

# DESIGN AND APPROACH OF A STORM RUNOFF INVESTIGATION AT SELECTED SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION MAINTENANCE YARDS

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**Abstract.** The South Carolina Department of Transportation (SCDOT) operates maintenance yards throughout the State. Currently, the SCDOT has no data to define the quality of stormwater leaving these sites. To provide these data, the U.S. Geological Survey and the SCDOT are conducting a 4-year cooperative investigation to identify and quantify constituents that are transported in stormwater runoff from two maintenance yards and a section shed. The two maintenance yards, located in North Charleston and Conway, S.C., represent facilities where equipment and road maintenance materials are stored and complete equipment repair operations are conducted. The section shed, located in Ballentine, S.C., is a facility that stores equipment and road maintenance material. Water-quality samples and flow measurements of stormwater runoff will be collected at these sites. Rainfall data also will be collected. The water-quality samples will be analyzed for selected constituents including suspended sediment, total suspended solids, turbidity, total organic carbon, chemical oxygen demand, selected metals, nutrients, volatile organic compounds, polyaromatic hydrocarbons, and bacteria. Flow measurements will be made at the time of sampling in order to composite the samples and compute constituent loads leaving the facilities.

## Introduction

The South Carolina Department of Transportation (SCDOT) operates maintenance yards throughout the State. Currently, the SCDOT has no data to define the quality of stormwater leaving these sites. To provide these data, the U.S. Geological Survey (USGS), in cooperation with the SCDOT, is conducting a cooperative investigation to identify and quantify constituents that are transported in stormwater runoff from two maintenance yards and a section shed. The objective of this investigation is to collect sufficient stormwater water-quality and flow data to document the type, concentration, and event load of selected constituents transported by stormwater runoff. In addition to identifying and quantifying constituents that are transported in stormwater runoff from SCDOT maintenance facilities, the information collected in this investigation also may be used by the SCDOT in the development of stormwater management plans and to address future, potential National Pollutant Discharge Elimination System (NPDES) permit requirements to characterize and mitigate stormwater quality at these sites.

The two maintenance yards, located in North Charleston and Conway, S.C., represent facilities where equipment and road maintenance materials are stored and complete equipment repair operations are conducted. The section shed, located in

Ballentine, S.C., is a facility that stores equipment and road maintenance material (fig. 1). For this investigation, all SCDOT maintenance yards and section sheds are considered substantially identical (M. Leaphart II, South Carolina Department of Health and Environmental Control (SCDHEC), written commun., 2009).

### **Experimental Design**

Prior to sample collection, the USGS and SCDOT conducted several site inspections to determine appropriate sampling locations and methodologies for each site. Based on these inspections, the USGS has started collecting stormwater samples at five locations within the three sites using a combination of automated and grab techniques. The total number of sample locations at each facility are Ballentine (1), North Charleston (2), and Conway (2). At the Ballentine site, samples are being collected from the outfall of the detention pond that receives an estimated 90 percent of the runoff generated at the facility. At the North Charleston site, stormwater flow runs off the maintenance yard and enters Turkey Creek through a combination of pipes, ditches, and overland flow. Stormwater contributions of selected constituent loads and concentrations will be quantified at this site by collecting flow measurements and stormwater samples from Turkey Creek at the upstream and downstream limits of the SCDOT property. Increases in concentrations and loads from the upstream site to the downstream site will be attributed to storm contributions at the maintenance yard. At the Conway site, most stormwater flow leaves the facility through a grass-lined ditch. Samples are being collected from the ditch where flow from the paved areas enters the grass-lined ditch. Runoff near the fuel island leaves the facility by overland flow. A small detention area was constructed to capture the fuel island runoff; therefore, samples are being collected in this area.

Data collection began January 1, 2010, and by July 2010, five samples have been collected at these sites. The data collection effort will continue through December 31, 2011. Over this 2-year period, sample collection will target one sample per season (winter, spring, summer, and fall) at each site as a flow-weighted composite until a total of eight samples are collected at each location. Sample collection methods are described in published USGS and U.S. Environmental Protection Agency (USEPA) Environmental Technology Verification (ETV) protocols (U. S. Geological Survey, variously dated; U.S. Environmental Protection Agency, 2002). Samples are collected from runoff events resulting from rainfall exceeding 0.10 inch and at least 72 hours after the previously measurable (greater than 0.10 inch rainfall) storm event recorded at each site. These samples are being analyzed for selected constituents including suspended sediment, total suspended solids, turbidity, 5-day biochemical oxygen demand, chemical oxygen demand, selected metals, nutrients, volatile organic compounds, pesticides, herbicides, and polyaromatic hydrocarbons. Flow measurements are being made at the time of sampling in order to composite the samples and compute the constituent load leaving the yards for each event. Rainfall data are collected with a tipping bucket raingage at each site and transmitted via satellite for view on the internet at: <http://waterdata.usgs.gov/sc/nwis/current?type=precip>.

All water-quality samples are being analyzed by National Environmental Laboratory Accreditation Program (NELAP)-certified TestAmerica laboratories, except for suspended sediment and bacteria. Suspended sediment samples are analyzed at the USGS Kentucky Sediment Laboratory, in Louisville, Kentucky. Bacteria samples are analyzed by USGS South Carolina Water Science Center personnel using the Colilert-18 and Enterolert methods developed by IDEXX and multiple-

tube fermentation technique for fecal coliform. The Colilert-18 method is approved by USEPA for drinking water and ambient water (proposed for NPDES). IDEXX microbiological methods are described in Standard Methods for Examination of Water and Wastewater, 20<sup>th</sup> edition (Cleseri and others, 1998). Guidelines from the USGS National Field Manual for the Collection of Water-Quality Data (U.S. Geological Survey, variously dated) are used to ensure proper sampling procedures are followed. Procedures outlined in the USGS South Carolina Water Science Center Quality-Assurance Plan for Water-Quality Activities (C. Journey and W. Stringfield, U.S. Geological Survey, written commun., 2006) and Surface Water Quality-Assurance Plan (Cooney, 2001) are used to ensure proper data handling procedures are followed. Water-quality data from each sampled event will be reviewed for quality assurance when received from the laboratory, and the data will be made available through the USGS National Water Information System (NWIS) once accuracy is verified and the results of the investigation are published.

### **Ongoing Work**

Data analysis will begin immediately following the data-collection phase. Using measured flow and event-mean concentrations for each storm event, loads will be calculated for each storm event for each yard. The results of this investigation will provide the SCDOT with quantitative data to document the type, concentrations, and event loads of selected constituents transported in stormwater runoff from maintenance yard and section shed facilities. This information can be used by the SCDOT in the development or revision of stormwater mitigation plans that are more likely to improve stormwater quality by specifically addressing the types of constituents transported from the maintenance yards throughout South Carolina. These data also may be useful for other States that have similar maintenance yard operations.

(Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

### **Selected References**

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- Cooney, T.W., 2001, Surface water quality-assurance plan for the South Carolina District of the U.S. Geological Survey: U.S. Geological Survey Open-File Report 01-121, 48 p. accessed on March 16, 2004, at <http://sc.water.usgs.gov/publications/pdfs/OFR-01-121-QW.pdf>
- U. S. Environmental Protection Agency, 2002, Environmental Technology Verification Program--Draft 4.1 of the Protocol for the verification of stormwater source area treatment technologies accessed at [http://www.epa.gov/etv/pdfs/vp/04\\_vp\\_stormwater.pdf](http://www.epa.gov/etv/pdfs/vp/04_vp_stormwater.pdf) on January 15, 2003.
- U.S. Geological Survey, 1997 to present, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9, 2 v., variously paged. [Also available online at <http://pubs.water.usgs.gov/twri9A>. Chapters originally were published from 1997-1999; updates and revisions are ongoing and are summarized at: <http://water.usgs.gov/owq/FieldManual/mastererrata.html>]

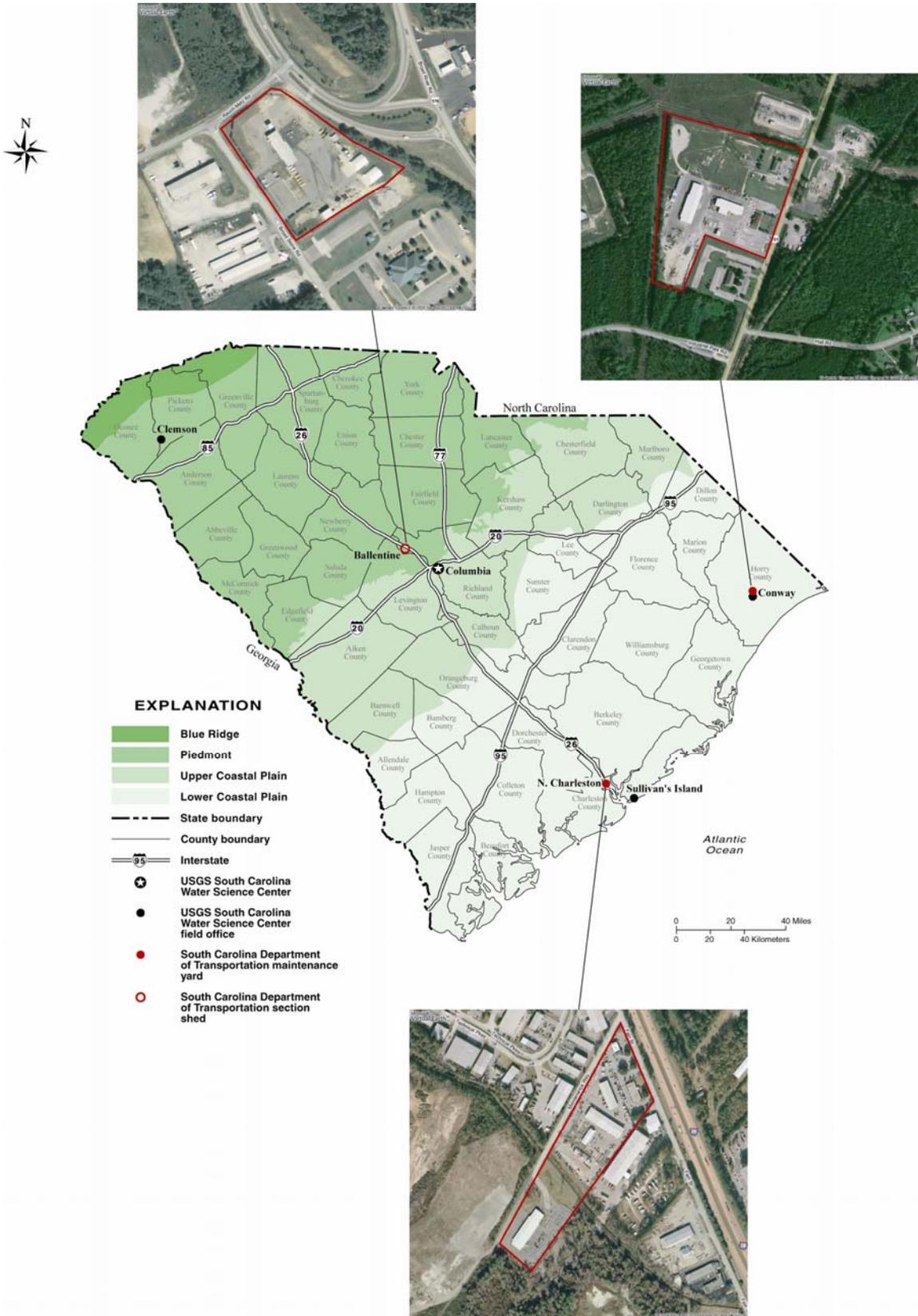


Figure 1-- Location of S.C. Department of Transportation facilities studied.