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Ohio State University – Changing Climate Webinar Series

Stormwater Management and Climate Change: Implications for the Great Lakes Region – David S. Liebl, UW-Cooperative Extension

Anne Baird: Thank you all for standing by and welcome to the second webinar of our winter series "Stormwater Management and Climate Change: Implications for the Great Lakes Region" webinar.

These webinars are an initiative of the Ohio State University Climate Change Outreach Team; with this webinar in particular, working in collaboration with the Great Lakes Regional Water Program, Ohio Coastal Training Program, USDA, and the NOAA Great Lakes Sea Grant Network. The OSU Climate Change Outreach Team is a multi-departmental effort within the University−led by OSU Extension, Ohio Sea Grant and six other OSU departments, to help localize the climate change issue for Ohioans and Great Lakes residents.

I am Anne Baird from Ohio State University Extension, and the School of Environment and Natural Resources. A few logistical aspects: during our presentation all participants will be in a listen-only mode. Afterwards- at 12:30- we will conduct a question and answer session. If you would like to ask a question during the presentation, please use the chat-feature located on the lower right hand corner of your screen. Please submit a question at any time during the webinar. I will pose your questions to our speaker at the end of his presentation. We have more than 200 participants on this webinar−a great, diverse group representing public and private organizations around the Great Lakes region. Feel free to keep those questions coming throughout the presentation and we will have an excellent Q & A session. As a reminder, this webinar is being recorded and will be posted on our website for later viewing. We will have a survey at the end of the webinar that we would appreciate if you would take the time to fill out. Your responses will help us continue to bring you better webinars.

Without any further delay, I would like to introduce David Liebl. David is a statewide outreach specialist for the University of Wisconsin Cooperative Extension. David is a member of the Wisconsin Initiative on Climate Change Impacts Science Council, he chairs the WICCI Outreach Committee and co-chairs the Stormwater Working Group, and Adaptation Working Group.

Dr. David S. Liebl: Thank you, Ann, and welcome everybody. I hope this is an interesting discussion for everyone. We're going to take a look at stormwater management and climate change, and what we learned in Wisconsin, primarily working with climate change impacts. And I hope that what we see today will be applicable, generally throughout the Great Lakes region. It's going to be a fairly technical talk. I don't want anyone to be put off or intimidated by that. And just to let everyone know, the slides from today's presentation will be available, so you can go back and look at the figures. Support for this program has been provided by a number of agencies, including NOAA Sector Applications Research Program - Water, so I want to express our appreciation.

Today, we're going to take a look at Wisconsin's changing climate, what we've learned about it through the Wisconsin Initiative on Climate Change Impacts, and then how that pertains to stormwater management and some of the impacts of precipitation from our changing climate and how we as a society might adapt to that. We'll be looking at a variety of figures like you see on the right, which show a historical average increase in temperature and precipitation across Wisconsin, and these are quite interesting, you'll find, as we discuss, you'll get a better feel for why we think it's such an important issue.

WICCI is a program that was pulled together by the Dept. of Natural Resources and the Nelson Institute for Environmental Studies at the UW-Madison campus. It's a very disciplinary effort. It has a number of working groups looking at different aspects of climate, and the goal is to really assess what climate's impacts will be on the state, and how we as a society might adapt to them.

Brian, I don't know if there's anything we can do about this, but you seem to have pdf slides and not ppt slides, but I'll just keep talking, and if we can change that, it would be great. As most of us know, what really concerns humans about climate is weather, and the impacts of weather on our built environment and the natural environment. These are just some examples of what we see day in and day out throughout the year, so probably for those two guys floating on that ice floe doing their ice fishing right at the end of the season, that's a fairly unusual thing that we might see some more of.

High water impacts are something that we have recently found that are more of a problem, especially in the western Great Lakes region. This is an example of a storm event that took place in 2008 during the period of 1.5 to 2 weeks. You can see from the radar images there that there were 12-14 inches of rainfall over south/central Wisconsin during that time period. That led to some serious overland flooding. We had two major interstate systems that were closed for days because the roadways were under water. In addition, as you can see, substantial sewer overflows into the lakes and streams, and a large number of rural drinking water wells that were contaminated by surface water and groundwater flooding from that event. Overall, $34 million in damage claims paid by FEMA just during that storm event, so these types of impacts are real and significant and something that we're growing more concerned about.

The way that we've approached this problem at WICCI is to begin taking a look at climate historically in Wisconsin to see if we can understand the nature of these changes in variability and how our current situation is in that context. And we have quite a long record in Wisconsin of measuring rainfall, temperature, and so forth. But you'll see from most of our slides, that it's really only in the last 50 years or so that we have a complete record from all of Wisconsin's weather stations that allows us to use the statistical approach to analyze this data.

Here are some fairly typical indicators of climate change. On the top left, you'll see a graph of the change in the global atmospheric temperature anomaly. This has been in the press quite a bit lately, from the IPCC. But more locally we have a chart here that shows the duration of ice cover on Lake Mendota in Madison, Wisconsin from 1855-2008. As you look at something that hits a little closer to home, it's quite dramatic in showing the reduction in number of days we have ice cover over the lake, and that most of the longest periods of ice cover are very early in this century or end of the 1800's. And the shortest days, as you can see, more recently around this last couple or three decades. So this would be a good indicator, I think, of what we're seeing in terms of if there's a way of measuring overall winter temperatures increase. On the lower left here is an annual precipitation record for Madison from 1869-2008. And you may see from this averaging line here that there seems to be a slight rise in amount of average annual temperature. Well, further on in today's talk when I take away this grey box, you'll see that the longer your record, the better you are at identifying trends in climate, and this is a challenge that we have for stormwater management in particular, how to identify and validate those trends.

So let's summarize what WICCI has found for recent historic climate change in Wisconsin. And again, this is the 1950's to 2006 National Weather Service co-op station record. You can see from the figure here that there's a disproportionate increase in temperature from the southeast part of the state to the northwest part of the state, but it's averaging about 1.5 degrees during that time period. Winter days and winter nights showing a little bit more warming than the rest of the time, and the number of below zero nights has dropped by almost twenty nights, which is good news for everyone but the skiers and snowmobilers up in NW Wisconsin.

Precipitation, on the other hand, tends to be a little less uniform. On the left, we can see annual average precipitation in inches over the same time period. But it ranges pretty dramatically from an increase of 7 inches to a decrease in 4 inches, which reflects drought conditions which have taken place in northern Wisconsin over the last several decades. On the right, we have an increase in the amount of 2 inch rainfall events from that same period. Again, 3.5 days increase to 1.5 days decrease. That's a lot of local variability, and it's important to keep in mind that as we measure precipitation in particular, we can't make generalizations about an area even as large as the state of Wisconsin, much less for the entire Great Lakes Basin.

We of course would be happy to be able to tell you that we can see into the future and tell you exactly what's going to be happening with climate. All over the world, people are wondering about climate and its impacts for the future. As you all know, the IPCC has done a tremendous amount of work trying to model as clearly as possible what we expect the shifts in climate to be across the globe in the next 50-100 years. Just as a review of that approach, using what are called General Circulation Models to simulate climate on fairly large scales across the continents and the oceans. The IPCC working groups have come up with a number of (15 or 16) different GCMs all trying to do the best they can to project how climate's going to act based on what we know today.

What WICCI has done with that infomation is to take 14 of those models and try and downscale them so that the resolution of the projections are scaled to the size of the state of Wisconsin. In the left figure, you can see the grid cell size for the IPCC GCMs and on the right is the statistically downscaled grid cell size that's used for the WICCI climate projections. The approach taken here was to, for each individual GCM, verify (or statistically de-bias) the data for the historical period of record that we know, so in other words, you're starting all those GCMs off with the same data, same conditions, as you run them off into the future. And then, using those 14 models, generating a statistical range of probable climate change for temperature, precipitation, and so forth.

And here is what that looks like, for example, for temperature. On the left, shows the annual average increase projected for the period 1980-2055 for the state of Wisconsin. Again,6.5 or so to 7 degrees F increase over that period, that's a significant warming trend. On the right, though, is a more detailed description of the data that was used to create that figure. The red line (or median line) shows the average between not all of the 14, but those of the 14 that fall below the 90% or above the 10% percentile confidence limit. So, throwing out the outliers here, this range shows how much you might expect that annual average to vary month to month into the future for that time period. Now, that's something that's pretty reasonable for temperature, but as we'll see for precipitation,that range itself can be problematic for projecting what we can expect from climate impacts.

The farther out we get into the future, those models tend to diverge from one another. By the time we get to the end of the century, even though we're showing an average increase of about 10 degrees F across the state, it's +/- 4 degrees, so a fairly large range. And, at least for stormwater management precipitation analysis, we feel that we'd like to limit our reliance on those long-range projections to something that's just a little bit closer to the next 50 years or so and try to reduce that uncertainty as much as we can.

So let's take a look at what some of the projected precipitation is, using this downscaling approach with the 14 GCMs. It looks to be about 1.25 to 2.25 inches increase in the annual average for Wisconsin over the next 40 to 50 years, and about 2-3 days per decade of additional 2 inch rainfall events during that period, and those are, I think, from the point of view of most stormwater managers, fairly modest and manageable increases, and something that, even looking at the range of probability, we think we can deal with as it's coming along.

More interesting is the seasonal aspect of what is happening. Even though water is increasing in terms of winter precipitation, snow depth is decreasing pretty dramatically during that same time. When you think about what we said earlier about temperature, both average annual increase and warming in wintertime, it certainly would make sense that you would have less snowfall and more liquid precipitation and rain during the wintertime.

This is just a little bit more fine analysis of that from work that we've been doing here at Madison, and this shows the percentage increase in precipitation as rainfall versus snowfall, comparing the historic record with the projected record for the months of November through March. As you can see, there are some fairly dramatic increases in the amount of rainfall versus snowfall that we're looking at in the near future. And over on the right in the table, note that even though these percentages are quite high, the actual amount of rainfall is not as dramatic as you might see in the summertime, so we're talking about a change in the character of our precipitation more than we're talking change in the amount of precipitation we'll be having during that period.

So, just to try and summarize briefly, what are we expecting in terms of Wisconsin's projected climate as far as stormwater management is concerned? Well, as I said, warming nighttime and winter temps, significant increases of rain during winter, reduced snow cover and a moderate increase in the frequency and intensity of precipitation, but not something that is dramatic. So, this still leaves us with a big question in terms of what this means for weather. Climate, of course, being something that we try and understand over a period of decades, generally. Weather being what we have to manage day in and day out, both personally and for whatever infrastructure or so forth that we need to be managing.

Let's take a look at the question of changing patterns of precipitation. As I said, more frequent and intense rainfall in winter and spring. We think that's going to lead to both more high water events or early spring flooding, and interestingly, we think we'll see more groundwater recharge. Lots of recharge takes place in a time period when there is either frost off the ground or shallow frost, snow melt and rainfall combining during a period when plants are not green, so there's very little transpiration. That groundwater recharge is something that we're very concerned about. In Wisconsin, as you can see on the right, we've a very high vulnerability from high water events during winter and spring. You're looking at the time of year, the season for the top 10% peak flows for these stream gauges throughout Wisconsin, the green being springtime, and as I think no one will be surprised to see, many of these areas see their highest flow rates in the spring, when we're talking about beginning to get more run-off and more rainfall.

Another impact of this change in seasonality would be sanitary sewer overflows. This is from the Milwaukee metropolitan area, where most of the system is a combined system of both stormwater and sanitary sewers. And here under the arrows are the examples over the last five years where we've had substantial combined sewer overflows that were the result of spring rainfall events. You'll notice that those are not major rainfalls that were causing CSOs in terms of inches of rain. However, you have a period when you have both snow melt and rainfall taking place, which means your runoff could exceed the expected amount of rainfall you'd get if you didn't have rain falling over snow. And you also have the high groundwater effect that I mentioned, causing inflow and infiltration into these systems. So we expect that this change in seasonality will have an impact on our ability to manage our sanitary sewer discharge into our lakes and streams.

Another question that we've come across is that we're seeing a changing pattern in rainfall itself, not just in the season, but in the way the storms are coming. And if you look at the graph on the upper left, this is the number of rainfall events that broke a weather station record or came within 90% of breaking a record for each of the decades from 1950 to 2000. So we can see that number (3,3,3 jumping up to 4, jumping up to 6) this might indicate that there's an increase in the number of these record storms that we're seeing in the recent future. And remember that the plot that I showed very early on of the annual total precipitation in Madison. On the right is the period of record that's shown in the graph on the left, and we looked at this long rising curve here. Well, going back further into the record, into the late 1800's, notice how much rainfall we had in Wisconsin, in Madison at that time. We really do wish that our rain gauge system was more complete that far back in time. It would be very helpful in developing statistics. So we don't really know at this point if we're looking at a gradual increase, the beginning of a steep increase, or a trend that we expect to rise more or less steadily into the future. There are also decadal cycles that come into play here, different oscillations in the weather patterns that may combine and give us these few years together of very heavy rainfall. In any case, what we're looking at in terms of stormwater management, is how to manage the rainfall that we can reasonably expect to happen in the next 10 to 20 years. And we've taken an approach that we think is robust and will be helpful for folks trying to do this elsewhere in the Great Lakes system.

Many of you may not be familiar with where the rainfall statistics come from that are used to design our stormwater management infrastructure. Technical Paper 40 comes out of the period 1948-1958. If you look at the graphs, the one on the left is a representation of the largest daily rainfall for Madison over that time period. On the right is the flow of the Mississippi River at Clinton, Iowa, which is downstream of Wisconsin. Both of these show that a period that we're now using for our rainfall statistics seems to be in a period that was relatively dry over the last 100-150 years. The question that we're asking is, by using these statistics have we been designing our stormwater management infrastructure for a climate that is historically dry or not?

Unfortunately, moving forward, we're faced again with this question of uncertainty. The graph on the left shows us the different projections for summer rainfall from the 14 different GCMs that were used for the WICCI analysis. As you can see, for June, July, August, and September, there's a great deal of disagreement on what is going to be happening in terms of monthly precipitation in the next 50 years or so. From this left graph, you couldn't really tell if we're expecting wetter or drier summers. On the right is a projection based on the same data, looking at the 100 years 24 hour storm event, over the course of the next century. The farther we get out into the future, the broader the spread in between those events, the more difficult it is to come up with a mean that is significant or meaningful in terms of stormwater management planning. You're kind of left with the choice of, do you think it's going to be 6" or 9"? These aren't really confidence-inspiring if you're designing a multi-million dollar stormwater management system.

Now one way to approach this is to upgrade our statistics. Remember that the TP 40 is quite old at this point, and NOAA is in the process of doing that for the midwest states. As you can see, for this area of the mid-tier states: Indiana, Illinois, Ohio, Pennsylvania this has been done already. The western Great Lakes states and the rest of the Midwest we expect to be available in May 2012. This increase in statistics may give us a handle on how we should be designing and managing our stormwater systems.

NOAA Atlas 14, which updates TP-40, uses more stations of record, a longer period of record, and a revised statistical method to get a more precise statistical and geographical idea of what we can expect for different types of storm events. Just as an example, this is what you'd get from NOAA Atlas 14 for South Beloit, Ill. for a 30-minute rainfall, and TP-40 would have given you this isohyetal map that you'd have to interpolate this general area from these different adjoining areas. So it's going to be much more precise and useful for designing and regulating stormwater management. We asked the question, if NOAA Atlas had been completed already for Wisconsin, what would the effect be on the way we look at our statistics? And fortunately, Davis Todd and others at Purdue had already done that in terms of looking at the increase in rainfall frequency and magnitude in the areas where NOAA Atlas had been completed already. We're looking at some fairly modest changes in these smaller storm events for these different states. Although when we start getting into the larger storm events, we're seeing some pretty big variability, some of which we think represents an improvement in statistics, also maybe some urbanization effects. All this is reasonably manageable. I guess the question that we have is, is that going to be adequate as our climate seems to be changing now and into the future.

So what we've done is taken a look again at historic rainfall. This is data from weather stations of events that have occurred. So there's no statistical projection or uncertainty involved. One of the things we were interested in seeing is for a fairly large 24-hour event, of 5 inches which is around the 100 year event for most of Wisconsin. How often has that occurred at the weather stations that we have records for? And again, this is 1950-2007. The size of the circle is a rough indicator of the number of events. The color of the circle, an indicator of the overall size of the event. And I don't think it's important to look at specific locations, except to say that you'll notice a large part of Wisconsin doesn't seem to have experienced too many of those major storm events.
Are these communities prepared to manage those types of storms? Much of the evaluation of stormwater management runoff and flooding is based on personal experience of the managers of these systems, and if they haven't seen anything larger than a 3 or 4 inch storm event, how are they going to manage for a 100 year event? And then there are the really really large storms. These are the 7-day 9-inch events for that same period, i.e. a week of heavy rainfall. Notice that they're very rare, and also that we have some cases where a storm system that delivers rainfalls over a very large geographic area. Those rainfalls are really of two types. One is from the
same event in the orange that we're looking at over here in western Wisconsin. A very very heavy 24-hour rainfall followed by almost no rainfall at all. On the far eastern end of that storm system, in Watertown, we've got rainfall, rainfall, and more rainfall again. And depending on whether your stormwater system relies on moving flood flows, or you have BMPs that

attenuate storm water, and whether or not you're in a very hilly terrain like over here in the west, or in a very flat terrain that doesn't drain very easily, these storm events can have a very dramatically different impact on community. We question whether any communities are prepared for these extreme events.

Here are some things we've concluded from looking at the situation of historic and projected stormwater impacts for Wisconsin that we think are probably valuable for the rest of the Great Lakes as well. Obviously our statistics need to be updated. We have to rely on those for our design criteria. We think that the uncertainty in our precipitation projections really does constrain our infrastructure design. Very few managers are going to spend millions of dollars to anticipate events that have a probability distribution over a range of 90%. So what we're more interested in doing is looking at where we have a lot of confidence, for example in the change in seasonality of rainfall, and understanding impacts and vulnerabilities from these heavier rainfalls we've experienced in the past as a way of identifying how communities can implement adaptation for climate events that we think may occur.

Let's talk about adaptation briefly. As you all know, I think, mitigation is something that is focused primarily on minimizing the causes of climate change, and that's not really where WICCI is focused. We're focused on the fact that we expect change to occur and we need to be able to manage those impacts. And because climate presents a wide variety of hazards of severity and likelihood. I think everybody's probably seen a silt fence overflow like the one on the left. But on the right, we have an impounded lake that completely breached its berm and drained into the Wisconsin River. That's unlikely, but we need to be able to manage for both of those.

So I'm going to talk about some impact and adaptation strategies briefly that we've found through the WICCI working group process, and these, I think, are going to be generally applicable to the Great Lakes region. Soil loss from changing precipitation in the springtime can be dramatic, and the thing that struck us is that the ICCI Soil Conservation Working Group said that we have the practices in place and we know how to do those practices, and if we were to do those practices, we could minimize that soil loss pretty dramatically. These are just some examples of the types of agronomic practices that are well-understood and accepted in terms of reducing soil loss.

Groundwater flooding, I mentioned that we expect an increase in groundwater flooding, i.e. when the groundwater table rises above the surface elevation. And you see here pictures of areas where the surface is internally drained, and there's no natural outlet, where people have built, that in recent years, because of the change in seasonality of precipitation, groundwater has come to the surface and flooded their property.

It would be a good idea we think for communities to have mapped hydric soils that are indicators of previous wetlands and high groundwater. And in fact, Wisconsin has a very good program for identifying where those hydric soils are located. On the other hand, we have to keep in mind that just because you know there is/might be a problem, that doesn't prevent somebody from putting a subdivision there. The stormwater working group feels that it's very important that there be some way for zoning administrators to identify those areas and prohibit the type of development that leads to these types of damages and flooding.

High water events, as I mentioned before, are common throughout the Great Lakes region. Upper left is the Reedsburg wastewater treatment plant that didn't have a high enough containment dike around it to prevent the Baraboo River from flooding that plant and shutting it down. Other examples are familiar to folks.

How about an adaptation to those types of high water events? Well, planning 25 or 50 years out is very challenging, and this is something we need to learn how to manage. We're looking at the bottom at a plan to take a neighborhood in south central Milwaukee, and raze residential buildings to recreate a floodplain to manage some of the high urban stormwater flows you're seeing on the left side of that picture. That type of effort requires incredible political support. The only way you can really effectively convince people that this is going to work is to be able to simulate what's going to happen for different types of rainfall events in a watershed like that one. We think that using those type of hydrologic simulations are going to be very effective tools for stormwater management planning, in light of what we're looking at in terms of climate and weather.

Something else that we've seen recently is that, in the upper right is the road crossing in rural Wisconsin where we got called to come in and take a look at why they were getting tremendous flooding in this area behind this road crossing. For those of you familiar with this type of structure, you'll notice that this grass and sediment here indicates there hasn't been much maintenance done here recently, and this was actually clogging up this drain, causing the flooding upstream, and could be very easily remedied. So communities that have, or are likely to have, large storm events are in a good position to go out and identify those types of vulnerabilities. Here's a list of types of things they should be looking at, and determine whether or not the risk from increased rainfall events is likely to carry with it a cost or risk to public safety that would justify making an investment in improving infrastructure, and certainly justify an improved approach to maintenance in some of these systems.

Sanitary sewer overflows, as we all know, are a source of pathogens and nutrients to the lakes and streams, the Great Lakes in particular. Sandra McClellen's lab at the University of Wisconsin-Milwaukee is doing a really good job of analysis of what the Milwaukee system is capable of in terms of transporting bacteria into Lake Michigan and to the beaches. And we've found that about 75% of Wisconsin's sanitary sewer overflows are the direct results of precipitation, either surface runoff entering the systems as in-flow, or groundwater seepage as infiltration.

Some of the things we'd be able to do to help with this would be to, for example, disconnect stormwater inputs. On the upper right, you see a cistern being used to collect roof water for later use as irrigation. However, that may not be politically feasible.

In Milwaukee, they've just backed away from requiring residences on the system to disconnect all their roof water from the sanitary sewer drains because of the cost (about $7,500 per household). Infiltration from groundwater is really a sanitary sewer system maintenance issue. They need to be tightened up to reduce infiltration. Temporary storage is being used by some municipalities to hold large storm events. Milwaukee and Racine do that. You can spend millions of dollars on that and you'll still have overflows. One of the more cost-effective approaches is to educate homeowners on how to prevent runoff inflow into basements and floor drains, how to make sure sump-pump discharges don't go into the sanitary system, and certainly wastewater treatment plants need to be preparing for those storm events like Reedsburg experienced.

So what about coastal vulnerabilities? I know folks in the Great Lakes are very concerned about water quality, and it's interesting, I think, to think about where climate is going to have the largest impact on some of these estuarian systems in our near-shore coastal waters. If you look at this map, the size of the watershed for the city of Green Bay, for the fractionthat runs through the city of Green Bay into the bay itself, it seems clear that upland stormwater impacts are going to be a major factor on these systems.

Here are some examples of vulnerabilities, both economic and environmental. None of these should be surprising. We already experience these now for much of our coastal areas. More interesting are areas where we have problems with bluff recession, freeze-thaw cycles, late winter and early spring rainfall increasing some of that bluff recession. As the Great Lakes rise and fall, people are tending to build out towards the ordinary high-water mark or beyond it, and with some of the heavy rainfalls we've seen and the inevitable temporary rise in lake levels that we expect, we may see flooding of areas that were previously developed with the idea that they'd be free from that type of problem.

So, some examples of impacts, adaptation strategies, vulnerabilities that we see from precipitation in Wisconsin and certainly also applicable to the Great Lakes region. How are we going to cope with this in the future? We've identified a number of gaps that we think need to be filled if we're going to be able to successfully manage our adaptation to a changing climate. Obviously we need to be constantly improving our modeling and our resources for understanding our climate. Certainly one of the things that we're concerned about is being able to tell the difference between an impact caused by climate and one caused by development and other human activity. We'd like to know what kind of strategies we can put into place so that resource managers can manage their systems proactively, given what the uncertainty that we have in terms of the projections we have for climate, temperature, and precipitation. We feel it's important to develop a cadre of trained resource managers that are going to be conversant in these issues as they go through their careers and carry through some of these adaptations/implementations into the future.

One of the major problems we've been encountering is lack of information, i.e. lack of data. We also have a deteriorating system of surface and groundwater monitoring facilities, at least in Wisconsin. If we're going to be doing a good job of managing for climate into the future, we need to understand climate better than we do, especially at the local level. These are many of the things we need to put more emphasis on society-wise to try and better understand our vulnerabilities and give us a better handle on how we're going to manage these climate impacts into the future.

I hope that this talk has provided you with a snapshot-view of what we're doing in Wisconsin in terms of identifying climate impacts and adaptation strategies. There is much much more that we've done than we could possibly cover in today's webinar. I want to make sure that you all know that you can get a copy of our working group report on stormwater management as well as the working groups on soil resources, agriculture, water resources, coastal communities, Green Bay, etc., as well as a summary report that's just come out from WICCI, called Wisconsin's Changing Climate: Impacts and Adaptation. All of these resources give a much fuller picture of the approach that we've taken to identify what we expect from Wisconsin's climate in the near future and how we expect society to manage that successfully. I think with that, I'd be happy to take some questions.

Q: Do you expect changes to occur quickly enough to start using climate models for sizing infrastructure, or should managers keep using historic data for their decisions? We had a couple of questions on the accuracy of those downsizing models..

A: We have talked with a number of system managers about that question, and I think there's two things to keep in mind: Many of the stormwater management facilities that are being designed today are being designed to meet regulatory standards that are based on those statistics, that will need to be changed, but that change process will be very slow and deliberate. In Wisconsin, we don't expect to see anyone adapting newer stormwater statistics until NOAA Atlas is available in a couple years. In the meantime, though, by raising the awareness of managers about these issues, what we're hearing is that, when it comes time to make a decision about whether to put in a 12 or 14 inch culvert, they're leaning towards the larger size. They feel that they want to be conservative and they want to err on the side of public safety. This provides more evidence that it's a good strategy.

Q: We had someone ask about the cost-benefit information that might be available regarding sanitary sewer overflow impacts and subsequent adaptations.

A: I'd direct people to the Milwaukee Metropolitan Sewage District website, and to look under CSO, or Combined Sewer Overflow. They've put forward a report that describes the process that they've taken in trying to control those overflows and the costs that are involved. I think that the cost-benefit calculation is something that every community is going to end up doing for itself, and that there's not a one-size-fits-all approach to evaluate.

Q: How is the increase in high water events likely to affect places where waste is stored? You mentioned sewers, they were asking additionally about runoff from landfills or even nuclear waste storage.

A: I think that's a really good idea. We've talked about things like petroleum storage and floodplains, chemical storage and floodplains, you know, we had a problem in Reedsburg, where LP tanks were shooting down the river near natural gas lines across the river... I think it's going to mean that we have to take a much closer look at our potential high water floodplains, and what's actually located in those floodplains, to understand what the vulnerability is. Aside from a residential or commercial building impact, for example, that FEMA might do. I don't think that there's a very good sense that we have a handle on exactly where all those potential hazards might lie.

Q: Does WICCI have an Illinois or Midwest counterpart, and are some of the downscaled models available for other states?

A: I'm going to refer you to Dan Vimont, who's part of the WICCI climate working group. Dan is working with several other states to expand the range of those downscaled projections to an area that encompasses the Great Lakes states and actually a little bit larger than that. In terms of an approach, though, WICCI really is the first of its kind in (at least the upper Midwest) and we're expecting that other states are going to follow the lead, as they see the value of the approach we've taken: vulnerability identification, impact analysis, and adaptation development.

Q: Is there a list of currently acceptable stormwater BMPs and their potential impacts that you would recommend?

A: I think EPA has a very good stormwater BMP webpage, an actual manual for municipalities. I would certainly send you to that one. I think a question that follows on that, however, is "What is it you're trying to accomplish, and what exactly are the vulnerabilities of the different BMPs to these changing climactic conditions?" If you're looking to infiltrate water, which is a very popular approach, especially distributed in residential neighborhoods that have rain gardens, for example.. we're concerned that prolonged periods of rainfall, high groundwater, might have the impact of flooding out those types of infiltration BMPs and killing the plants, for example. We certainly would hope that any new stormwater detention devices, whether they be ponds or whatever, are designed with these larger events in mind, so they can safely pass heavy water that's beyond what they're designed to contain. Those are some of the important questions municipalities need to be looking at as they design their stormwater BMPs.

Q: People wanted to know where they can get information on the climate models you discussed, and if the resources are available at the website.

A: Absolutely. If you go to the WICCI website, on the very front page, right now there's a link to the full WICCI report, and under the WICCI report, there are links to each of the working group reports, and you'll want to look at the climate working group report which gives you the details on how the downscaling was done.

Q: And we can also link to those the changing climate data on the osu.edu site as well. I want to go back to a couple of big picture questions we got. Given that each state has varied ways of how they look at climate change, are there any plans for gauging stormwater management across the region, or more of a comprehensive analysis?

A: That's interesting. Certainly some of the national organizations like the Army Corp of Engineers are looking at what you'd expect the impacts to be from runoff on these large river systems that cross boundaries between states--the Red River, the Mississippi, the Missouri… However, as far as I know, most of the stormwater management regulations are state by state, so while water quality might reflect EPA national discharge standards, quantity is not often regulated in Wisconsin. We don't have any statewide regulations for managing stormwater for quantity, that is actually down to the local municipality. So it's going to be important to have a regional awareness and education on these type of issues, especially with the engineering practitioners that are generally the ones that are designing these facilities and working with municipal managers to get the best response that we can.

Q: Somebody asked about natural vs. human influence regarding some of these changes you've discussed. If you could talk about that briefly.

A: A good example would be the river that runs through Racine, Wisconsin. Racine has been seeing higher and higher flood levels on the river over the last decade or so. The community needs to know if it's caused by a change in climate, or increasing urban development beyond the boundaries of Racine. Those are the kinds of trade-offs we talk about. Another would be a wetland situation where you might have a previously drained wetland, what is the impact of that drainage system on the wetland structure, i.e changing climate vs. one where the drainage system has been removed and the wetland's been restored.

Q: We have a question about the cutoff on the risk-benefits of reconstruction. Specifically, should planning be done on a hundred year storm or five hundred year? What about getting citizens to pay for removal of CSOs?

A: Ok, so a couple of things. Let me just start out by saying that in terms of adapting to climate, the climate changes that we're projecting are long-term. But many of the infrastructure decisions that we make are not as long as that, so wastewater treatment system might be making decisions for infrastructure that's going to be in place for 50 years, whereas a suburban development might have a much shorter planning horizon. That's something we need to think about a little bit. Certainly when we're talking about disconnecting from combined sewer overflows, it's going to be the community that's going to decide how that's going to be paid for--whether the homeowner or the wastewater treatment facility's going to do it and charge back to the entire system. I don't think we have specific recommendations for that.

Q: We had a question about changes the average citizen can make in their own home to address some of these potentially new trends in rainfall or flood events.

A: Well, I think that you should first of all understand where your house is in relationship to a floodplain. Secondly, you should understand what happens with stormwater on your property when it does rain hard, which I'm afraid means going outside in the rain and getting wet, looking around when it's coming down. To most homeowners, especially if you're on a sanitary sewer system, you want to avoid rainwater coming into your basement, going into your floor drain. If you have a roof downspout that goes into a drain that goes into the sewer, you want to disconnect that and run it off into the street or into your lawn if at all possible. You can do more than that--putting in a rain barrel or rain garden to capture contaminants from smaller storm events, and there are many good guides out there for residential stormwater management.

Q: We have a question about calculation of $7500 per resident for downspout connection. I'm not sure what that related to, but if you want to just speak to, in general, how that was calculated.

A: That was a calculation that came from the Milwaukee Metropolitan Sewerage District for disconnecting the downspouts and I believe closing the drains that led from the surface into the sanitary system. More info would be available on that from Milwaukee Metropolitan Sewerage District, or if you want to email me.

Q: Just a question on the idea of outreach to other institutions. Someone asked if info will be shared with USEPA, especially as they're looking at negotiating with cities dealing with CSOs.

A: Certainly, and I know the McClellan group in Milwaukee is actively involved in that process, and that's where this info came from.

Q: A couple people have asked about equivalents to the WICCI group in other states.

A: I hope if you're planning on putting together a group to look at climate impacts that you'll take time to look at the model that WICCI used. It's been very successful. We've been very collaborative and collegial, and I think one of the things we've done is to educate ourselves as we begin to educate others, and that's a very powerful approach.

Closing:

I wanted to again thank David and all of our participants for an excellent discussion. This presentation and related education materials are posted at: changingclimate.osu.edu

We would really appreciate it if you would let us know what you thought about today's webinar. There is a short evaluation that is posted and available at the link located in the chat box that we would like you to complete following today's webinar.

The next webinar will take place on March 1at noon EST it will address the Economic Implications of Climate Change to Great Lakes Ports, Harbors, and Marinas. This webinar will be of particular interest for those of you involved in stormwater infrastructure. Dale will introduce a new infrastructure cost matrix that can be applied to calculate current value and future liability of stormwater infrastructure with a changing climate. Registration is now open and the link to register is located in the chat box.

Thank you and have a great afternoon.

[DSL 3/8/11]