Annual Stormwater Report

Year 4—April 1, 2008—March 31, 2009

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

October 2009

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Annual Stormwater Report

NC Department of Transportation

NPDES Permit Number NCS000250

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Eugene A. Conti, Jr.
Secretary of Transportation

9/28/09
Date

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Annual Stormwater Report

NC Department of Transportation

NPDES Permit Number NCS000250

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
DOT	North Carolina Department of Transportation
DREE	Division Roadside Environmental Engineer
DWQ	North Carolina Division of Water Quality
ESC	Erosion and Sediment Control
ESM	Environmental Sensitivity Map
EPA	Environmental Protection Agency
HSP	Highway Stormwater Program
HS4	Highway Separate Stormwater Sewer System
IDDE	Illicit Discharge Detection and Elimination
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
NCDA	North Carolina Department of Agriculture
NCSU	North Carolina State University
NPDES	National Pollutant Discharge Elimination System
PAM	Polyacrylamide
REU	Roadside Environmental Unit
ROW	Right-of-Way
SC	Stormwater Control
SCMS	Stormwater Control Management System
SECREF	Sediment and Erosion Control Research and Education Facility
SPCC	Spill Prevention, Control, and Countermeasures
SPPP	Stormwater Pollution Prevention Plans
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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Illicit Discharge Detection and Elimination Program

DOT's NPDES Permit Part II.A

Example gray water discharge in eastern North Carolina

What is an IDDE?

IDDE stands for "Illicit Discharge Detection and Elimination." Illicit discharges are nonstormwater 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 motoring public. DOT Division staff and the Highway Stormwater Program (HSP) coordinate with the Department of 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 and hazardous spills.

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

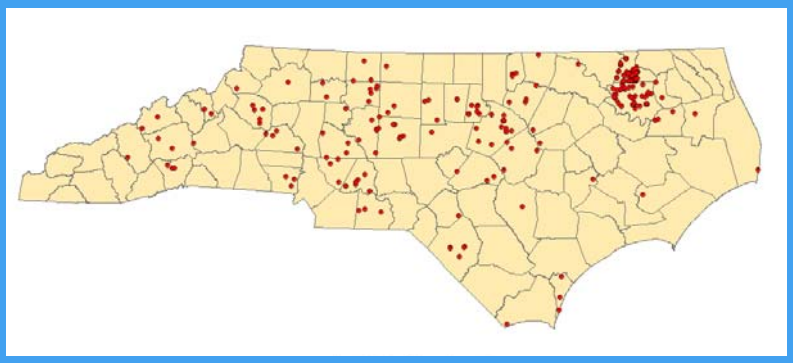
Objectives established by DOT's Permit Part II.A

- 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.

IDDEP Training

Training on the importance of the IDDEP program and how to recognize and report illicit discharges and illegal dumping is provided to DOT employees and Adopt-a-Highway volunteers. Employees receive IDDEP information during other training events, such as the Stormwater Pollution Prevention Team Leaders training, the County Maintenance Engineer's monthly meetings, and the Roadside Field Operations quarterly meetings. Field crews are training on IDDEP during "tailgate" safety meetings and during monthly "bull pen" meetings, and through posters. Training is provided per **Management Measure a**.

26 Cases of Illicit Discharges and Dumps found in Year 4



Location of illicit discharges located statewide as of March, 2009

DOT Staff are trained to recognize illicit connections and illegal dumps (ICIDs) during the course of their daily work efforts (**Management Measures a and b**). Most often, ICIDs are identified during site assessments for large, new construction projects, called transportation improvement program (TIP) projects or during roadside maintenance activities.

DOT has reported over 320 ICIDs to DENR's Division of Water Quality (DWQ) Regional Offices during the course of the program, with 26 ICIDs reporting during this permit year. Eight of these were reported to DWQ for enforcement, with the remaining sites addressed by DOT staff.

Most sites are located in rural areas of the state. Illegal dumps often include used oil, concrete, and empty containers.

Household gray water discharges make up approximately 86% of the illicit discharges found. Therefore, DOT coordinates with county Heath Departments where possible to address these discharges. Other reports were forwarded to local municipalities, including Stormwater Services of Winston-Salem, Cary, Charlotte, and Durham. Reports to DWQ Regional Offices (in accordance with **Management Measure d**) are made on a monthly basis and include a map and latitude and longitude coordinates to the reported site.

DOT Maintains Standard Point of Contact and IDDEP Tracking

In accordance with **Management Measure c**, DOT maintains a standard reporting format (see example form) and contact for all complaints and report of illicit discharges. Citizens of North Carolina are informed of and may contact this position through DOT's Environmental Excellence website.

ICIDs reported are tracked through DOT's web-based tracking system (**Management Measure e**) which is accessible to DOT's county and Division-level offices for reporting to the IDDEP Manager. Once verified, the sites are then reported to DWQ's Regional Office and other appropriate agencies (see above).

NCDOT NPDES PERMIT HIGHWAY STORMWATER PROGRAM

ILLICIT DISCHARGE DETECTION AND ELIMINATION PROGRAM* FIELD REPORT (FORMALLY ILLICIT CONNECTION & ILLEGAL DISCHARGE)

DATE: ____

Instructions: A DOT supervisory personnel shall investigate, fill in date above, complete information below, and forward it to Roadside Environmental Unit – Environmental Operations Section. Telephone Number: (919) 733-2920; Mailing Address: NCDOT Roadside Environmental Unit, 1557 Mail Service Center, Raleigh, NC 27699-1557; Fax: (919) 733-9810

Pollution Source Observed By: ☐ NCDOT Personnel ☐ NCDOT Contractor ☐ Adopt-A-Highway
Date Identified: _____ ☐ General Public, Name & Phone: _____
Notes from Reporter: _____

Investigator Information: Name: _____ (Last) (First)
Phone: _____ Agency: _____ Position: _____

Location: NCDOT Division: _____ County: _____ City: _____
Highway or Site: _____ Nearest Intersection or Mile Post: _____
Specific Location Info.: _____
Latitude Longitude (optional) _____

Type of Stormwater Structure with Illicit Connection or Illegal Dumping (Check One):
☐ Ditch (Size, Type) _____ ☐ Pipe (Size, Type) _____ ☐ Catch Basin
☐ Manhole ☐ Grated Inlet ☐ Other: _____

Physical Observations: ☐ Dump ☐ Discharge Flow: ☐ Yes ☐ No

Odor: ☐ Sewage ☐ Rotten Eggs ☐ Fishy ☐ Skunk ☐ Petroleum ☐ Other:
Vegetation Condition (If applicable): ☐ None ☐ Normal ☐ Excessive Growth ☐ Inhibited Growth
Color: ☐ Black ☐ Brown ☐ Yellow ☐ Green ☐ Gray ☐ White ☐ Other:
Land Use: ☐ Residential ☐ Commercial ☐ Industrial ☐ Rural
Appearance: ☐ Oily Sheen ☐ Sewage ☐ Chemical ☐ Detergent ☐ Other:
Source: ☐ Residential ☐ Sanitary Sewer ☐ Spill Release ☐ Commercial/Industrial ☐ Other:
Comments: _____

FOR ROADSIDE ENVIRONMENTAL UNIT STAFF USE ONLY

Date Received: _____ Processed By: _____ (Last) (First)
Forward Report to NCDENR DWQ: ☐ Yes; Date: _____ Whom: _____
☐ No; Why Not? _____
Database ID Number: _____ River Basin: _____ Database Entry Date: _____
(Division) (County) #
Follow Up and Remarks: _____

* Illegal Discharges also include Illegal Dumping as defined as significant materials that are soluble or easily transported by stormwater runoff, such as used oil, chemical solvents, septic waste, etc. Solid materials not easily transported by stormwater are addressed through other DOT programs and should not be reported on this form. Version 3-21-05

Example IDDEP reporting form from DOT's IDDEP tracking website.

For more information about DOT's IDDE Program, Contact

Ken Pace, PE
HSP Manager
919.733.2920
or
Bob Holman, PhD
IDDEP Manager
919.861.3779

Stormwater System Inventory Program

DOT's NPDES Permit Part II.B.1

DOT has developed a field outfall inventory procedure to be implemented in priority areas.

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 4

DOT continues to maintain and update its GIS-based stormwater outfall inventory as required by the NPDES Permit Part II.B.1. In Year 4, approximately 20% of the expected state-wide 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 4 (**Management Measure c**).

DOT Identifies Priority Watersheds for Field Inventories:

DOT has assigned a high priority for a field outfall inventory to selected nutrient sensitive waters (NSWs) watersheds in order to support nutrient load reduction initiatives, such as those ongoing for Jordan Lake. Additionally, DOT partnered with DWQ and the Coastal Federation to complete a field inventory in the White Oak Basin. See the TMDL Program overview for more information on this activity.

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

Matt Lauffer, PE
HSP Manager
919.250.4100
or
Andy McDaniel
SSI Manager
919.250.4100

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BMP Retrofits Program

DOT's NPDES Permit Part II.B.2

Filtration basin constructed along US 64 at the Hiwassee River

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.

BMPs at Maintenance Yards

Two filtration basins were designed to control and treat stormwater runoff from two maintenance yards in Guildford County. Each of the basins will control approximately 4 acres of impervious yard area where maintenance buildings are located and where maintenance vehicles and materials are stored. Installation of BMPs at these maintenance facilities was an excellent opportunity to maximize treatment of built upon area for the projected funds expended (high benefit to cost). The filtration basins also represent implementation of BMPs in a non-linear (or non-roadway) environment. Lessons learned from the project can be utilized to refine future BMP selection and design efforts for other non-roadway DOT facilities.

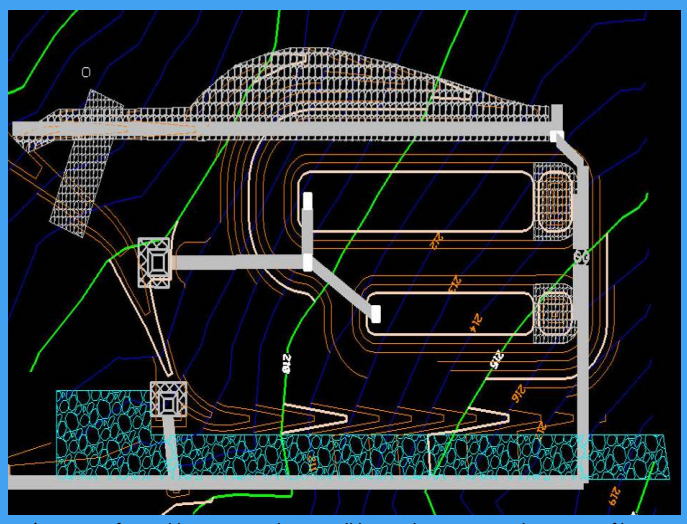
Filtration Basins along the Hiwassee River

Two hazardous spill basins were designed and constructed to control and treat bridge and roadway runoff along US 64 and the Hiwassee River in Cherokee County. Placement of these BMPs are a good example of opportunistic planning by DOT to recognize and take advantage of available right-of-way area around bridge crossings for BMP installation. These basins also represent implementation of BMPs in the mountains eco-region. The two basins were designed with different dimensions (thickness and area) to allow for future evaluation of required design criteria, which can be incorporated into future design of hazardous spill basins.

Retrofits Implemented in Year 4

Through its Retrofit Program, DOT has identified over 20 sites for Year 4 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). During the first four years of this permit term, DOT has implemented over 70 retrofits to address the pollutants of concern (**Management Measure b**).

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, hydrodynamic vortex separator, and hazardous spill basins.



A system of paired bioretention basins will be used to compare the impact of basin size on effectiveness to treat bridge deck runoff.

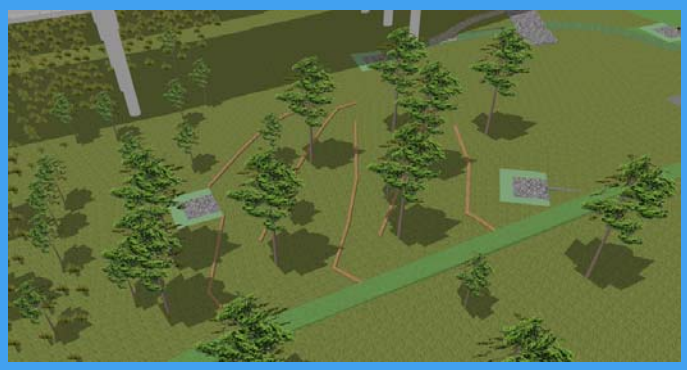
Mango Creek Water Quality Enhancement Demonstration Site Planned

DOT has initiated the design and construction of the Mango Creek Water Quality Enhancement Demonstration Site through the Department's Bridge Stormwater Project (BSP). Located in Wake County, the Site will be used to monitor four different BMPs, including two bioretention basins receiving identical flows of bridge deck runoff via a splitter box. One basin has been designed in accordance with DWQ's BMP Manual while the second is approximately one half the size. North Carolina State University researchers will collect samples to compare the impact of basin size on effectiveness. If found to be effective, smaller bioretention basins may be more applicable to linear systems.

A bioswale with amended soils and shade-tolerant plantings will also be constructed to treat bridge deck runoff. This BMP will also be evaluated by the researchers to determine its ability to treat nutrients and total suspended solids as compared to dry and wet swales studied at other sites in North Carolina.

The fourth BMP will be a low impact development (LID) basin. The first of its kind, this novel approach will promote vegetative filtration and infiltration of bridge deck runoff in a wooded area.

During the course of study, the US Geological Survey will be assessing the water chemistry of bridge deck runoff. Results of the project are expected in 2010.



A low impact development (LID) basin is planned for the Mango Creek Water Quality Enhancement Demonstration Site as shown in this rendering.

Pet Waste Retrofits Completed

Although roadways and other DOT activities don't produce fecal coliform, this pollutant may be transported by DOT's highway separate storm sewer system (HS4). Therefore, DOT has incorporated public outreach and education with its Retrofit Program to install signs and waste collection stations for the motoring public to use to pick up after their pets. The installation program was completed in 2008 with a total of 144 stations located at all 49 DOT rest areas and 13 ferry terminals.

DOT's program to retrofit rest areas and ferry terminals with pet waste stations was completed in 2008.

For more information about DOT's IDDE Program, Contact

Matt Lauffer, PE
HSP Manager
919.250.4100
or
Brian Lipscomb, PE
Toolbox Manager
919.250.4100

BMP Toolbox for Post-Construction Runoff

DOT's NPDES Permit Part II.B.3

Schematic of a vegetated swale showing how it functions.

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.

DOT Continues Use of Toolbox

The *Best Management Practices (BMPs) Toolbox* (March 2008 version) has been made available to DOT staff and contractors, and to the general public for use in designing BMPs for linear systems. The *Toolbox* can be downloaded from DOT's website at www.ncdot.org/doh/preconstruct/highway/hydro/BMP/default.html. No additional chapters have been added to the Toolbox during Year 4 of the permit. However, DOT has been evaluating the design requirements for bioretention basins in DWQ's *Stormwater BMP Manual* in preparation of developing a chapter for this control, as required in **Management Measure b**. Once completed, the chapter and any subsequent chapters will be submitted for review and approval by DWQ prior to implementation as required by **Management Measure d**.

Through the Bridge Stormwater Project, DOT is constructing and evaluating stormwater controls involving 50 bridges. This information will be used to develop further chapters in the toolbox. In addition, DOT is using research to evaluate soil amendments, pavement overlays, and anaerobic zones in filtration basins for possible inclusion in the Toolbox in the future.

Flow-weighted samples of roadway runoff show the variation in turbidity that can be experienced under varying conditions and at different periods of the storm event.

Evaluation of Nutrient Loading and Effectiveness of Roadside Vegetation

DOT is sponsoring ongoing research by Drs. Jy Wu and Craig Allen of the University of North Carolina at Charlotte to characterize solids and nutrient concentrations in stormwater runoff from secondary roadways. The project will compare suspended solid and nutrient concentrations and load from impervious portions of the right-of-way (ROW) with concentrations and loads from the entire ROW (impervious plus vegetated ROW). As a secondary objective, the study will identify the impacts of temporary disturbance from utility and driveway encroachment on stormwater characterization. Data on turbidity, total suspended solids (TSS), nitrogen and phosphorus will be collected.

The results of this research may influence design of secondary roads and the assessment of pollutant loads for total maximum daily loads (TMDLs).

Evaluation of Innovative BMPs Completed

The need for confined-space entry protocols for maintenance in conjunction with inconclusive results makes evaluated proprietary BMPs unattractive.

Researchers from the Departments of Geography and Earth Sciences and Civil and Environmental Engineering at UNC-Charlotte evaluated three proprietary manufactured stormwater BMPs at DOT facilities. An underground stormwater vault and a catch basin insert (CBI) were installed at rest areas and received drainage from parking areas and roadways. A hydrodynamic vortex separator (HDVS) was installed at a maintenance yard and received runoff from impervious surfaces.

The study showed that the stormwater vault and HDVS were able to reduce total suspended solids (TSS) if the influent concentrations were high. The CBI was not effective at reducing TSS. Analysis of the sediments collected in the stormwater vault and HDVS showed the majority of total nitrogen and phosphorous per unit weight of sediment was associated with silt and smaller sediment size fractions. However, the majority of particulate-bound nitrogen and phosphorous was associated with medium sand size particulates and higher. Results for removal effectiveness for other parameters were mixed.

Ongoing difficulties with structural maintenance and failures of the devices, along with difficult maintenance practices, some requiring specialized equipment and confined-space protocols, has lead DOT to remove all CBI devices which had been installed. Additionally, DOT will carefully assess the implementation of proprietary BMPs at other locations.

Ongoing Research: Open Grade Friction Course (OGFC)

Research by engineers at North Carolina State University's Biological and Agricultural Engineering Department are continuing evaluations of the nutrient removal capabilities of linear wetlands along interstate roadways. One site drains roadway that is surfaced with open grade friction course, an asphalt material made without fine aggregates, causing void spaces through which runoff can drain. Preliminary results of the study show lower concentrations of pollutants from the OCFG-surfaced areas compared to other roadways that have been studied across North Carolina. A final report for the project is expected next year. If beneficial, OCFG may be a design-related BMP useful to DOT. Design-related BMPs are evaluated per **Management Measure c**.

For more information about DOT's Toolbox Program, Contact

Matt Lauffer, PE
HSP Manager
919.250.4100
or
Brian Lipscomb, PE
Toolbox Manager
919.250.4100

BMP Inspection and Maintenance Program

DOT's NPDES Permit Part II.B.4

The photos above compare a well maintained BMP (left) to one needing removal of undesirable and overgrown vegetation (right).

LOS Ranking: _____

STORMWATER BMP: BIORETENTION BASIN
DIVISION: _____ BMP ID#: _____
COUNTY: _____
DATE INSTALLED: _____
LOCATION: _____

INSPECTOR(S): _____
_____
INSPECTION DATE: _____

Structural Components

Y	N	N/A	
☐	☐	☐	Sediment forebay is structurally sound and functional.
☐	☐	☐	Inlet and outlet ditches are structurally sound and functional.
☐	☐	☐	Outlet box and/or overflow box is in place, structurally sound, and functional.
☐	☐	☐	Outer walls (berm) of stormwater device are structurally sound, and functional.
☐	☐	☐	Grate to outlet box/overflow box is in place, structurally sound, and functional.
☐	☐	☐	Underground drainage system appears to be structurally sound and functional.

Areas of Maintenance

Y	N	N/A	
☐	☐	☐	Sediment forebay is clean free of silt, leaves, trash and other debris.
☐	☐	☐	Inlet and outlet ditches are clean, free of silt, leaves, trash and other debris.
☐	☐	☐	Grate to outlet box /overflow box is unobstructed free of leaves, trash and other debris.
☐	☐	☐	Basin is clean free of silt, leaves, trash and other debris. No erotion in basin.
☐	☐	☐	Basin floor and side slopes are adequately mulched to a minimum 3-inch depth.
☐	☐	☐	Basin remains well vegetated with desirable vegetation. Plants are in good order.
☐	☐	☐	Grass has been mowed and undesirable vegetation removed as needed.

Y	N	
☐	☐	Are there structural repairs needed at this site? (If yes, describe below)
☐	☐	Are there maintenance needs at this site? (If yes, describe below)
☐	☐	Were maintenance activities conducted during the time of inspection? (If yes, describe below)

Comments/Recommendations/Actions Taken:

_____
_____
_____
_____

LOS Category	LOS Description
A	Some aging and wear has occurred but no structural deterioration or maintenance needs were found. Device is functioning properly.
B	Minor structural deterioration and/or maintenance needs were found but function of the device has not been affected.
C	Moderate structural deterioration and/or maintenance needs were found but function of the device has not been significantly affected.
D	Serious deterioration in at least one structural component and/or major maintenance needs were found. Function of the device is inadequate.
F	Device no longer functional due to the general or complete failure of a major structural component and/or the lack of adequate maintenance.

Example inspection checklist

Program Objectives

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

- Develop and implement a BMP Inspection and Maintenance Program to aid in the inspection, operation, and maintenance of BMPs.

DOT Continues Development of the Inspection and Maintenance Manual and Program

Throughout Year 4 of the permit term, DOT has continued to evaluate the inspection and maintenance needs of BMP types in DOT's *BMP Toolbox* (a requirement of **Management Measure a**) and of individual BMPs already in place along DOT's roadways and facilities. These assessments become the foundation of inspection checklists and instructions for regular maintenance for the BMPs which are documented in the on-going development of new chapters for the BMP Inspection and Maintenance Manual, a requirement of **Management Measure b**.

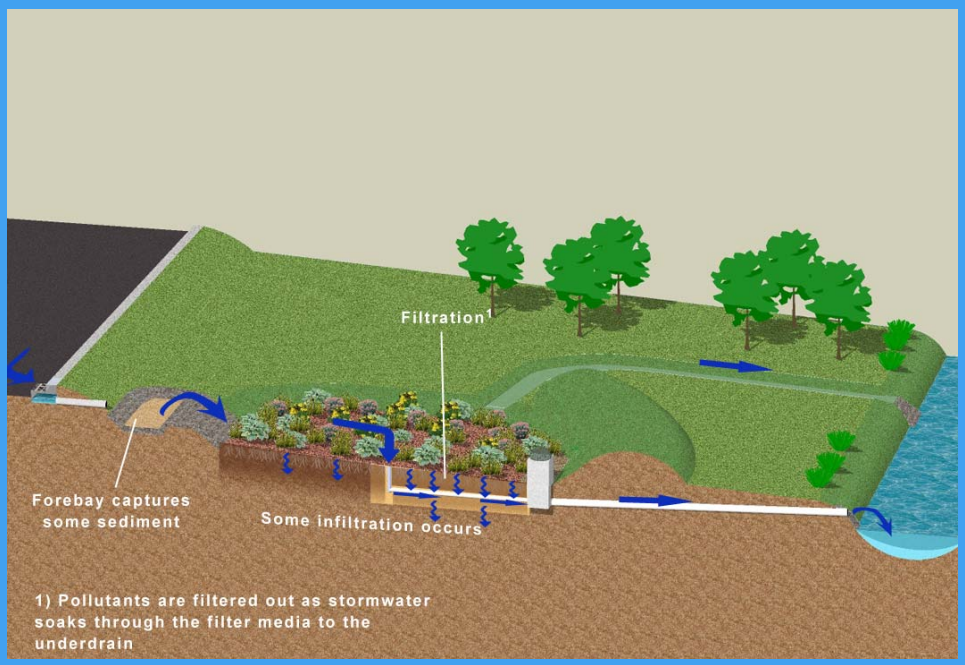
Part of this assessment, the inspection of BMPs already installed, is the implementation of the BMP Inspection and Maintenance Program (**Management Measurement c**). The inspections are performed by making visual assessments of the BMPs using inspection report forms included in the Manual. Noted items include health of desirable plant materials, visual indicators of the BMP's performance and effectiveness, structural failures, trash and debris accumulation, and the need for routine or non-routine maintenance. For each observed BMP, a level of service (LOS) was assigned.

DOT currently has over 800 BMPs in its inventory. Inspections revealed most maintenance needs were for removal of unwanted vegetation. On average, DOT's BMPs were scored a "B", where minor maintenance needs or structural problems were found but the function of the device had not been affected.

Stormwater Control Management System Updates

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**) known as the Stormwater Control Management System (SCMS). DOT's Divisions 3, 4, and 5 tested SCMS in Year 4 and, with the REU and DOT's Information Technology Unit, will be completing the website in Year 5 in preparation for statewide rollout. DOT continues to make upgrades to the web-based SCMS by expanding it to include tracking of potential retrofit locations and retrofit BMPs. This expansion of SCMS allows an integrated tracking of the retrofit BMPs from design and construction (initiated by DOT's Hydraulics Unit), into the post-construction inspection and maintenance phases (performed by DOT's Roadside Environmental Unit [REU]). Details would be stored on the website including plans, pictures and drawings in pdf format. These drawings can be used during future inspections to compare conditions to the original design. Once a retrofit was built, it would automatically enter the inspection and maintenance phase and would appear in the appropriate Division's inventory.

Inspection and Maintenance Manual Explains Unit Operations and Processes



Unit processes and operations are shown on a diagram of a bioretention basin in DOT's Inspection and Maintenance Manual.

Stormwater BMPs function much like wastewater treatment units by using physical operations and biological and chemical processes to remove pollutants. Maintaining the functionality of these operations and processes is critical to the ongoing ability of a BMP to treat stormwater. Therefore, DOT's Inspection and Maintenance Manual developed under **Management Measure b** includes information on the unit operations and processes. This information helps DOT's Division Roadside Environmental Engineers (DREEs) and their staff understand the importance of individual components of a BMP so that the functionality of that component can be appropriately assessed during the BMP inspection process. For example, the filter media used in a bioretention basin allows filtration to occur, removing solids and other potential contaminants. Understanding this concept reinforces the need to avoid compaction of the filter media.

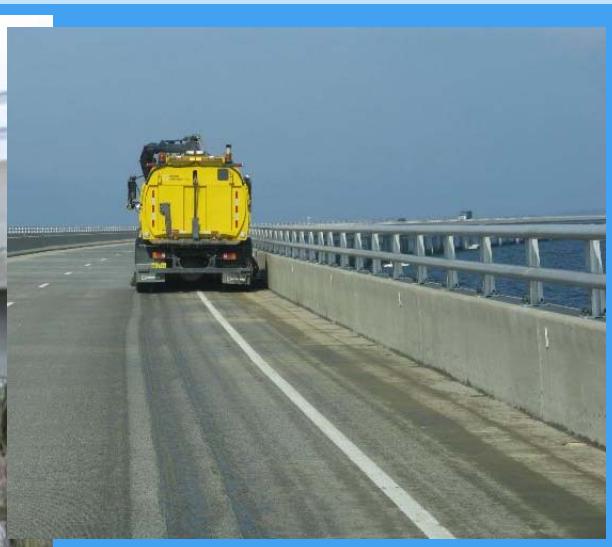
These diagrams will also be used in training programs planned for BMP design, construction, and inspection and maintenance activities. The manual also includes photographs of problems found within BMPs so inspectors can identify with real world conditions and knowledgably request maintenance on the BMP.

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

Ken Pace, PE
HSP Manager
919.733.2920
or
Johnie Marion
I&M Manager
919.861.3770

Post-Construction Stormwater Program

DOT's NPDES Permit Part II.B.5



DOT implements Post-Construction BMPs for discharges to sensitive waters, including bridge stormwater collection systems (left) and sweeping (above)

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.

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

Matt Lauffer, PE
HSP Manager
919.250.4100
or
Andy McDaniel
PCSP Manager
919.250.4100

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**). Controls are selected to eliminate, minimize, or mitigate discharges into sensitive waters. Common BMPs used include buffers, filtration basins, infiltration basins, bioretention basins, vegetated swales, street sweeping, and bridge stormwater collection systems like the one shown above.

Planned DOT projects, such as major widenings or highways on new location, are closely coordinated and reviewed by numerous 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). To ensure the protection of sensitive waters from the impacts of post-construction runoff, DOT consults with these agencies to make decisions regarding appropriate BMPs to protect water quality standards and use. This collaborative process ensures that an environmental protection solution is customized for unique characteristics of the particular project.

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Vegetation Management Program

DOT's NPDES Permit Part II.B.6

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.

DOT's Vegetation Management Program strives to provide aesthetic roadsides while maintaining safety and minimizing environmental impacts.

DOT Continues Consultation with NCDA

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**). This is performed through ongoing research 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**).

To disseminate information on the updated approved chemicals and other educational topics such as pollution prevention, DOT holds an annual one-day conference for the Roadside Environmental Unit (REU) and Division Roadside staff (**Management Measure c**).

Innovative Spill Prevention Building Wins Award

Herbicide applications are made by trained DOT staff in the Division Offices. Part of this training (required under **Management Measure c**) includes pollution prevention and spill prevention. Through this awareness, DOT staff at Division 4 recognized a need to park their application equipment and store the inventory of herbicides in a location that would contain accidental spills and avoid contact with stormwater. Their solution was to design and construct a four bay building with an integrated collection system in the floor. Materials which reach the floor drains would collect in a sump and be pumped to a tank for reuse. This solution was the winner of the Energy and Environment Continuous Process Improvement award in 2009.

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 have a license. Employees that do not have licenses must work directly under the supervision of a licensed applicator. 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.

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

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Encroachment Program

DOT's NPDES Permit Part II.C

Example of an encroachment from non-DOT materials stored along the right 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 11.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 11.C. The strategy may be revised as necessary to maintain compliance.

GIS Used to Protect BMPs from Encroachment

Historically, BMPs located along DOT's roadways have been documented using paper forms. While this method was adequate to track and inspect the BMPs, is was not easy to quickly compare their locations to requests from outside parties for new driveways or other land-disturbing activities along DOT's right of way. Subsequently, three existing BMPs were inadvertently destroyed.

As a solution, Division 5 (Wake, Durham, Granville, Person, Franklin, Vance, and Warren Counties) staff began using the GIS layer associated with the pilot Stormwater Control Management System (SCMS). This BMP inspection and maintenance tracking database is used to review each encroachment application to determine if a BMP in the area will be impacted. This process received a Continuous Process Improvement award for improved communications in 2009.

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Construction Program

DOT's NPDES Permit Part II.D

DOT Continues Erosion and Sediment Control Program Delegation

Delegation for DOT 's Erosion and Sediment Control Program has been continued by the NCDENR Division of Land Resources and the Sedimentation Control Commission, covering projects that disturb one or more acres of land surface. DOT's delegation has been continuous since 1983.

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 washout, 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, DWQ, and DLR Continue Coordination

DOT continues it quarterly coordination meetings with staff from DWQ's regional offices to review DOT construction projects. The meetings enable the agencies to verify appropriate controls are being used as necessary. Starting in 2008, DOT also began monthly coordination meetings with the State Sediment Specialist from the Division of Land Resources (DLR).

Additionally, DOT, DWQ, and DLR Directors and staff collaborated throughout the year to develop science-based approaches to solving real world problems to address the unique aspects of linear construction. Together, the agencies developed guidance on the requirements of DWQ's General Permit for Construction Activities (NCG01) which were applicable to DOT's program, and to approve the use of DOT's Multi-sensor Precipitation Estimate (MPE) website. The MPE notifies DOT staff of rain events at construction sites so that timely inspection of BMPs can be made. As a result, DOT has issued guidance and expanded tools to their staff and contractors involved in applying the Sediment and Erosion Control program. The use of MPE has reduced field staff travel.

For information on training activities for construction staff, see the Internal Education Program overview.

Temporary wrapped rock silt check type A dam with coir matting. Inset shows application of polyacrylamide.

Enhanced Erosion Control Techniques Clarified

DOT uses the Revised Universal Soil Loss Equation (RUSLE) 2 model to determine the size of basins necessary for sediment storage during construction projects on secondary roads. When the available area is not sufficient to accommodate the determined basin size, DOT implements enhanced erosion control techniques such as baffles in the basins, and wrapped rock check dams or excelsoir wattles, and polyacrylamide in conveyance systems. Training on the use of RUSLE 2 and proper selection and installation of the enhanced erosion control techniques has been provided to DOT employees and contractors through hands-on demonstrations and instructions posted to DOT's website at http://www.ncdot.gov/doh/operations/dp_chief_eng/roadside/fieldops/downloads/.

Sedgefield Lakes Research on Construction Impacts Completed

Between 2004 and 2009, DOT sponsored research by North Carolina State University's Daniel E. Line of the Biological and Agricultural Engineering Department to assess construction impacts on the I-40 bypass around Greensboro. Researchers monitored during the pre-construction, construction, and post-construction phases of the project—one of the first comprehensive monitoring programs by DOT. Continuous monitoring for total suspended solids (TSS), total solids, and turbidity were performed in addition to periodic monitoring for temperature, dissolved oxygen (DO), conductivity, and pH.

Results indicate that TSS, total solids, and turbidity rates increased during the construction phase at all monitored sites, but were reduced during the post-construction phase, which still included some minor activities. At some sites, in-lake turbidity levels returned close to pre-construction levels quickly after construction was completed, and at one site in a tributary to the lake, turbidity levels during the post-construction phase were significantly lower than the pre-construction phase. No significant effect on temperature, dissolved oxygen (DO), conductivity, nor pH were seen between the pre-, during, and post-construction phases.

Mr. Line concluded that, "[w]hile erosion and sediment control regulations and technologies have changed, data from this project provide an estimate of sediment export from highway construction under similar conditions of 11-18 tons/ac-yr. Limited post-construction monitoring suggested that sediment export from similar completed highways range from 0.79 to 1.24 tons/ac-yr."

Borrow Pit and Waste Pile Reclamation Program Continues

Several advancements in DOT's Borrow Pit and Waste Pile Reclamation Program have occurred this year:

- To provide increase protection to the environment and reduce the potential for sediment loss from construction projects, DOT expanded its borrow pit and waste pile reclamation procedures to include construction staging areas.
- DOT refined it's reclamation procedures through the development of specific instruction and guidance for the design, maintenance, and inspection of borrow pits and waste piles on DOT and contract properties. This guidance provides a centralized summary requirements for environmental evaluations, details of the reclamation plan, and identifies responsibilities of individuals.
- DOT has also developed and distributed design spreadsheets developed by the Field Operations Section to guide engineers through the design of sediment basins and borrow pit dewatering basins. Use of the design spreadsheets streamlines the implementation of practices and guidance approved by DLR. The borrow pit dewatering basin spreadsheet applies the principles of recent DOT-sponsored research proving beneficial results if the design is based upon the detention time and discharge rate of the basin.
- DOT-sponsored research into the impact of borrow pits on wetlands has been reviewed and approved by the US Army Corps of Engineers (USACE). DOT engineers and contractors can now apply a software program to determine the necessary width of buffer needed between a borrow pit and a wetland to avoid impacts.

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Industrial Activities Program

DOT's NPDES Permit Part II.E

Hoppers for salt spreading are stored under cover at DOT's county maintenance yards to avoid contact with stormwater as a pollution prevention technique.

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.
- Evaluate the effectiveness of the SPPP for each industrial facility.

SPCC Integrated into SPPP program:

In order to streamline the inspection and reporting requirements of the Spill Prevention Control and Countermeasures (SPCC) regulations at 40 CFR 112, which are similar to the SPPP requirements, DOT has coordinated the tracking and reporting processes into one SPPP/SPCC Website in 2008. Over 100 facilities have SPCC plans.

SPPPs Maintained at DOT Industrial Facilities

To maintain and make improvements to its network of roadways, DOT employs Maintenance Yards statewide. These facilities participate in industrial activities such as stockpiling of construction materials such as rock, asphalt, and dirt; storage of liquid asphalt in tanks; storage and maintenance of vehicles and equipment used in roadway repairs; storage of pesticides and herbicides and its application equipment; and storage of salt or brine de-icing materials and its application equipment. Thus, these facilities maintain Stormwater Pollution Prevention Plans (SPPPs) (**Management Measure a**). Over 190 facilities have SPPPs which consist of site-specific information regarding the materials stored on site and practices put in place to prevent contact with stormwater and stormwater pollution. The location and description of potential sources of pollution are included in the SPPP, along with a discussion of structural and non-structural BMPs which are implemented to address the sources. Through the SPPP, each facility's Stormwater Pollution Prevention Team performs qualitative monitoring of the facility's stormwater discharge outfalls (**Management Measure b**) and inspects each structural BMP on a regular schedule.

As required under the SPPP, applicable employees are trained to perform the inspections, and to prevent and respond to spills on site. Employees are also trained to perform housekeeping to reduce stormwater pollution and to report any stormwater concerns to the Stormwater Pollution Prevention Team.

Reporting for the SPPP is performed through a web-based tracking program. This program allows quick identification of needs by the Roadside Environmental Unit (REU) which oversees the Industrial Activities Program.

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Internal Education Program

DOT's NPDES Permit Part II.F.1

The NCHRP/AASHTO domestic scan on *Best Practices in Addressing NPDES and Other Water Quality Issues in Highway System Management* visited six Departments of Transportation, , including NC DOT.

DOT Participates in AASHTO Scan for BMPs to Address NPDES Permits

The North Carolina DOT was selected as one of six states to be interviewed as part of a domestic scan on *Best Practices in Addressing NPDES and Other Water Quality Issues in Highway System Management*. Sponsored by the American Association of State Highway and Transportation Officials (AASHTO) and the National Cooperative Highway Research Program (NCHRP) through the Transportation Research Board, the scan Team consisted of representative from the Federal Highway Administration, EPA, other state DOTs, and AASHTO. DOT staff from the Hydraulics Unit were also on the Team.

The NC DOT was selected based upon its leadership in erosion and sedimentation control as well as innovative solutions in highway stormwater management. The Team collected information on how DOT addresses TMDLs as well as construction and post-construction stormwater controls, among other items. Of great interest was the interaction between DOT and DWQ throughout the NPDES permitting process, with DWQ staff also participating in the 2-day interview. The scan provided an opportunity for DOT to provide additional internal education to its core stormwater staff.

Training for Construction Staff

In August 2008, DOT's Field Operation Engineers and Technicians from the Roadside Environmental Unit (REU) were honored to be trained on the use of the Revised Universal Soil Loss Equation (RUSLE) 2 software by its developer, Dr. Daniel Yoder of the University of Knoxville, Tennessee. The software program takes site-specific characterizations such as topographic location, slope length, and soil erosivity into consideration to assist the user in selecting and designing appropriate erosion and sediment controls. DOT uses RUSLE2 to estimate sediment storage volume requirements on construction projects for secondary roads.

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.

Stormwater Pollution Prevention Training is Ongoing

Members of the Stormwater Pollution Prevention Teams are trained in small groups or one on one on implementing the SPPP.

DOT continues to provide regular training for its employees on stormwater pollution prevention and the SPPPs. Members of the Stormwater Pollution Prevention Teams and Division level staff are trained to perform visual inspections of stormwater discharge outfalls and structural BMPs and to report these observations on DOT's SPPP/SPCC Website. Training has been performed for each Highway Division, and for Rail and Ferry Divisions, and includes information on identifying illicit discharges under the Illicit Discharge Detection and Elimination Program (IDDEPP).

In turn, the Team members provide general environmental awareness, housekeeping, and spill prevention training to DOT's work crews during frequent staff meetings. Training for work crews is performed on a regular basis during monthly safety meetings. Team members use informational fliers to relay information to the work crews and also display posters in the "Bull Pen", a general meeting area at each county maintenance yard. Additionally, a video on environmental awareness and the SPPP requirements is shown annually to all applicable employees. Records of this training are kept in the SPPP at each facility using a standard form available on the website.

DOT and Contractors Continue ESC Certification Program

DOT employees and contractors attend the Level I Erosion and Sediment Control Stormwater Certification Program at NCSU.

Since 2006, DOT has required its staff and contractors working on construction projects to be certified in erosion and sediment control (ESC). To achieve this end, DOT partnered with North Carolina State University (NCSU) to offer a tiered certification program, which includes installers and inspectors (Level I), site managers (Level II) and designers for ESC and stormwater plans (Level III-A) and waste pile/borrow pit reclamation plans (Level III-B). Currently, DOT has 675 employees certified statewide.

This training includes general stormwater awareness, methods to implement the applicable requirements of the North Carolina Construction General Permit (NCG01), identification of pollution potential, appropriate spill response actions and contacts for reporting spills and illicit discharges and illegal dumping per **Management Measure a**.

This training is also required of contractors wishing to bid on DOT's design-build projects. Most prime contractors have key personnel certified in multiple levels. Including both contractors and DOT employees, the number of individuals certified to date for each level are: Level I Installers/Inspectors (836); Level II Site Managers (1,878); Level IIIA Designers for ESC and stormwater plans (325); and Level IIIB Designers for waste pile/borrow pit reclamation plans (288).

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Transportation Supervisors Trained on Environmental Concerns

Transportation Supervisors from the Bridge Maintenance and Roadway Maintenance Units were provided with general environmental training as part of a larger 2-day training conference. Environmental training includes awareness of the DOT's NPDES permit requirements, including illicit discharge detection and erosion and sediment control.

External Education Program

DOT's NPDES Permit Part II.F.2

DOT displayed components of a rain garden at the State Fair to demonstrate similarities between rain gardens and a bioretention basin which can be implemented by DOT.

Program Objectives

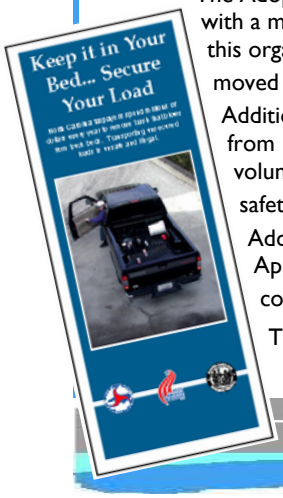
Objectives established by DOT's Permit Part II.F.2

- 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 involvement in DOT stormwater quality programs.

Ferry Riders Are Informed

Over 1000 copies of the brochure, "Pollution, What's our Connection?" have been distributed to riders on DOT's Ferry system. The brochure explains DOT's role in reducing impacts on stormwater discharges. It also outlines every-day actions citizens can take to make a difference in their own watersheds and explains the impacts of common pollutants. One recommendation in the brochure is to pick up after your pet. With the installation of pet waste stations at all DOT Ferry Terminals, Riders can immediately put their new knowledge to work!

DOT's Adopt-a-Highway Support Jordan Lake Big Sweep



The Adopt-a-Highway program at DOT has a long-standing relationship with the North Carolina Big Sweep, a grass-roots nonprofit with a mission to make North Carolina's waterways litter free. During the annual Jordan Lake Big Sweep, DOT partnered with this organization to supply over 100 pairs of work gloves and over 1,000 heavy duty trash bags to over 70 volunteers, who removed an estimated four tons of trash from the lake using boats and walking along the shoreline.

Additionally, over 6,000 volunteer groups participated in Adopt-a-Highway in 2008 and collected 3.4 million pounds of trash from 12,000 roadside miles. Ten percent of this material was recycled. DOT provides training to the volunteers, including the identification of illicit discharges and illegal dumping, in addition to providing safety equipment, gloves, and bags.

Additionally, the Adopt-a-Highway program sponsored Tarp Day with NC Keep America Beautiful. Approximately 3,600 tarps were distributed along with "Secure Your Load" brochures to patrons at 38 county landfills statewide.

These project addresses the **Management Measures b, d, and e** of the permit.

Stormwater BMP Installed at Smyrna Elementary School

Educational rain garden installed by DOT at the Smyrna Elementary School

DOT completed the construction of an educational rain garden at the Smyrna Elementary School in August 2008. The rain garden was engineered to remove fecal coliform before discharging to a stream leading to Jarrett's Bay, which supports shellfish production. In consultation with the school, the rain garden was planted with all native vegetation so that it may be used as an aid in teaching students about conservation landscaping. Additionally, the landscape design included entry points for the students to enter the basin, groundwater monitoring ports so the students can learn about groundwater hydrodynamics, as well as a designated location for the future installation of education signage which DOT is developing in collaboration with the school. Additional planned educational enhancements to the site include water quality monitoring stations to be constructed which will allow the students to collect samples for analysis.

This site was selected in part because it receives drainage from a DOT roadway. Rain gardens are examples of the bioretention basins used by DOT to treat stormwater runoff. This project addresses the **Management Measure b**.

Educational Materials Available in Spanish

Educational materials in Spanish

Another effort under **Management Measure b**, DOT is approaching all of North Carolina's citizens about litter education using materials in Spanish as well as English. DOT reminds bus riders to "Join the Fight Against Litter—cigarette butts are litter. Leave them behind and you could be fined up to $1,000" by using bus placards in English and Spanish. The placard is part of a program to increase the general awareness of litter and the everyday actions we can take to beautify our surroundings.

Adopt-A-Highway brochures and safety information are also available in Spanish and English. These materials are also available on DOT's website (**Management Measure c**).

DOT Makes Educational Materials Available

DOT's most popular outreach programs is the components of a rain garden display at the North Carolina State Fair. Not only are families introduced to rain gardens, a stormwater control that can be constructed in their own yards and is similar to DOT's bioretention basins, they receive instructions on how they can build one themselves (See photo on front). Teachers visiting the booth also receive stormwater activity sheets for their students and can sign up for other materials to be distributed. In Year 4 of the permit, almost 14,000 activity sheets were distributed at the Fair, in addition to 750 Illicit Discharge/Illegal Dumping brochures and 325 "Pollution, What's Our Connection" brochures.

The booth is operated in conjunction with DWQ, one of DOT's partners for educational programs, as part fulfillment of **Management Measure d**.

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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.

DOT Continues to Sponsor Research:

In an effort to develop science-based solutions to real world problems, DOT continues to partner with researchers from Universities and the US Geological Survey to assess the DOT's impact on the environment and to identify effective controls to reduce the impacts. Research sponsored by DOT under ***Management Measure b*** *addresses all phases of DOT's activities from planning and location selection, through construction, post construction stormwater controls. Examples of sponsored research are included herein. DOT's Research Plan required under* ***Management Measure*** *a was submitted to DWQ in Year 1.*

Using Platinum and Lead as Markers for Transportation Impacts

Researchers at the North Carolina State University's Department of Environmental and Molecular Toxicology, lead by Dr. Gregory Cope, investigated the use of platinum group metals (PGMs) as indicators of impact from surface runoff from DOT's roadways. The source of PGMs in the roadway is automotive catalytic converters. Stormwater collects PGMs when rain comes into contact with vehicles during storm events.

Historically, lead has been an indicator of impacts associated with transportation land uses. However, lead was phased out and eventually banned in fuels by the US Environmental Protection Agency from the 1970's to 1996. The researchers assessed concentrations of lead and PGMs (consisting of platinum, palladium, and rhodium) found in freshwater mussels (Family Unionidea) to determine toxicological impacts from the metals.

Researchers collect mussels to assess impacts of roadway runoff

In the course of the project, which was completed in early 2009, researchers collected eastern elliptio mussels (*Elliptio camplanata)* and sediment samples upstream and downstream of 50 highway crossings in NC's Piedmont area with a range of average daily traffic (ADT) loads, to quantify the concentrations of PGM and lead at these locations. Some of the collected mussels were also exposed to varying concentrations of metals in a laboratory and analyzed after a 28 day exposure period to determine accumulation of the metals, and acute and chronic effects of various metals concentrations.

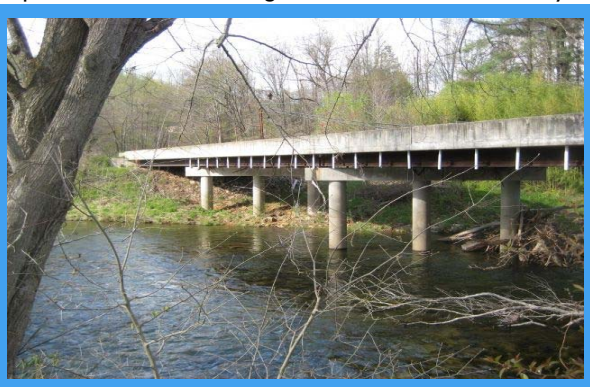
At the completion of the research, Dr. Cope and his associates found that mussels continue to be impacted by historical lead accumulation but primarily from industrial areas. Lead accumulation from roadway runoff was similar to rural and forested areas. Additionally, mussel tissue concentrations of PGMs in downstream samples correlated to the human population and the percent of forested land in the watershed, but some effect from the road crossing was seen.

Information from this project will assist DOT and other resource agencies in better understanding the impacts of runoff on sensitive biota. This study was the first to report concentrations of PGMs in mussels in North America.

Ongoing Research: Assessment of Bridge Deck Runoff

DOT has partnered with the US Geological Survey (USGS) and DWQ to comply with Session Law 2008-107 that requires a monitoring program to assess the effect of bridge deck runoff on receive streams. As part of the Bridge Stormwater Project (BSP), USGS will be collecting water quality samples from bridge deck runoff and within streams at monitoring sites across North Carolina. Additionally, the toxicity of bridge deck runoff and instream samples will be assessed using time-variable chronic toxicity tests and benthic macroinvertebrates will be studied upstream and downstream of the bridges during biosurveys. The sites were selected to represent the wide range of bridge types, receiving streams, and average daily traffic (ADT) loads experienced statewide.

The data will also be used to refine the selection process for BMPs to prevent or treat bridge deck runoff. The study is expected to be completed in the summer of 2010.



The bridge over Pigeon River is included in DOT's BSP.

A model settling basin was used in the recently completed research on the use of polyacrylamide and baffles to reduce turbidity and TSS.

New Stilling Basin Design Field Tested

Stilling basins are used at DOT construction sites to reduce the turbidity and total suspended solids in water pumped from borrow pits or other excavations, prior to discharging the water. Although DOT has been using stilling basins for some time, the basins are not as effective at capturing fine sediments as they are at capturing larger particles. Fine sediments such as silts and clays contribute to high turbidity in receiving streams.

Therefore, improvements to the basin using porous baffles and polyacrylamide (PAM) were the subject of DOT-sponsored research recently completed by Dr. Rich McLaughlin from North Carolina State University's Soil Science Department.

Using experimental field sites at NCSU's Sediment and Erosion Control Research and Education Facility (SECREF), Dr. McLaughlin was able to determine that including porous baffles in a basin and distributing the incoming flow along the bottom of the basin reduced turbidity and TSS by up to 25%. Furthermore, the use of a porous baffle with 10% open pore space was more effective than a baffle with 45% open pore space.

The use of PAM reduced turbidity by up to 88% and TSS by up to 84%, with or without the use of the baffle system and bottom inflow techniques. Both application PAM techniques evaluated (in solution or running the water over a solid block) were found to be effective. One porous baffle can be used to collect floating flocculates of sediment caused by the PAM application, prior to discharge.

For more information on other research projects, see the Retrofit, Construction, TMDL, and Toolbox overviews.

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TMDL Program

Total Maximum Daily Load Program

DOT's NPDES Permit Part III.C

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.

DOT supports investigations by researchers from the University of North Carolina system. Projects include determining nutrient load from roadways and rights of way. This information is used to support both the TMDL Program and selection of BMPs to control nutrients.

Year 4 Program Highlights

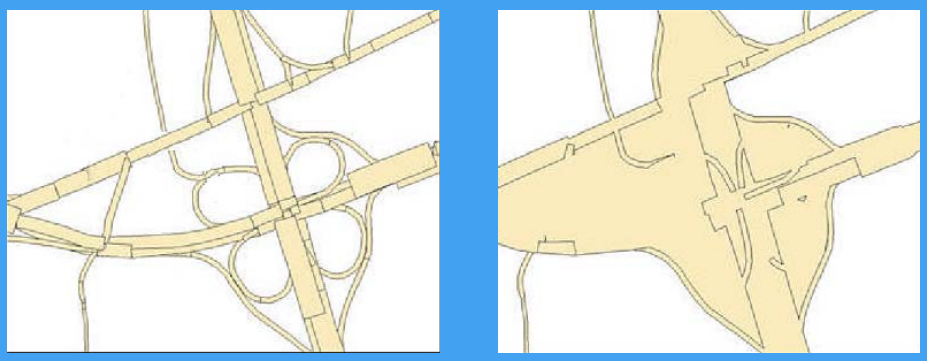
- *Participated as a Technical Advisory Committee member for TMDLs in Falls Lake, High Rock Lake, White Oak River, and Lockwood Folly.*
- *Assigned a high priority to the Jordan Lake Watershed to perform an outfall inventory data collection effort.*
- *Completed a field outfall inventory for the White Oak TMDL area (see the IDDEP report for more discussion).*
- *Developed a nitrogen sources and budget white paper summarizing nitrogen sources and their relative nitrogen load within the DOT Right-of-Way.*
- *Collaborated with NCDWQ modelers in developing TMDLs through developing nutrient loading, atmospheric deposition, land use, and climate model input parameters.*
- *Developed and maintained a database of Research applicable to the TMDL Program.*

DOT Continues Research and Support of TMDL Program Statewide

Through the Highway Stormwater Program, DOT has continued to expand it's efforts with partner agencies to increase the understanding of pollutants, especially nutrients and fecal coliform, from the roadway environment. The following projects highlight a few of DOT's ongoing activities in Year 4 of its permit.

Nitrogen Sources and Budget within DOT Lands

Using the Falls Lake Watershed as a test case, DOT assessed potential sources of nitrogen to the roadway environment and developed a model budget of those sources. Major contributions were found to include atmospheric depositions from agricultural and industrial emissions, terrestrial contributions from urban and rural land uses, and animal excretions within the right of way. Minor contributions were found to include fertilizer application in the right of way. The study also identified further research of other contributing factors would be necessary, such as the impacts of DOT and non-DOT construction activities, and illicit discharges. This information will be used to better characterize DOT loading in future TMDLs, influence the selection and design of BMPs and other nutrient controls, and to direct and design future DOT research projects.



Example of the GIS land cover data development process DOT is using to support the Falls Lake and High Rock Lake nutrient TMDLs. After creating the initial right-of-way boundaries along linear roadway sections, GIS professionals fill in additional right-of-way areas at selected locations, such as interchanges, to ensure the most complete representation of DOT-owned lands.

TMDL TAC Participation

DOT participated as a member of the Technical Advisory Committees (TACs) for Falls Lake, Lockwood Folly, and High Rock Lake. Through this avenue, DOT assisted the TACs by updating DWQ's GIS land use/cover data layers to include DOT roads to allow the appropriate assessment of impacts from DOT's roadways to water quality. Additionally, DOT provided Doppler radar–based precipitation estimates and atmospheric deposition information in the Falls Lake watershed to improve model calibration.

DOT also continued participation in the Falls Lake TAC, and provided a review and comments on the WARMF and EFDC models proposed by DWQ with the goal of assisting in the development of a representative and applicable TMDL what will result in tangible improvements to the Lake.

DOT Supports TMDL Development for White Oak River Basin

DOT partnered with the NC Coastal Federation and DWQ to develop the *TMDL for Fecal Coliform for Embayments in Southeast White Oak River*, a shellfish harvesting area that has experienced numerous harvesting closures in the past several years. The TMDL found that nonpoint sources were the primary contributors of fecal coliform, and are believed to originate from stormwater contacting waste from pets and wildlife, and from septic systems for residences located on marginal soils. DOT is the only entity holding an NPDES permit to discharge stormwater in the watershed and thus received a wasteload allocation in the TMDL. The final TMDL report was submitted to EPA in March of 2009.

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