

All too often, local cities and counties pay little attention to storm water infrastructure. Only when major flooding from a rain event in an area with an inadequate drainage system occurs do storm water issues become newsworthy. Unfortunately, polluted runoff is the number one cause of water pollution in the state, and the effects of urbanization and the lack of adequate controls to protect natural resources—from shellfish water closings and beach advisories on the coast to extensive property damage from severe rain events in mountains—are being seen more and more. And, as North Carolina's population continues to grow, the state's water quality is at risk.

Communities across the state are now being required to address storm water and the water quality of their streams, as well as take steps to reduce polluted storm water runoff. However, dedicated funding for storm water infrastructure is not typically available, nor have communities consistently budgeted to clean their drainage systems. **As a result, the state's storm water infrastructure has been given a grade of C-.**

## BACKGROUND

The impact of storm water on replenishing our water supply, providing recreation, habitat for fish and wildlife, economic prosperity and a higher quality of life, is very important. For drainage and flood control purposes, storm water systems collect, store or transport rain or other storm water runoff. This runoff typically flows into the nearest creek, river, lake or ocean, but in North Carolina most storm water receives marginal treatment, if any, before it enters local waterways.

Land development and changes in natural ground cover and soil conditions alter the amount and rate at which storm water runoff occurs. If sufficient mechanisms are not in place to temporarily hold the extra runoff, or return it to the ground through infiltration means, streams and other conveyance systems will become inadequate to carry the additional load—resulting in flooding and erosion that can jeopardize public health, safety and welfare.

Additionally, development, combined with everyday activities associated with residential living (urban and rural), commercial business, industrial production and construction have increased the potential for non-point source pollution. Every time it rains, runoff from rooftops, lawns, streets and parking lots picks up dust and dirt, oil and grease, pet waste, pesticides and fertilizers, leaves and grass clippings, paint and other household products. Add to that the runoff produced by agricultural irrigation over the last 30 years, and the stress

on the state's water resources has significantly increased.

The state's existing storm water infrastructure consists of conveyance systems such as pipes, ditches and culverts, as well as natural and engineered facilities to control the quantity and quality of runoff—also known as detention facilities or water quality best management practices (BMPs)—and receiving streams, lakes and estuaries, including the intercoastal waterway and the ocean.

For years, the Federal Emergency Management Agency (FEMA) has maintained the National Flood Insurance Program (NFIP) to help communities identify areas subject to flooding, and to establish programs to minimize development within regulated floodplains. The United States Environmental Protection Agency (EPA) has also recognized the impact of storm water through the implementation of its National Pollutant Discharge Elimination System (NPDES) regulations. North Carolina's Department of Environment and Natural Resources (DENR) is administering this program. These regulations require designated communities to develop a storm water management plan based on six minimum measures, or BMPs: public outreach and education; public involvement and participation; illicit discharge detection and elimination; construction site runoff control; post-construction runoff control; and pollution prevention/good housekeeping for municipal facilities.

People swimming or playing in waters with high bacteria levels have an increased risk of developing gastrointestinal illness or skin infections. In order to comply with the Beaches Environmental Assessment and Coastal Health Act, DENR's Division of Environmental Health monitors beach water quality at both ocean and sound-side beaches weekly from April 1 to September 30, twice a month in October and on a monthly basis from November through March, as part of the Recreational Water Quality Program. When levels are exceeded based on a beach's usage, a swimming advisory or alert is issued. Many of these advisories are a result of storm water runoff or its secondary effects (e.g., wastewater collection pipe overflows due to excessive storm water infiltration).

The Clean Water Act (CWA) requires states to report their

water quality biennially to the EPA, including how well its designated uses, such as swimming, aquatic life support and water supply, are being supported and likely causes (e.g., sediment or nutrients) and sources (both point and non-point) of impairment. CWA also requires the state to develop a list of waters that do not meet quality standards or that have impaired uses. Listed waters must be prioritized, and a management strategy or Total Maximum Daily Load (TMDL) must be developed. In 2002 DENR set a goal to develop TMDLs for all impaired bodies of water within 10 years of their first placement on the list. In addition, non-point sources which have caused streams to get on the NC 303(d) list have caused wastewater treatment facilities to spend more dollars to meet higher standards under the development of TMDLs because it is easier for the State to regulate and monitor direct dischargers.

## CONDITIONS

North Carolina does not have a current, comprehensive inventory of storm water systems statewide or a record of community's past practices on operation and maintenance. However, in 2006 the North Carolina Rural Economic Development Center (REDC), through its Water 2030 Initiative, collected detailed information on storm water systems statewide, identifying 465 municipal systems that merited further consideration and analysis.

### Managing Growth

Growth in the state's storm water systems has generally been linked to growth in the state's largest municipalities. Policies are in place to curb added flooding on properties as a result of increased runoff to downstream conveyance systems or streams, and detention control programs exist in many cities and counties to control peak rate runoff from new developments. However, policies vary across the state on what magnitude of storm event mandates control.

As the population grows and more land is developed, the quantity of runoff increases, creating greater potential for flooding. And, as the state trends toward higher frequency and severity of hurricanes and flooding—resulting in increased monetary damages—efforts have increased to redefine flood-prone areas and remove or prohibit development in those areas.

In 2000, North Carolina began an effort to update FEMA floodplain maps statewide. Since then, over \$30 million has been invested in engineering, mapping and program management. The goal was to update data on all 17 river basins by the end of Fiscal Year 2005 (FY2005). Many of the eastern counties now have updated maps available. The program is now focused on the remaining counties in central and western North Carolina. Also, six out of every ten municipalities with storm water systems have guidelines preventing new development within the 100-year floodplain—the minimum standard for the NFIP.

Period of Record	1979 - 1982	1983-1988	1989-1993	1994-1999	2000-2003
Damage in 1995 Dollars	Less than \$1 Million	\$13.9 Million	\$8.82 Million	\$20.5 Million*	\$9.02 Million

\* excludes 1999 with \$2.9 billion in damages from hurricanes

## Maintenance

Historically, maintenance of a town's drainage systems has remained "out of sight, out of mind" until a problem occurs. Unfortunately, when communities do try to address the problem, all too often they find the cost of the solution is prohibitive or that it will have a significant impact on private properties. More than 75 percent of municipalities reported their system to be in fair or poor condition.

According to REDC's Water 2030 survey results, only 5.6 percent of municipalities currently apply fees to their storm water systems to raise revenue for future improvements, and reported operation and maintenance expenditures for 2004 were over \$38 million. Locating existing storm water systems is also a major challenge, with only 16 percent of North Carolina's towns reporting that they have a map of their storm water system, and only 8 percent using Geographic Information System (GIS) technology to keep updated records of the system's location and condition.

## Public and Environmental Health, Safety and Welfare

As part of the permitting process, EPA's NPDES program calls for considerable attention to educating and engaging the public, as well as controlling and preventing pollution. Six of North Carolina's largest municipalities have been held to the program's requirements since Phase I began in 1990, and in 2004 an additional 130 communities were included as a part of the program's second phase. However, while Phase I and II communities represent the highest concentration of population and growth in the state, they represent less than one third of the 465 communities with storm water systems. Some rapidly growing communities in sensitive areas may not be required to comply with these new water quality initiatives due to the criteria used by the NPDES program (i.e., smaller towns along the coast experiencing growth due to tourism).

Growth and lack of proper land use management can impact water supply as well. Currently, the state has more than 700 river segments, totaling nearly 3,000 miles, which are considered "impaired" by pollutants and unable to support designated uses. Also, a total of 46 swimming advisories

were issued on 31 beaches during the 2004 season, up from 35 advisories issued in 2003. Fortunately, the total days under advisory dropped significantly, from 874 days in 2003, to 555 days in 2004.

## Integrated Water Resource Planning and Management

Management and regulation of the state's water resources is a multi-jurisdictional effort in its current form. Consider that agencies separately address issues in water supply, flood management, water quality management, wastewater treatment, and environmental impact on receiving waters. Each promulgates regulations in a narrow range of applicability. The combined result is that many management tools have been ruled out in one context or another, often leading to the conclusion that nothing can be done to balance one issue against another and find some aggregate solution. It should be noted that some attempt to address this is being seen with the optional Universal Storm Water Management Program by the Division of Water Quality. This program attempts to provide a uniform, consistent set of design standards across jurisdictional boundaries addressing watershed protection, stormwater regulation, water supply watershed regulations, and others.

Grades were assigned for the Storm water category in four areas. A grade of C- was given to development regulation for the 60 percent of communities statewide that have guidelines to prevent new development in floodplains. A grade of D+ was given to management because only 16 percent of the state's systems possess a current map of their storm water infrastructure. A grade of B was given to policy and procedures because 135 communities—which make up the majority of the state's population—have established or will soon be under the new NPDES Phase II storm water permitting process which emphasizes additional requirements to protect water quality. And finally, a grade of D- was given to funding because less than six percent of communities reported having a dedicated revenue source for storm water infrastructure operations and maintenance. Those four areas combined for an overall grade of C- for North Carolina's storm water infrastructure.

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## POLICY OPTIONS

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Changes in land use and natural hydrology from increased development are adversely impacting storm water runoff, and the state's population is expected to continue its rapid increase. New innovations in storm water and water quality management are available, and applying these new solutions should be expedited—especially where results in the new technology are proven.

Development policies must also become a priority in light of the ever increasing cost of natural disaster relief. This should also include the implementation of the NPDES Phase II program—focusing on awareness, protection, prevention and evaluation.

In far too many cases, the approach to public infrastructure is reactive instead preventive—systems being built and operated with minimal maintenance. Without dedicated funding for the

state's storm water systems, the cost of maintaining pipes, channels and streams will only rise after the damage from a storm event is done.

The REDC Water Initiative found that by 2030 the state's storm water investment need would be \$1.47 billion, \$570 million of which would be needed by 2010. Because a considerable number of communities do not know the extent of their systems or their needs, these figures could be significantly underestimated.

While grants are available to help enhance and protect water quality, the demand usually outpaces the availability of funds by two to one. However, fully funding the Clean Water Management Trust Fund at \$100 million—adjusted annually for inflation—in addition to other permanent funding, such as the proposed Clean Water Bonds Act of 2006, will help to close the current funding gap.

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## RECOMMENDATIONS

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- Continuation of and support for the North Carolina Rural Economic Development Center's development of a statewide inventory database;
- Develop a permanent funding source for storm water improvements that can keep pace with the state's necessary improvements and population growth over the next 25 years;
- Encourage regional cooperation and management of systems, including state encouragement of inter-local agreements, including multi-objective planning and management for all water-related agencies throughout all levels of government;
- Implement NPDES Phase II permitting to guide communities in the management and maintenance of their

storm water—including providing suitable state staffing and resources to guide the educational and monitoring process over the next five years and encouraging more communities to enact the guidelines to prevent floodplain development;

- Develop Standards for Inspection and Maintenance of BMPs. With the aspect of the new storm water permit focusing on water quality protection and pollutant removal, communities will be faced with a high influx of engineered storm water devices for pollutant removal into the system (both the public and the private components of the storm water system). Privately-owned BMPs especially will be susceptible to infrequent maintenance thereby jeopardizing the integrity of the overall system.
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## SOURCES

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American Society of Civil Engineers, Georgia Section, Report Card on Georgia Infrastructure, 2003.

American Society of Civil Engineers, Wisconsin Section, Report Card on Wisconsin Infrastructure, 2003.

<http://h2o.enr.state.nc.us/tmdl>

North Carolina Rural Economic Development Center, Water 2030 Initiative, 2006.

North Carolina Division of Water Quality Assessment and Impaired Waters List (Integrated 305(b) and 303(d) Report), 2004.

[http://www.deh.enr.state.nc.us/shellfish/Water\\_Monitoring](http://www.deh.enr.state.nc.us/shellfish/Water_Monitoring)

<http://www.flooddamagedata.org/>

<http://www.ncfisheries.net/paprocs/>

<http://www.ncstormwater.org>