you know, surface water flowing into and then back out of, what are the functions of a wetland that has that sort of condition. Obviously, topography plays a big role

when you're talking about land form and landscape position. Is it a depressional type wetland? Are you in a flood plain? And so on and so forth.

Slide: Step 1. Enhance

So this is sort of one slide that more or less sums up that entire classification process. The wetlands we see isolated from surface water and in a headwater position we call terrene. Again, this would be our landscape position descriptor. Wetlands that are adjacent to rivers and streams are lotic. Wetlands adjacent to lakes are lentic. So those are essentially the three major landscape position types that we have in Michigan. And then, again, we're also looking at things like depressional wetlands versus flat wetlands versus flood plain wetlands from a land form perspective.

Slide: Step 1. Enhance (2)

Now, as a second step to that, we want to be able to do some comparisons between our current wetland inventories and our pre-settlement wetland inventories. So what we've done is, again, utilized the hydric soils as a GIS base for our pre-settlement wetland locations, and so to actually fill out the HGM type descriptors for that pre-settlement wetland inventory, we had to go back to our General Land Office surveys from the early 1800s. And this was, essentially, the federal government paid surveyors to go out and walk section boundaries in a gridded way to essentially map the resources that they saw within each section. And this is an example. One of these grid squares would be a section here, so we've knitted a few of these things together. But you can see they have actually mapped stream locations and, at times, wetland and lake locations. So when we pull this stuff into a GIS environment, we actually get a pretty good idea of if a stream course was not only present but it was occupying the same location as it was pre-settlement. And obviously, there's been a lot of hydrologic alteration in our state, due to agriculture and other things, so we like to get a feel for where the surface water existed originally in much the same way we do for our wetlands. So that's how we go about our pre-settlement enhancement.

Slide: Evaluated Wetland Functions

So the point of all of that, again, is to drive at wetland function. We want to be able to predict, you know, significance of wetland function for each wetland within the National Wetland Inventory. So again, which wetlands are particularly situated in the landscape to trap and store floodwater? Is it wetlands on flood plains? Is it isolated wetlands in a cornfield? These are the questions that we're trying to answer. We're very lucky in that we have a lot of spatial information hydrologically in this state, so we've been able to take a stab at groundwater inputs to wetlands with some groundwater spatial data that we have in terms of an inventory. Kerryann mentioned climate change as an emerging thing and use for this type of process. We've actually adapted a carbon sequestration function that we can evaluate based on vegetation and landscape position so that we can predict which wetlands would be uniquely situated to store carbon. So important to stress at this point that all of these things are landscape-based. None of these things are derived from an actual site visit. So we tend to put a disclaimer on this information that it's really a planning tool for use by groups like watershed groups and municipalities to try and prioritize areas for wetland protection and restoration and that, you know, each and every wetland polygon may not be exactly correctly classified given the landscape nature of the analysis.

Slide: Step 2. Prioritize

So step two, again, is to prioritize all of that information. Once we're looking at a watershed that's got 10,000 wetlands in it, it's very useful for us to be able to prioritize where there's been the most loss by certain functions. And that's really what we start to get into in this table. You know, if you're looking to prioritize wetland restoration projects that are going to store and trap floodwater, you may want to be

looking down here at Chester Township, where you've had more of a loss of that particular function, whereas, if you're trying to address habitat losses or, let's say, combined water quality loss, you might be looking more in the Bear Creek Sub-basin. So again, we can actually start to break the information down and actually look at loss by function for each of these sub-watersheds or townships or municipalities,

Slide: Step 2. Prioritize (Rank by Geography and/or Function)

and that becomes more clear when you start looking at the maps.

So here -- let me grab my pointer here -- here we're actually prioritizing by sub-basin. We're actually looking at sediment retention loss by sub-watershed in this particular graphic, and you can see we've got our total wetland acreage and then also our functional loss for sediment retention, specifically. So again, if your major water quality problem from a nonpoint source perspective was sediment loss, you would be looking up here at Duck Creek as a potentially very good place to restore wetlands that might perform that function. Now, obviously, we're not always working within the bounds of a sub-watershed. Many times, if you look at this by municipality, you have many, many different local entities involved in attempting to get a wetland restoration done on the ground. So many times, we break these things up by political boundaries, as well, to get a feel for, you know, what local entities we're going to have to interface with to actually get something done.

Slide: Step 3. Utilize

So step three, this is, I think, where we've gotten a lot of attention for our work from this standpoint, is in the utilization process. So these maps make it pretty clear what we're looking for. Again, we're looking here, I think, at a particular function. Basically, the red is what would be identified as a hydric soil area where no current wetland exists in our inventory. So we're picking this up as a wetland loss, and again, we can rank each of these separate polygons by function so we know what function they would be likely to provide if a restoration was done. So this is what we're looking for, is pieces of actual property on the ground where we may able to contact a landowner and let them know that they've got some potential for potentially a wetland restoration on their property, and there may be some incentive for them to doing that. Over here, same sort of thing only we're looking more at our current wetland inventories. If you're looking for particular functions to be preserved, obviously all that functional information is stored within each polygon, so we could prioritize by just looking at the wetlands that store floodwater particularly well.

Slide: Step 3. Utilize (Targeting Outreach, Strategic Planning, Decision Making)

Now, some of these materials here are materials that were actually created by the watershed groups we work with. The Van Buren Conservation District, which is where the Paw Paw Watershed is located, has been setting up actual training sessions where they bring in and invite landowners who have property that's been identified as uniquely suited for wetland restorations and kind of give them a primer on the restoration programs that are available to them. The other thing we've seen is letters drafted to landowners where watershed groups are actually looking at our maps, trying to pinpoint the properties they want to focus on in terms of contacting landowners and trying to get some restoration enhancement work done on the ground. And they can actually, you know, send a letter and a map to specific landowners based on the information we provide them.

Slide: Step 3. Utilize (Decision Making)

So again, this is actually from a group here that's doing a watershed planning project, I think for the Red Cedar River. Many times, you know, when we're dealing with current wetlands as in these instances, it's good to know, from a municipality or a local government standpoint, what wetlands

might be providing certain functions at a high level so that, you know, zoning and land use decisions can be made with that information in mind. So that you're not wasting, you know, even future opportunities for protection and restoration, having this information at their fingertips is really, really useful for making those types of decisions.

Slide: Flood Water Storage

So again, all of this comes back to the maps. I'm a GIS expert, so that's really what I deal with. Essentially, for all of the 15 functions that we evaluate,

Slide: Flood Water Storage (Map)

we can actually go in and map these at a watershed level in the same manner that I've been showing, which is, again, these red wetlands would be wetlands that we've identified as lost that were providing this floodwater storage function. Green are, you know, existing wetlands that are still providing that function based on our analysis. But again, if you're looking to do a basic restoration to provide some floodwater storage, then we're giving you some pretty good opportunities, just at a cursory level here, to start your looking.

Slide: Sediment and Other Particulate Retention

So same thing with all the functions.

Slide: Sediment and Other Particulate Retention (Map)

Many times, we see the floodwater storage and sediment and nutrient retention wetlands grouped together and lumped together. But again, that speaks more to, you know, if you can restore a wetland in one of these areas, you're likely to get more than one wetland function provided than if you were to restore a wetland in, say, this location, in a headwater position in the watershed. You know, you're likely to provide streamflow and capture more nutrients and sediment. So we can almost use this tool as sort of a PR campaign for what economic uses the wetlands are providing to the communities.

Slide: Step 3. Utilize (Decision Making)

So again, how do we utilize this stuff in terms of decision making? You know, obviously having this information at the fingertips of a watershed planning group can strengthen grant funding requests for implementation funds. You know, we've seen a lot of success from the groups we've worked with in the planning stages coming back and saying, "Hey, we've already identified these three or four properties for focusing wetland restoration efforts.: And actually, applying for money to do that is obviously a stronger proposal when you've already got those properties identified. Again, we've seen it helping to unite agencies that have similar resource interests. You know, getting NRCS and DEQ and Fish and Wild life Service to all utilize the same information has been really useful when we're working with our partners. So obviously, identifying restoration and preservation sites is sort of the main use, but there's been a lot of sort of secondary benefits, as well, of doing this.

Slide: Successful Watershed Applications

If you're looking for further information on any of this stuff, we do have a full report on our Landscape-Level Wetland Functional Assessment that I can send. We're only probably a couple of weeks from putting that out on our website, as well. And then you can also link to the actual watershed plans that we've worked with. We cited these here essentially because they've done the best job of actually going out and utilizing this information. And a lot of the reports are actually online on our website, and I can provide that link if anybody is interested.

Slide: Applications Continued …

And I think I'll skip that slide just to bring up our latest status map.

Slide: LLWFA Watershed Status Map 1-22-2013

These are the watersheds that we have worked on so far. Most of these are completed now, so even the green watersheds have now gotten this process done. We actually have some money outside of the 319 process now to continue this work, so we're going to be shooting, ideally, in the next year or two, to close some of these gaps up in Southwest Michigan. This is the Kalamazoo River Watershed here, where we're looking to start work hopefully in the next year or so. So that's essentially what we've done thus far. We are looking to do this statewide over time, and, you know, for now we've got about a third of the state done.

Slide: Landscape Level Wetland Functional Assessment (LLWFA) Cover and Speaker Contact Information

So that's all I have for now. Again, this is our methodology report that is available if anyone is interested in the nitty-gritty details of our process. And there is some contact information for -- excuse me -- both me and my coworker, Jeremy Jones, who actually does the classification and NWI enhancement. So feel free to shoot us either an e-mail -- either one of us an e-mail, and we'd be happy to pass on more materials or answer questions. So that's all I have for now.

Cynthia Curtis

Fantastic. Thank you, Chad. And also, thank you, Siobhan and Kerryann. What I'd like to do right now is open up for questions. If anyone has any questions, they can type it in the chat box. While people are thinking about that, I do have a question for both Chad and Siobhan. One of the things is, listening to you go through the methodology, and you set criteria to define success or good places where this effort -- where watersheds could direct their efforts. Now, since it seems like some time has passed and some work has happened, has there been any shift in criteria or recommendations or how you're analyzing the data with watershed groups based on your interactions on these -- work with those specific watersheds?

Chad Fizzell

I think I still have the mic. Can everyone hear me? Okay. Yeah, I can go ahead and answer that and then pass it off to Siobhan here. Yeah, we focused a lot more in the last couple of years on the actual prioritization and utilization parts, so step two and three that I covered. We had spent a lot of time covering step one with watershed groups, where we went really in-depth with the wetland analysis and classification, and we tended to see that we were losing people, getting into that sort of level of detail. So we've really started to focus our efforts more on trying to help them prioritize by whatever, you know, whatever subgroup they would like, whether it be municipalities or sub-watersheds, and then actually help them go from, you know, sort of these landscape-level huge datasets down to specific properties where they can actually get some things done on the ground. So from our standpoint, that's really the major shift that's happened, is we're focusing more on that step two and three with the groups and staying in contact through that entire process.

Siobhan Fennessy

Yeah, I guess I would say much the same. When we undertook our project, it was much less -- I guess there was just much less facility with having these large GIS databases available. And so that's why we focused on sort of one area and really had to develop. That makes me sound like I'm a dinosaur, I know, but we had to really focus on one area and get the data even into a form that was usable. We also really wanted to focus on implementation and making, you know, a recommendation or some kind of site-specific recommendations for each land parcel in the watershed. One reason we

chose the Cuyahoga is not just because it was sort of infamous but because there was a very strong watershed group working there that really was interested in this kind of information, and we felt like they could really help put it to use on the ground. Since then, since I've left the agency, there's been more and more sort of landscape-level planning, although there has not, as far as I know, been a systematic sort of implementation of this method to identify restoration sites and prioritize them for things like the 319 program. There is a co-author I should mention who worked -- who was the sort of GIS expert on this project. His name is Dale White. He is still at the Ohio EPA and would also be a very good contact for people who are interested in discussing sort of the project or its -- things that have happened since then.

Cynthia Curtis
All right. Thank you very much. Siobhan, I don't know if you noticed. We did get a request in the chat box if they could get your contact information.

Siobhan Fennessy
Sure. Can I just type it in here?

Cynthia Curtis
Yeah, absolutely, just right in there. And if you return that, people can link it. So right now, I'm watching the time, and we've got about three minutes before the webcast is wrapped up. So if there's any last minute questions, we can take them. But in the interim, what I would like to do is remind people that our next webcast is October 2nd, and it's Wisconsin's Nitrate Groundwater Initiative. Is it going to be Mary Ellen Vollbrecht from Wisconsin DNR. Also, if you didn't catch it on the last e-mail I sent, we are gradually getting some recordings and transcripts up online from the beginning of the year. So as we're getting all of this worked out, it's a little bit delayed, but just keep an eye. And I'll keep putting that posting in the announcements of future webcasts and keep you apprised on where the recordings will wind up. All right. With that, thank you, Siobhan, thank you, Chad, and thank you, Kerryann very much for a great presentation. And with that, I guess we will talk to you all again in October.