Nothing Compares
NORTH CAROLINA

TRB ADC60 Summer Workshop

Using Research to Enhance NCDOT's Highway Storm Water Program: An Overview

Ryan Mullins, PE ● Karthik Narayanaswamy, PhD

Overview of NCDOT Research Program

- Originated as a requirement of NCDOT's Phase 1 NPDES permit
- Multiple types of funding:
  - In-cycle: Competitive proposals funded by State Planning & Research Program (SP&R) research funds
  - Out-of-cycle: NCDOT business unit funds for research as needed
  - Technical Assistance Agreement: 80 hours for literature review and immediate, limited assistance
  - Other national sources: NCHRP, TPF, etc.
- Solicit ideas from internal staff and research community
- Periodic meetings and research round tables with researchers

Types of Research Projects

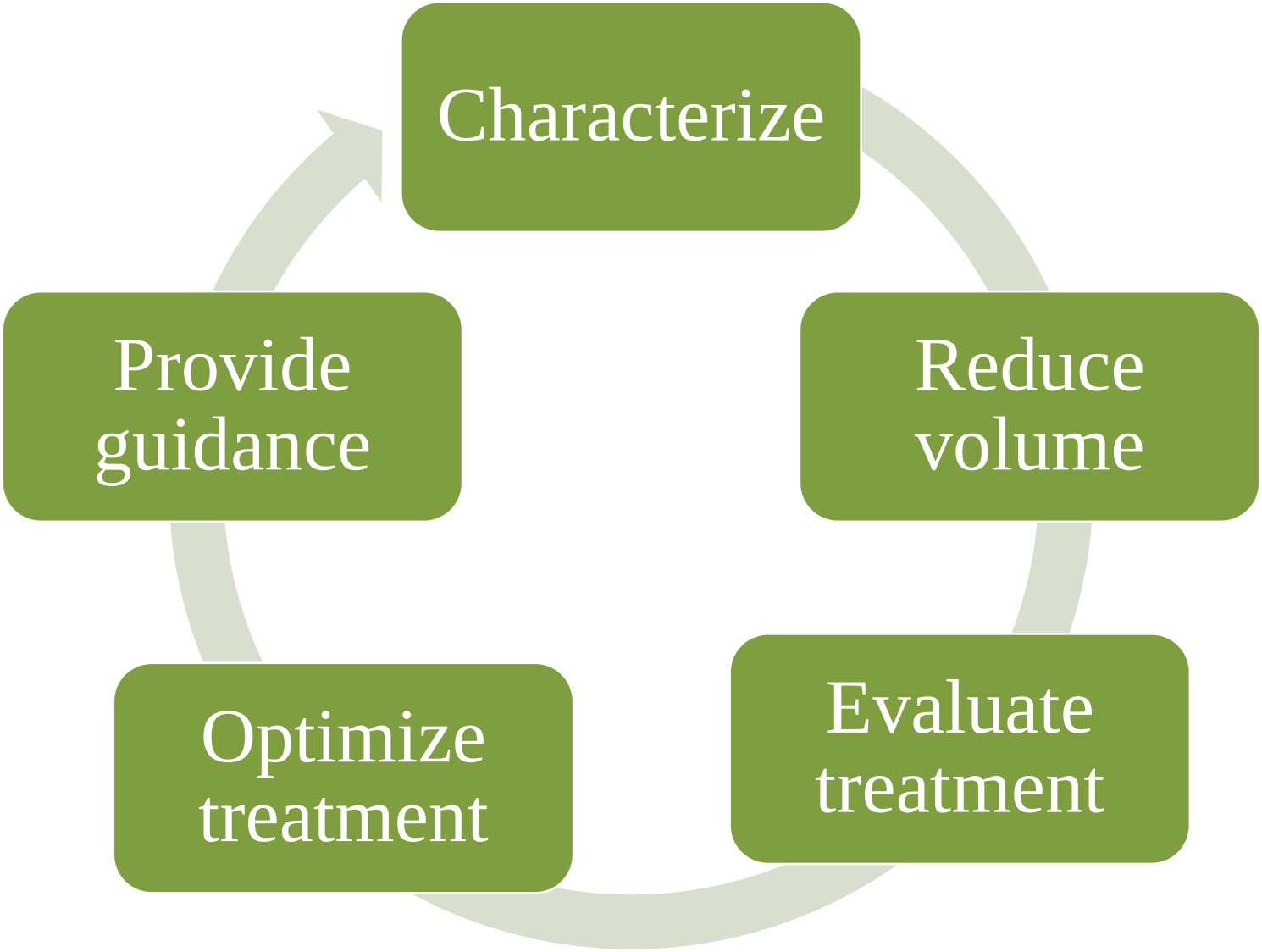
Post-Construction (permanent measures)

- Runoff characterization
- BMP performance characterization
- Manufactured device evaluation
- Vegetation management

Construction (temporary measures)

- Erosion and sediment control
- Vegetation management

Research Spans Entire Gamut



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Just How Much Research?

A recent internal compilation for post-construction research alone

- **71** sites monitored across NC
- **2,751** storm events
- **33,579** event mean concentrations
- **162** different analytes

Multiple Characterization Studies

- NCDOT has characterized runoff quality since 1998
- Primary and secondary roads
- Large bridge study under legislative mandate
- Weight of evidence approach to addressing impacts

Runoff Solids Characterization

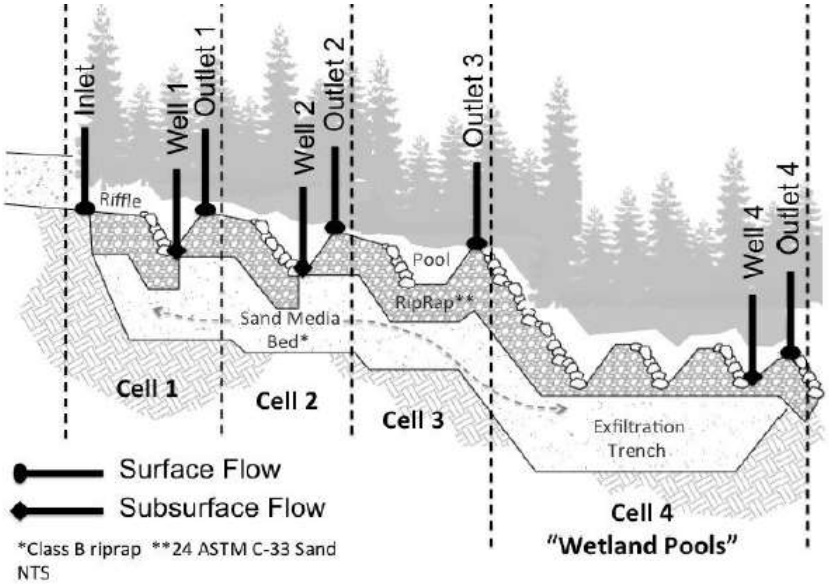
- Performance of vegetated BMPs primarily by settling, which in turn is a function of particle size
- Autosamplers at eight sites across the three ecoregions - PSD, TSS, nutrients
- Gross solids at four locations
- Median particle size 32-167 um
- No significant variation in PSD based on roadway classification, ecoregion, AADT
- Only significant factor was presence of PFC overlay
- Leaf litter accounted for 0.6% TN, 3.6% TP annual load

Tillage

- Infiltration rates and grass growth with and without tillage
- Longevity with traffic loading, maintenance
- Do amendments enhance performance and longevity?
  - Compost
  - XPAM
  - Gypsum
- Pilot and field studies

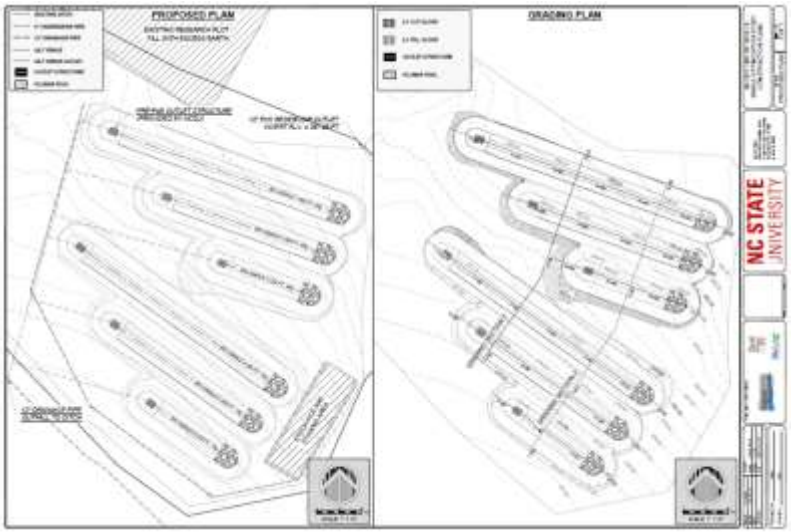
Biofiltration Conveyance

- Inspired by riverine systems
- Series of step pools with riffle weirs or similar for peak flow mitigation and use on steep slopes
- Monitored two sites for hydrology and water quality
- Very effective at converting surface runoff to shallow interflow, reducing nutrient concentrations



Swale and Bioswale Design Optimization

- Evaluate swale and bioswale design in controlled facility with simulated rainfall
- Use results of pilot testing to validate in the field
- Design parameters
  - Length (98’, 66’, 33’)
  - Slope (4%, 1%)
  - Check dams (Y/N)
  - Top dressing (concept idea)
- Bioswale media – 85-88% sand; 8-12% fine, 3-6% stabilized pine/bark/organic material; P-index 10-30



Reducing Pathogen Concentrations

- Partnered with Town of Kure Beach to significantly reduce the incidences of swimming advisories near ocean outfalls using gravity driven stormwater control measures
- Research on 200-ft long, 3-ft deep bioswale in Supply, NC indicates substantial reduction in various indicator bacteria

Improving Quality

- NCDOT has developed a programmatic Quality Assurance Project Plan (QAPP)
- Sets minimum standards for data quality and reporting
- Researchers will soon be required to submit Project QAPP (P-QAPP) that comply with minimum standards in the programmatic document


NCDOT Highway Stormwater Program

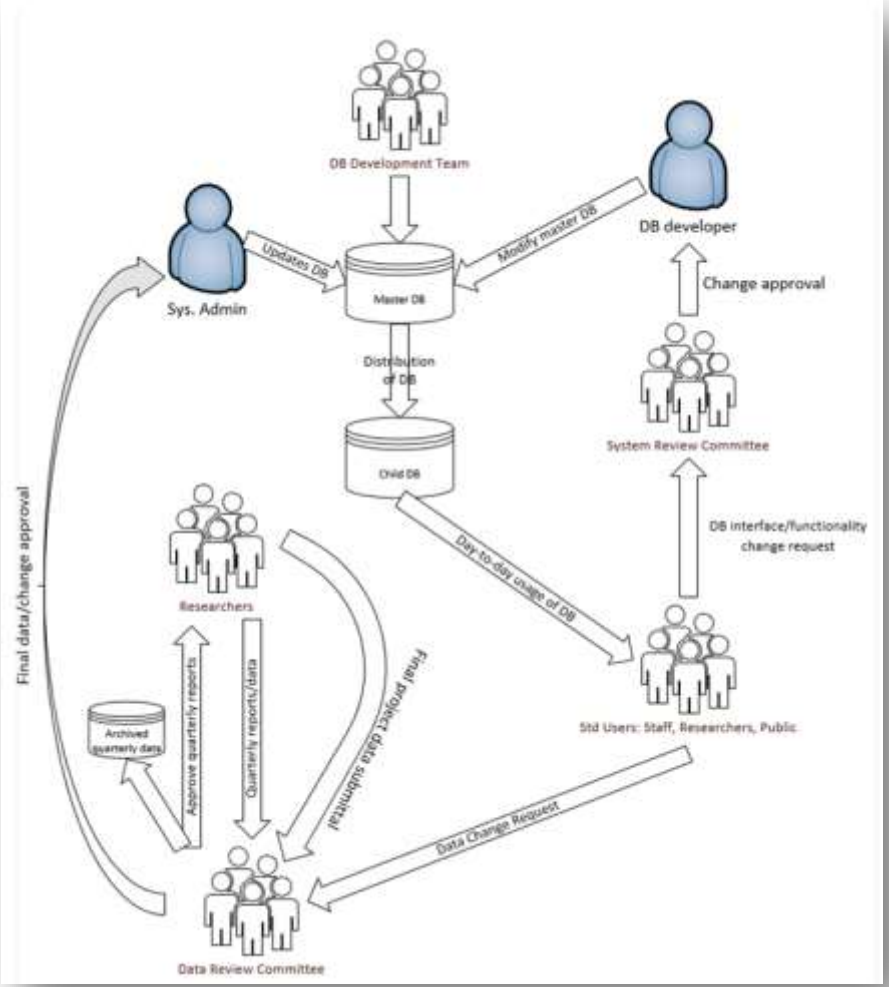
Quality Assurance Project Plan

NC Department of Transportation
Hydraulics Unit
1590 Mail Service Center
Raleigh, NC 27699-1590
919.707.6700

August 2013

STORMDATA

- NCDOT is currently developing a database of research data
- Schema based on FHWA/USGS Highway Runoff Database but modified to purpose
- Will allow users to query research data, find trends, test correlations, etc.
- Integrates with the QAPP in that data quality will be recorded in the database

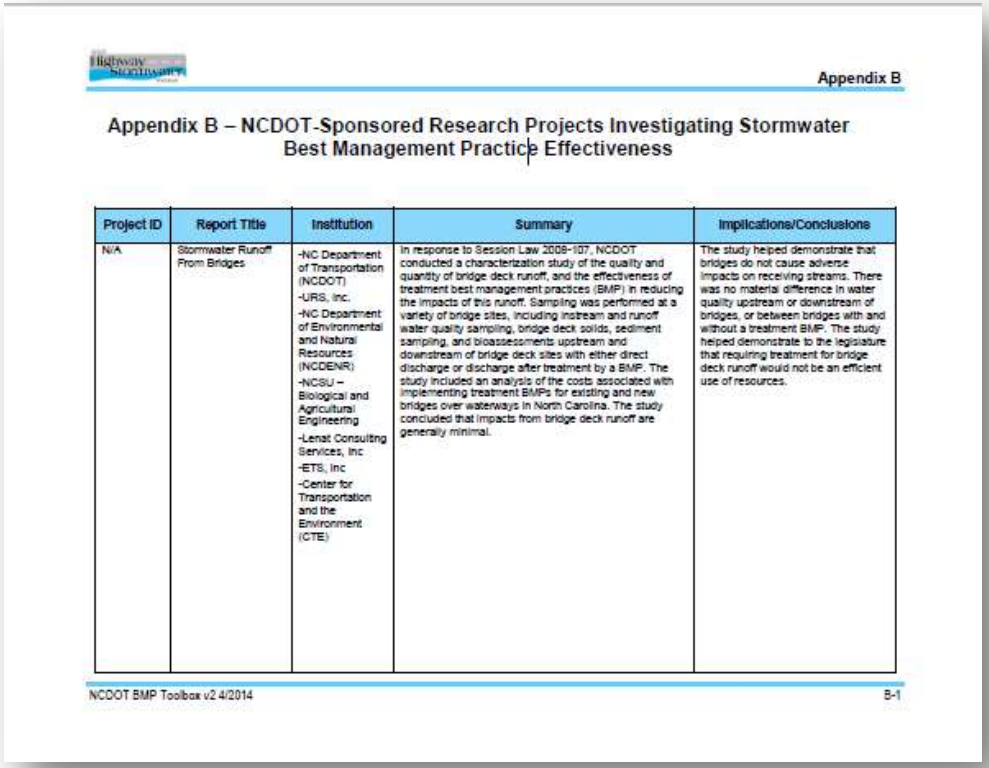


Application in Impaired watersheds

- Research data allowed NCDOT to develop a statewide protocol for identifying water quality parameters of concern in the highway environment and determining DOT's contribution to impairment
- Data was used to provide model inputs for TMDLs and TMDL alternatives (e.g. EMCs and annual loading rates) and "check" model output to validate results
- Loading rates were critical in establishing compliance with nutrient rules in Falls Lake and Jordan Lake
- Used to develop NCDOT-specific version of the Jordan Falls Stormwater Nutrient Accounting Tool (JFSNAT) to calculate pre- and post-development nutrient loading on new non-road development projects

Updates to BMP Toolbox

- NCDOT maintains its own BMP manual based on appropriate practices in the linear roadway and non-road environments
- Research used to guide chapter updates

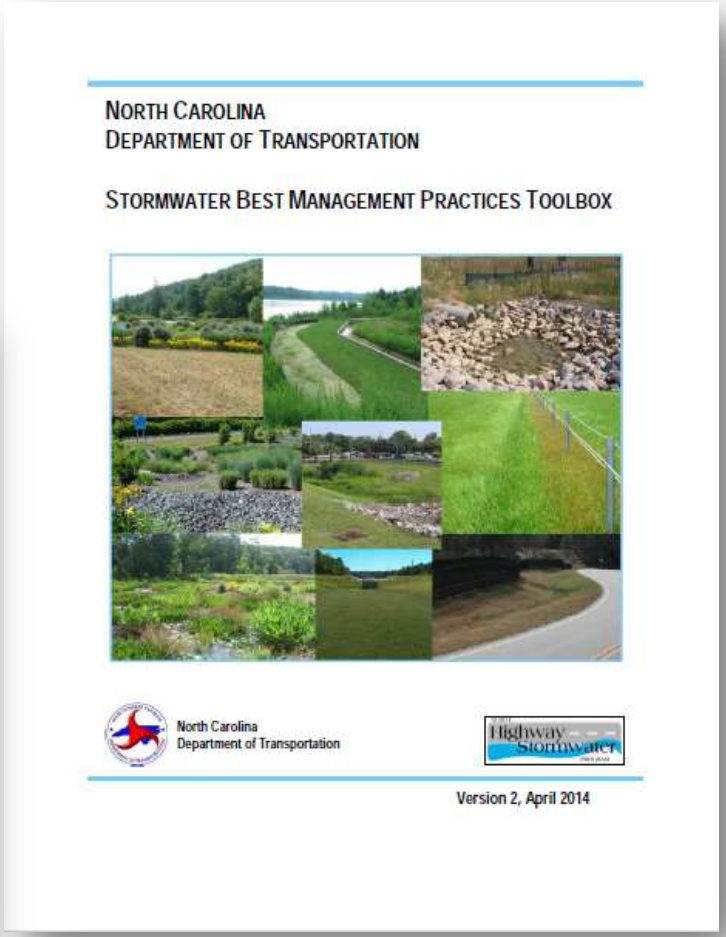


Appendix B

Appendix B – NCDOT-Sponsored Research Projects Investigating Stormwater Best Management Practice Effectiveness

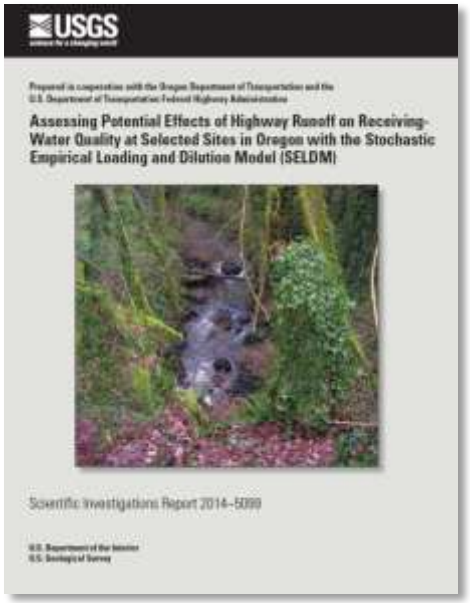
Project ID	Report Title	Institution	Summary	Implications/Conclusions
N/A	Stormwater Runoff From Bridges	-NC Department of Transportation (NCDOT) -URS, Inc. -NC Department of Environmental and Natural Resources (NCDENR) -NCSU – Biological and Agricultural Engineering -Lenat Consulting Services, Inc -ETS, Inc -Center for Transportation and the Environment (CTE)	In response to Session Law 2008-107, NCDOT conducted a characterization study of the quality and quantity of bridge deck runoff, and the effectiveness of treatment best management practices (BMP) in reducing the impacts of this runoff. Sampling was performed at a variety of bridge sites, including instream and runoff water quality sampling, bridge deck solids, sediment sampling, and bioassessments upstream and downstream of bridge deck sites with either direct discharge or discharge after treatment by a BMP. The study included an analysis of the costs associated with implementing treatment BMPs for existing and new bridges over waterways in North Carolina. The study concluded that impacts from bridge deck runoff are generally minimal.	The study helped demonstrate that bridges do not cause adverse impacts on receiving streams. There was no material difference in water quality upstream or downstream of bridges, or between bridges with and without a treatment BMP. The study helped demonstrate to the legislature that requiring treatment for bridge deck runoff would not be an efficient use of resources.

NCDOT BMP Toolbox v2 4/2014 B-1



Using SELDM

- Stochastic Empirical Loading and Dilution Model (SELDM)
- Developed by USGS and FHWA
- NCDOT providing USGS data to enhance model with NC-specific data
  - Stream flow
  - Precipitation
  - Highway runoff quality characterization
  - SCM performance data



Questions?

Ryan Mullins, P.E.
North Carolina Department of Transportation
Highway Stormwater Program
Raleigh, NC
rmullins@ncdot.gov

Karthik Narayanaswamy, Ph.D.
AECOM
Morrisville, NC
karthik.narayanaswamy@aecom.com