



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

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June 30, 2008

Ms. Coleen H. Sullins, Director
North Carolina Department of Environment and Natural Resources
Division Water Quality
Stormwater & General Permits Unit
1617 Mail Service Center
Raleigh, North Carolina 27699-1617

RE: Annual Report for Year 3 of the NPDES Stormwater Permit Number NCS000250

Dear Ms. Sullins:

The North Carolina Department of Transportation (NCDOT) is pleased to submit with this letter the Annual Report for Year 3 of the Department's National Pollutant Discharge Elimination System (NPDES) Stormwater Permit Number NCS000250. As part of the permit requirements, this report covers the Department's compliance schedule and progress during the period of April 1, 2007 to March 31, 2008. If you have any questions, or need additional information, please feel free to contact us at (919) 733-2520 or Matthew Lauffer of the Hydraulics Unit at (919) 250-4100.

William F. Rosser, P.E.
State Highway Administrator

Roberto Canales, P.E.
Deputy Secretary for Transit

MSL:bs

Attachment

cc: Bradley Bennett, NCDENR DWQ
Mike Randall, NCDENR DWQ
Dave Henderson, P.E., Hydraulics Unit
Matt Lauffer, P.E, Hydraulics Unit
Ken Pace, P.E., Roadside Environmental Unit

NC DOT

Highway
Stormwater
PROGRAM

Annual Stormwater Report

for the
North Carolina Department of Transportation
Highway Stormwater Program

For Submittal to
NC Department of Environment and Natural Resources
Division of Water Quality

NC Department of Transportation
NPDES Permit No. NCS000250



June 2008



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Annual Stormwater Report

NC Department of Transportation
NPDES Permit Number NCS000250

Certification

"I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations."

Roberto Canales, PE
Deputy secretary for Transit

Date

W.F. Rosser, PE
State Highway Administrator

Date

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Annual Stormwater Report

NC Department of Transportation
NPDES Permit Number NCS000250

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List of Acronyms

BMP	Best Management Practice
CPI	Continuous Process Improvement
DCM	North Carolina Division of Coastal Management
DENR	North Carolina Department of Environment and Natural Resources
DLR	North Carolina Division of Land Resources
DMV	Department of Motor Vehicles
DOT	North Carolina Department of Transportation
DREE	Division Roadside Environmental Engineer
DWQ	North Carolina Division of Water Quality
ESC/SW	Erosion and Sediment Control/Stormwater
ESM	Environmental Sensitivity Map
EPA	Environmental Protection Agency
FIP	Field Inventory Program
FHWA	Federal Highway Administration
HiRuST	Highway Runoff Screening Tool
HSP	Highway Stormwater Program
IDDE	Illicit Discharge Detection and Elimination
ICPP	Integrated Cooperative Planning Procedure
ITRE	Institute for Transportation Research and Education
I&M	Inspection and Maintenance
LOS	Level of Service
LQS	North Carolina Land Quality Section
MS4	Municipal Separate Stormwater Sewer System
MSDS	Material Safety Data Sheets
NCCF	North Carolina Coastal Federation
NCDA	North Carolina Department of Agriculture
NCSU	North Carolina State University
NPDES	National Pollutant Discharge Elimination System
PAM	Polyacrylamide
PSRM	Permanent Soil Reinforcement Matting
REU	Roadside Environmental Unit
ROW	Right-of-Way
SC	Stormwater Control
SCMS	Stormwater Control Management System
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SECREP	Sediment and Erosion Control Research and Education Facility
SPCC	Spill Prevention, Control, and Countermeasures
SPPP	Stormwater Pollution Prevention Plans
SP&R	State Planning and Research Program
TIP	Transportation Improvement Project
TMDL	Total Maximum Daily Load
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WRC	North Carolina Wildlife Resources Commission

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An example of an illicit discharge into the DOT right of way

What is an IDDE?

IDDE stands for "Illicit Discharge Detection and Elimination." Illicit discharges are non-stormwater discharges that are not otherwise permitted under the NPDES program. Examples include wastewater, car wash wastewaters, improper oil or radiator flushing disposal, laundry wastewaters, improper disposal of auto and household toxics, used oil, and chemical solvents. The benefit of the identification of illicit discharges is the protection of water quality by allowing for the removal of these potential hazards.

Occurrences of illicit discharges and illegal dumping are identified by DOT staff and the monitoring public. DOT Division staff and the Highway Stormwater Program (HSP) coordinate with the Department of the Environment and Natural Resources (DENR), who then handle enforcement of the regulations. Occasionally, coordination with the North Carolina State Highway Patrol is also necessary to address illegal dumping.

Drainage into the existing DOT stormwater drainage system is also monitored through DOT's encroachment permits. These permits require the landowner connecting to DOT's right of way (ROW) to determine whether any drainage entering the ROW is adequately permitted and will not generate an illicit discharge or otherwise impact DOT's drainage.

Program Objectives

Objectives established by DOT's Permit Part II.A

- Implement an Illicit Discharge Detection and Elimination Program to assure that the illicit discharges, spills and illegal dumping into the DOT municipal separate storm sewer system (MS4) are detected and eliminated.
- DOT shall implement appropriate procedures and actions to report illicit spills, discharges and illegal dumping for appropriate enforcement or other action by DENR.

Training Opportunities for DOT Staff

DOT has prepared and regularly distributes training documents for staff, contractors, and volunteers to identify and report illicit discharges (**Management Measure a**). Volunteers of the Adopt-a-Highway Program and correctional inmates performing litter removal are trained with a brochure, "Help Reduce Water Pollution Along NC Highways", describing illicit discharges and how to report them. The brochure is also made available to the traveling public at rest areas and welcome centers, and through DOT's public education website at <http://www.ncdot.org/programs/environment/stormwater/awareness/involved.html#>.

DOT staff and contractors receive additional training through the Stormwater Pollution Prevention Plan (SPPP) training, the Erosion and Sediment Control/Stormwater Certification Program, and periodic training conferences. Additionally, a mini-poster has been distributed to DOT industrial facilities to be discussed in staff meetings. Through these measures, appropriate staff are trained annually on IDDEP topics.



23 Cases of Illicit Discharges and Dumps found in Year 3



Over 290 cases of illicit discharges and illegal dumping have been found on DOT right of way since 1998.

Since its inception in 1998, the DOT IDDE Program has identified over 290 illicit discharges or dumps along NC roadways and reported these to DENR's Division of Water Quality (DWQ) Regional Offices. Nearly two hundred of these illicit discharges and dumps have been identified since 2003 with 23 identified during the third year of the second permit cycle (April 2007—March 2008).

Over the past year illicit discharges or dumps were found in seventeen counties scattered across the state in nine DOT Divisions and eleven river basins (Cape Fear (2), Catawba (2), Chowan (2), French Broad (1), Little Tennessee (3), Lumber (2), Neuse (4), New (1), Roanoke (1), Tar-Pamlico (4), and Yadkin-Pee Dee (1)). Of the twenty-three reports, nineteen were identified as dumps while three were identified as flows. Ten of the reports identified residential areas as the primary source, while seven were rural sources, two were commercial sources, and one was an industrial source.

Household graywater discharges make up approximately 86% of the illicit discharges found. Therefore, DOT coordinates with county Health Departments where possible to address these discharges. Reports to DWQ Regional Offices are made on a monthly basis and include a map and latitude and longitude coordinates to the reported site.

Standard Format and Contact are Core to DOT's IDDEP Tracking

Use of DOT's IDDEP Tracking Website is well underway. Introduced in Year 3, the website allows DOT staff within County- and Division-level offices to document illicit discharge and illegal dumping sites found during their normal operations, and submit electronic reports to DOT's IDDEP Manager. Once verified, the sites are then reported to DWQ's Regional Office and other appropriate agencies (see above). Use of the website allows the DOT staff members to track the status of the reported site.

Additionally, the website can be used to track statistics on where reported sites are found for planning and reporting purposes (see photo, right). This system is integral to DOT's compliance with **Management Measures b, c, d, and e.**



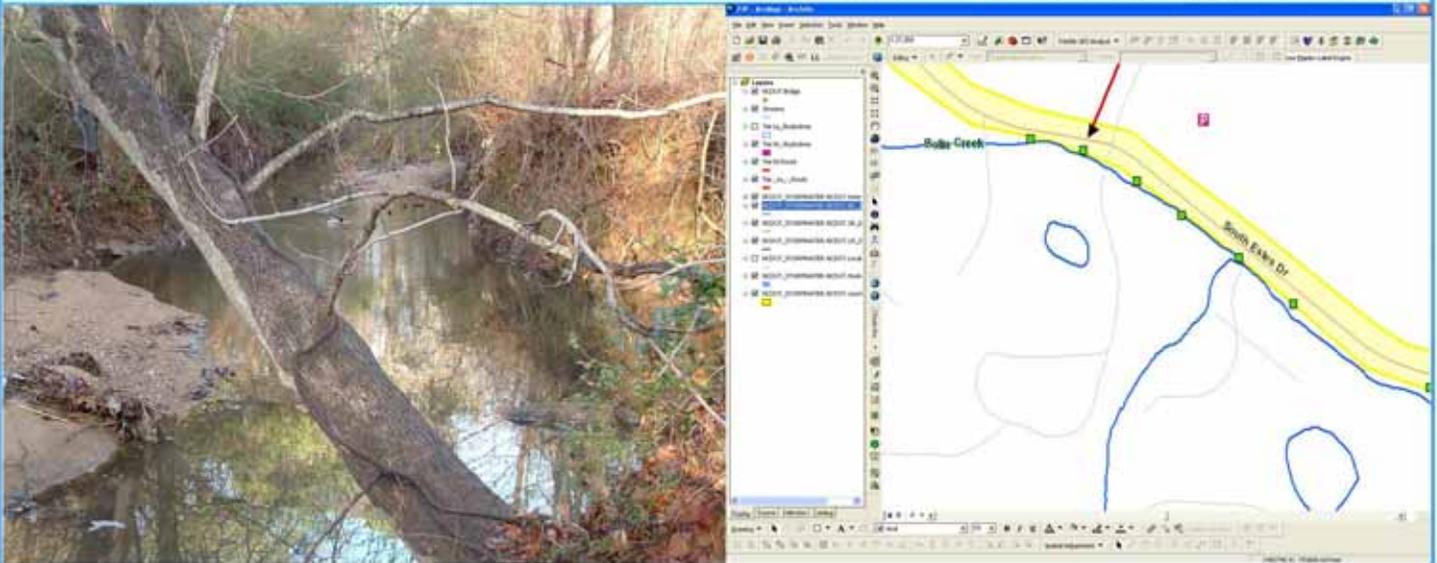
IDDEP statistics displayed by riverbasin from DOT's web-based tracking database.

For more information about DOT's IDDE Program, Contact

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Stormwater System Inventory Program

DOT's NPDES Permit Part II.B.1



Typical environment trekked during the Field Inventory Program (left); Screenshot of ESM showing implicit outfall locations as green dots (right)

Program Objectives

Objectives established by DOT's Permit Part II.B.1

- Continue to build the statewide DOT stormwater system inventory for the purpose of supporting the Retrofit Program, Post-Construction Program, and Illicit Discharge Detection and Elimination Program.
- Maintain a stormwater system GIS map and prioritize sensitive water crossings.
- Develop a field inventory procedure to be used for DOT/DWQ-identified priority areas.

Outfall Inventory Updated in Year 3

DOT continues to maintain and update its GIS-based stormwater outfall inventory as required by the NPDES Permit Part II.B.1. In Year 3, approximately 20% of the expected statewide implicit outfalls from primary and secondary roadways which cross or parallel sensitive streams have been generated and added to DOT's Environmental Sensitivity Map (ESM), a GIS- and web-based repository of geographical information used for permitting and design (**Management Measure a**). The ESM was also updated with the most recent roadways layer to locate outfalls from new construction (**Management Measure b**).

Outfalls from industrial activities were inspected and assessed as part of DOT's Stormwater Pollution Prevention Plan (SPPP) requirements. New outfalls identified were also added to the ESM in Year 3 (**Management Measure c**).

Hardware and Software Used to Develop the FIP

- Desktop GIS software to edit field data.
- Mobile GPS software to collect data.
- Spatial Database Engine software to store data.
- Sub-foot accuracy GPS unit to collect the data in the field.



DOT Expands Pilot Studies for Field Inventory Program

DOT's Hydraulics Unit conducted a Field Inventory Program (FIP) Pilot Study in Year 3 which encompassed stormwater inventories in four (4) predetermined work areas. Each field study was based on the tiered inventory system developed and documented in the FIP Needs Assessment Report completed in Year 2. Each tier represents a hierarchical level of information to be collected depending on the data requirements identified once a priority area is identified and the work area is predetermined. The tiers are described as:

- **TIER IA** identifies true outfalls to waters of the state at or within the ROW boundary (known as DOT outfalls per the NPDES Permit);
- **TIER IB** identifies points where concentrated stormwater exits the ROW (known as ROW discharge points), as well as Tier IA DOT outfalls;
- **TIER IC** includes the collection of Tier I A and B data plus the locations of non-DOT outfalls to Waters of the State outside of the ROW extending from ROW discharge points;
- **TIER II** identifies the stormwater drainage system within the boundaries of the ROW; and
- **TIER III** identifies the complete DOT and non-DOT owned stormwater drainage system.

The pilot studies completed in Year 3 were held to validate the geodatabase design and business processes necessary to implement the FIP successfully.



ROW Discharge Point from Concrete Pipe—Near James Taylor Bridge/Chapel Hill

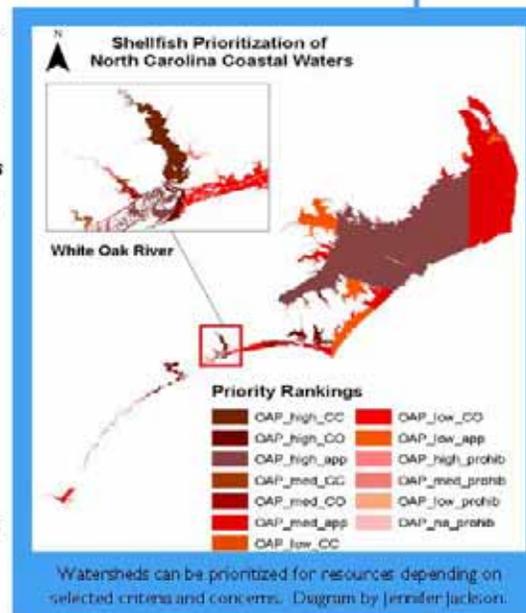
GIS-Based Coastal Prioritization Method Established

Since 2004, DOT has been working closely with DENR's Shellfish Sanitation and Recreational Water Quality Section and the NC Coastal Federation (NCCF) to develop methods for enhancing the identification and distribution of information related to stormwater problem areas potentially affecting shellfish harvesting waters.

As an extension of this effort, the first phase of the DOT's prioritization system to direct FIP activities focused on the coastal region. DOT sponsored research to develop a GIS-based prioritization method using integrated data from several resource agencies and DOT's implicit outfall locations to identify sites where resources should be applied for optimum results in reducing DOT's impacts to water quality. The results can also be used to assess watershed needs and more accurately identify areas needing an in-field inventory assessment such as the FIP.

The algorithms behind the prioritization method are divided into three water quality management issue areas reflecting concepts in DWQ's use support rating system, including shellfish harvesting, primary and secondary recreation, and aquatic life support. The prioritization method assigns groupings of attribute data to geographic areas coincident with DWQ's coastal assessment unit polygons based on the 1:24,000 scale hydrology GIS dataset and DOT's implicit outfall point locations.

Water quality managers can use the attribute data to prioritize geographic areas and management actions. Hence, the prioritization method is very flexible and broadly applicable to a variety of needs. Detailed documentation of the prioritization method is provided in the report entitled "A Coordinated Prioritization of North Carolina Coastal Waters and Stormwater Outfalls as Part of NCDOT's Stormwater Inventory and Prioritization Program".



For more information about DOT's Stormwater System Inventory Program, Contact

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BMP Retrofits Program

DOT's NPDES Permit Part II.B.2



Bioretention basin retrofit installed at a rest area off of I-40 near Warsaw.

Program Objectives

Objectives established by DOT's Permit Part II.B.2

- Develop, implement and support the DOT program to be consistent with NPDES post-construction control measures.
- Use Retrofits to address pollutant loading from existing DOT activities.
- Retrofits should not be associated with meeting the requirements of any other DWQ program.

Retrofits Implemented to Address Pollutants of Concern

Through its Retrofit Program, DOT has identified over 70 sites for Year 3 to address potential pollutant loads from DOT roadway facilities and industrial activities (**Management Measure a**), which are suitable for the construction of a best management practice (BMP) also known as a stormwater control (SC).

During the first three years of this permit term, DOT has implemented 43 retrofits to address the pollutants of concern. An additional 26 retrofits are currently active or

in progress (**Management Measure b**). Conventional retrofit types implemented to date include dry and wet detention ponds, bioretention basins, sand filtration basins, infiltration basins, grassed swales, stormwater wetlands, catch basin inserts, level spreaders and hazardous spill basins. A hydrodynamic vortex separator is currently in use at Cumberland County Maintenance Yard; research on this innovative technology retrofit is being coordinated through DOT's Research Program.

Support of other DOT Activities

In addition to objectives listed under Part II.B.2, the BMP Retrofits Program supports other programs and activities of DOT associated with stormwater, such as:

- **BMP Toolbox Program**—Incorporate lessons learned through the implementation of innovative design procedures and methods into the BMP Toolbox as design standards.
- **Construction Manual**—Solicits feedback about construction concerns to improve future design efforts.
- **Inspection and Maintenance Program**—Gather information about BMP maintenance concerns to improve future design efforts.
- **Education Program**—Use retrofits as demonstrations for education purposes.
- **Research Program**—Perform research on retrofits to confirm their effectiveness.

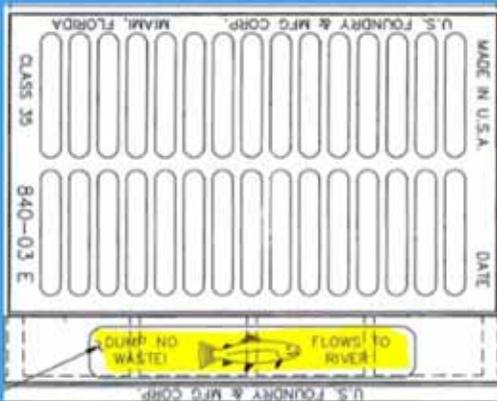


Filtration Basins in McDowell Creek Watershed

Filtration basin BMPs were installed in partnership with Mecklenburg County as part of the McDowell Creek Watershed Management Plan implementation (see photo at right). Water quality concerns for McDowell Creek include biological impairment and potential contamination of downstream drinking water sources. The two basins operate in series and were strategically located to mitigate significant erosion occurring in an existing roadside ditch. Construction presented many challenges, including erosion of side slopes, embankment failures, and sediment buildup on the filter areas, all due to large rain events. Lessons learned from implementation of the BMPs will be beneficial for future design and construction efforts.



Two Filtration Basins in series located near Charlotte off of I-77.



DOT's standard drop inlet grate has been retrofitted with a fish logo as a non-structural BMP.

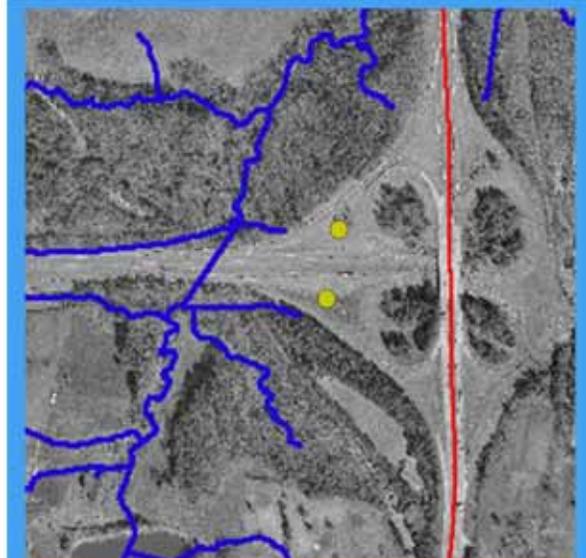
Non-structural BMP Retrofits

Non-structural BMPs are practices that prevent the contact of stormwater with pollutants and control the source of pollution. In Year 3 of the permit term, DOT changed its design standard for drop inlet grates (shown in picture at left) to increase awareness that most storm drains discharge directly to rivers and creeks. Grates with the logo have already been installed on some DOT projects, and all future projects are expected to utilize grates with logos.

Where possible, BMPs are designed to benefit multiple programs, such as the Pet Waste Stations, implemented in over 55 rest areas, which are also a part of the Public Education Program. Other examples of non-structural retrofits include vegetated buffers, and street sweeping.

Retrofit and Research Programs

Potential retrofits along Wade Avenue in Raleigh, NC provide an example of interaction between the BMP Retrofits Program and the Research Program. The locations of the retrofits (yellow circles) and drainage ways (blue lines) are shown on the aerial photo, right. This joint effort between DOT and North Carolina State University (NCSU) will assess the effectiveness of certain retrofits to treat stormwater runoff by monitoring storm water quality before and after the implementation of BMPs. The retrofits will include installation of a dry detention basin, conversion of a drainage swale to a filtration basin, and the addition of soil amendments to improve hydraulic conductivity. Lessons learned from the project can be utilized to refine future BMP selection and design efforts.



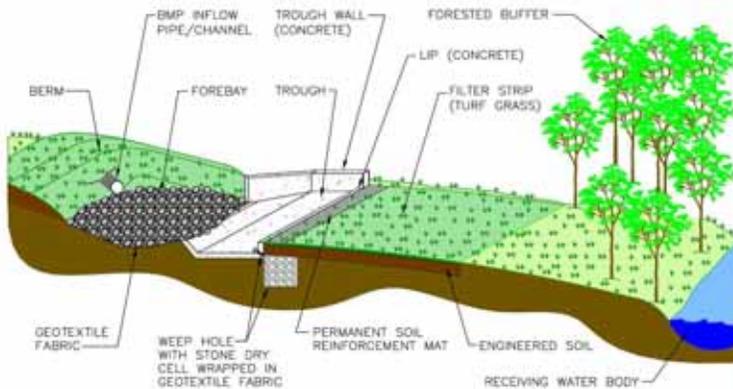
Aerial photo and location of linear wetlands along Wade Avenue in Raleigh, NC. Photo courtesy of

For more information about DOT's BMP Retrofit Program, Contact

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Retrofit Manager
919.250.4100
or
Matt Lauffer, PE
HSP Co-Manager
919.250.4100

BMP Toolbox for Post-Construction Runoff

DOT's NPDES Permit Part II.B.3



Rendering of a level spreader from the BMP Toolbox, June 2008 (left) and a level spreader implemented in the field (right)

Program Objectives

Objectives established by DOT's Permit Part II.B.3

- Develop and update as necessary a **BMP Toolbox** to aid in the siting, design, and construction of stormwater quality BMPs with guidance on the suitability of each for DOT applications.
- Evaluate **BMPs** for applicability to the linear highway system.
- Implement new and innovative technology on an experimental basis.

BMP Toolbox to be posted to DOT public website

The Toolbox is intended to be a dynamic document and will be updated on a regular and as-needed basis. To improve access to the most recent versions of the document, the Toolbox will be posted on the DOT Environmental Excellence website in Summer 2008.

Development of the BMP Toolbox

Per Part II.B.3.b **Management Measure a**, DOT has developed a design manual for best management practices (BMPs) to provide internal and external guidance on the design of post-construction runoff control measures. Development of the manual was performed by a multi-disciplinary team of Hydraulics Unit engineers and other DOT staff with environmental expertise. Development of the Toolbox began with an evaluation of post-construction BMPs presented in DENR's Stormwater BMP Manual (**Management Measure b**). Those BMPs for which there was an adequate history of successful application in the linear environment were included. The initial eight chapters of the BMP Toolbox were submitted to DENR in Year 1 of the permit (January 2006) and was approved in February 2007. Upon approval, the BMP Toolbox became the standard for BMP design within DOT rights-of-way.

Various components of the Toolbox include:

- Photos and rendering of each **BMP** type implemented within DOT's right-of-way.
- Design checklists to be filled out after **BMP** design has been completed and submitted with design plans.
- Decision flow charts for **BMPs** whose application and design may be dependant on specific site conditions or other regulations.
- Clear and uncluttered figures identifying major components. The figures are not intended to be used as details on plans, but are provided within the text for educational purposes.

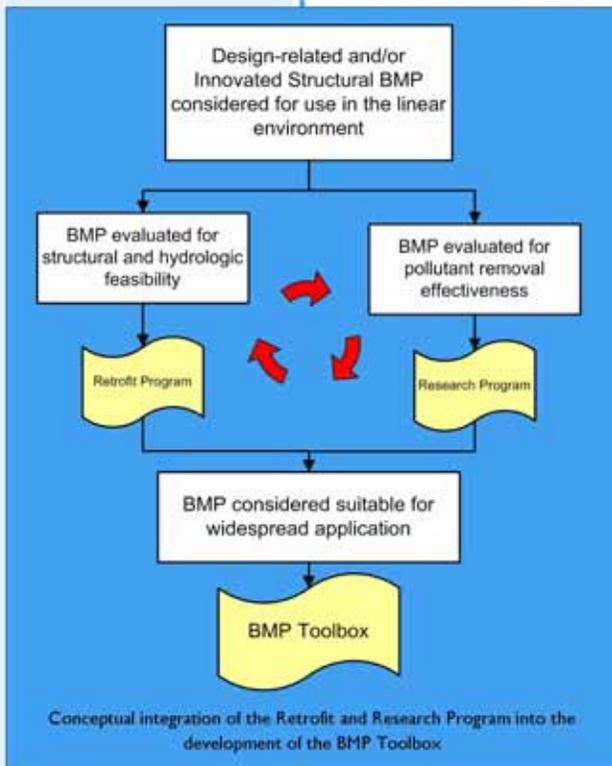


Innovative and Design-Related BMPs

Under permit requirement Part II.B.3.a and II.B.3.c, DOT is required to evaluate innovative and design-related BMPs for inclusion in the BMP Toolbox. Because the BMP Toolbox itself outlines standard design practices for statewide use, only BMPs with a history of successful application in the linear environment are included.

Untested practices are first evaluated via the DOT Research and Retrofit programs. The Research Program is used to quantify pollutant removal capacity of BMP types receiving runoff from transportation land uses. The Retrofit Program is used to test alternative designs of traditional BMPs and emerging technology from both a hydraulic and water quality perspective. Once successful application of a new technology or design has been demonstrated adequately, it is incorporated into the BMP Toolbox.

Examples of innovative and design-related BMPs are provided below.



Research Project: Linear Stormwater Wetlands

DOT and researchers from North Carolina State University (NCSU) are evaluating the pollutant removal effectiveness of linear stormwater wetlands in the right of way versus traditional grassed swales. The project is currently in the initial implementation stage. Installation of monitoring equipment will occur in the summer of 2008. If the research project shows that stormwater wetlands improve the removal of solids and nutrients (specifically total nitrogen and phosphorus), design alternatives will be developed for future consideration.

Research Project: Dune Infiltration System

DOT, researchers from NCSU and the Town of Kure Beach have evaluated the dune infiltration systems as an innovative BMP. Results from monitoring indicate that the pilot system was capable of capturing 97% of runoff that entered the basin and significantly reduced bacterial concentrations during the study period. A second phase of the project, starting in Fall 2008, will evaluate a similar system designed to accept runoff from multiple outfalls. Depending on the results from the second phase of the project, the Dune Infiltration System will be considered for wider application in coastal areas.

Retrofit Project: Buffalo Road and I-540 Stormwater Wetland

A silt basin, located at the intersection of I-540 and Buffalo Road in Raleigh, will be retrofitted to serve as a stormwater wetland. Lessons learned from the retrofit project will determine the feasibility of retrofitting silt basins into wetlands in nutrient-sensitive watersheds. Design requirements for silt basins in nutrient sensitive watersheds may be altered to facilitate transition to post-construction controls after construction is complete. This project, initiated in 2007, is currently in the design phase.

For more information about these projects, please refer to the Research and Retrofit Overviews

For more information about DOT's
BMP Toolbox Program,
Contact

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or
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BMP Inspection and Maintenance Program

DOT's NPDES Permit Part II.B.4

DOT is developing a web-based Stormwater Control Management System (SCMS) to better manage required inspections and maintenance for stormwater BMPs across the state. A screenshot of the pilot database is shown at left. Example inspection checklists are shown to the right.

DOT Uses Feedback from Inspection and Maintenance Pilot Program in Division 3

Program Objectives

Objectives established by DOT's Permit Part II.B.4.

- Evaluate BMP inspection and maintenance needs.
- Develop a BMP Inspection and Maintenance Manual.
- Develop and implement a BMP Inspection and Maintenance Program.
- Submit BMP Inspection and Maintenance information to DWQ for review.

Stormwater Control Management System Underway

As part of its Best Management Practices (BMP) Inspection and Maintenance (I&M) Program, DOT has developed an I&M tracking system (**Management Measure b**). The Stormwater Control Management System (SCMS) will serve as a major upgrade to the initial, spreadsheet-based tracking system developed in Year 2, and will also include functionality to track research on specific stormwater controls and the development of retrofits.

DOT's IT group is partnering with the SCMS project team to create the website. The completion date is estimated to be late

2008. Division Operations personnel will test the website before the statewide rollout occurs.

It is expected that the Division Roadside Environmental Engineer will be the primary user of the Inspection and Maintenance portion of the website (i.e., the I&M point of contact) and Hydraulics Unit Design Engineers will use the website to track and document the development of retrofit projects. Division Operations Maintenance personnel will also use the website to document structural maintenance performed on stormwater controls.

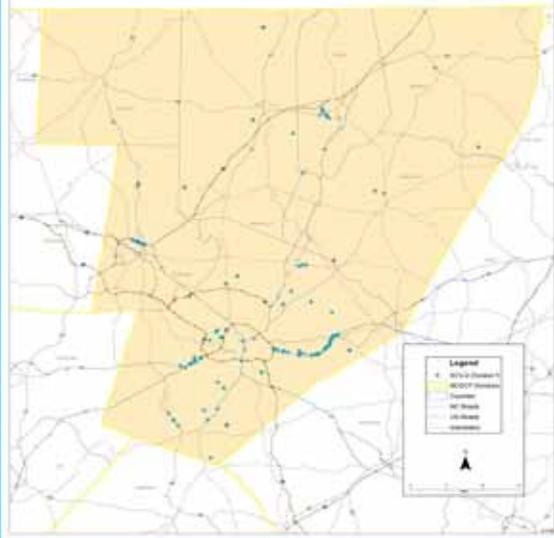
Prior to developing the SCMS website, DOT conducted a pilot study to test its Inspection and Maintenance (I&M) Program protocol in Division 3. An I&M tracking database was developed and loaded onto the Division 3 Roadside Environmental Engineer's (DREE) computer in 2007.

After a brief training session, the DREE began using the database and provided valuable feedback to the I&M Project team over a six month period. The database was modified as necessary and is serving as the backbone for the SCMS website.

The I&M database is being used in conjunction with the I&M Manual and the SCMS website to allow DOT to post additions/new chapters of the Manual in a timely manner.



Stormwater Controls NCDOT Division 5



Example of SC inventory for Division 5 as mapped by ESM.

Existing Stormwater BMPs Inventoried and Rated

Over the past couple of years, DOT has identified, rated and documented all DOT-owned stormwater controls (SCs) across the state. There are over 500 SCs on record and it is likely that the inventory will double in just a few years (**Management Measure d**).

REU staff performed functional assessments on all SCs and rated them with a level of service (LOS) grade of A, B, C, D, or F. Division Operations staff will use these ratings to prioritize the order in which SCs receive maintenance. The SCMS website will be used to document all updated LOS ratings and future assessments and inspections.

ESM to be Linked to SCMS

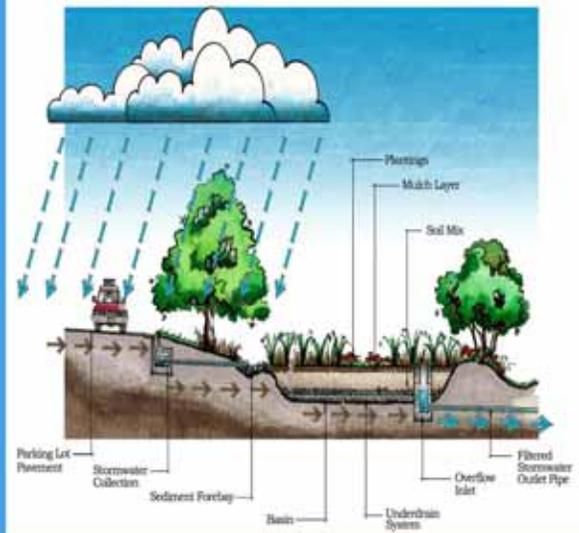
The Environmental Sensitivity Map (ESM), which hosts a myriad of environmental and geographical data, is going to be linked to the SCMS. SCMS users will be able to import specific stormwater control data, including controls that were associated with Stormwater Management Plans directly from ESM.

Currently, DOT uses the ESM to perform planning and analysis on various stream, environmental and road data. Transportation Improvement Project (TIP) data is available on ESM and is widely used by DOT personnel.

Inspection and Maintenance Manual

DOT is developing its stormwater BMP Inspection and Maintenance Manual. Instructions on eight BMP types have been developed to date and were submitted to DWQ for approval in Year 2 (**Management Measure b**). Nine additional BMP types are planned for inclusion in the manual and will be submitted to DWQ for approval. (**Management Measure d**). The Manual will address BMP functionality and provide "how-to" guidance for conducting inspections, routine and non-routine maintenance. Inspection checklists have been developed for each type of BMP.

Additionally, the Manual includes the results of DOT's assessments of BMP siting conditions, BMP type, and State Stormwater Permit requirements (**Management Measure a**).



Schematic of a Bioretention Basin as shown in the Inspection and Maintenance Manual.

For more information about DOT's
Inspection and Maintenance
Program,
Contact

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or
Ken Pace, PE
HSP Co-Manager
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Post-Construction Stormwater Program

DOT's NPDES Permit Part II.B.5



Planning, design, construction, and maintenance in a linear system requires unique applications and techniques that are different from parcel-based development. The PCSP describes how the DOT and DWQ address these differences.

Program Objectives

Objectives established by DOT's Permit Part II.B.5

- In cooperation with DENR, develop and implement a post-construction runoff program to regulate stormwater runoff by requiring structural and non-structural best management practices to protect water quality, reduce pollutant loading, and minimize post-construction impacts to water quality.
- Submit the Post-Construction Program for review by DWQ.

Post-Construction BMPs Address Sensitive Waters

DOT continues to select and implement best management practices (BMPs) for post-construction control of discharges to sensitive waters (**Management Measure a**). Often, the selection of these BMPs relies on input from the resource protection agencies, such as the Department of Environment and Natural Resources (DENR), US Army Corps of Engineers (USACE), the NC Division of Land Resources' (DLR) Land Quality Section (LQS), Division of Coastal Management (DCM), US Fish and Wildlife Service (USFWS), and/or the NC Wildlife Resources Commission (WRC). This is often collected through the Merger Process, which streamlines the environmental permitting process for DOT projects.

The Clayton Bypass (US 70 in Johnston County) is a prime example of this collaboration to address sensitive streams and other concerns such as threatened and endangered species. Approximately 60 structural BMPs have been implemented in this 10.5 mile project, including level spreaders, preformed scour holes, and infiltration basins.

DOT Environmental Projects Win Continuous Process Improvement Awards

DOT management sponsors an annual Continuous Process Improvement award to recognize exemplary projects which showcase DOT's efforts to providing safe, efficient, and environmentally sound transportation services to the citizens of North Carolina. In Year 3, two projects associated with environmental concerns were recognized:

- **Multi Sensor Precipitation Estimator Website** notifies staff when significant rainfall has occurred on construction projects, requiring inspection of BMPs.
- **Stormwater Pollution Prevention Plan Website** allows staff to update and report SPPP requirements easily and improves management review



Stormwater Management Report Describes the PCSP

To document and fully assess DOT's efforts to address stormwater concerns in its daily work, DOT developed the Stormwater Management Report, which was submitted to DENR early in Year 3 (**Management Measure c**). The report divides DOT's activities into four core practices as shown in the diagram to the left, and describes how numerous groups within DOT are responsible for and implement structural and nonstructural BMPs. Further, the report describes the implementation process for the BMP Toolbox, including a training program.

In addition to DOT's independent efforts to protect water quality, DOT's approach to stormwater management includes a decision-making process by which the DWQ, DOT, and other agencies meet site-specific water quality objectives and watershed strategies through cooperation, understanding, and application of scientifically based approaches. With this foundation of collaborative efforts and DOT's independent pledge of stewardship for the environment, the Department is committed to continue and expand its role in protecting stormwater quality.



DOT's approach to stormwater management is constructed of four Core Pillars supported by regulations, guiding principles, business units, partnerships and environmental programs.

Green Highway Concepts Aid in Stormwater Management

DOT is committed to implementing post-construction stormwater controls as an integral part of the planning and implementation of new roadways and facilities. In addition, the HSP Research and Retrofit Programs are dedicated to improving the proper application of post-construction BMPs department-wide. Both of these programs alone have implemented structural and non-structural controls as necessary to address the water quality needs of sensitive streams.

Continued integration and collaboration between these programs to increase the understanding of the efficiencies and benefits of controls which are cost effective, address regulatory and policy concerns, and are environmentally sound and protective, is leading DOT into the emerging field of Green Highway Concepts. While the science and practices behind this initiative are not new as they stand individually and have previously been implemented, the concept of using a wide range of practices and regulatory flexibility to manage stormwater in a collaborative effort is showing increasing benefit to the linear environment. The figure to the right provides an example of the use of planning, design, and construction practices to support the Green Highway Concept. DOT has initiated research on implementing Green Highway Concepts routes at its House Creek retrofit study.

Nationwide, the Green Highways Initiatives program is supported by the Federal Highway Administration (FHWA) and the Environmental Protection Agency (EPA).



For more information about DOT's Post-Construction Stormwater Program, Contact

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or
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919.250.4100



The forebay on a bioretention basin overlooks plants specially-selected to contribute to stormwater treatment

Program Objectives

Objectives established by DOT's Permit Part II.B.6

- Manage application of pesticides, fertilizers, and other vegetation management materials to minimize pollutant potential of stormwater runoff.
- Use only approved vegetation management materials.

Division-wide Vegetation Control Plan leads to Reduced Mowing, Pesticide Use, and Weeds

Division 6 (Harnett, Cumberland, Robeson, Bladen, and Columbus counties) has developed a division-wide vegetation management plan to synchronize mowing and pesticide use to reduce application of pesticides and mowing activities through establishing a dense population of preferred Centipede and Bermuda grass.

By applying selective herbicides after a mowing cycle for roadside brush, the population of undesirable plants, such as broomsedge, can be kept in balance with the desired grasses. Within the first 2 years of the program, the need to mow was reduced significantly. In years 3-5 of the program, the dense population of preferred grasses have resulted in mowing and pesticide applications being cut in half when compared to before starting the program.

The division-wide vegetation management plan is part of an Integrated Cooperative Planning Procedure (ICPP) developed by Division 6. The ICPP won a Continuous Process Improvement Award in 2008 for communication.

DOT Continues Consultation with NCDA and NCSU

DOT consults with the North Carolina Department of Agriculture (NCDA) and North Carolina State University (NCSU) to select appropriate pest control and fertilization methods and materials (**Management Measure a**) through ongoing research (see back page) and reviews of new products and technology to support the standard operating procedures identified in DOT's *Vegetation Management Manual (1998)*. As a result, DOT's list of approved chemicals is updated annually and the application of pesticides on DOT roadways and facilities is restricted to the approved list (**Management Measure b**).



Research Continues to Identify Optimum Management Techniques



Maintaining a thick vegetative cover using native and robust plants improves stormwater runoff by decreasing sediment in the runoff and decreasing the need to use fertilizers and chemicals.

DOT continues to sponsor university-based research to determine optimum techniques for pesticide selection and application along North Carolina's roadways. Once identified, the results are implemented through DOT's annual training. Research sponsored in the past few years includes:

- *Innovative and Environmental Responsible Methods for Controlling Invasive Woody Plant Species in North Carolina Right of Way*, Drs. Neal and Burton, NCSU
- *Application Placement Technologies for Vegetation Management on NC Roadsides*, Dr. Yelverton, NCSU
- *Herbicide Options for Weed Management in the North Carolina Highway Wildflower Program*, Dr. York, NCSU
- *Establishing Native Vegetation and Improved Invasive Species Control on North Carolina Roadsides*, Drs. Richardson and Burton, NCSU

For PDFs of final research reports, please refer to TRIS Online, a bibliographic database funded by supporters of the Transportation Research Board at <http://ntlsearch.bts.gov>

Annual Training Provided to DOT Staff Applying Pesticides

DOT provides training for its staff involved in pesticide applications through its annual, day-long certification/recertification program. The training agenda includes topics such as general and unique chemical selection and application techniques. Examples of unique applications include specific plant types or the DOT Wildflower Program. Training also includes chemical handling and disposal requirements; reading labels and material safety data sheets (MSDS); required documentation and recordkeeping; and techniques for spill response. All Division Roadside Environmental Engineers have a pesticide application license and most of the staff also has a license. Employees that do not have licenses must work directly under the supervision of a licensed staff person. Additional training is provided to the staff applicator and a wider audience at the annual Roadside Environmental Conference, including topics such as impacts on water quality and proper management techniques including mowing.

Vender Selection Reduces Wastes

In 2007, DOT contracted Aquamix, Inc. to provide pre-mixed pesticide solutions. As a part of their service, Aquamix provides the material in reusable containers. The application technique and equipment results in triple-rinsed containers which are then collected by Aquamix for reuse. This program reduces the handling and mixing required by DOT staff and streamlines the container disposal process, in addition to reducing waste deposited in landfills.



Structural BMPs for the highway setting are designed to treat stormwater runoff in a sustainable fashion. Where possible, they also provide an aesthetic

For more information about DOT's Vegetation Management Program, Contact

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Encroachment Program

DOT's NPDES Permit Part II.C



Examples of encroachments from commercial entities draining to DOT rights of way

Program Objectives

Objectives established by DOT's Permit Part II.C

- Assist DENR to ensure all discharges to DOT's roadway drainage are properly permitted under applicable laws and rules.
- Coordinate with DENR the reporting of non-permitted or under-permitted private dischargers that adversely impact or have the potential to adversely impact DOT's discharges, including discharges that result from direct or indirect stormwater discharged entering its system from new development or redevelopment.

DOT Requires Certification of Appropriate Permitting

The DOT and Department of Water Quality (DWQ) have collaborated on an encroachment strategy which relies on DOT's authorization of driveway permits. These permits require new development or redevelopment entities requesting connection of discharges or drainages to the DOT right of way to certify that they are adequately permitted through the Department of Environment and Natural Resources (DENR) (**Management Measure a and b**).

Additionally, DOT identifies discharges which may impact DOT's drainage through its Illicit Discharge Detection and Elimination Program (see separate overview). In coastal areas, DOT has worked with DENR's Shellfish Sanitation and Recreational Water Quality branch to identify the impacts from various runoff sources including non-NCDOT sources. In areas where the requirements of Part II.C Total Maximum Daily Load Assessment are activated, DOT and DWQ will further work together to assess the impacts of indirect discharges to DOT's discharge affected by Part II.C. The strategy may be revised as necessary to maintain compliance.



For more information about DOT's Encroachment Program, Contact
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 919.733.2920
 or
 Matt Lauffer, PE
 HSP Co-Manager
 919.250.4100

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Construction equipment stands ready to move earth for a roadway construction Project.

Program Objectives

Objectives established by DOT's Permit Part II.D.1—*Sediment and Erosion Control*

- Continue to control development activities disturbing one or more acres of land surface including activities by DOT contractors.
- Require construction site operators to implement appropriate erosion and sediment control practices.
- Require site inspection and enforcement of control measures.
- Establish requirements for construction site operators to control waste that may cause adverse impacts to water quality such as discarded building materials, concrete truck wash-out, chemicals, litter, and sanitary waste at the construction site.

Objectives established by DOT's Permit Part II.D.2—*Borrow Pit and Waste Pile Activities*

- Continue to implement sediment and erosion control measures and reclamation plans on all borrow pit and waste pile projects, including activities at Ferry Terminals associated with dredging activities and contractor owned or leased borrow pits associated with DOT projects in keeping with the sediment and erosion control program established by the North Carolina Sediment Control Commission.

DOT Continues Borrow Pit and Waste Pile Program

Throughout Year 3 of its NPDES permit term, DOT continues to implement erosion and sediment control measures and reclamation plans on all borrow pits and waste piles (**Management Measures a and b**) in conjunction with its Borrow Pit Discharge Management Program approved by DENR in Year 2 (2006—2007) which includes management measures, an inspection and maintenance program, and training materials for borrow pit operations (**Management Measure c**). DOT completed the pilot study identified in **Management Measure d** in Year 2.

DOT provides Erosion Control spreadsheet to staff and contractors

A committee at DOT's Roadway Environmental Unit developed an electronic spreadsheet to help DOT staff and contractors select appropriate erosion controls for construction projects. The *EroDes (Erosion Design)* spreadsheet was first distributed in March 2007 and is regularly updated. The spreadsheet can be used to determine the appropriate velocity control requirements and settling basin size and depth based on site-specific information, including watershed classification.

Also, *EroDes* identifies when temporary ditch liners are necessary and helps engineers determine whether riprap or permanent soil reinforcement matting (PSRM) should be used.

EroDes and other construction guidance documents can be downloaded from DOT's website at http://www.ncdot.org/doh/Operations/dp_chief_eng/roadside/fieldops/downloads/



ESC Training Expands to New Skills, Languages and Staff

In 2005, DOT initiated the first courses in a tiered certification program administered by NCSU to train staff and contractors on the principles of Erosion and Sediment Control and Stormwater (ESC/SW) related to job-specific knowledge needs for inspectors (Level I) and site managers (Level II). Starting in January 2008, certifications were also available for designers of construction sites (Level III A) and reclamation sites (Level III-B). Contractors awarded construction projects are required to have certified employees for each appropriate skill set related to their contracted project. Level I and II training has also been provided in Spanish for contractors, a part of DOT's efforts to promote clear communication regarding ESC/SW with all workers. As of November 2007, over 3000 staff and contractors have been certified.

DOT has also expanded its ESC/SW training this permit year outside the certification program to include Bridge Maintenance employees and Transportation Supervisors. Regional training on ESC/SW principles were provided to these staff, including proper design and installation of construction and post-construction structural stormwater controls, pesticide and fertilizer application, and general environmental awareness.

Research Results in Innovative Controls

DOT continues to sponsor research to improve techniques used in designing and implementing erosion and sediment controls. Much of the research is performed by Dr. Rich McLaughlin at North Carolina State University's Sediment and Erosion Control Research and Education Facility (SECREF) through NCSU's Soil Science Department in Raleigh, NC.

DOT distributes the research results through its ESC/SW Certification and has implemented research in its ESC Plans. Important research includes:

- Selection of appropriate polyacrylamide (PAM) products based on soil types.
- Use of PAM with standard stilling basins and wattles to improve efficiencies (especially useful in trout stream basins).
- Use of sediment bags as a post-stilling basin polishing system.



Experimental Post-stilling Basin Polishing System.
Photo courtesy of Dr. Rich McLaughlin, NCSU

Renewed ESC Delegation from DLR Expands to Vertical Construction

DOT's delegation under the Division of Land Resources' (DLR's) Erosion and Sediment Control (ESC) Program is evaluated and renewed annually. It was renewed again in February 2008 after review of several construction projects statewide, including two division-lead projects. Through this program, DLR and DOT coordinate quarterly cross-training inspections to "calibrate" the inspection criteria of both agencies. Cooperation between the agencies is demonstrated well by the recently completed Clayton Bypass (US 70) in Johnston County which underwent monthly checks by DLR and other resource agencies to confirm ESC activities intended to protect the dwarf wedge muscle, an endangered bivalve, were implemented.

Starting this year, DOT's ESC delegation will also apply to the construction of buildings such as Department of Motor Vehicle (DMV) offices, equipment shops, and others, known as "vertical construction".

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Construction Program,
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Program Objectives

Objectives established by DOT's Permit in Part II.E

- Maintain and implement a Stormwater Pollution Prevention Plan (SPPP) for each facility with an industrial activity that is covered by this permit.
- Develop and implement a Plan prior to operation of any new facilities.
- Perform visual monitoring/inspections at each facility.
- Implement BMPs.

DOT Upgrades Stormwater Pollution Prevention Plan Website

The SPPP is a process-intensive program that requires reporting and updating over time. DOT streamlined problems with maintaining hard copies of the SPPP by updating its web-based management system that allowed for the over one-hundred and fifty (150) end users across the state to input, update, and receive information in an efficient process that facilitates communication and control while maintaining environmental compliance.

Additionally, DOT integrated required Spill Prevention, Control and Countermeasure (SPCC) requirements into its SPPP program, as shown in the diagram below.

DOT staff document monitoring required by the Permit via the website twice each year. DOT also ensures that Stormwater Pollution Prevention Plans (SPPPs) are created for new industrial facilities and all existing SPPPs are implemented and maintained per Part II.E.1.b. of the Permit. There are currently over 190 SPPPs for industrial facilities and over 100 facilities requiring SPCC Plans.

This project received first place in the Continuous Process Improvement Program for the Labor Hours Saving category in 2008.

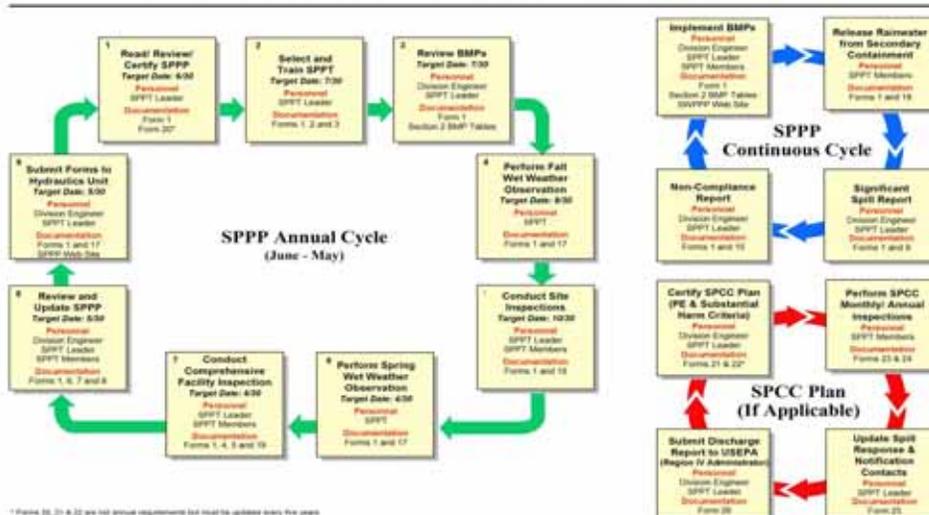
SPPP/SPCC Training Utilizes Illuminate Live Web-based Approach

To introduce the upgraded SPPP website, DOT IT staff worked with the SPPP/SPCC project team to organize a web-based training session for DOT Operations Staff across the state. A few hundred staff members "dialed in" to a training session hosted out of DOT's IT Center, without having to leave their home base.

Additional training tools for the upgraded website include:

- Division-wide training sessions covering website modifications in greater detail took place in early 2008
- DOT is updating their SPPP training video and adding a new video on spill response to better cover the SPCC regulations.
- The Industrial Facility and Maintenance Activities Guidance Manual will include chapters on SPPP and SPCC-related topics.

NCDOT Process Diagram for Stormwater Pollution Prevention Plan (SPPP) & Spill Prevention, Control and Countermeasure Plan (SPCC) Plan



* Forms 20, 21 & 22 are not permit requirements but must be updated every five years



A typical County Maintenance Yard, DOT's most common Industrial Activity site.

Industrial Facility and Maintenance Activity Training Manual In Development

DOT is in the process of developing a comprehensive Industrial Facility and Maintenance Activity Training Manual that will cover topics ranging from Fertilizer Storage and Application to Bridge and Culvert Maintenance. The Manual will focus on how to conduct industrial activities while protecting stormwater quality. In addition to the Manual, posters, flyers and interactive games are being created to better equip Operations staff with stormwater training materials.

Research at Maintenance Facilities

A hydrodynamic vortex separator (HDVS) has been installed at the DOT maintenance yard in Fayetteville, NC (Cumberland County Maintenance Yard) to determine whether it effectively removes certain constituents from stormwater. Water samplers have been installed at the inlet pipe and the outlet pipe of the device. Runoff samples are collected sequentially during multiple storm events and either automatically or manually composited. Bulk precipitation chemistry is also collected at each installation. Water samples are analyzed for the following constituents: total suspended solids, turbidity, pH, specific conductance, ammonia-N, nitrate-N, total nitrogen, dissolved total phosphorus, total phosphorus, dissolved organic carbon and oil and grease.

Training Comes in Many Forms

As Part of its SPPP program, DOT utilizes several approaches to provide training to its staff on topics including (but not limited to) salt storage; good housekeeping; spill prevention, clean-up and reporting; illicit discharges; and vehicle and equipment washing. Training materials include:

- Educational posters (see the Internal Education Overview for more information).
- A video shown to employees annually, in addition to being shown to new hires.
- Monthly safety meetings include an environmental topic.
- In-person discussion of Erosion and Sediment Control (ESC) and material management handling.

For more information about DOT's
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DOT's NPDES Permit Part II.F.1



DOT staff members participate in Environmental Awareness Training (above); Examples of Stormwater Training Fliers distributed to DOT Staff



Program Objectives

Objectives established by DOT's Permit Part II.F.1:

- Develop and implement a program to train DOT staff and contractors about the importance of stormwater quality.
- The training should include topics such as spill control, chemical application, illicit connections and illegal dumping, etc.

P 2 Training for Employees and Contractors Combined with

DOT has incorporated permit requirements for pollution prevention (P2) awareness, Construction general permit NCG01, stormwater pollution potential, and appropriate response to spills, illicit connections, and illegal dumping into its Erosion and Sediment Control/ Stormwater Certification facilitated by North Carolina State University (**Management Measure a**).

The training is provided in three tiers to correspond with the job-specific knowledge needed for Inspectors (Level 1), Site

Managers (Level II), and Designers of construction sites (Level III-A) and reclamation sites (Level III-B). Since 2005, over 3300 staff and contractors have completed these courses, including contractors from numerous companies. Per a memorandum from the State Construction Engineer dated January 10, 2006, all private engineering firms must use appropriately certified individuals to provide construction engineering and inspection services on DOT projects. See the article on page 2 about ESC/SW training in Spanish.

DOT Training Opportunities for Staff

In addition to the training activities required in DOT's permit and those discussed in this brief, DOT staff participate in the following training opportunities:

- **Construction Engineers Conference** (biannually)—Stormwater pollution awareness, illicit discharge and illegal dumping identification and reporting, and other permitting issues
- **Vegetation Management Conference** (annually)—Stormwater pollution awareness and the importance of proper application of pesticides and fertilizers
- **County Maintenance Engineer's Safety Meeting** (monthly)—Stormwater management, including salt storage, illegal discharges, secondary containment, and good housekeeping
- **Roadside Field Operations Meeting** (quarterly)—Erosion controls issues



Required Training for Maintenance Staff

DOT has also incorporated the required training for roadway maintenance staff (**Management Measure b**) into its Stormwater Pollution Prevention Plan training (**Management Measure c**). In addition to regular training events for County Maintenance Engineers and their staff, informational flyers on topics such as illegal discharges, salt storage, and good housekeeping (photos on page 1) are made available. Over 1,200 Highway Division staff have viewed the Good Housekeeping flyer, which was distributed in 2007.

Participants in the Adopt-a-Highway program as well as inmates from the NC Department of Corrections are informed whom to call if they find illicit discharges or illegal dumping while they are picking up roadside litter (**Management Measure b**).

ESC Training Provided in Spanish

DOT's Erosion and Sedimentation Control/Stormwater (ESC/SW) Certification is now being offered in Spanish to DOT contractors. As the population becomes more multicultural, Spanish instruction is essential to ensure that Spanish-speaking workers understand and follow proper procedures. On January 10, 2008, Level I ESC/SW Training was conducted by a Spanish-speaking instructor using Spanish slides. Attendees were given a Spanish notebook and took the test in Spanish.

A similar session was held on June 10, 2008, for Level II training. DVDs of these training sessions are available for contractors who wish to complete the training at their leisure. They will be provided with a Spanish notebook, and they must travel to Raleigh to take the certification test. About 60 crew members and their supervisors, half English-speaking and half Spanish-speaking, recently attended a training session in Greensboro (see photo at left). A letter from DWQ dated April 17, 2008, praised DOT for providing this bilingual training session.



Photo by Ted Sherrard

Bilingual session of Erosion and Sedimentation Control/Stormwater Training

Staff Participate in State and National Conferences

DOT staff members attend various conferences in an effort to bring the best in knowledge, research, and engineering to NC roads. Here's a sampling of presentations given by DOT:

- Transportation Research Board, *North Carolina Department of Transportation's Approach to Low Impact Development*
- Roadside Environmental Unit Conference, *Comprehensive Stormwater Management*
- NC GIS Conference, *Stream Mapping and Transportation Decision Making*
- NC Chapter of American Public Works Association, *NCDOT's TMDL Program*
- DOT Construction Conference, *Rainfall Website*
- NC Chapter of American Public Works Association, *Stormwater Programs*
- Water Resources Research Institute Annual Conference, *Pet Waste*



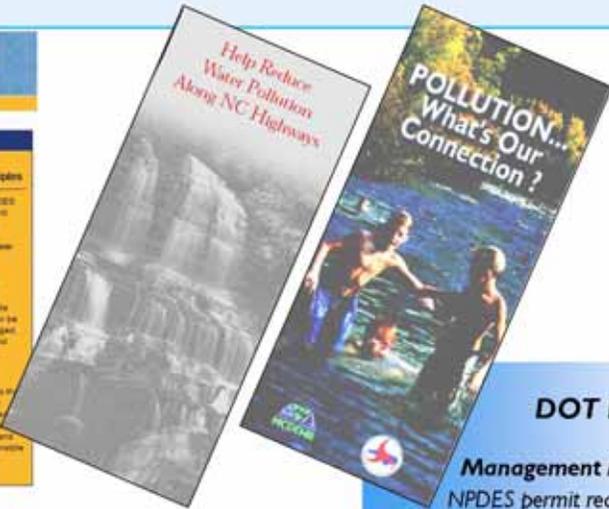
DOT staff speaking at an HSP Workshop

For more information about DOT's Internal Education Program, Contact

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DOT's Public Education Website (above)
 Examples of stormwater brochures distributed to the public (above right)



DOT Partnerships

Management Measure d in the NPDES permit requires DOT to develop educational partnerships with other agencies to promote and distribute public education materials. Here's a sampling of DOT's partners:

- Cape Fear Council of Governments
- City of Greensboro
- Institute for Transportation Research and Education (ITRE)
- NC Coastal Federation
- NC Department of Corrections
- NC Department of Environment and Natural Resources (DENR)
- North Carolina Keep America Beautiful
- North Carolina State University
- North Carolina Zoo
- Town of Kure Beach
- Town of Nags Head
- UNC-Charlotte

Program Objectives

Objectives established by DOT's Permit Part II.F.2

- Develop and implement a program to educate the public about the importance of stormwater quality, including chemical application, illicit connections and illegal dumping, etc.
- Develop diverse educational materials to engage and educate the public from different social, economic and age groups.

Public Education Website

In March 2005 DOT launched its public education website. Developed to meet the NPDES requirement at **Management Measure c**, the website informs the public about DOT's role in managing and reducing stormwater pollutants from roadways and industrial facilities. The website presents the permit and a description of all 12 programs covered by the permit. Specific requirements of the permit are listed at the website, which also describes why DOT is required to have a stormwater permit and lists DOT's contacts.

The **What's New** section is updated regularly to showcase new projects in the Highway Stormwater Program. Perhaps the most useful section for the general public is **Frequently Asked Questions**. This section defines stormwater and explains how stormwater affects the public and the environment. The section de-

voted to kids, which meets partial compliance for **Management Measure b**, features stormwater flash cards, photographs, and links to additional stormwater activities.

The **How Do I Get Involved?** section has links to information about how the traveling public can dispose of their waste and sanitary wastewater at dumping stations (**Management Measure b**). The **Stormwater Awareness** section has a link to the popular brochure entitled "Pollution: What's Our Connection?" (see cover this page) that encourages pollution prevention awareness (**Management Measure b**). Developed jointly with the N.C. Department of Environment and Natural Resources (DENR), the brochure is widely distributed.

For more information, visit the website:
www.ncdot.org/programs/environment/stormwater/





Photo by Bob Holman

Pets of all sizes frequent the Pet Waste Station at the Moore County Rest Area

Pet Waste Stations

DOT has installed Pet Waste Stations at rest areas along many of North Carolina's highways. The stations educate pet owners on the impacts of pet waste in stormwater, such as a potential source of disease and parasites to receiving streams, especially in shellfish and swimming areas. The stations provide bags to encourage pet owners to pick up and properly dispose of their pet's waste, thereby keeping pet waste out of the stormwater.

In addition to educating the public, the pet waste stations are retrofit best management practices (BMPs) which address specific pollutants of concern as required in the Retrofit Program under Part II.B.2 of DOT's permit. A total of 130 Pet Waste Stations have been installed at over 55 Rest Areas and Welcome Centers throughout North Carolina.

Stormwater Flash

At the Warsaw Rest Area off I-40 in Duplin County, DOT is using a structural BMP retrofit as another public education opportunity. The Stormwater Flash, an educational display situated near a bioretention basin, describes what a bioretention basin is, how it is constructed, and how it works. Photos of plants commonly used in a bioretention basin help the public identify plants growing in the Warsaw basin. Companion photos are located in the building. Bioretention basins are constructed to treat stormwater that flows off paved areas. The runoff is filtered by the soil media, where various physical, chemical, and biological treatment occurs. Water is detained and released slowly into the soil. As a bonus, bioretention basins are attractive and provide habitat for wildlife. Similar public education displays are also installed at the Dune Infiltration System at Kure Beach, the bioretention basin at the North Carolina Zoo, and the Catawba County Rest Area.



Educational signage at Warsaw Rest Area on I-40

Teachers Benefit from Stormwater Material

Stormwater Flash Cards were such a hit at the 2004 NC State Fair that teachers have been clamoring for them since then. Originally developed by DOT and printed for distribution at the State Fair, the flash cards have been reprinted and are now sent in response to requests from teachers throughout North Carolina. The cards feature questions and answers to teach schoolchildren about stormwater.

The popular brochure entitled "Pollution...What's Our Connection?" explains how people can improve stormwater quality by making educated choices in their daily lives. Developed through a partnership between DENR's Office of Environmental Education and DOT, the brochure is also available to teachers. Teachers can also use the resources available in the Stormwater Kids section at DOT's public education website (see previous page).

Adopt-A-Highway

Adopt-A-Highway volunteers are encouraged to report illicit discharges and illegal dumping they encounter as they pick up highway litter (**Management Measure e**). Reporting information is included in the brochure "Help Reduce Water Pollution Along NC Highways" distributed to all volunteers (see cover on previous page).

For more information about DOT's
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Contact

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Research Program

DOT's NPDES Permit Part II.G

Program Objectives

Objectives established by DOT's Permit Part II.G

- Conduct research with faculty and staff at state universities or other designated institutions that results in independent quantitative assessment of pollutant loads from DOT permitted activities and or measure structural BMP effectiveness.
- Conduct research to enhance or improve existing practices or develop new methods or processes with state of the art technology to meet future permit requirements.



To promote the sustainability of initiatives and best serve both the public and the environment, Highway Stormwater Program policy decisions must be supported by science. Therefore, the Research Program's primary mission is to support all other aspects of the HSP. Research projects are selected to provide immediate and practical solutions to stormwater management information needs.

At left: An automated sampler is installed in the Jordan Lake Watershed to collect stormwater runoff from a secondary roadway.

Summary of the Research Program

The HSP Research Program is jointly administered by the Hydraulics Unit, the Roadside Environmental Unit, and the Research and Analysis Unit. Primarily, stormwater-related research projects supported by DOT are funded through the State Planning and Research Program (SP&R), a requirement of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). For more information, see <http://www.tfrc.gov/services/state/stateplan.htm>.

Through the development, implementation, or performance of activities, DOT staff identify information needs that can be satisfied by research. Stormwater research projects are selected based on need and the ability to support multiple Permit areas. Currently, approximately 12 major, multi-year research projects have been completed and 7 more are in progress. These projects either quantify DOT's contribution to stormwater impacts

or evaluate the effectiveness of best management practices (BMPS).

The Research Program is discussed in further detail in the DOT HSP Research Plan, a requirement of the Part II.G.2 of the permit. The Research Plan outlines a process for requesting funding, determining research needs, and identifying the appropriate research team from the North Carolina university system. The Research Plan was submitted to DENR for review in June 2006. The Research Plan was approved by DENR on May 19, 2007. DOT will continue to implement the Research Plan throughout the Permit term by identifying research ideas and sponsoring research projects.



Linear Stormwater Wetlands Provide Pollutant Removal

DOT and researchers from North Carolina State University (NCSU) are investigating the pollutant removal capability of swales and stormwater wetlands along Interstate 40. Through the Research Program, NCSU will investigate the stormwater pollutant removal of solids and nutrients in typical swales compared to linear stormwater wetlands. In addition, NCSU will determine the infiltration capacity of the vegetated area between the roadway and the swales, and monitor rainfall.

NCSU researchers believe DOT may be able to capitalize on benefits of linear stormwater wetlands for stormwater treatment. If improved stormwater treatment is demonstrated, these systems will represent how traditional best management practices can be tailored to the linear environment.

For more information about this project, contact Matt Lauffer with the DOT Hydraulics Unit.



A swale with wetland vegetation along I-40. Photo taken by NCSU.

Dune Infiltration System

In coastal areas, stormwater outfalls often empty stormwater, contaminated with bacteria and other pollutants, directly into the ocean or sounds. Through a partnership with DOT and the Town of Kure Beach, researchers from NCSU conceptualized, installed, and tested an innovative best management practice called the dune infiltration system (DIS).

Open-bottom, commercially available infiltration basins were installed beneath the dunes at Kure Beach in the spring of 2006. Monitoring indicates this pilot system is economically and technically feasible. The system captures 97% of the stormwater diverted into the dunes, the dunes remained structurally stable during the study, and *Enterococcus* concentrations entering from the outfalls were reduced by over 97%.

For more information about this project, contact Bob Holman with the DOT Roadside Environmental Unit.



Installation of the Dune Infiltration System, Town of Kure Beach, NC

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Want to know more about DOT Research Projects?

Refer to other Highway Stormwater Program Overviews for more examples of DOT Stormwater Research.

For PDFs of final research reports, please refer to TRIS Online, a bibliographic database funded by supporters of the Transportation Research Board. <http://trisearch.bts.gov>

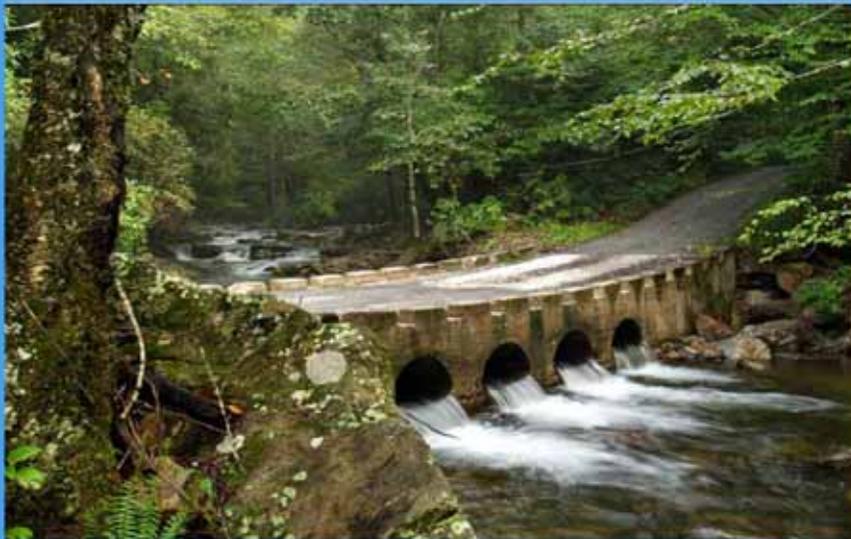
DOT's Role in the Total Maximum Daily Load Process

The DOT is the first regulated entity in North Carolina to have total maximum daily load (TMDL) implementation-related requirements included in its NPDES stormwater permit. The DOT is also unique in that it is the only single entity in the State with NPDES permit coverage in virtually every 303(d)-listed watershed. This unique situation emphasizes the importance of the DOT and DWQ working together in partnership to develop a sustainable and mutually beneficial communication framework regarding TMDL matters. The goals of this framework include:

- Ensuring a smooth, efficient, and transparent TMDL development process,
- Applying highway impact analysis methods rooted in science, and
- Targeting implementation of management measures to achieve the most environmental benefit while controlling cost.

The DOT and DWQ have proactively initiated steps to develop this communication framework, and they have partnered on a number of other TMDL-related activities, many of which can be considered example control measures.

Although DOT's permit does not require action until the agency is assigned a waste load allocation (WLA) as a significant contributor in a TMDL approved by EPA. DOT has initiated the TMDL Program in cooperation with DWQ.



Forest Road 140 in Pisgah National Forest, NC. Image by John Roberts 2007

Year 3 Program Highlights

- DOT hosted an interagency (with EPA, DWQ, DAQ, DOT, and consultants) workshop to discuss ways to address atmospheric deposition through managing air and water resources in North Carolina.
- Participated as a Technical Advisory Committee member for TMDLs in Falls Lake, High Rock Lake, White Oak River, and Lockwood Folly.
- Coordinated with DWQ, North Carolina Coastal Federation, and others to develop a Priority Ranking System to prioritize coastal waterbodies for TMDL activities.
- Developed a Highway Runoff Screening Tool (HiRuST) to estimate DOT pollutant loading relative to other sources in the watershed.
- Developed a Nitrogen Deposition white paper summarizing sources and fate/transport of nitrogen in NC.
- Developed a Database of Research applicable to the TMDL Program.



Characterization of Nutrients in the Roadway Environment

Through the Highway Stormwater Program, DOT has invested considerable time and effort in better understanding the nature and importance of nutrients, and in particular nitrogen, in the roadway environment. From conducting nutrient-related research to our involvement in watershed modeling studies, the following 2007 projects highlight a few of DOT's ongoing activities.

Partnering to Manage Nutrient Runoff

DOT hosted an interagency (with EPA, DWQ, NC Division of Air Quality (DAQ), DOT, and consultants) workshop to discuss ways to address atmospheric deposition of nitrogen through managing air and water resources in North Carolina. The meeting included a review of current approaches and detailed discussion on air and water models, including an air-water linkage tool called the Watershed Deposition Tool (WDT) developed by EPA. In conjunction with this work DOT developed a white paper titled *Nitrogen Deposition in North Carolina: Implications for Water Quality Management Efforts* to better inform and integrate those groups involved in pursuing water quality management efforts in North Carolina.

Nutrient Runoff and Characterization Research

DOT teams with researchers from across North Carolina to conduct water quality related studies. In 2007, researchers from the University of North Carolina in Charlotte worked with DOT to implement a comprehensive monitoring program that will provide data to derive nutrient loading rates for secondary roadways. The information and data collected under this study will also be used to assess the pollutant-loading reduction potential of existing vegetative cover along roadsides.

Applied Research through Modeling and TMDL Development

DOT participated as a member of the Falls Lake Nutrient TMDL Technical Advisory Committee (TAC). In this capacity, DOT assisted the TAC by updating DWQ's GIS land use/cover data layer to include DOT roads. The amended land use/cover data layer subsequently allows for an analysis of the impact of state-maintained roads on the lake's water quality, which would otherwise not be feasible with the original data layer. The DOT applied the WDT to provide recommendations for atmospheric chemistry model inputs and provided science-based recommendations for roadway pollutant model parameters substantiated by peer-reviewed published research from North Carolina highway runoff characterization studies. Additionally, DOT provided Doppler radar-based precipitation estimates for multiple locations throughout the Falls Lake watershed to improve model calibration. DOT also developed a Highway Runoff Screening Tool (HiRuST) to estimate DOT pollutant loading relative to other sources in the watershed.

Coastal Waters Prioritization Plan

DOT coordinated with the DWQ, North Carolina Coastal Federation, and others to develop a Priority Ranking System to prioritize coastal waterbodies for TMDL activities. The DOT has also contributed matching funds to support the 319 funded White Oak River and Lockwood Folly River fecal coliform TMDL projects. The DOT is an active participant, along with a diverse set of project partners, working to ensure the development of a TMDL designed to directly support implementation decision making. The resulting water quality modeling and TMDL analysis will be used to support development of an implementation plan to restore the shellfish harvesting uses.

For more information about DOT's
TMDL Program,
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