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Best Practices in Addressing NPDES and Other Water Quality Issues in Highway System Management: Results of a U.S. Domestic Scan Tour
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[Opening Titles with Music]

Fran Wescott: Hello and welcome to this webcast presented by the Center for Transportation and the Environment at North Carolina State University in Raleigh. I'm Fran Wescott of the North Carolina Agency for Public Telecommunications, and on behalf of CTE, we're pleased to bring you this 45th program in the Center's national broadcaster series. This forum is a part of CTE's technology transfer initiatives to engage transportation and environmental professionals in a dialogue about emerging issues, new policies, research applications and best practices. CTE is a nationally recognized university transportation center established by the U.S. Department of Transportation. Today's webcast will discuss best practices in addressing NPDES and other water quality issues in highway system management. The program will present results from a recent U.S. domestic scan tour conducted in the summer of 2009. The Scan Team of transportation and environmental professionals toured several states to study their stormwater programs. The study revealed a number of best practices that can help state DOTs increase their compliance with National Pollutant Discharge Elimination System permits, and help reduce transportation project delays and costs associated with NPDES violations. We're pleased to be joined today by Scan Team members from the Federal Highway Administration, Environmental Protection Agency, state DOTs, and consulting agencies who will provide an overview of the scan and discuss its results. Before introducing today's moderator, here are a few notes about the webcast to get us started. First, thank you to the many
professionals across the country viewing this webcast. We hope you'll be an active participant in today's live discussion on March 25, 2010. You may email your questions and comments for the panelists to cte_email@ncsu.edu. The address will appear on the screen throughout the webcast. Panelist will respond to your questions following their presentations during the two question and answer segments of the program. Today's program agenda is available for download from the CTE website at cte.ncsu.edu and includes the schedule of today's presentations, a brief profile of each panelist, instructions on how to access the live audio feed by telephone if needed, and contact information just in case you need technical assistance while viewing the live webcast. Finally, we want to recognize and thank the Federal Highway Administration for its partnership and valuable assistance in producing the program, and thanks to the Environmental Protection Agency for its assistance in promoting the webcast. Now it's my pleasure to introduce Scott Taylor who will moderate today's presentations and discussion. Scott is a senior vice president with RBF Consulting headquartered in Irvine, California. Scott is a professional engineer with experience in flood control engineering and surface water quality and specializes in highway drainage and stormwater quality design. Scott serves as subject matter expert for the Scan Team and will introduce our other panelists. Welcome, Scott.

Scott Taylor: Thank you, Fran. Our panelists for today's program include members of the Scan Team as well as representatives of the host field visit locations. I'm pleased to introduce three of our panelist joining me in the first part of this webcast. Karuna Pujara is Chief of the Highways Hydraulics Division for the Maryland State Highway Administration. Karuna manages the Division’s stormwater management facilities, NPDES efforts, and highway drainage improvement projects. David Harris is the State Roadside Erosion Control and Vegetation Management Engineer for the North Carolina Department of Transportation. David is currently implementing new erosion and sediment control technologies for the Department's construction operations. And lastly, Andy McDaniel, also with the North Carolina DOT, is project engineer for water quality assessment in the Highway Stormwater Program. Andy manages compliance activities for the statewide NPDES permit. Karuna, David, Andy, thank you very much today for being here. In later segments of the webcast, we'll be joined by other panelist from North Carolina DOT, EPA, and FHWA. Now let's jump into the technical part of the program. Today our panelists will provide an overview of a national cooperative highway research program scan that was completed in the summer of 2009. The topic of the scan was implementing a DOT stormwater program. As you'll see today we focused on four topic areas of special interest to DOTs. Next slide. The domestic scan program is designed to focus on innovative practices of high performing transportation agencies that can be beneficially adopted by other interested agencies. The scan program provides the opportunity for and facilitates technology transfer on a relatively economical basis with potentially significant benefits on a national scale. Domestic scans are carried out by a team of 10 to 12 representatives from DOTs, FHWA, in this case the U.S. EPA, and a subject matter expert. The Scan Team members worked initially from a scan overview paper developed by the NCHRP. A team refined the topics in the overview paper into four primary areas. A desk scan report was then drafted by the team that consisted of a literature review, interviews with national experts on selected topics, and recommendations for scan site visit locations. Scan travel to the field locations included interviews with local DOT staff and presentations by the DOTs to the Scan Team. Following the field visits, a summary report, a PowerPoint presentation and draft final report were completed documenting the team's findings. These products will be available on the TRB website by late April. The final portion of the scan is implementation or getting the word out on the findings and building the teams recommendations through research, policy and program improvement which is part of what we're doing here today. Next slide. The desired outcomes from the scan were, one, to provide reference information for DOT stormwater programs. The final report will be a good resource for documenting stormwater program challenges and some potential solutions. Second, to generate recommendations for future applied studies. Third, to provide information to help guide changes to agency business practices and policies. And finally, to help guide the national policy discussions relative to stormwater regulation. Storm program implementation is becoming more complex and requiring more DOT resources with each new NPDES permit cycle. While specific water quality problems can be unique and reflect local conditions,
many of the stormwater program and policy issues are common to all DOTs. Additionally, the BMP technology used by DOTs is readily transferable both domestically and internationally. Next slide. This is a list of the entire Scan Team members, some of who are in studio with me today. Overall, the team was made up of representatives from six DOTs, three from FHWA, one from the U.S. EPA, the subject matter expert (myself), and a facilitator from the NCHRP contractor, Aurora and Associates. Next Slide. The scan sites were selected based in findings from the desk scan. The final scan sizes were confirmed by the Scan Team following discussions with representatives from each of the host locations. Our team settled on six field sites. The first was the New York State Department of Transportation. NYSDOT has experience in advanced treatment system application for construction sites. They also have experience with TMDLs, BMP research, and ultra urban BMPs. The team was interested in viewing the database assembled by the DOTs environmental science bureau that tracks the maintenance requirements and other data associated with their treatment control BMPs. The next field site was Washington DC DOT or DDOT. DDOT is implementing low impact development BMP installation in a retrofit program for LID. They have a unique structure in that the DOT reports to the city council for the District of Columbia along with all the other district agencies. Many of the receiving waters within the district are on a 303(d) list for a variety of pollutants and a portion of the DDOT system are on a combined sewer outfall. The next field site was the Maryland State Highway Administration. The Scan Team found from literature review and personal communications with national experts that the SHA is one of the leaders in LID implementation. And as a key state within the Chesapeake Bay watershed, the SHA faces many stormwater management challenges at the regional, state, and local levels. The SHA has a state of the art tracking system for post construction BMPs, maintenance, and operation. The Scan Team was also interested in their construction site stormwater compliance program and their design, build, operate and maintain model for post-construction BMPs. The SHA holds both Phase 1 and Phase 2 MS4 permits. The North Carolina Department of Transportation was the next site. The team was interested in NCDOT since it is actively involved in TMDL planning and participates on state work groups for TMDLs. NCDOT partners with state universities to conduct water quality research such as the use of soil binders for erosion control and to investigate post-construction BMP performance. The DOT bases a portion of employee reviews on stormwater program performance metrics and has successfully created a culture of environmental stewardship in their organization. Our next site was the Texas Department of Transportation. TXDOT also partners with public universities to implement a research program for highway BMPs, and has pioneered the use of sand filters in the highway environment in the Edwards Aquifer Recharge area. Texas A&M University maintains a hydraulic sedimentation and erosion control laboratory for testing erosion and sediment controls for use in the highway environment. The Scan Team was interested in the post-construction BMP research studies that TXDOT has funded through the University of Texas and Texas A&M. And lastly, we visited the Florida Department of Transportation. The Scan Team was interested in Florida as a field site visit for several reasons. First, responsibility for the stormwater program resides with each of the DOT’s districts rather than with the central office. NPDES permits for the DOT are within the DOT’s districts as a co-permittee with MS4s. FDOT also operates the Florida Turnpike Authority, a system of toll roads, and funds a BMP research program through the University of Central Florida. Next slide. The Scan Team invested a considerable amount of time refining the topic areas prior to the travel portion of the study. The objective was to investigate topics of national importance that were emerging as technically, fiscally, or programmatically challenging for DOT stormwater programs. The team agreed on investing in the four topic areas that you see here: TMDLs, BMPs, DOT practices and procedures, and the working relationships with regulatory agencies. Our panelists will discuss the topic and the findings of each of these areas in more detail. But first, I’d like to give an overview of the general scan findings and recommendations which will help frame the remaining discussions for this webcast. Next slide. One of the main findings of the Scan is that DOTs are unique from a stormwater permitting perspective. The Scan Team found that MS4 NPDES permit system was developed more for municipalities and that the unique aspects of DOTs makes application of traditional MS4 permit a difficult fit. Some of these discriminators are, first, DOTs cross nearly every watershed in a given state and multiple jurisdictional boundaries while controlling only a very small part of the watershed within their right-of-way. This means that DOTs must coordinate with a large
number of stakeholders on water quality issues and may not necessarily be in the position as the lead
stakeholder. Second, DOTs operate infrastructure that has practical limitations for what can be
controlled in the right-of-way. Some issues are clear zone requirements, limited space, and safety of
maintenance workers in the traveling public. And lastly, DOTs primarily operates single purpose facilities.
This suggests that a permit with more focused objectives as compared to a traditional MS4 permit is
possible. For example, there are not unique—there are not multiple pathways for potential stormwater
contamination in the highway environment as there are with traditional MS4s since access to most
roadways is controlled and public activities are restricted. Also, a significant portion of pollution sources
are outside of the direct control of the DOT. Next slide. The Scan Team found that the stormwater
regulatory program is in flux nationally and a source of uncertainty for all of the DOTs visited. Some
implementation approaches that the team found in high performing agencies are, first, commitment. An
effective stormwater program requires commitment from the highest level in the organization. It also
requires nearly continuous communication with the public and regulators to ensure buy-in at all levels.
DOTs, nationally, face similar issues on a program level. An annual national DOT conference on stormwater
issues is highly recommended. And a stormwater track at the TRB conference is suggested. The team
found that it will be important for DOTs to partner with other stakeholders to develop cost-effective
stormwater solutions particularly for TMDLs. It’s important that each program element be evaluated on a
cost-benefit basis. The DOT stormwater program manager is responsible for spending stormwater
resources to obtain the best benefit for the environment; having accurate cost data is critical and can build
support for these programs. And finally, it’s important to integrate stormwater management throughout the
project deliver process. The most effective stormwater mitigation can be provided by incorporating
considerations for stormwater quality early in the project environmental process and continuing through
project construction and operation. Next slide. Based on these findings, the team developed a set of
recommendations. The Scan findings support that there is a need to change how DOTs are regulated. It
would be beneficial to change how DOTs can comply with stormwater regulations through participation in
credit programs and focus on tools for compliance that are suitable for the highway environment. In the
long term, source control of constituents will likely be one very cost effective approach for DOT systems
and more research is needed in this area. A national model transportation separate storm system permit is
recommended to assist states in developing an effective stormwater regulatory program for the DOTs and
to take advantage of some unique aspects of DOT programs and infrastructure. Similarly, national
guidelines for DOTs as a stakeholder in TMDLs could assist states in DOTs by ensuring that DOTs are
aware of and ready to participate in pollutant water body listings which there is a scientific nexus with
highway stormwater quality. The development of case studies and guidance on how DOTs are dealing with
TMDLs within their permits would help all DOTs learn from the process. A long term strategy for DOTs may
be an additional emphasis on source control. The cost to remove pollutants from stormwater varies from
discharger to discharger, but the point of greatest control, usually at the source, being the most effective
and economical location to expand the resources. Stormwater programs are entering a defining period
where treatment control retrofit may be required to meet numeric limits and TMDL waste load allocations.
What has not been adequately investigated, however, is the life cycle cost of a treatment emphasis type
approach as compared to a combination of treatment control and true source control. Finally, it’s
important to integrate stormwater program responsibility within the DOT. Having persons in each DOT
division that are charged with stormwater program responsibility helps create stormwater program
ownership. Next slide. Just a few more recommendations, one of the findings of the Scan was that the
similarity of DOT facilities in associated water quality issues on a national—from a national perspective. The
use of pooled fund studies to assess important areas of stormwater research allowed DOTs to leverage
resources and reduce the duplication of research while meaningfully advancing the science. The team
found several advanced university programs nationally that are producing exceptional applied research
programs for DOTs. A reality is that many DOTs do a relatively poor job of tracking stormwater program
costs. The lack of cost data makes it difficult to assess program implementation options and demonstrate
the impact of regulatory actions on agency operation. Better cost tracking is needed. The Scan Team found
that there’s additional progress that can be made on institutional and maintenance BMPs for DOTs.
Controlling roadside erosion, mowing, the application of traction aids, the use of herbicides, litter pick-up, and sweeping programs are some of the potential target areas. That concludes our brief overview of the main Scan findings and recommendations. We're going to spend the next hour and half or so discussing the four topic areas with our panel members who will highlight some case studies. Next slide. At this point, I want to introduce the first of our four topic areas which is TMDLs. DOTs cross many watersheds in their respective states and have the potential to be a stakeholder in most TMDLs. According to the U.S. EPA, there are currently over 40,000 water bodies listed as impaired from over 73,000 causes of impairment. There are about 38,000 approved TMDLs nationally from over 40,000 causes of impairment. These numbers have approximately doubled over the past 10 years. Clearly, TMD development, implementation, and compliance will be a primary issue for DOTs in the near and long term. The TMDL topic for the Scan was divided into two subtopics, TMDL implementation and credit trading for TMDL compliance. Andy McDaniel of the North Carolina DOT is going to lead us–lead the panel in this part of the discussion. Andy?

Andy McDaniel: Well, thank you, Scott, and good afternoon to everybody. For the next few minutes, I'd like to spend some time talking about the interface between TMDLs and state DOTs. As you'll see on this next slide, some of the topics--one more slide please--some of the topics I'll talk about are why DOTs should be paying close attention to TMDLs. How can DOTs best position themselves to manage TMDL compliance? And then I'll touch on a few current and future challenges. So, on the next slide, what is a TMDL? Well there are many--there's a wide variety of interpretations as to what the acronym stands for and, believe it or not, I didn't make any of these up myself. I borrowed a number of them from an EPA presentation I once saw. But Too Many Darn Lawyers is in reference to the amount of litigation that we've seen over the years surrounding TMDLs. And this was especially acute in the late '90s and early 2000s. And even today when you go on EPA's main website, you can still find a link for litigation status. Totally Misinformed Discharge Limit and Terribly Misunderstood, Divisive, and Litigious, both speak to the fact that TMDLs have not enjoyed a very favorable reputation. That being said, however, a well thought out TMDL, one that's rooted in sound science, really can be a useful tool to guide watershed restoration. So what does TMDLs really stand for? Well on the next slide, you'll see that it stands for Total Maximum Daily Load. And in theory, a TMDL represents the maximum allowable pollutant load a water body can assimilate and still meet water quality standards. In other words, you can think of a TMDL as a pollution budget that if it's attained can result in the achievement of water quality standards. On the next slide, you'll see a formula that represents the definition of a TMDL and that formula should be the clue that a TMDL is actually a number. It's a numeric load allocation. It's not a watershed restoration plan, although watershed restoration plans are commonly used to meet water quality standards. Those plans really are not a TMDL. The TMDL again, is the load allocation, mass load allocation. And when you look at the equation, a TMDL represents the sum of the waste load allocation plus the sum of the load allocation plus a margin of safety. Now the waste load allocation is the allowable load allocated to NPDES permittees and that includes both waste water permittees as well as stormwater NPDES permittees which DOTs fall into that category. A DOT's conveyance system may be covered by an NPDES—if it is covered by the NPDES permit, as I've mentioned, will fall into that waste load allocation category. The load allocation category represents that allowable load that is given to those entities that are not permitted by NPDES permits. Agriculture for example is a common category. So, small municipalities and some DOTs that are not covered under NPDES actually would fall under that LA category. The margin of safety represents a portion of the waste load allocation that's not allocated out. It's actually withheld–held in reserved to account for the uncertainties in the actual TMDL analysis. So for example, if you look at the pie chart here, the red area that you see is the portion that would be allocated to the non-point sources. The yellow portion of the pie is the waste load allocation that may be allocated to say a waste water treatment plant and the MS4s which DOTs and municipalities are again fall into that waste load allocation category and are given an allowable load there. The—kind of the take home message from this slide is that it's important to realize that the Clean Water Act does not dictate how that pie is divvied up. So if there is one take home message from this slide is that it's important for DOTs to be engaged in the TMDL process so that the portion of the pie that you are given is—it fairly represents your contribution to the impairment. On the next slide, you'll see sort of a flow
chart of what is a typical TMDL process. There are several variations of this process but probably the most common one starts off where the water is being deemed impaired by the state resource agency and placed on the 303(d) list. That 303(d) term refers to the section of the Clean Water Act that mandates that states inventory impaired waters and it also refers to the portion of the Clean Water Act that discusses the TMDL process itself. Once that water is placed on the 303(d) list then the state agency has an obligation to develop the TMDL for that pollutant of concern. Now EPA is established a goal that the TMDL should be developed for the water body, know in a period between 8 and 13 years from when it's first originally placed on the 303(d) list. After the state develops that TMDL then it's put out for public notice and the public as well as the DOTs can comment on it. However, as an aside from my experience, I would really recommend that if you are representing a DOT agency that you not wait to engage in the TMDL process until the public comment period begins. I think if you wait to get engaged at that point, you've really waited much too long and you've really missed an opportunity to try to effect change. And the reason why that is, is many TMDLs are developed using fairly complicated computer models. And if you have a—depending on what the DOT's comment is, if you have a comment that results in the need for a re-calibration of the model and that sort of thing, that could be very time consuming. And the resource agency is really going to be hesitant to take on that kind of delay. So that's all the more reason why you should be engaged earlier in the process. Next slide please. So what happens after the TMDL is developed? What's important to note that TMDLs are not self implementing under the Clean Water Act. In other words, the Clean Water Act does not provide EPA or the states with any new additional authorities to require implementation of the TMDL. Rather EPA and the states have to rely on existing regulatory authorities and these really fall in two main categories. The first being NPDES permits, which I'll spend most of my time talking about; and then state specific rules can also be used to mandate implementation. In the TMDL world, there are two main categories of sources of pollutants, point sources and non-point sources. And we traditionally think of a point source as a source of pollutant being delivered through a pipe or some other discreet open channel conveyance. However, technically speaking, the definition of a point source really has very little to do with the characteristics of the conveyance system. It actually has everything to do whether or not you're permitted under NPDES. So that's kind of an interesting twist especially for those DOTs out there that may have only a portion of their highway system permitted under NPDES, say in the Phase 2 area, and then that portion outside in the county may not be permitted under NPDES. So in that case, you've got actually two definitions of pollutant load from DOTs. One part under NPDES is considered a point source and the other part is considered a non-point source. And thus you fall into those two different waste load allocation and load allocation categories. For non-point source, it's useful to recognize that there is no federal regulatory enforcement program. So thus efforts to reduce pollutant loads from the non-point sources are largely voluntary supported by 319 grants and other sorts of things. Now again, state specific rules can mandate a non-point source entity be required to reduce pollutant loads and we see a number of those cases in North Carolina where nutrients are of a concern. On the next sides—On the next slide, let me kind of cut right to some of my main take home points here. The first is that DOTs are uniquely affected by TMDLs as Scott mentioned at the start. And the reason is, is that due the linear nature of our transportation system is spread over a wide geographic area. This makes DOTs very much susceptible for inclusion into many TMDLs. North Carolina is probably the poster child for this point. If you look at the map there, you can see in black our secondary road system and in red our primary road system and it becomes quickly obvious that we have a road way facility that's likely crossing every single impaired watershed in North Carolina. When you combine that with the fact that North Carolina DOT has a blanket statewide NPDES permit that covers all of our roadway system statewide, then the NCDOT could potentially be susceptible to every TMDL that's developed in North Carolina and that could be hundreds. So it's really quite an important issue that, yeah, we need to be aware of here. Even if your roadway system is not as large as North Carolina, you could still be faced with having to comply with many, many TMDLs over time. And for that reason, it's important that DOTs become proactively engaged in the TMDL process which leads me to my next point here. Point number two which is that, we're really advocating that—excuse me, DOTs take a pro active leadership role in the TMDL process. And the reason for this recommendation is that more often than not, state DOTs along with Federal Highways have a very high level of technical knowledge
and expertise on pollutant loading from transportation facilities because that's what we do. It's transportation all day, every day. We're not worried about so much agriculture or urban commercial development or residential development. We're focused on transportation facilities and thus our research program is focused on transportation facilities as well. In this slide, you can see some of the tools that the North Carolina DOT has used to support TMDL development. There is a wonderful report that was prepared by FHWA in partnership with USGS entitled, "The National Highway Runoff Data Methodology Synthesis" which was published in 2003. This is a multi-volume report that contains a lot of useful data that are directly applicable to TMDLs. Also with this package and material was developed a Microsoft Access database which you can see the front end of on the right side of the screen, the blue side that indicates—that contains a lot of the data that we use to help support TMDL development. And there are many other tools as well that have been developed and used. Finally, on the next slide, my final point is that a clear measurable pathway to compliance is essential. Now this may sound like an obvious point to make but I think it is really important to emphasize, because when you're having to juggle compliance with many, many TMDLs across the state, it's really important that you have a clear pathway to success there. And I think the key to that is really held in your NPDES permit. It's the NPDES permit that will drive the compliance. Finally, let me touch on a couple of current and future challenges in this next slide. Fair, reasonable, and proportionate TMDL implementation requirements are very important. Again, there's no rules for how that pie is divided up so it's important to keep a handle on what your state resource agency is doing. The lack of a TMDL appeal process for waste load allocations is another issue that may become more important in the future. How much credit DOTs get for the implementation of proprietary stormwater devices is another interesting topic that deserves some attention. In North Carolina, proprietary devices are not allowed for new construction. However, the resource agencies are allowing them for compliance with TMDLs but we don't yet know how much credit proprietary devices will be given. Treating co-mingle drainage is another very interesting issue where you got pollutant loads coming into the right-of-way from off site. And potentially, if the DOT treats those, does the DOT get full treatment credit for that offsite pollutant load or do we have to somehow divide it up among the parties? And finally, one of the bigger challenges I think we're facing in the future is the impervious cover TMDLs, many of which had been developed in the northeastern part of the United States and EPA Region One. Last year, we had an impervious cover TMDL in North Carolina be approved by EPA and we do have another one out for public notice as we speak. These TMDLs require typically a reduction in impervious cover across the watershed. And as you know, there is not exactly a lot of excess travel lanes out there for us to remove. So how do we comply with these types of TMDLs? That's going to be a real challenge for us in the future. Thank you.

Scott Taylor: Alright, well, thank you Andy. We're going to move on to our second topic area now. But remember, we're going to be taking your questions in about 15 minutes so if you could email them in to cte_email@ncsu.edu. On this next slide, you'll see an overview of our second topic which is BMPs. BMPs are the foundation of DOT stormwater programs and are generally categories into non-structural source control and structural treatment controls. BMPs are used for all aspects of DOT stormwater programs including construction, maintenance, and operation. It's important that BMPs used by DOTs are effective, economical, and can be operated safely in the highway environment. Limited right-of-way, geographical diversity and the need for passive operation create special conditions for DOT BMP development and implementation. Karuna Pujara of the Maryland State Highway administration and David Harris from North Carolina DOT are going to lead the discussion on BMPs. Karuna will start. Karuna?

Karuna Pujara: Thank you, Scott. In today's presentation, I will focus on post-construction stormwater facilities and best management practices that perhaps can help us move towards meeting the TMDL goals. And David will follow up with the erosion and sediment control or during construction stormwater best management practices. If we go to the first slide, it just brings back the map Scott described earlier. And it shows six states that the Scan Tour visited. And I'm learning a lot about best practices that are applied nationwide while you are all listening here. One thing I want to bring up is context is very important. Things that are important and one region of the nation may not be as important in another region. And so,
the agency or state approach to stormwater should be within that context of framework of watershed it serves. In Maryland, obviously, we are affected by Chesapeake Bay, its condition, and we hear more frequently about sediment, nutrient, perhaps dissolved oxygen and temperature. If you go to another part of the nation, you may have issues such as recharge which may have higher importance over temperature or a higher importance over sediment. And so, as you take on the messages that we are giving here, please bear in mind that your challenges maybe slightly different and when you adapt those, keep your watershed context in mind. So the next slide, if we go, what does this bigger context really mean. And what--Andy just talked about TMDL being a numeric value. What does it mean when you are planning your stormwater program and you're trying to decide what your operational strategies may be, and what BMPs do I apply whether I'm designing a project or I'm overseeing a maintenance program within the State Highway. And so here is a map of a county within Maryland and all the black lines indicate state highways, owned by State Highway Administration and operated by SHA. The blue dots that you see are the stormwater--post construction stormwater BMPs that are built and serving impervious surfaces of the highways. The green-shaded areas are the areas that have TMDL established. And white areas are the areas that do not have TMDL established. And so you can see the upper portion of the county where you have roadway network served by post-construction BMP, at the same time, you have TMDLs established. You may feel comfortable that the pavement is being treated. However, what happens in the portion of the watershed or the county where you have roadway network, TMDLs are established. You do not have highway construction project or capital project, how do you meet those TMDL? And that is where you look at suite of stormwater best management practices alternatives and it may be a source control strategy, it maybe a site control strategy, or it may be end of pipe or watershed scale best management strategy. So if we--in the next three slides, I will talk about those. Just before that, again, I want to reiterate what Andy had just said, is that TMDL is really just the pollution budget. And how do you meet your portion of the budget that's assigned to you. It may not be assigned to you like Andy said. But we have to keep in mind portion of the watersheds that have TMDL established. Your land use that exists within that watershed, that's owned and operated by the state agency. And you do the math pretty much that would be the strategy here. So the source control strategies--if we go to the next slide, please, could be multiple of them. Erosion control in parts of the nation where it is easy to establish vegetation right after construction. This is perhaps the best strategy you can have if the sediment is a TMDL that you're looking at. How do you do that? Either you limit the area of disturbance or in fact the timing. How long do you have to keep the site open before you stabilize the site with some sort of erosion control practice? You may have streams that are unstable regardless of whether there's a project or not. Many of our maintenance forces are aware of unstable areas with along the highways that they have to repeatedly go and either reduce or address the sediment that maybe passing through the culverts, bridges, point you to areas that are unstable within the watershed. Many of our highways have some sort of landscaping program or management program for vegetation control. And nutrient management plan could be to limit amount of fertilizers that are being applied. So that there is enough amount of fertilizer or nutrient being applied for vegetation growth at the same time your curtailing the excess amount of nutrient being applied on the roadside area that would ultimately run--produce runoff and excess pollution. In addition, you can look at other alternatives such as street sweeping, drainage system cleaning, deicing operation or another strategy that is being looked at more and more and many agencies are looking for alternative ways or different strategies as to how some of the salt application can be reduced. Micro-scale stormwater facilities, many people know them as LID practices, are another methodology. Good thing about these facilities is that they can be built anywhere in any small space that you may have available. Especially when you have them in the right-of-way and you're always maybe within highly urban areas. Of course, public education is another strategy than can be applied. Many of--the difficulty of this is that you cannot quantify benefits of source control strategies into pounds of pollution that you are going to reduce. Again, we are in infancy of TMDL implementation, so certainly our knowledge and understanding will approve and we will find ways to measure their effectiveness. When we cannot employ a source control strategies, if we go to the next slide, you have to go to the site control and that's where you look at the sediment control from construction site, larger sites that you have to stabilize or keep the sediment within your site. There are many sites that are eroding
along the highways that you need to stabilize and, of course, many of the stormwater management facility options such as sand filters, infiltration trenches or ponds that you can employ. When many of these don’t function or do not work, you can go to the next option or next slide, end-of-pipe or watershed scale BMP. Of course you’re looking at ponds that can treat many acres. You can look at unstable streams such as what you see in the bottom of the picture that do contribute sediment and pollution to the ultimate water body. Important part of this is that end-of-pipe controls are not favorably seen and it is very, very important that DOTs measure effectiveness of these types of facilities. And so the last point I want to bring up is whether it’s a source control, or site control, or end-of-pipe system, no matter whether it’s a small, large, where is it located, maintenance is very important. And so you must account for administrative and long term maintenance cost of any system you build. David?

**David Harris:** Thank you, Karuna. I'm David Harris and in the North Carolina Department of Transportation we are actively trying to improve our erosion sedimentation control program. Some of the challenges that we face are unlike the challenges you face. North Carolina DOT has a unique program. It was granted to us from Land Quality in our Department of Environment and Natural Resources. Let’s have the first slide, please. Linear construction like most of you face every day is a unique challenge. It crosses multiple watersheds, wetlands, streams, urban areas, rural areas, farms, historical sites, narrow footprints, right-of-way is limited due to constraints from factors that you do not have influence on. Trying to install erosion sediment control that meets the demands of what our public expects from the DOT is very challenging. In the next slide, you'll see traditionally over the years the technology that we used was the standard basin, rock sediment trap, these devices were the best that we had. A lot of silt fence used. The one thing that we started noticing though was the efficiency of them. We kept having failures. We kept having sediment migrating down streams. The agencies in North Carolina allows—the law allows us to have a performance based system. So when the agencies were asking us why are you not collecting the sediment, we turned to the only thing that we had. And that was NC State's research department. Next slide. Dr. McLaughlin, which if you haven't heard of him you probably will in the near future, has been a critical part to doing the research work for NCDOT in trying to find ways to improve our system. And some of the things him and other fellow researchers include Melanie McCaleb have found I think will be beneficial to everybody in this nation. Next slide. The one thing that they found out was that turbulence in the sediment basin creates a problem with the efficiency. We traditionally thought as long as the water entered the basin, the particles would be allowed to settle out. What we found out was the turbulence prevented the fine colloidal clays from settling out. If you have a real sandy area, the sands, no problem. But the clays they couldn’t. We tried the silt fence baffle. Some states are trying silt fence baffles to try to create a longer run for the water to travel. What we found out there was the imperviousness of the silt fence created more turbulence as it went around the little cut through at the—that you were required to cut in them. What Dr. McLaughlin and his researchers found was a porous baffle worked like a manifold. As the water entered the basin, it didn’t really trap any sediment but it reduced the turbulence. You reduce the turbulence, you start settling things. And when you settle things, that give us more opportunity to become efficient. In the next slide, what this evolved into after he did all of his research was a lot of the practice that—practices that we did on daily basis, the vertical ditches that we had for silt ditches are vertical side slopes in our basins. Not seeding areas fast enough. This was contributing to our problem. So as you see here in this picture here, we have evolved to stabilize side slopes 2 to 1. We have our baffles to reduce turbulence. We use an outlet energy—well an outlet dewatering device, skimmers I think you probably are used to them. You can also use a flash borderizer. We've also protected our outlets for our spillways. Overall, you’re seeing an improvement of efficiency go up by 30 or 40 percent for each basin. We changed our design criteria. We included the entire watershed instead of just the construction area. In the next slide, you're going to see—although we trapped almost of all the particles that we were required to in our sediment law, Water Quality started expecting more from us in the finer particles. This created our turbidity issues that a lot of you are facing today on your construction sites. There's two ways you can do this. You can either do it actively through a water treatment facility or you can do it passively. We tried—all of our research was focused on the passive approach. Try to introduce something into the runoff system, treat it, drop it out before it leaves our right-
of-way. We felt like this would be a better effective way of reducing the sediment and turbidity load that we're releasing into the system. Polyacrylamides is the area that we focused on. In the next slide, you see we introduced polyacrylamides to various techniques. In this one, we've used waddles. We sprinkle about 100 grams of PAM product, for North Carolina we found that works for us which can in every area the different soil types, different soil conditions, you might have to use a different type of polymer. The research is ongoing and we continue to find new ways to introduce this. But once you introduce the polyacrylamide, it helps the flocculation of the sediment particles. And in the next slide, which is a picture of the research that was done in the North Carolina mountains which started a lot of the research on turbidity because of our trout streams. You can see we have--before we treat it with polyacrylamides, we have the sample on the left. The sample on the right was after we treated with polyacrylamides and you can see the significance that it made in our turbidity. The polyacrylamides that we used all have to go to toxicity test and have to be approved by Department of Water Quality. We cannot use any polyacrylamides that discharged directly into any natural water course. All the polyacrylamides have to go through settling basins. So, we look for the most environmentally conscious way to help reduce that turbidity load. Next slide. So in the end, we have a better system, a better passive system introducing polyacrylamides, stabilized sided slopes. We have found out that even some of our basins and our sandy soil areas, the infiltration rates are at such a level that a lot of our basins never discharge out the spill way or the skimmer. In those cases, our efficiency has gone up to 100 percent. In a typical basin like you see here, we're probably on the average of 95 to 100 percent with that basin. So, a dramatic increase, overall, for the efficiency of a passive erosion control system and our hopes are that we'll continue to explore the flocculation treatments. We'll continue to look for new techniques in seeding and mulching, using matting products, and ultimately give us a better system that will meet the TMDLs that will be put on us during construction practices.

Scott Taylor: Very good. Well, thank you panelists. We'd now like to take about a half an hour to respond to some of your questions on TMDLs and BMPs. Remember that you can email questions and comments to cte_email@ncsu.edu. And I do have a couple of questions that have come in, but I want to start first with you, Andy, because I think the impervious cover TMDL is very interesting. What is the pollutant of concern on an impervious cover TMDL?

Andy McDaniel: Well, a part of the genesis of how the impervious cover TMDLs came about is the fact that, particularly in urban areas, it can be very difficult to figure out what the actual pollutant of concern really is. It's kind of like death by a thousand knives if you will. There could be many, many different pollutants. And as a result of that difficulty and the delays associated with trying to figure all that out, the resource agencies in the EPA have come up with the impervious cover TMDL concept which essentially says that stormwater or excess stormwater is the problem. And as a surrogate for the effect that stormwater have and the pollutants that it carries as a surrogate to those pollutants, we use impervious cover, the percentage of impervious cover as a measure of the impact that stormwater could have. So there really is no single pollutant of concern there. It's the cocktail of pollutants that they're trying to get after. And the primary means of addressing those is controlling impervious cover and controlling stormwater.

Scott Taylor: So, your load--your waste load allocation would be?

Andy McDaniel: The waste load allocation is a maximum allowable percentage of impervious cover to the watershed. In the TMDLs that have been developed for North Carolina, they haven't allocated the DOT specifically a limitation to how much impervious cover can be laid down, so to speak. So really, it's kind of a group compliant situation where the load allocation and the waste load allocation are all rolled up into one. In North Carolina, 10 percent is considered the maximum allowable percentage of impervious cover in these TMDL watersheds.
Scott Taylor: Interesting. Well, we do have a question from DNR in Missouri and it's for you, Karuna. Question about how to address different sources of pollutants. What about PAHs and oil and greases?

Karuna Pujara: That's an interesting question. It's a two-part question. How do you address different source of pollutants? And again, it depends on which source you're looking at. If you are specifically looking at PAH and oil and grease, in newer standards you see there are a lot of pretreatment areas that are being planned before the runoff enters a stormwater facility. I believe what also helps perhaps is the length of flow and sheet flow conditions or road side channels, where runoff travels before that runoff gets to a stormwater facility. We are also experimenting with vegetative check dams within the swale. If when you are depending on swale itself to provide water quality benefit as to how a stone check dam versus a vegetative check dam may improved its performance.

Scott Taylor: I want to give David a quick question here. What are some of the challenges that you face in implementing a passive erosion and sediment control plan?

David Harris: I think in order to have a successful passive erosion control program you have to have the standard specifications, special provisions in your contracts. It has to be a complete system. These are not devices that you can put out and forget about. Your contract persons need to be trained. Your inspection force needs to be trained. You need to have a follow up with another entity to come through and verify that everyone is doing their job. Through this, you will be able to effectively control the contractor to ensure that they accomplish what they need to. You will be able to accomplish everything that was intended when you put the device out there. You also will need qualified staff that when something starts to go wrong everyone knows. Friday afternoon, they got something planned. It's—they're ready to go home, the motorgrader guy runs by, puts up a berm of dirt and completely short circuits your entire erosion control system and your last device fails. This is where that staff—this is where that series of checks and balances have to come in play. North Carolina has been very successful in developing that contract language and our contractors have been very good at adhering to it, working with it, and they even realize the benefits of staying on top of this, that they're going to have less complaints from property owners. They're not going to have the headaches from the regulators. When it starts raining, thunder storms, whatever, you do not want to be the first person the regulator's coming to. You would like to have a good working relationship. So DOT tries every month on our projects to have court meetings with the regulators to look at the site, talk about the problems, inform them of what we're doing, so that they're educated, understand, and that everyone works together when a problem arises. I think that is very critical in a passive system.

Scott Taylor: What are some of the other areas that NCDOT is working on to improve their construction program?

David Harris: One of the things that we're really looking into is how fast we can establish vegetation. In North Carolina, we grow grass, it's not a hard thing. In the Western States, in more arid climates, it is an issue. But in North Carolina, we can grow grass very quickly. How we get it out there, how fast we can get out there and stabilize these areas is by far the best system that we have. We are looking at hydro mulches, bonded fiber matrix systems, matting products. How can we get it out there? How can we control it? How can we stabilize it? I think as water quality standards go to the point that we cannot achieve some of these standards, we'll have to cover them up. What we cover them up with is what our research is going to find. And that will be our next big way of, I think, of research and areas that we will improve.

Scott Taylor: Great. Well, Andy, I'm kind of fascinated with this impervious cover TMDL, I hate to tell you. And you mentioned that it's a watershed effort and that 10 percent is the nominal target, I guess, but how then are you going to divide up the impervious cover waste load allocation among a watershed. It just seems like a recipe for disaster. Do you have any ideas there?
Andy McDaniels: I think it is a recipe for disaster. And as a result, I don't think we'll see an effort to try to divide up the waste load allocation or the load allocation. You know, one obvious way you might consider doing, it is based on the percentage of land cover that your entity controls but, you know, is that really the best way to go about it? So, if there's one thing I'd like folks to do after watching this presentation is really to start talking about these impervious cover TMDLs and do they make sense for your state, and really start a national dialogue on how we can address what really the core root problem is. It is two-fold—one, the amount of time it takes to develop this TMDL is lengthy so that's one of the reasons why the concept has come about. And then, look at ways that a watershed-based approach might be used to achieve water quality standards. And the challenge there though, especially with DOTs is that DOTs are often thought of as having very deep pockets and infinite resources. But really, the DOTs make up typically—in North Carolina the average is about 2 to 4 percent of the land area in any given watershed. So where does that balance come in, in terms of how much we're willing to spend and contribute to the restoration effort? I think that's going to be one of the big challenges.

Scott Taylor: Definitely. Well kind of continuing on the TMDL theme then, it seems like, you know, in my intro we talked about how that numbers have doubled over the past 10 years roughly in terms of the amount of—or number of TMDLs in the country and it certainly is becoming, I think, kind of the major, major portion of a—or it has the potential to become the major portion of the stormwater program for a DOT. Do you have any ideas or guesstimates for us on what NCDOT is going to be spending to comply with some of these TMDLs in the future?

Andy McDaniels: Well, I think it's fair to say that the portion of our program dedicated to TMDLs is going to be rising and it's going to be increasing very significantly. There's new transfer—big concern in North Carolina particularly in the Piedmont where we have water supply reservoirs that are having problems with excessive algal growth, eutrophication and that sort of thing. There's been a big push by the regulatory agencies to develop rules for these areas. And as a result, we have looked into the cause of compliance with a TMDL associated with nutrients and some of our more recent efforts at analyzing costs are in the range of about 12 million dollars over a 5-year period to meet some of the minimum compliance targets there so...

Scott Taylor: For a single TMDL?

Andy McDaniels: ...for a single TMDL. Now in these cases, it is over maybe a larger geographic area than your rank and file small urban type of TMDLs would be. But still, that's a lot of money and particularly for a DOT such as North Carolina that has permitted facilities all across the state crossing all of these water supply watersheds. Those kind of dollars are really going to add up.

Scott Taylor: Well, I'll say. Let's focus back on BMPs for a minute with Karuna. How does Maryland promote vegetation establishment during construction?

Karuna Pujara: In multiple ways. One is placing requirement right in the specification in the contract documents for contractors to limit the disturbed—total disturbed area that is open at any given time. Another way we promote that approach is simply by education. We have a training and certification program for inspectors, contractors, as well as designers. And one of the things that we objectively demonstrate to contractors is that if they can keep a site stable or undisturbed until they're absolutely needed. There is less amount of money they will spend in controlling the sediment either through passive controls like what David described such as application of PAM, or silt fences and other sediment control practices that they have to install and maintain. And if you really go through the dollar value of that, it is not very difficult to demonstrate that. It is in contractor's interest to keep the area vegetated until they actually need to disturb a site for their construction activity. And we find that contractors do find innovative ways or they plan their work activity in a manner that they can limit their disturbed area. The other
approach we have is in fact a performance-based. We have a specific objective rating system for construction sites during construction. And we also provide incentive in liquidated damages. And if the site is not well maintained, certainly we can use those tools to either, you know, provide additional incentive or impose liquidated damages.

Scott Taylor: Got one more question for you. How does Maryland monitor stream restoration effectiveness? For example, how do you monitor restoration projects with physical, chemical, and biological measurements, or do you?

Karuna Pujara: We do monitor stream restoration effect as part of permitting process. We are required to do at least physical monitoring for about 5 years. And so we do that. You know, we either we take cross-sectional profile surveys. We take photographic documentation either periodically each year or after major storm event. But in addition to that, we also do biological monitoring where we may do pre-construction monitoring of a site and then we follow that up with a post-construction biological monitoring and we would measure Maryland physical habitat index or fish index or benthic indexes. And we basically skip the chemical monitoring part of the monitoring. And if we see that, if the physical benthic and fish indexes are improving, then you are in fact improving the chemical constituents or you are curtailing some of the potent or you're attaining that those values that you need to. And then once we measure those indexes at the restore reach, we compare them to statewide regional Maryland biological stream survey results. So Maryland Department of the Natural Resources has a system where they, in fact, establish baseline levels of indexes for their--for the stream reaches that are stable. And so that gives us a good benchmark of what a restored stream is compared to average regional values that exist for the fish or benthic.

Scott Taylor: A measure of success in essence, huh?

Karuna Pujara: Absolutely.

Scott Taylor: Great. Well we have one more question from the Colorado DOT and that is that they don't allow the use of polyacrylamides, I imagine, in their state. Any comments or suggestions? I guess I'll start with David and see what he thinks.

David Harris: I would suggest that they work with university, with research facilities. We have found out that it's very difficult for us to do any type of investigation and for the regulatory community to take what we say. Bringing in research, I think you're going to find that there's a lot of evidence out there that PAMs can be used safely, that their toxicity rates are insignificant. And I do know there are some states that you almost you have to have a water treatment license in order to use anything chemical. I think you want to work with the regulatory communities and explain to them, do you want us to clean up the water? Do you want the water clean? If you are, this is a technology that is proven that can help you. It's just getting the trust and working out the methodologies which you can introduce in to the system, catch it and go on with it. But it is a great tool in the toolbox in order to accomplish this massive task that we have to do.

Scott Taylor: And when I think that the EPA referenced in their effluent limit guidelines, didn't they?

David Harris: Yeah, they've touched into what Dr. McLaughlin found and you can find a lot of that written in the EPA Effluent Guidelines that are being issued now.

Scott Taylor: We have another question that comes in from the DNR in Missouri, and I think this is going to be an impervious TMDL question. So, is the goal to arrive at 10 percent imperviousness or rather to understand the impacts based on percentages and to enhance protection accordingly? Would it be appropriate to ignore the need based on inability to achieve 10 percent?
**Andy McDaniel:** Well, I think that's a great question. And part of our concern with these TMDLs is that it's not clear what the goal is. Is it 10 percent, which is what the TMDL says, or is it improved stormwater management which the TMDLs go into—typically into great detail about how reduction of impervious cover is not actually needed, but rather if you do improve stormwater management then you'll—that'll be a surrogate for that reduction in pervious cover. The problem that we see with the concept is that improved stormwater management is an undefined term. And we don't know how much improved stormwater management will be needed to achieve water quality standards. And recall my last kind of take home point was that a clear pathway to compliance is essential. Well, this is an excellent example of why that is. If you don't understand what it's going to take to achieve compliance with your waste load allocation then how do you know how to budget for this compliance? How do you know how much resources to dedicate? How do you know really what to do? So I think there really needs to be, as I was advocating earlier, a national discussion on what is it that we're really after here in terms of these impervious cover TMDLs. I understand that we're interested in achieving water quality standards ultimately, but in some of these urban areas where these TMDLs are targeting, you know, it could be quite a long time to achieve compliance with water quality standards and so the DOTs have this balance of at what rate do we try to improve our stormwater management knowing that the goal could be a long, long way off. So I think we really need to be working closely with our regulatory community to better understand each other's concerns on this particular type of TMDL and come to a common understanding of what really needs to be done and what we're trying to achieve.

**Scott Taylor:** Well, hold that thought on TMDLs because we have another TMDL question from TerraLogic in Colorado and they say, "There's no regulatory hammer for TMDLs or numeric limits on BMPs." And I guess that what they're saying there is they're not self-implementing as you mentioned. "What is the incentive for a DOT to spend limited financial resources on TMDLs and what are the regulatory and financial risks" as opposed for not doing so?

**Andy McDaniel:** Right. Well, they're correct in the sense that the Clean Water Act does not provide any new authorities to require implementation of the TMDLs. However, there is a regulatory mechanism under the NPDES permits and under North Carolina DOT's second term permit that was renewed in 2005, we were the first permanent entity in North Carolina to have TMDL-related permitted language in our permits. So there is a regulatory mechanism to acquire BMPs. There's a regulatory mechanism to make sure that they're functioning properly and working. So again, at all the compliance with a TMDL is totally related back to the language that's in your NPDES permit. So one thing I'm kind of excited to learn about recently is there's an NCHRP project that's in the works. I believe it's, what, 25, 25-54, something like that, I don't recall the exact number, where we're canvassing all the DOTs across the nation and summarizing the various permit requirements and approaches there. And I think that's a great opportunity for states to look at what other communities—what other state DOTs have in their permits in terms of TMDL-related language. In preparing for this presentation, I looked at several other states' permits and said, "Oh, that's a great idea. I'd like to see that in our permit and other language that I saw." Or I said, "We need to do everything possible to keep that out of our permit." So there's a wide range of approaches that different state regulatory agencies are taking and it's really worth our while to investigate what approaches are working for the DOT and what approaches are problematic. And that kind of gets back, Scott, to your mention of a transportation specific NPDES permit that could be very useful moving forward.

**Scott Taylor:** Well great. Well thank you panelists. That's all the time we have for questions for this first part of the program. Thanks to the participants as well for your questions and discussions so far. We're going to take a short break now. Change some of the panelists here in the studio. Participants you can continue to email your questions and comments to cte_email@ncsu.edu for the next discussion segment. We'll resume the webcast in 10 minutes. Thank you.

[Break]
Scott Taylor: Welcome back to our discussion of Best Practices in Addressing NPDES and Other Water Quality Issues in Highway System Management. I’m Scott Taylor with RBF Consulting, your moderator for today's program. Let’s resume the presentations and introduce our panelists for this second part of the webcast. Here with us again is Karuna Pujara, Chief of the Highway Hydraulics Division for the Maryland State Highway Administration. Joining us now in studio are Ken Pace, Environmental Operation Engineer for the North Carolina DOT. Ken's section is tasked with coordinating field implementation of the Department's NPDES Stormwater Permit components for construction and maintenance activities. Matt Lauffer is the Project Manager for the North Carolina DOT Hydraulics Unit. Matt manages the NCDOT Highway Stormwater Program and the Department’s NPDES Statewide Stormwater Permit. And finally, Rachel Herbert is a physical scientist in the U.S. EPA's Office of Wastewater Management in Washington DC. She is a member of the NPDES Stormwater Permitting Team and focuses on stormwater issues pertaining to municipal and transportation facilities. Thank you all for being here. Let's begin the discussion on the third of our four major topics from the Scan. Can I get the first slide? The next topic is duty, practices, and procedures. As DOTs receive their third and fourth round NPDES Stormwater Permits, we're generally finding more stringent requirements. These new permit requirements include additional program tracking and reporting responsibilities, TMDL implementation, and BMP asset management. Tracking of BMP treatment measures is important to ensure performance through effective maintenance. We also previously mentioned that there is probably room to innovate an area of institutional and maintenance BMPs. Annual reporting requirements are coming more prescriptive and time consuming requiring additional DOT resources. Program effectiveness assessment is a vital component to improve underperforming practices and focus the program on delivering the maximum benefit to water quality for the least cost. Our stormwater program architecture is based in part on this adaptive process. Leading us in the discussion of this topic will be Karuna Pujara of the Maryland State Highway Administration and Ken Pace of North Carolina DOT, and we're going to start again with Karuna.

Karuna Pujara: Thank you Scott. Measuring performance of stormwater BMP is a two-part effort. One is to ensure that the BMPs or stormwater facilities that are built are maintained in good condition. And the second part is in fact, knowing that there is a good performance or pollution reduction as a result of construction and maintenance of these BMPs. So in Maryland, we are in the third generation of state stormwater regulation and second cycle of NPDES Phase 1 permit. And with all that over the years we have built about 2,000 facilities statewide within state highway right-of-ways. And so how do we make sure that they are doing what they are supposed to be performing. Over the years, obviously, we started building them in early 1980s. And until NPDES permit came about, we almost built them and forgot what they were and what they were supposed to do and if we were maintaining them or not. And our maintenance forces were maintaining them but we really did not have a good track record or documentation of performance—maintenance that was occurring at the site. So we begin our stormwater management facilities program in early 1990s. And if we go to the first slide, our approach, really the business process if you will, is the Plan, Do, Check, and Act. If you go to the next slide, the Plan is really at a bigger scale to meet the water quality standards, the requirements of the permit, and so forth, and how we select the facilities to go in and provide the water quality that is needed, either it is for water quality management, quantity management, recharge, general protection or so forth, or whether the facility is a source control, site control or end of the pipe. And that is where we implement the program. The idea is also to have no net loss of pavement treatment since the Stormwater Act was implemented in Maryland. And so we are actually tracking amount of impervious surface we're building and amount of impervious surface we're treating with post-construction BMP. And through the years, there are acres of impervious being tracked and we know if we are treating additional above and beyond what is required as part of state regulation. However, there is a lot of legacy pavement that was built prior to stormwater management regulation and that is what is bringing some of the issues that we've previously talked about is the impervious surface TMDL is to how we get control over it to make the water quality standards. The Check part is actually then talking about how do we maintain these BMPs making sure—are they functioning? If they are not functioning, how do we
maintain them? How do we provide funding? What types of resources are available? And the Act part is really learning from that processes, to make modifications either in design standards. What type of facilities you might select? We find along the way that many facilities require more maintenance of traffic than actually the cost that goes into maintaining a BMP. And we find that because of the constraints that we have within the DOT right-of-ways, we may prefer one type of facility over the other. And of course, we are changing our design standards to ensure that this facility may function longer than what we have traditionally or historically found them to be. The next slide is really the Plan is to meet the water quality standard, meet the permitting requirement, whether its anti-degradation policy or impaired waters, and goals may be TMDL. In Maryland obviously, Chesapeake Bay restoration, and the questions that are many times debated are whether we are trying to recover the health of the bay or merely trying to preserve the health of the bay. And as we are trying to build new stormwater facilities for post-construction, we are merely preserving them and it takes a lot more to recover health of the bay or health of a water body. And obviously, that takes lot more strategies to be placed. However, most of these goals are given to you as part of regulatory process. DOTs typically do not build these plans. The plans are given to you in terms of either watershed improvement plans or permit or regulation, and you’re just merely taking it on as part of either construction projects or maintenance activities. So the second slide is how do we track our BMP? In Maryland we are tracking BMPs statewide within SHA right-of-way. We’re tracking impervious surface that we are building for every project we build. As you see, at the bottom of the screen on the left side, every project is entered into database, what is amount of impervious surface that is added, impervious surface that is treated. If there is access treatment, which watershed it belongs in. And on the top where you see the map of Maryland with watershed boundaries, you see some watersheds that are white and some are yellow and green, and that just merely demonstrates status of water quality amount provided in that watershed, whether we are getting close to zero. Meaning, no net increase, or we are excessively treating payment in certain watershed, or we are getting close to–or projecting in a situation where we may have projects and we’re not finding water quality facility sites and we may be looking at loss situation and that helps us find mitigation projects to recover that loss in pavement treatment if you will. So if you go to the next slide, we have these facilities that we have built over the years. As I said earlier, we built them and we forgot them. And so in 1990s, we began effort first to inventory our facilities and we went through as-built plan search, site search, site visits, and finding where these facilities are, how many do we have, where they are located, and began a database and GIS effort to collect that information in a central location. The picture you see on the top left is just a picture of a manual that we have developed to–it provides us standard procedures for inspection of these facilities. So as we are inventorying them, there are also people going out and inspecting them for its function, collecting data as to what these facilities were designed to do, whether they were infiltration, pond, retention, or filtration facilities, what type of hydrologic discharges that the facility was supposed to provide, and we are collecting GPS boundary of these watersheds, the stormwater facilities, and placing them in the database which is what you see in the middle of the screen. And if you want to look at this on a map scale, you can see how facilities are located along a corridor of a highway. The facilities are rated, for example, you can see A to E. Rating of A means facility is functioning as designed and no problems exist. Rating of B would mean that the facility is functioning. There are some minor problems that needs to be addressed. And if you go to rating of E, it would mean that facility has failed its function or it may mean that it is still functioning but it poses a hazardous condition for the environment or the traveling public. And this rating system provides us a framework of action to take in order to remediate these facilities. So remediation occurs. The information goes back in the database and we constantly track how facilities are–in which state they are overall as–either within the watershed or overall statewide. If we go to the next slide–so what have we learned? There are many ways we can deliver our remediation programs. We have used our maintenance forces. We have used design, build, operate, and maintain model where we privatize efforts for contractor to come and maintain county-wide stormwater facilities for a period of time. We have also employed our design forces to work with construction forces to maintain these facilities and bring them back in function. We are tracking their progress as we go year by year, quarter by quarter. And we’re also tracking the expenditures that are spent on different type of remediation or different type of facility. And when we are doing that, we
also understand which type facilities that require more maintenance dollars versus the other. And it also helps us plan in future, what type of dollars we would need to sustain the program. So that is really the BMP management program. But the additional part that we need to keep in mind is to understand the asset we have and what type of assets we have and how they're functioning. And so if we go to the next chart, you'll see that we have tracked what type of facilities we are building since we had storm water regulation change in 2000. And you can see with blue bars, the facility types that we built prior to 2000. You can see mainly three or four type or maybe six types of facilities after 2000 and, understanding source control options, there are a lot more options that became available. And we find that we built lot of swales, different versions of swale, either they maybe grass swale, dry swale, wet swales. We also see that we're building less of infiltration basins because we had lot of problems historically. And so, we initiated study to understand them even further to improve our understanding and performance of the systems overall. And then the next slide, you will see that we have taken grass swale study to understand efficiency of pollutant removal in a grass swale in different configuration either changing its slopes, flat bottom, different type of check dams, vegetation, different types of vegetation, and insuring that our designs perform to provide better pollution reduction because we do build many grass swales is another way to ensure the performance of overall stormwater program and pavement treatment is producing results that are intended. And in the next slide, we have taken on infiltration basin study. If you see the top slide, top picture, the infiltration facility is filled with water. Obviously, it is supposed to infiltrate. But again, we feel that it has some pollution removal ability and we're measuring those and trying to produce documentation and proof that they do provide pollution reduction. So at the bottom of all of this is to check how many facilities we have and how they're functioning. And if you go to the last slide, you'll see that we begin with our facilities being 65 percent functioning as intended in 2002 to our goal of 90 percent functioning as intended in 2012, with about 85 percent in 2010. And insuring that we're counting all this helps us maintain funding, helps us be in good compliance of the program. And with that, turn it over to Ken for NCDOT program.

**Ken Pace:** Thank you, and good afternoon. Our NPDES permit has measurable goals for inspection and maintenance. And what I'd like to do this afternoon is just give you an overview of our program and also show you how we've integrated inspection or integrated those performance measures and accountability into our program. Listed here are stormwater permit requirements or measurable goals for BMP inspection and maintenance program. And they range anywhere from BMP inspection to maintenance needs by creating stormwater control inventory, developing and implementing an inspection and maintenance program, implementing inspection and maintenance manual, and also reporting on our activities and our performance back to our Division of Water Quality. We have over 800 post-construction stormwater BMPs that are distributed over approximately 79,000 miles of roads in North Carolina and we've got BMPs located in industrial facilities and also at our rest areas. And as you can tell, it's been a challenge–we think it's been a challenge to determine how to manage these devices effectively. So we decided we needed an effective tool to help us manage these assets and ensure that they're performing has intended. Next slide please. So the highway stormwater program staff has worked closely with our information technology unit to develop a web-based tool, it's called our Stormwater Controlled Management System or SCMS as I'll refer to it. And when it's completed, it will provide a tool for us to record BMP locations, track inspection and maintenance activities, and document specific permit requirements for each device. The system is under development, currently being beta tested, and we're planning to have it completed and rolled out department-wide later this year around June or July. Next slide please. I'm going to show two or three screen shots of the application itself and this is just the introductory screen for the site and it provides examples of BMPs that have been added to the system. Next slide please. This displays the type of information that's recorded for each BMP. And here, you just enter basic information, allows you to locate and manage each device in future years. Next slide please. We've also got a section for entering maintenance information and we can also attach PDF files for future documentation of inspection reports, photos of the device, and other relevant information such as permit information or specific conditions for that device itself. Next slide. And finally, we can also, as with Maryland's, we can depict the locations of the
devices throughout the state down to the county level and down to the street level so you can recognize where the sites are and what devices we’ve gotten out there. So we’re excited about our SCMS application and look forward to its implementation later this year as we feel like it will be an important tool for our program management. Next slide. Now I would like to discuss the next permit requirement which is the development and implementation of a BMP inspection and maintenance program. We’ve done this in our program now, define such things as BMP inspection and maintenance frequencies, how-to instructions for regular maintenance, and evaluation reporting procedures for non-routine maintenance. And one thing we’ve added to this program also is performance standards as part of our inspection and maintenance program. And we’ve done this by including stormwater BMP performance rating into the Department’s Maintenance Condition Assessment Program which I’ll refer to as MCAP. And MCAP is a process in which DOT assesses the conditions of our assets, the science targets, and the level service ratings to determine the health of our infrastructure. Performance standards and level of service ratings have been developed for assets such as pavement condition, traffic control, rest areas, roadside features. Next slide please. If you see this slide is a depiction of our 2008 MCAP ratings. And if you will notice on the slide there is red and green shown and that they pertain to each element and each score in the division, and an overall grade. As you can tell or may have guess, the green really indicates that we’re meeting expectations or exceeding expectations, while red we’re below our targets and we’ve got some work to do. Stormwater devices are actually shown on there, you can’t see but they’re green. Next slide please. Here’s the list of the stormwater control devices at NCDOT installs along our right-of-way in our facilities and these were evaluated for level of service ratings. And they range from bioretention basins to hazardous spill basins. Next slide please. And in 2008, this depicts our level of service ratings in our MCAP cycle for interstate, primary and secondary roads, and our county maintenance yards. And we achieved an average statewide rating of B during that cycle. Next slide please. So what are we hoping to achieve with the implementation of these performance majors? Well first and foremost, we’re interested in compliance—that’s our number one priority. And if we are not compliant, then delivery of our projects and programs will jeopardize. Also this rating provides a mechanism to manage our assets effectively which helps us prioritize our resources and provides a way to make data-driven decisions based on actual documented field conditions. And finally, we are able to roll these level of service ratings into our employees’ performance reviews to ensure accountability. Next slide. Here we have an example of performance measures currently listed on our Division Roadside Environmental Engineer’s performance review. And as you’ll notice there’s an infrastructure health and performance metric listed which has submetrics for various roadside elements including turf condition, brush and tree control, rest areas, and also stormwater controls is listed. So what happens is the level of service ratings for all of these items are uses to compute an overall composite score for infrastructure health. And that’s used for the employee’s performance rating. Next slide please. And as with Maryland, we also have a BMP inspection and maintenance manual. Next slide. And here’s the table of contents of the manual and it describes there all of the items that are needed for inspection and maintenance activities including specific things that are required for different types of devices. Next slide. And also included in the manual are the inspection and maintenance forms for all of our devices and we have separate forms to address specific inspection and maintenance needs for each type of these devices. Next slide. So in closing we feel that we have the correct measures in place to ensure a sustainable inspection and maintenance program for the Department that hopefully will result in well-managed BMPs rather than BMPs that are out of compliance and not managed appropriately such as the photo shown in this last slide. And thank you for letting me speak today.

Scott Taylor: OK. Thank you, Karuna and Ken. Last of our four main topic areas is DOT interface with regulatory agencies. And I want to remind everybody that you can email your questions into cte_email@ncsu.edu. Well, I’d like to introduce the last of the topics now which is regulatory. The Scan Team found that working in partnership with regulatory agencies can dramatically improve the performance of stormwater programs through prioritization of resources and the reduction in administrative tasks. Communication is a critical part of improving the working relationship. This topic assesses the structure of DOTs and regulatory agencies and explored options such as DOT-funded staff
positions at the regulatory agency. Matt Lauffer of the North Carolina DOT and Rachel Herbert of the U.S. EPA will address this topic area. And Rachel is going to lead off. Rachel?

Rachel Herbert: Thank you, Scott. So as part of the Scan tour, we really were interested as Scott just mentioned in looking at the regulatory and regulated relationship in order to figure out what was working and what wasn't working. We were also trying to assess specific program attributes that seem to be working for the DOTs as well as the organizational structure of the DOT to see what role all of these played in their stormwater program. So as we have been saying the whole time, we really acknowledged that communication is definitely an important part of the laying a solid foundation for DOTs and the regulatory agencies to work together. So as part of this, acknowledging commonalities is definitely a first step toward this goal. And in reality, DOTs are just like EPA and state water quality agencies in that we're both charged with effectively and transparently using public funds in order to provide some sort of public good. For DOTs as you know, it's really to maintain the roadway environment and move people back and forth. For EPA and state water quality agencies it's to protect water from contamination so the people have access to safe water, the communities for recreation and drinking water. So in the Scan tour, one thing that was really standing out for me is just the fact that when we arrived, the regulatory agencies were present at the table. And I was definitely not expecting that at all. I thought it was a good indicator that the DOTs were working with the regulators and trying to make sure that they were part of the discussion. So it was great to have that there. The other thing is that, we've really been trying to work with regulators-sorry, with state regulators, and with the DOTs in order to make sure that we're reaching out to DOTs. And I think just the fact that I'm here today is a great indicator since my management has allowed me to work on transportation issues in particular. Region Three has also created a Green Highways partnership and they provide a lot of technical support to their states and DOTs through that partnership that I think is also important to note. We also have a specific website that we've created and you can see the website address on the screen right now. And we really worked in partnership with AASHTO and with state DOTs to make sure that it was user-friendly and provided information that the DOTs would find useful. Things like specific parts of various DOT programs that were interesting and that not every state seemed to be doing. So we thought it would increase the relationship in spreading the word on those various aspects of the programs. It also includes some innovative materials and practices that the DOTs are working on as well as links to various programs in order to have one location where all of that is present. Next slide. So we also learned that some DOTs were actually funding positions or offering consultant resources at the regulatory agency and this is something that seemed very good to do in terms of--if you think about all of the various industries that the permit writers are working with, it can be quite a daunting task to figure out all the ins and outs of these various industries. So to the point that you can have someone on staff who is knowledgeable in transportation-specific practices, it helps to speed up the process, review time in many instances, and it can also just result in some consistency across the board. Another important thing to note is that Federal Highway Administration is actually supporting a transportation liaison at EPA in the Office of Water which is the office I'm in. And this position has been great in making sure that all the various offices that are working on stormwater and on transportation issues actually coordinate together and are better linked together so that we can share information and pull from all of our various components and our diverse expertise. Next slide please. So communication within the DOT itself is also important. And it's important to point out that across the nation people are regulated and permitted in many different ways. Texas DOT is actually covered under a really wide range of permits and includes Phase 1s, Phase 2s, individual permits, their co-permittees on other permits. And under a scheme like this, it's pretty interesting to see how they work together and how their various districts are coming together in order to share information and really work at improving water quality and protecting water quality. So one thing that came out of our Scan tour is that with all of these various districts in Texas and in other states working on various components of stormwater, it seemed like having a single permit where all of the information was contained was a good idea. Just so that you would have a single document housing all of these requirements so that the whole state was on the same page as to what was required statewide. So the District of Columbia's DOT structure was definitely a lot different than Texas DOT structure. They were
more localized. And I think the interesting part of their structure is that they are physically located closer together. So their relationship and interaction was on a, I guess, more routine basis you could say. And they also, I think someone had pointed out in an earlier session, all report to the DC council for their stormwater programs and not just the DOT but all of the stormwater entities in that location. So this kind of removed some of the common institutional barriers that are found in a lot of states where DOT roads cross many jurisdictional boundaries and it might be a good setup and framework for trying out a watershed-based approach which we at EPA have been promoting recently because they would be able to probably work more seamlessly together and have been doing so. So the other last point I wanted to make is that North Carolina DOT actually included environmental sensitivity into their mission statement. And I thought this was really pretty telling in that it was showing that stormwater and other environmental management is a key part of their mission. And it also showed me and I'm sure other regulators, I'm sure the North Carolina Water Quality Agency that the DOT was truly dedicated to environmental stewardship and working together with a common goal across the state of improving and protecting water quality. So with that, I'm going to turn this discussion over to Matt Lauffer, who's seating next to me. He's going to talk a bit more about North Carolina DOTs program and things that they're doing to improve communication and foster an environmental stewardship culture.

**Matt Lauffer:** Thank you Rachel. I'd just like to start off with just saying thanks for the opportunity here to speak today and just to speak to the regulatory coordination and the success we've seen on the Highway Stormwater Program due to former or past environmental successes at the North Carolina DOT. So first slide please. Routine regulatory coordination is an important component of the North Carolina DOT's NPDES Stormwater Permit efforts. The Department with partnership agencies practiced four areas of coordination that have brought value to managing stormwater program. These include creating an environment—environmental stewardship, providing opportunities for information exchange between agencies, interactive compliance, and participating in partnership opportunities. Next slide please. The establishment of environmental stewardship has been an effective component in regulatory coordination between the North Carolina Department of Transportation and resource agencies. While environmental stewardship has been practiced for many years at DOT, DOT formalized this commitment through an environmental stewardship policy that was signed by the Secretary of Transportation and the Chairman of the Board in 2002. This policy statement made it the responsibility of every employee to incorporate environmental stewardship into their daily activities. In addition, this policy provided the foundation for the 2008 NCDOT mission statement that reads, "Connecting people and places in North Carolina safely and efficiently with accountability and environmental sensitivity." Through the environmental stewardship policy and the mission statement, DOT has an expectation for every employee to incorporate environmental sensitivity into their daily activities therefore providing a stronger foundation for DOT and resource agencies to coordinate more effectively since there's a realization of a common goal. Next slide please. Another component of resource agency coordination that has been effective in North Carolina is the availability of the opportunities for information exchange. Opportunities for information exchange exist from top management to project staff. North Carolina established the ILT or Interagency Leadership Team in 2004 to develop an interagency leadership plan for North Carolina to balance successfully mobility, natural and cultural resource protection, community values, and economic vitality. The team is comprised of 11 agencies that include the Department of Transportation, Department of Environment and Natural Resources, Department of Agriculture and Consumer Services, Department of Commerce, Department of Cultural Resources, Army Corps of Engineers, Federal Highways, Fish and Wildlife Service, Environmental Protection Agency, and the National Marine Fisheries. The 15 members of the ILT are composed of directors, deputy secretaries, administrators, and other high-ranking officials of the participating organizations. The goals of the ILT are to improve the merger process, which I will mention later, partner with stakeholders to integrate local use and long range transportation planning as well as applicable environmental and economic planning initiatives to meet mobility, economic and environmental goals. And also to develop a comprehensive shared GIS database to support effective decision making. In addition to the ILT, the Department of Environment and Natural Resources and the Department of Transportation
have established a peer-to-peer meeting with executive leadership of both departments through quarterly senior management meetings to discuss relevant issues affecting the environment and the delivery of transportation projects. Since these meetings occur on regular frequencies, issues between the departments can be discussed more efficiently in a proactive rather than a reactive mode. These meetings also provide an opportunity to share positive success stories between the departments. Effective project communication at staff level between the agencies is another aspect of regulatory coordination that occurs in North Carolina. In 2001, the Department of Environment and Natural Resources, Department of Transportation, Federal Highways, and the Army Corps of Engineers as lead agencies implemented the Merger process. This process is used primarily for environmental-sensitive projects that require significant resource agency communication and coordination in meeting Section 404 requirements during the NEPA-SEPA process. Benefits of the Merger process include improved coordination, efficiency of operations, expedited delivery of transportation projects, enabling more transportation projects to proceed on budget and on schedule, and improve protection and enhancement of environmental features. The Merger team is comprised of 11 partnering agencies that include Environmental Protection Agency, U.S. Fish and Wildlife, National Marine Fisheries Service, North Carolina Wildlife Resources Commission, Department of Cultural Resources, U.S. Coast Guard, U.S. Forest Service, Tennessee Valley Authority, National Park Service, Metropolitan and Rural Planning Organizations, and Eastern Band of Cherokee Nation. The Merger process involves seven concurrence points in the project development process where partnership agencies sign before moving to the next step. Concurrence points are defining points in the Section 404 NEPA Merger Process. Concurrence implies that each project team member and agency they represent agress to decisions made that these defining points in the project development process and, in doing so, pledges to abide by the decision made unless there is profound change condition. Concurrence is sequential and must be achieved in proper order. More information about the Merger process is available on the links provided on the webcast page and on the DOT website. Finally, a unique aspect of DOT when compared to other regulated entities in North Carolina is that DOT funds positions–positions in the resource agencies. This funding allows the resource agencies to dedicate staff to provide timely oversight to projects and maintain a consistent communication framework that provides uniformity in the implementation of transportation-regulated activities. The DOT provides support for 34 full-time equivalence in agencies that include the Department of Environment and Natural Resources, Environmental Protection Agency, U.S. Fish and Wildlife Service, and Department of Cultural Resources. Next slide please. A third area of regulatory coordination that DOT and DENR practice is interactive compliance through regularly scheduled NPDES permit compliance meetings and shared coordinate–compliance coordination. NCDOT and the Division of Water Quality meet as frequently as every month to review progress on measurement goals of the permit. These meetings take place in both, in the office and in the field to provide insight to how requirements are meeting the desired objectives. Through these compliance meetings, DWQ has a better understanding of DOT's performance and DOT has a better understanding of DWQ's expectations. This process has allowed DOT to be more concise in the annual report and spend more time on meeting performance objectives. Another good example of interactive compliance practice between DOT and DWQ is the Illicit Discharge Detection and Elimination Program or IDDEP. This permit program requires DOT to identify and report non-allowable discharges to the transportation right-of-way to the Division of Water Quality for enforcement actions. The two agencies have partnered and developed a website to share information about these violations and track the status of the enforcement. In partnership, the two agencies are improving water quality. A final example of how North Carolina–next slide please, thank you. A final example of how North Carolina practices resource agency coordination is through partnership opportunities. In September of 2009, the director of the North Carolina Zoo along with the director of the Clean Water Management Trust Fund and the chief operating officer of DOT dedicated a stormwater wetland that treats 20 acres of drainage from the zoo parking lot. This partnership project will be available to the 750,000 annual visitors, provide educational information on how wetlands improve water quality, and provide opportunities for teachers and school groups to learn about wetlands and water quality. Through the support of executive leadership, this project became a reality and contributed to DOT's stormwater permit compliance by providing education and retrofit credits.
required by the permit. In closing, the DOT practices regulatory coordination with resource agencies through the establishment of culture, of environment—a culture of environmental stewardship that has been developed through the Department's environmental stewardship policy and the Department's mission statement. This regulatory coordination is supported by processes that support information exchange between multiple state and federal agencies with both executive leaders and staff through the interagency leadership team and the Merger process respectively. The funding of positions in agencies helps to maintain a transportation-focused approach that prevents project delay and protects the environment. More specifically, DENR and DOT senior staff meetings provide the foundation for both DOT and the Division of Water Quality to practice coordinated compliance for the NPDES stormwater permit and participate in the partnership opportunities.

**Scott Taylor:** Alright, well thank you panelists. We'd now like to respond to some of your questions on DOT practices and procedures and DOT interface with regulatory agencies. And I've got quite a few here and it looks like Rachel, you're going to be the first one up. This is from the Virginia DOT. And they ask, “What about unpermitted activities such as mining and agriculture which are not required to comply with any discharge levels. “For example, coal companies in our state are permitted to dump spoils directly in the streams,” which sounds hard to believe. “We get many complaints due to the commingling of these discharges through our system, is there any movement to address this issue or do you have any suggestions for dealing with this?”

**Rachel Herbert:** Well, let's see. I think first off, I'm looking at Scott right now and probably many of you at home can't see this but he has a little phone sitting beside him. So I'd like to phone a friend, because this is kind of a hard question. But seriously, even though I'm not aware of the specific pieces that your question is referring to, some of the activities in agriculture are actually permitted under our industrial stormwater permits. So I'm not sure of the specific activities besides the dumping in the stream that you talked about but you might want to check into that. And in reality, I think, you know that's a difficult piece because you don't really control the activities that they're currently engaging in. But if you could somehow talk to them and see if there are any things that they could—things that they could change or alter, that would be beneficial for you, that might be one good option. You could also talk to your state water quality agency and see if there are any things that they could—anything they could work on. I am not currently aware of anything specifically dealing with engaging for mining activities or agricultural activities and ways to deal with those sorts of issues if you're DOT per se. And it is kind of a tricky situation. But I would say definitely, try to work with your state water quality agency a little bit more if you haven't already and ask them for their opinion on what you can do, because commingling is definitely an issue for other entities as well.

**Scott Taylor:** Yeah, I think some States have non-point source programs and I know not all do, but if your states does it's probably a good way to attack that as well, most likely.

**Rachel Herbert:** And there are also grants available for non-point source pollution like EPA's 319 grant that can help those non-permitted entities to do things related to stormwater that—and those funds aren't available to regulated entities, so that could be another thing too.

**Scott Taylor:** Okay, great. Our next question is from the Alabama DOT. And I am going to go to Karuna on this. Other than using EPA's urban BMP performance tool, where can we find the list of enhanced BMPs targeting the pollutants of concern for TMDLs? Good question.

**Karuna Pujara:** Absolutely. For sure, I cannot tell you that right now. It's something maybe we can look up and post it on the website later. But certainly, there are many research information available out there. In Maryland, I can tell you what is going on Maryland. We are in the third generation of stormwater regulation. The first state stormwater regulation passed in 1982, I believe. The second generation was implemented
in year 2000 and a third generation in 2007. With each generation of stormwater regulation, obviously, the knowledge and standards of stormwater practices have improved. And so understanding is that pavement which is treated by stormwater facilities prior to 1982, obviously, is questionable. But pavement that was built between 1982 and year 2000 received stormwater facilities that were built at that time. And based on scientific documentation or research of what type of pollutant removal efficiencies those facilities provided, the pavement itself will be assigned percent removal efficiency. Then after pavement that was built or any development that was build prior to 2007 and after 2000 was built with enhanced stormwater facilities and are expected to have better pollutant removal efficiency. And then land that will be developed after 2007, in fact, implementation will begin in 2010. So any land that is developed after 2010 is expected to have higher level of pollutant removal efficiency. So the Chesapeake Bay model or Maryland pollutant removal models are expected to apply removal efficiency to the actual land use as opposed to modeling each BMP separately and having efficiencies apply to each BMP. So that could be a model that may be applied elsewhere. I'm certain that may be more applicable within the Chesapeake Bay watershed and upstate of the Chesapeake Bay watershed but certainly that's an approach in Maryland.

Scott Taylor: Great. You know, one of the things that I would suggest is, just looking at the BMP manuals from other DOTs, I found that there's—in Washington State for example, I know it has some pretty advanced and kind of new emerging BMPs that they've tested. And so that might be another option for you to find some of the newer technology and things that is just coming on the scene. So our next question is from Colorado DOT. And I think this is for both Ken and Karuna, it says, “What percent of the cost of an average construction project goes to water quality protection in each of your respective states? Also, who is doing the inspections and maintenance, etc., of the facilities?” So Ken, you want to lead off?

Ken Pace: Sure. When I think of water quality for construction projects, I'm thinking of post-construction and also construction efforts. In terms of construction, we've--we keep pretty detailed cost tracking for the construction activities for sediment erosion control and maintenance of those devices. And they typically, for those activities, it's normally around 4 to 8 percent of the total construction cost, because we have got pay items for seed and mulching and temporary seed and things of that nature, silt cleanout. Now, in terms of post-construction control cost, I don't think we've done very good job as a department in terms of tracking what those overall cost are in NCDOT. Matt may be able to expand upon that somewhat but I will defer that to Maryland.

Karuna Pujara: Okay, so I would say in Maryland, the cost of stormwater post-construction and during construction ranges about 2 to 10 percent of the capital program budget. Larger the project, lower the percentages. More streetscape type of project that is in the urban area where cost of land is significantly high, you may need to relocate utilities in order to build a sand filter, if you will, increases the cost, overall cost of stormwater management construction. So that is generally the rule of thumb that we've been using. For maintenance project such as resurfacing or so there is no cost associated with them except just a sediment control which is fairly minor. And the second part of this question was, who does the inspection and maintenance, consultants and designed engineers do inspection of the stormwater facilities—post-construction stormwater facilities, and they will do the rating and the maintenance is done by our maintenance forces or construction contractors.

Scott Taylor: What about during construction, who does your inspections there? I know you have a pretty sophisticated program for that.

Karuna Pujara: Yes. During construction, stormwater or sediment control facilities are—well primary responsibility is with the contractor. So contractor is required to do their daily inspections, weekly inspection, post-storm event inspections. State highway inspectors also do inspections. In addition, State Highway has a delegated authority for compliance part of the sediment control. And so we have independent quality assurance inspectors who will do inspection of the site randomly, at least once in two
weeks. And in addition, Department of the Environment may come on site and do inspections independently at the same time.

Scott Taylor: Great, thank you. Our next question is from the Alabama DOT. What mo--And I'll throw this open to the entire group. What models would be good for use to use with the enhanced BMPs to calculate percent removal to meet waste load allocations? Anybody have any thoughts? I guess I can start it off. You know, I think that the BMP database, the ASCE BMP database has lot of good information on the performance of BMPs and this could be used in combination with the EPA simple method, I think. And it's probably the right tool in a lot of cases depending on how much sophistication and money you want to spend right to build into your models. HSPF would certainly be one of those models that you could use or the stormwater management model SWMM. I think HEC-RAS now even has kind of pollutant translator built into it as well. And I believe the EPA is working on just releasing a model called SUSTAIN that is also being used to model BMPs and watersheds. So those are some, but I think, you know, probably most importantly is to figure out what level of sophistication you want to get in your modeling that is right for the situation that you have in hand, huh? Alright, we're going to the next one which is for Ken. From the Massachusetts DOT Highway Division, this is short and sweet. What is the hazardous spill basin?

Ken Pace: That is a basin that we install at our industrial facilities, rest areas, and along some sections of roadway and it just capture spills for tankers in any type of oil spills or hazardous materials that may be dumped along the roadway. We have installed these devices in sensitive watersheds also along our right-of-way.

Scott Taylor: Alright. And Rachel, our last question here is from Washington State DOT. And it says, “In my state EPA has retained NPDES municipal permitting authority for stormwater discharges on federal and tribal lands. Does EPA headquarters have examples of EPA-issued municipal permits on tribal reservations?”

Rachel Herbert: Well, I can't think of a specific tribe name that's been permitted right now at the top of my head, but I am pretty positive that we have written permits for tribes, for municipal stormwater permitting. So if you want, I can look that up and give you some examples later on, if that would be useful for you.

Scott Taylor: Great, thank you. There was couple other points I just wanted to hit very quickly with Karuna. You--I know that it's a big struggle nowadays with the economy the way it is. Revenues are falling for agencies and obviously maintenance forces are stretched thin. How do you maintain these stormwater management facilities that you're showing us in Maryland and keep them functioning adequately?

Karuna Pujara: Well, like you said Scott earlier, that success of some of the stormwater program really requires commitment from the top. And in Maryland State Highway Administration, we are certainly committed to providing stormwater management facility function as it is intended. And you saw earlier, I showed a goal that we have to reach 90 percent of facility functioning as intended by 2012. With that, having established a dedicated funding category, primarily, that draws into the activities that are required for maintenance of stormwater facilities. In addition, if we--we find that sometimes some facilities just fail. They need to be replaced or abandoned and mitigated at some point later. We have, in those instances, found innovative ways to provide either additional amount of water quality or improved efficiencies by some other facility at another location. And at times, we have used transportation enhancement funds to fund some of the large retrofit projects that we have. And again, maintenance is done by our maintenance forces or during winter months. Some of our construction folks are more available. They would jump in and we can tie into those resources as well. And we have also used design, build, operate, maintain construction contracts where we would enter into an agreement with a design and construction firm and expect them to take the entire inventory on a county-wide basis and perform remedial maintenance, routine maintenance, or even major retrofits to ensure that the facilities are functioning over a period of
time. And currently, we have a pilot project under way in one county where 99 facilities are turned over to a private entity and they're expected to maintain them for the period of three years with an option to extend the contract for another three years if both parties find it satisfactory.

Scott Taylor: Yeah, the Scan Team really liked the acronym for that, design, build operate—D-BOM, yes. We had a lot of good fun with that one. Ken, you had mentioned, and I believe I remember from the Scan tour that you have kind of have a unique program where the employee’s performance review is tied into, you know, how well their BMPs that are under their watch are maintained. And I just wonder if you could explain that a little more because I think it really goes to this whole, you know, walking the walk and the stewardship angle and what constitutes then a bad a performance review if you're out in the field, performance does not right?

Ken Pace: Well, DOT over the past couple years, we've--as a whole, we've tried to become a more performance-based organization, more outcome-based, and part of that was changing our performance review process for employees. And so each employee now has outcome-based goals and targets and metrics on their performance reviews. And this is rolled up--that stormwater review or compliance component is in the Division of Roadside Environmental Engineer’s performance review as it is with mine as I help managed the program statewide. I'm always--I'm interested in how they're performing out there in terms of maintaining those devices and making sure we're compliant because I'm also graded on that among other things. So--and it's not just the stormwater component, we've also got sediment erosion control compliance that's part of other employees' PDAs, their appraisals every year. So we found it's very effective program so far. We're still learning. In terms of the level of service for the devices, we're actually shooting for a level of service C. And I guess, it's just how you define what A, B, C, or D, or F grade is, but with the C, on our part, if we've got the device at a C that means it's performing its function. It may have some minor maintenance issues that need to be addressed. But it's actually functioning and we're compliant. And that's the main thing we're looking for. And level of service A is typically a newer device. It's just been constructed that doesn't need any maintenance whatsoever. And failing--a D is very close to failing. It's still functioning somewhat, but we may have a major erosion control problems or vegetation management-type problems. And, of course, an F that means the device is not compliant.

Scott Taylor: Great, thank you. Well Rachel, I know we've got a lot of DOTs out in the audience. And I think I'd be remised if I didn't ask you, now what are some of the things you see that the DOTs could do to enhance or improve their relationship with the regulatory community and then also vice-versa? I mean, what can the regulatory committee do to improve its relationship, do you think, with the regulated community?

Rachel Herbert: I think for DOTs, one thing that they could do is consider inviting their regulatory agencies to various meetings that they’re having. The more that you can--information you can provide to them, the more knowledgeable they will be on your particular practices that you're using and they'll understand your industry a little bit better. And I think it kind of goes the reverse, too, for us in the regulating side of the house. I think we need to be more proactive and inviting the DOTs to the table so that we can really have a formal or informal discussion whichever one seems more appropriate to just walk through the various program pieces and see what's working, what's not working without it, necessarily, being a compliance-type of situation. Because we really, you know, want to provide technical assistance before problems start happening down the road so that we're all on the same page. And something else, that maybe everyone at this table might disagree with me on, is if you're having an issue and you know that it's a problem, you may consider talking to your permitting authority about it because, to the point that you're providing information ahead of time before it becomes a huge problem, I think that you'll start getting, you know, the sort of relationship built up so that the regulators trust you and so that you can really trust the regulators.
Scott Taylor: Great. Well Matt, to kind of finish up this segment, we've spent a lot of time on the regulatory relationship and things. I know you guys had a good--and seem like in the Scan tour, a very good relationship with your regulators, DNR, I think it is. What are some of the tangible benefits that you see of having an established and working relationship with your regulator?

Matt Lauffer: I can share a couple examples, Scott, I think are pretty important. In--one thing that we implemented, we have about 11–9 programs in our NPDES permit that we've got to comply with. So that's a significant amount of requirements, measurable goals that you need to go through and discuss with the regulator. So I mentioned that setting up those monthly review meetings with the regulators. And those have yielded a lot of benefits. One Rachel was talking about, just the communication process. You don't--you know, what are the expectations of the regulators? Do you know what they are? What goals are you two trying with the regulator and the department? What are you trying to achieve? And the end result is better water quality, but how we're going to get there? Is what we're doing working, and can we do a better job? So that's also led to better development of the permits themselves where our NPDES permit—we're in our second phase, we currently have our third permit coming up here soon. It should be approved in the next couple months. But that's allowed us to work with the regulator on a permit structure that allows flexibility and implementation. In North Carolina, significant increases in rules and stormwater regulations have occurred over the last five years since we got our second permit term. And that requires us to, basically, up the bar as far as what we are doing for stormwater management. And so that communication also allows us to make modifications to documents and effectively build a stronger permit. I think we also see that in the field. We've got division of environmental officers in the 14 divisions at DOT, and that one-on-one communication with those regional offices of DENR, DWQ, as well as our DOT divisions has just reaped significant benefits and the flexibility and efficiencies in those fields. So I think that's really important. And, Scott, you brought up at the beginning of this discussion today, just the importance of transportation, or TS4 transportation stormwater permit. I think EPA really needs to look at that in the upcoming new stormwater regulations so that, we've got about a million miles of highway in this country, and they are diffuse, they are passive systems, and they are serving the public good, and I think there's a lot of things that EPA, Federal Highways can do to, you know, basically maximize the benefit for dollars spent. So I think those are the important issues that we really need to be focused on. I think the final one, too, is when EPA moves forward with stormwater regulation changes, allowing states to have flexibility. Allowing states to have flexibility in the--just what Karuna was saying, to be each state--each region in the country has different issues they have to deal with as far as pollutants and their impact. So we really need to structure a flexible system in stormwater management as we move forward.

Scott Taylor: Great. Well, EPA is sitting right next to you, so I think they probably heard. [Laughter] Well, unfortunately, we're out of time for questions on this segment. But I want to thank our participants and panelists for all the questions and discussions. And we're going to take another short break and bring our final group of panelists out. So we'll resume the webcast in about five minutes.

[Break]

Scott Taylor: Welcome back to our discussion of Best Practices in Addressing NPDES and Other Water Quality Issues in Highway System Management. I'm Scott Taylor with RBF Consulting, and we're moving to the third part of the webcast, which is assessing the strength of stormwater programs and performance metrics for successful programs. Returning for this discussion is Rachel Herbert with the U.S. EPA's Office of Wastewater Management in Washington, DC. And joining us now in studio is Brian Smith. Brian is an ecologist with the FHWA Resource Center in Olympia Fields, Illinois. Brian serves on the center's environmental–environment technical service team, and also serves as co-chair of the Scan Team. Thank you both for being here. Brian, let's being with you.
Brian Smith: Thanks, Scott. Good afternoon. The term maximal—maximum extent practicable is not well-defined, but we do know that taking initiative is a component of that definition. Most DOTs are taking initiative to improve stormwater management and working hard to comply with NPDES permit conditions and requirements. Because DOTs are so diverse, they're performing many activities that are similar across the nation but have specific nuances. For example, our Scan Team learned that DOTs are designing various documents to help them track activities including project report forms and BMP inventory spreadsheets. Many DOTs are also in the process of updating their various manuals, procedures, and education programs to continue to protect and approve water quality, and keep pace with changing requirements and regulatory expectations. The DOT should continually seek to improve the stormwater management programs. In order to improve stormwater management programs, there needs to be seamless flow of—seamless flow of information between disciplines, shared accountability across departments, support for management, and mutually beneficial partnerships from contractors and local government stakeholders. The term “maximum extent practicable” includes reviewing what was learned and relevant information that reduces uncertainty and continually evaluating risks, so that future decisions are made with greater certainty. Good information reduces uncertainty and improves the likelihood of achieving expected outcomes. Rachel?

Rachel Herbert: So, on the next slide, you can see that the Clean Water Act is really the foundation for everything that we've been talking about. I think everybody who's listening today knows that. But the regulatory agencies really use the NPDES permits that we've also been talking about as the mechanism for implementation of the Clean Water Act requirements. And in reality, it's really important to review the permit conditions very thoroughly so that you have a clear idea of what is expected of you so that you can ensure that you are following those requirements and meeting those goals. And another piece of this is to make sure that you have clear measurable objectives and measurable goals that really will help you figure out if your program is moving toward meeting your requirements, and just improving water quality. Next slide. So these measurable goals should really contain specific actions that you are going to take—for your program and for all the various components of the stormwater program. And you should really clearly list the expectations of each of these goals, and try to include frequencies and dates for finalizing these actions. And these goals should definitely be part of your stormwater management plan, and they should be included there and continually reevaluating toward the progress of ensuring that these goals are met, and figuring out if the plan needs to be revised or if you're headed in the right track. And without these sorts of measurable goals, you won't really have a roadmap to determine if you're being compliant with the permit, and if your program is actually effective. Next slide please. So this slide is just kind of lists out the steps that you should take when you're developing your programs and defining your measurable goals. Things like clearly identifying your objectives so that you're on the same page with everybody else who's in charge of implementing and putting in the ground the BMPs and everything else. You should really look at your current program that's existing to see what things you're already doing so that you can—one, take credit for those sorts of things and—two, figure out if something is not working, what you might have to change and tweak in order to make sure that you're moving toward the objectives. It should also include a selection of your controls. And this includes both specific structural controls, things that are actually in the ground, and nonstructural controls like source reduction and source control. I think Karuna mentioned a few of those earlier in her presentation. Each of these controls should definitely have milestones to make sure that what you're doing is actually going to make a difference. And you have to continually evaluate the effectiveness of these different controls to make sure that you are moving toward the goals that you stated and set out. And finally, use all of these components to really derive the specific measurable goals that you state in your management program, and like I keep saying, reevaluate because that is definitely a key component of your program. With that, I'm going to turn it back to Brian.

Brian Smith: And while the objectives of the permitting process delete the permitting and the direction of the goals of the Clean Water Act, the steps needed to get there are not always well-defined. Unlike the 404 goals, evidence of performance measures are actually measured through avoidance of minimization
procedures or performance through constructive wetland mitigation. NPDES performance is measured indirectly using managerial, administrative, or programmatic measures until a practical direct measure can be identified. For example, an indirect measure would be improved compliance rates of construction operations resulting from inspections. So DOTs must continue to be resolute in their documentation. The documentation is need to ensure that correct information flows through the system, and information is addressed properly in planning, design, construction, and maintenance. Scan Team members all agreed that some interdepartmental coordination are valuable and some organizational structures are more conducive to communication and networking than others. Also, obtaining ideas from other DOTs will be useful as well.

Rachel Herbert: So lastly on this slide, we at EPA headquarters have completed a guidance called MS4 Program Evaluation Guidance, and you can see the web link at the bottom there. And this guide was really developed for the regulators to actually assess the programs of the various permitted entities out there. But it's definitely valuable for DOTs and other permittees also, because it lays out the specific ways that you can go through your programs and figure out what's working and what's not working. And it lays a good foundation for you to sort of do a self-audit before possible auditors come in from EPA or your states. So you should check that out definitely.

Brian Smith: Yeah, that is definitely a useful bit of guidance there. Next slide. In two states, the NPDES regulators provided the Scan Team with their perspectives. In both cases, they were confident in the DOT's demonstration of program efficiency and efforts to make progress. That confidence comes from the assurance that information as being handled correctly. Generally in those states, where there is a strong regulator-DOT relationship, we saw these attributes. Leadership was very evident. Leadership was very informed and active in the program, and they voiced their support for collaboration and the stewardship approach. These states also have well-developed BMP manuals, including procedures for sensitive areas, and partnering on a watershed scale. Inspection is the backbone of a strong program. Regulators must trust inspectors and the key people involved with project management. Inspection reports provide evidence that action and key—is key to demonstrating the program is moving in the right direction. Some states have identified situations where higher levels of review and additional meetings are warranted such as pre-construction environmental meetings. This is good risk management. As far as documentation, every inspection requires timely and documented responses to verify the needed corrective activities and actions have occurred. When there is no verification, there is an assumption that no action has occurred. Tracking is very important as well as reporting inventory, and keeping track of inventory of stormwater controls is important to the internal functions of budgeting, scheduling and prioritizing workloads. Tracking and reporting inventory systems should be easy to use. During the Scan, it seemed that real-time information was a valuable asset that likely improves cost savings in the long run, particularly for maintenance and facilitating compliance. Please don't esti—underestimate the role of maintenance in achieving compliance. Real-time accessibility of this information seemed beneficial across several DOT disciplines. Maintenance is an essential program element, and maintenance history as a sound rationale for considering BMP alternatives. Overtime commitment for maintenance will increase. Next slide.

Scott Taylor: Thanks, Brian and Rachel. I think we want to conclude the webcast by providing you with some of the upcoming events, where you can learn more about the domestic Scan and the opportunities to join what we sincerely hope is the national dialogue and the topics that we've outlined here today. Brian, where can the participants learn more?

Brian Smith: Well, the DOTs will be meeting in Denver in April at the Practitioners Conference where we’ll be discussing stormwater regulations, perspectives regarding innovative stormwater compliance and stormwater research. Also, in Park City, Utah, state, federal practitioners of hydraulic engineering will be meeting to discuss practices and techniques and research in that area. And then finally, the Green Streets & Highway Conference in Denver will be addressing sustainable transportation issues and sharing
information regarding leading edge and environmental stewardship and sustainability practices and principles. Next slide. As far as training, FHWA has worked with EPA on two courses listed here. Water Quality Management of Highway Runoff covers an overview of basic water quality parameters and processes and discusses requirements and guidance on best management practices for mitigating highway runoff impacts and protecting water quality. And Design and Implementation of Soil Erosion and Sediment Control is also a course that might be useful. And at that—and at this time, we're currently working on updated regulations to—updating the course to address the new construction effluent guidelines. Next slide. Some ongoing research that's going on, FHWA is researching the quality of runoff through the stochastic, empirical loading and delusion model, in cooperation with USGS. This model will be a redesign of the current FHWA water quality model. This model is an update will address changes of upstream, receiving water concentrations. It will be a data base application that will allow users to easily create and run highway runoff simulations. SELDM will also simulate storm flows, concentrations, and loads. SELDM will also calculate the risk of exceeding water quality criteria with and without user-defined BMPs. Then also, we have the NCHRP Report 25-31, which will look at beneficial modifications to existing roadway and urban—ultra-urban areas. And we’ll have Task 56 which will relate whether or not DOT should consider pursuing a DOT-specific MS4 permitting. Thank you, Scott.

Scott Taylor: Alright, well thanks again, Brian and Rachel. Regrettably, we're out of time for today's webcast. Let me thank all of our expert panelists for taking time from your busy schedules to be here today and present and discuss this important topic. And thanks very much to our webcast participants from across the country for joining us today. Now, I'm going to hand the program back to Fran Wescott for some final information about the webcast.

Fran Wescott: Thank you very much, Scott, for moderating today's program. Now, if we were unable to answer your question on air today, we invite you to visit CTE’s “After The Broadcast” web discussion forum on the CTE website. All unanswered questions received during the live webcast will be posted on the form and forwarded to our panelists for reply. You may also post additional questions for the panelists about issues raised during this program. So visit the CTE website at cte.ncsu.edu to find the discussion forum link. The forum opens later today and will remain active for two weeks. We'd also like to get your feedback on today's webcast. An online evaluation form also is available on CTE's website. Please, if you will, take a moment to complete the form and let us know your comments and suggestions for future broadcasts. In the coming days, you can view a video recording and download a written transcript of this webcast from the CTE video archive. DVDs of this and past broadcasts also can be ordered from the website. The program agenda and the panelists' slide presentations will remain available online for download as well. We invite you to regularly visit the CTE website for more information on national broadcasts in development throughout the year. CTE is pleased to recognize the services of several organizations which help make today's broadcast production possible. Production studio facilities and closed-captioning for the webcast were provided by the North Carolina Agency for Public Telecommunications in Raleigh. Additional webcast services were provided by East Bay Media. Finally, our thanks again to FHWA and EPA, and to the U.S. Department of Transportation's Research and Innovative Technology Administration whose financial support of CTE through the University Transportation Centers program makes possible our national broadcast series. That's our program for today. I'm Fran Wescott and it's been a pleasure sharing this discussion with you. Until next time, thank you and good day from Raleigh, North Carolina.

[ Closing Credits with Music ]