Polluted Runoff in North Carolina

The effect of polluted runoff on North Carolina's waters

NCPIRG Education Fund

Fall 2005

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Jasmine Vasavada
Christine Wunsche

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NCPIRG Education Fund
112 S. Blount Street
Suite 102
Raleigh, NC 27601

Cover Photos: (clockwise) Tar River, Pamlico-Tar River Foundation; Shellfish bed closing, NC Coastal Federation; Fish kill on Neuse River, Larry Baldwin, Lower Neuse Riverkeeper; Construction site pollution photo, NC Division of Water Quality.

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Executive Summary

North Carolina is experiencing steady population growth and ensuing loss of open space as forest and agricultural land is converted to residential and commercial development. This urbanization is associated with strong negative impacts on water quality due to sharp increases in polluted runoff. As North Carolina works to meet the needs of its growing population, reining in polluted runoff will be a critical step in achieving the water quality goals of the Clean Water Act.

Runoff is already harming water quality

- Polluted runoff is a leading cause of impairment in 40% of waterways assessed as impaired in North Carolina.
- The most widespread impacts of polluted runoff have been documented in four river basins: Cape Fear, Catawba, Yadkin-Pee Dee and Neuse. However, with anticipated explosion of development in other parts of the state, many other basins are at risk.
- Runoff has already contributed to the closing of more than 350,000 acres of contaminated shellfish beds in North Carolina, and one billion fish dying in massive fish kills.

Runoff will get worse due to increasing development

At current rates, North Carolina has been losing 383 acres of land to development a day—an area equivalent to approximately 350 football fields. Over the next two decades, developers will pave over an estimated 2.4 million acres of open space. In the continued absence of strong programs to address runoff, North Carolina can anticipate:

Harm to Drinking Water supplies:

- Lost drinking water supplies. Water that currently filters into the ground to recharge aquifers could become runoff. At current development rates, this could result in the diversion of 150 billion gallons of water from aquifers annually by 2025—an

amount that could satisfy North Carolina's freshwater needs for over 8 months.

- Contaminated drinking water supplies. Runoff bears toxic contaminants, sediment, and pathogens into surface waters, potentially contaminating surface water supplies and engendering high remediation costs to restore water quality.

Damage to Ecological Resources

- Degraded water quality in rivers, lakes and streams. Studies have shown that due to runoff pollution, water quality declines significantly when even 10% of a watershed is paved.
- Damage to fish and other wildlife dependent on healthy aquatic ecosystems, leading to economic losses due to harmed commercial and recreational fishing and shellfish harvesting.

Other Economic Impacts

- Fewer water-based recreation and tourism opportunities;
- Reduced aesthetic and market values of lakes, streams and coastal areas leading to decline in property values; and
- Increased risk of damage from flooding or drought conditions.

North Carolina Has Tools to Minimize Runoff Pollution

North Carolina need not consign its waterways to destruction by rampant runoff. A number of existing policies and policy improvements can go a long way toward reducing the amount of runoff pollution that new development will generate:

1. Maximize Natural Areas to Control Runoff

- Preserve as much open space as possible to allow natural filtration of rainwater.
  - o Create a permanent, dedicated source of funding to help the state reach its goal of preserving one million acres of open spaces by 2010.
  - o Provide tax incentives to encourage conservation easements.
  - o Encourage planning tools at the local government level to protect open space.
- Protect all waterways with mandatory buffer zones that help trap contaminants and slow down runoff, minimizing its impact on water quality.
  - o Establish strongest protections from runoff for pristine waterways by classifying them as Outstanding Resource Waters or High Quality Waters, which enables maximum land use standards in their watersheds.

2. Minimize Impervious Surface in New Development

Promote development that creates less runoff pollution than traditional development through use of environmentally sound alternatives.

- Implement Structural Management Controls to Treat Polluted Runoff
- These physical controls may include systems to filter or slow down runoff.

Rich Sevenson

The beautiful Horsepasture River in Transylvania County is threatened by runoff pollution from residential and golf course development.

3. Strengthen North Carolina's Phase II Regulations

- Expand reach of the regulations so that they capture future growth instead of just development inside municipalities.
- Require post-construction polluted runoff controls for all developments statewide over an acre to ensure water quality is protected.
- Retain the Environmental Management Commission's definition of "designation" so that more entities can be brought in under the Phase II rules as development increase and water quality suffers.

4. Ensure Adequate Staff and Funding for Programs that Control Runoff

- For all of the above policies, the state should ensure that adequate staff and funding are available to achieve the above objectives and enforce critical environmental programs already in place.
  - o Programs like the Erosion and Sedimentation Control program remain understaffed, and new programs like National Pollutant Discharge Elimination System (NPDES) Phase II have no express sources of funding dedicated to ensure they run smoothly.
  - o The state should fully fund the Clean Water Management Trust Fund.

Chapter 1: Polluted Runoff Threatens North Carolina's Future

North Carolina is in the midst of unprecedented urbanization and population growth. As a result, the state is at the cusp of a transition in which clean, safe water can no longer be taken for granted. In a recent poll, 75% of voters expressed concern about water quality and safety in North Carolina's rivers, lakes and streams.[1] 54% say that current state laws do not do enough to protect the state's water quality.[2] The culprit is polluted runoff—water that lands on our streets, picks up pollution from human activity, and directly or indirectly delivers that pollution into our water supplies.

1.1 The Strong Link between Land Use, Runoff, and Water Quality

When open space is paved to build parking lots, roads, and driveways, the result is significant increases in runoff. Stream water quality begins to deteriorate when as little as 5% of land in a watershed is paved over.[3] Consequently, one of the most rapidly growing threats to North Carolina's waterways is runoff from urban and suburban development.

There is a direct connection between land use and water quality. When rain falls on forests and vegetated areas, the soil structure can gradually absorb and slow the flow of rain and snowmelt, preventing concentration of pollutants and helping to filter out much of the pollution before it enters a waterway or seeps into an aquifer or groundwater supply.

In contrast, when rain falls on most man-made surfaces (e.g., paved roads and rooftops) it sweeps soil and other debris along with it. This runoff, conveyed through a system of storm drains, underground pipes and aboveground open channels, ends up in a river, lake, stream, or estuary. The end result is a significant increase in the concentration of harmful pollutants and sediment that are swept into waterways. Furthermore, increased pavement is linked to increased flooding. When water that formerly would have filtered into the ground to recharge underground aquifers is instead quickly swept into a surface waterway, the result is higher volumes of runoff that can in-

crease the risk of flooding during storm events—and the loss of critical drinking water supplies.

A recent study by New Jersey PIRG Law & Policy Center revealed that in areas of New Jersey that experienced rapid development in the 1990s, more than 1 in 3 watersheds exhibited a significant decline in water quality largely attributable to runoff pollution.[4]

Numerous studies have documented more generally that where land is developed and impervious surfaces (pavement, housing) increase, water quality suffers. Some findings from the literature include:

- Replacing a meadow with a parking lot leads to a 16-fold increase in runoff, on average.[5]
- A typical suburban development in which 23% of the land is paved or "impervious" diverts over 40 million gallons of water per square mile away from underground aquifers annually.[6]
- A significant correlation exists between development and increased levels of nutrient pollution (nitrogen and phosphorous), which impacts aquatic life throughout the food chain.[7]

1.2 Runoff Has Already Damaged North Carolina's Resources

Under the federal Clean Water Act, the state is required to compile a list of water bodies that fail to meet water quality standards, and report this "impaired waters list" to the U.S. Environmental Protection Agency (EPA), identifying the probable causes of the impairment and sources of the pollution.

Polluted runoff has been cited as the primary source of impairment of over 1,300 miles of waterways, responsible for nearly 40% of all known impaired stream miles statewide.[8] As Figure 1 shows, urban runoff has been documented to have the most widespread impacts on four river basins: Cape Fear, Catawba, Yadkin-Pee Dee and the Neuse.

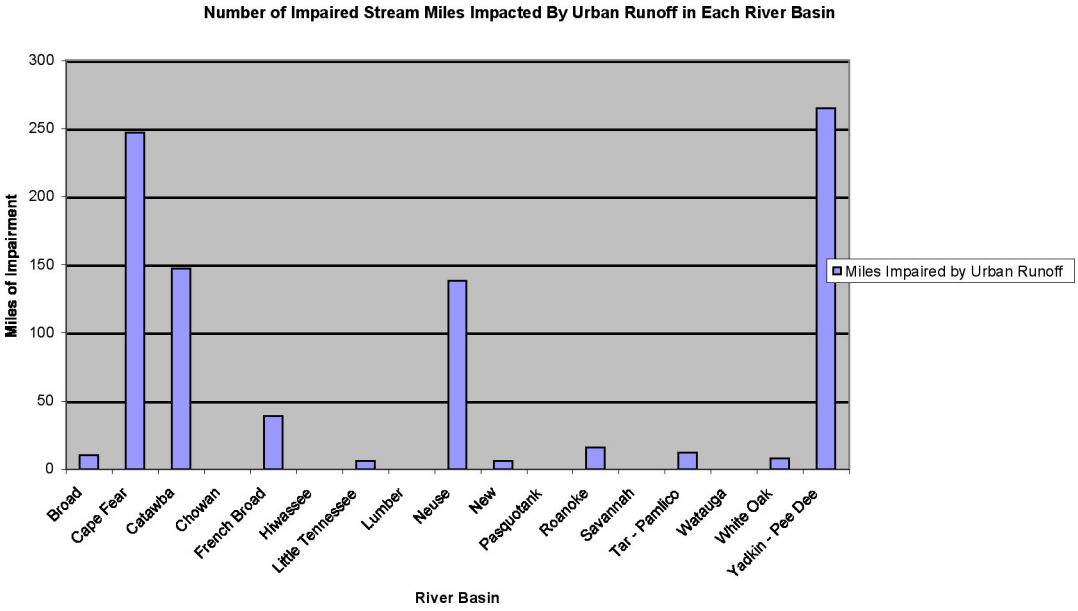
According to an analysis by the North Carolina State University Water Resources Research Institute, runoff from urban development is already considered a primary source of impairment in many North Carolina river basins. (See Table 1.)

Table 1. North Carolina River Basins in which Urban Runoff is the Primary Source of Impairment[9]

- Cape Fear
- Catawba
- French
- Little Tennessee
- Lumber
- Neuse
- New
- Roanoke
- Tar Pamlico
- White Oak
- Yadkin-Pee Dee

While federally mandated impaired waters lists have identified polluted runoff as a major cause of degraded water quality, these reports do not include projections of how current development patterns may affect water quality over the years to come. With North Carolina's population booming and development replacing open space, runoff pollution will likely intensify in the absence of additional controls. It is predicted that by the year 2027, 1,157,592 acres of forestland will be lost, along with 1,341,790 acres of cropland. Meanwhile, developed land area in the state will increase by 2,177,336 acres.[10]

Figure 1. Miles of Streams Impaired by Runoff in North Carolina's River Basins. [11]



Defining Polluted Runoff

Runoff in North Carolina can be categorized based on its source. Runoff from urban and residential development, runoff from agricultural lands, and runoff from forestry practices are all of significant concern in North Carolina.

This report is primarily concerned with runoff that is resulting from rapid urbanization of the state. Therefore, throughout the report unless otherwise noted, references to polluted runoff refer to runoff created in whole or in part by urban and suburban development.

Runoff may fit regulatory definitions of both point source and nonpoint source pollution. When speaking of runoff from development, agriculture, or forestry practices, many use the term "nonpoint source" pollution, since it can be attributed to many tiny sources rather than discharge from a single, discrete source, such as a pipeline of a factory. However, once urban runoff is collected by a sewer system, drainage system, or other conveyance, a specific point of discharge into a waterway becomes identifiable. In those cases, urban runoff meets the regulatory definition of point source pollution.

Runoff from urban sources, construction, and other development has been identified as a primary source of impairment in over 1,300 miles of North Carolina's rivers and streams.[12]

1.3 Rapid Development Could Lead to Rampant Runoff

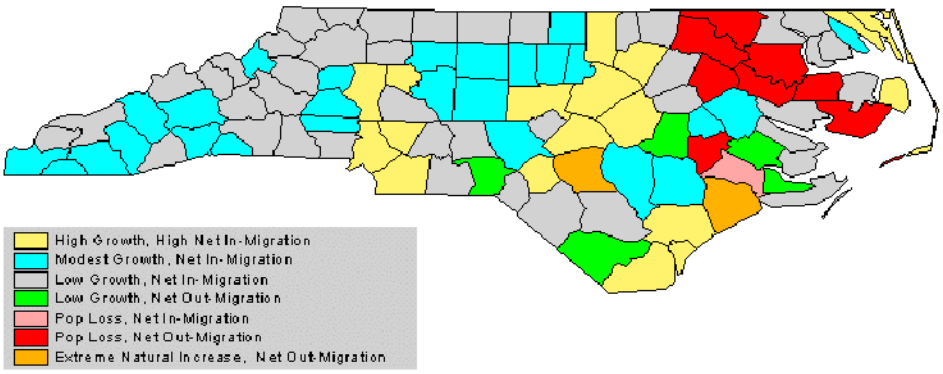
North Carolina is developing land at the fifth fastest rate of any state in the nation.[13] In the twenty-year period 1982-2002, North Carolina converted 2.8 million acres of cropland and forestland. Our population grew, but not as much; developed, urbanized land increased by 82% while population grew by 42%. If we continue to develop new land at this pace, an additional 2.4 million acres of open space is likely to be paved over statewide over the next two decades.[14]

Over the next twenty years, this population growth is projected to continue at a similar rate. North Carolina State Demographics and the U.S. Census Bureau predict that by 2025, the state population could be about 9.3 to 11.7 million, a significant increase above the 2004 population of about 8.6 million.[15,16] Currently, North Carolina gains more than 100,000 people each year, and its population growth rate (3.4%) is faster than that of the United States as a whole (2.5%).[17,18]

Figure 2 shows anticipated population growth rates over the next decade in North Carolina. High growth areas correspond to the Catawba, Neuse, Tar, and Cape Fear river basins. As Figure 1 above shows, three out of these four basins have already suffered many miles of impairment attributable to urban runoff.

In 2004 alone, more than 93,000 new housing units received construction permits in North Carolina.[20] If these development rates continue without state-of-the-art management practices and changes in development patterns, current problems with polluted runoff will become much worse

Figure 2. 2000-2010 Projected Population Growth.[19]



Chapter 2: How Runoff Causes Harm in North Carolina

Runoff contributes to high levels of pollutant contamination, erosion, and sedimentation, which alter the ecological balance of rivers, lakes, and streams. As more land is developed in North Carolina, ensuing runoff pollution can lead to the following consequences:

- Loss of natural runoff storage capacity in vegetation, wetland and soil.[21] This capacity loss causes an increased volume and velocity of runoff; peak (storm) flows many times greater than flows in natural basins, and increased frequency and severity of flooding.
- More pollutants, bacteria, sediment, and other contaminants ending up in stormwater runoff. This pollution leads to degraded water quality in rivers, lakes and streams, public health threats from contaminated drinking water supplies, and high remediation costs to restore water quality.
- Damage to fish and other wildlife dependent on healthy aquatic ecosystems. Habitat and population degradation harms commercial and recreational fishing and shellfish harvesting, which contributes to economic losses.
- Fewer water-based recreation and tourism opportunities and reduced aesthetic and market values of lakes, streams and coastal areas. These losses lead to declines in property values and tourism revenues.
- Less water filtered directly back to recharge aquifers. Reduced groundwater recharge leads to loss of critical drinking water supplies.

2.1 Flooding and Erosion

As more land is paved over, the natural flow of the water cycle is altered in ways that change the physical flow and structure of waterways and increase the likelihood of both flooding and drought conditions.

Increased runoff causes higher peak flows after storms and leads to higher flood levels and frequency of flooding.

Flow levels during storm events in urbanized areas can be 10 to 100 times the levels in undeveloped areas.[22]

Without adequate management, runoff resulting from increased development in a watershed can increase the likelihood of flooding. When 25% of a watershed is developed, large floods that previously would occur once in 100 years could occur once every 5 years, and could become an annual event when impervious cover reaches 65%.[23]

Higher peak flows also alter habitat by ripping channels in streams and eroding riverbanks. Erosion can also result from loss of plant cover during development or other land use change. These alterations affect streams' ability to support a full and healthy range of organisms.[24] It is estimated that North Carolina has already lost 34 percent of its coastal wetlands, including critical fisheries habitat.[25]

2.2 Increased Pollution

Runoff from urban and suburban development contains a variety of harmful pollutants. These pollutants impair ecosystem health and in some cases directly threaten human health. The most significant of these pollutants are as follows:

- **Toxins**

  Runoff from residential and commercial development is of particular concern due to the high concentration of toxic chemicals that it carries. Pesticides, fertilizers, metals (such as copper and zinc) and organochlorines (including known carcinogens) may be present in runoff. These substances are known to harm human health and wildlife.[26]

- **Nutrients**

  Runoff is also a primary source of nutrient pollution. Phosphates and nitrates in fertilizer and debris are nutrients that affect plant growth. When high levels of these nutrients enter waterways, rapid growth of bacteria, algae, and plant life can result, and in turn chokes the waterways, lowering the oxygen levels available to fish and other aquatic wildlife. Excess nutrient loading can also result in toxic blooms such as red tide or Pfisteria outbreaks.[27]

- **Pathogens**

  Sewage can end up in runoff due to illegal connections of sanitary sewers to the stormwater drainage system, resulting in contamination by bacteria and pathogens known to harm human health. Similar pathogens existing over land can enter waterways through runoff containing pet waste.[28]

- **Oxygen Depleting Substances**

  Debris and manure washed into waterways by runoff feeds bacteria, which use up oxygen dissolved in the water. If the oxygen is consumed beyond a safe threshold, fish are stressed and will die when lethal levels are reached. Anaerobic decomposition (without oxygen) produces gases, such as hydrogen sulfide, that are lethal to many organisms.[29]

- **Sediments**

  Finally, even outside of peak storm events, runoff may carry large amounts of sediment into a waterway. Over time, this sediment can significantly alter how water flows, alter habitat and limit other uses. Sediments that erode from stream banks can smother fish eggs laying

on the bottom of streambeds, clog fish gills, and suffocate bottom-dwelling organisms.[30]

2.3 Other Impacts on Fish, Habitat, and Recreation

Without adequate controls, runoff can result in massive fish kills, closing of shellfish beds, degraded habitat, and water conditions unsafe for swimming or other recreational use.

Degraded Habitat

By altering aquatic habitats, increasing nutrient loads, and affecting oxygen levels and temperatures within waterways, runoff can lead to both a loss of fish production and changes in fish species composition. This is not only a direct impact upon wildlife, but also may ruin the recreational value of waterways that thousands of North Carolinians know and love.

Already in North Carolina, 21% of freshwater fishes and 53% of freshwater mussel species are designated endangered, threatened, or of special concern at the state level.[31] North Carolina ranks fifth in the nation in the number of imperiled fish found here. This extreme number can be considered a telling statement of the many serious threats to our state's diverse aquatic species.[32]

There is much left to lose. For example, North Carolina, currently considered the premier trout fishing state in the South, contains roughly 4,000 miles of streams capable of supporting brook, brown, and rainbow trout. These streams, located at higher elevations in the state's 25 westernmost counties, maintain temperatures cool enough to support mountain trout. Land use changes resulting in lower stream levels or nutrient enrichment could easily compromise trout habitat.[33] In fact, an EPA-funded study of Maryland streams found that pollution sensitive brook trout *are never found* when upstream impervious land cover exceeds 2% of a watershed.[34]

In lower elevations, development is overtaking wetlands and reducing their ability to naturally filter sediment and pollutants out of slow-flowing waters. Instead, fast-flowing runoff carries pollutants into coastal waters, where they then degrade shellfish beds and fisheries.[35]

Degradation of fisheries could have negative consequences for North Carolina's valuable commercial fishing industry and for communities that are economically reliant on the fishing industry. The local economy of most of the state's coastal fishing counties relied on 3 major sources of income: tourism (including recreational fishing), agriculture, and commercial fishing.[36] The benefits of having healthy waters and a thriving fish population go beyond the more visible fishing and tourism industries. In Pamlico County, seafood processing, boat building, and government manufacturing account for most of the county's manufacturing outpost. As much as 10% of the county's population is directly or indirectly involved in the commercial fishing industry.[37] As fish habitat is destroyed and populations decline, the economic health of our coastal counties suffers.

Eight of the coastal fishing counties, Bertie, Camden, Carteret, Craver, Hertford, Onslow, Perquimans, and Washington Counties, have all experienced a decline in their fish landings since 1999 or 2000. Many counties earn significant income from their commercial fishing industries. In 2001, that economic impact of the commercial fishing-harvesting sector in Dare County totaled $32,053,286.[38] Hyde County had the largest percent of its workforce composed

of commercial fishermen in 2001, followed by Carteret, Dare, Pamlico, and Tyrrell Counties.[39] Protecting North Carolina's waters from polluted runoff safeguards the state's fishing industry and the jobs it provides.

Fish Kills

Over the past decade, more than one billion fish have died in massive fish kills in North Carolina waterways. In 2003 alone, two kills on the Neuse River attributed to polluted runoff resulted in 4 million fish dying.[40, 41]

Nutrient pollution, transported via runoff, is to blame for the horrendous fish kills of recent years. Excessive use of fertilizers in agricultural operations, hog factories, wastewater treatment plants, golf courses, lawns and city streets all cause nutrients to drain into rivers and other surface waters.[42] High concentrations of nutrients in water lead to algae overgrowth, increased cloudiness, and fish kills. Waste from animal operations and grazing lands can also export nutrients (as well as bacteria and pathogens) into streams.[43] *Pfiesteria* related fish kills, where the dead fish are covered in open bleeding sores, have also been conclusively linked to nutrient pollution.[44]

Figure 3. Neuse River Fish Kill [45]

Closed Shellfish Beds

Shellfish bed closures, often a result of polluted runoff, indicate insufficient water quality, a threat to the state's fishing industry, and a threat to public health. A study in five coastal states has documented that polluted runoff and storm sewers are the most common cause of closed shellfish beds.[46] In North Carolina, more than 350,000 acres of shellfish waters are closed to shellfishing, and the area of closure is increasing.[47] In these beds, the oysters, clams, and mussels are no longer considered fit for human consumption because of fecal coliform contamination.

Shellfish like oysters, clams, and mussels feed themselves by filtering water. One 3-inch oyster can filter about 50 gallons of water per day.[48] This feeding process can result in the bioaccumulation of bacteria, protozoa, and viruses. Although these bacteria are not harmful to the shellfish themselves, they can be harmful to people that eat the shellfish, especially if the shellfish are consumed raw.[49] Shellfish contaminated with fecal coliform, for example, can cause gastrointestinal illness and death for people with compromised immune systems.[50] Fecal coliform abundance is associated with rainfall because it generates runoff that carries fecal matter into surface waters.[51]

Besides fecal coliform contamination, polluted runoff causes other problems for shellfish. For instance, runoff can carry eroded sediment into shellfish waters, effectively smothering the shellfish.[52] Also, failing water quality may leave oys-

ters more susceptible to disease.[53] As mentioned above, one small oyster can filter a large amount of water every day. When water quality is degraded by polluted runoff, fewer oysters survive, so less water is cleansed, leading to continued poor water quality and the demise of even more oysters.[54]

The economic costs of fewer harvestable shellfish can be considerable, especially to full-time shellfishers who depend upon the availability of these creatures for their livelihood. In 2001, shellfish landings by commercial fisheries were valued at around $52 million.[55] Shellfish are at about 5% of their historic range because of runoff, disease, and over harvesting. Oyster harvests in recent years have totaled about 50,000 bushels, whereas 19th century harvests were counted in the millions of bushels.[56] A 2002 report issued by the North Carolina Coastal Federation calculates the state's oyster crop will take decades and hundreds of millions of dollars to restore because of poor water quality.[57]

Loss of Recreational Opportunities

Polluted runoff can prevent recreational fishers and shellfishers from pursuing these activities. It can also hinder other ways of enjoying water resources. In 2001 alone, there were 79 beach closings or advisories in North Carolina due to bacterial and other contamination attributed to polluted runoff. There were none of these in 2002, likely because it was a dry year with little rain to produce polluted runoff.[59]

The reason for these closings: swimming in water contaminated by polluted runoff can make people sick. One study has shown that swimming near active stormwater outlet pipes increased the risk of respiratory illness and more than doubled the likelihood that the swimmer would contract a gastrointestinal illness within the next 9 to 14 days compared to swimmers who did not go near stormwater outlets.[60]

Figure 4. Example of shellfish bed closures in North Carolina [58]

Coastal counties economic health depends in large part upon their appeal to tourists. Coastal tourism generated $2.9 billion and supported 44,800 related jobs in 2000.[61] Many coastal areas worry that if their beaches develop a reputation of pollution and contamination—or if prospective beachgoers are discouraged by even one notice of closure—the local economy could lose its tourist base.[62]

2.4 Loss of Drinking Water Supplies

Conventional wisdom is that North Carolina has abundant available drinking water supplies. However, the state's surface drinking water sources are becoming increasingly polluted, and groundwater sources are being depleted. Regions of the state are beginning to project water shortages over the next few decades.

Surface Water Contamination

With increased polluted runoff comes a greater likelihood that runoff pollutants (nutrients, bacteria, and toxic organic chemicals) will contaminate surface drinking water supplies, threaten public health and necessitate advanced, costly treatment.[63] In fiscal year 2002 alone, more than 170,000 North Carolinians were served by water systems with reported health violations.[64]

Furthermore, water shortages can lead to disputes among local governments or even between neighboring states. South Carolina, for instance, receives a third of its surface water from rivers that flow into the state from North Carolina. This has already led to interstate fights over water diversions and use of the Pee Dee River.[65]

Disappearing Groundwater Supplies

Runoff not only directly pollutes surface waters, but also leads to declines in groundwater levels since water no longer filters down to aquifers. This in turn can lead to lower water levels in rivers and streams. In North Carolina, approximately 60% of all stream flow and nearly all stream base flow in the state is groundwater discharge. Therefore, diverting groundwater supplies may lead to lower water levels in many of the state's rivers, lakes, and streams.

Figure 5 shows how runoff from development can lead to both higher peak flows and lower base flows in a watershed.[66] Lower stream flows during the dry season result when runoff depletes groundwater available to recharge surface waters.[67] These decreased flows result in loss of critical water supplies. They also impact habitat by contributing to higher stream temperatures that do not support the same organisms that previously lived in the waterway.

Groundwater is especially important in North Carolina's Coastal Plain, where high-yielding wells supply water for municipalities, industries, and agriculture. Environmental quality in the region is likewise highly dependent on groundwater: large amounts of groundwater are discharged into surface waters, wetlands, and estuaries throughout the Coastal Plain.[68]

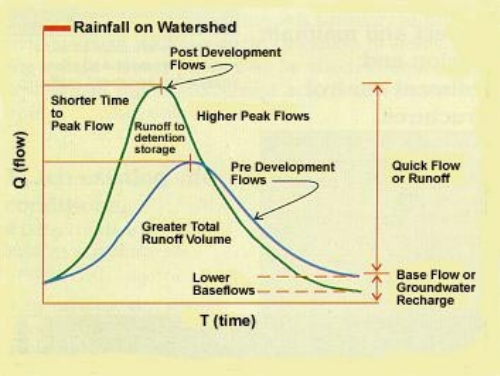
The U.S. Geological Survey indicates that two of the major issues related to groundwater in North Carolina are related directly to increasing runoff: declining water levels (especially in the Coastal Plain region); and effects of urbanization on water quality.[69]

Major metropolitan areas in North Carolina like Raleigh, Charlotte, and Greensboro already have lost significant aquifer supplies due to runoff resulting from development between 1982 and 1997. These losses total at least 30 billion gallons.

Table 2. Estimates of Lost Groundwater Supplies Resulting from Urbanization (1982-1997) [70]

Charlotte	13.5 billion - 31.5 billion gallons
Raleigh-Durham-Chapel Hill	9.4 billion - 21.9 billion gallons
Greensboro, N.C.	6.7 billion - 15.7 billion gallons

Figure 5. Impact of Development and Runoff on Stream Flows



If current rates and types of suburban development continue, projected population growth in the state will result in the development of 2.4 million acres, causing the diversion of 150 billion gallons annually from state aquifers. This amount is equal to the gallons of freshwater North Carolinians used over a 9-month period during 2000.[71]

Chapter 3. Strategies For Minimizing Polluted Runoff

The most effective way to prevent runoff is to maximize naturally vegetated areas and minimize the amount of impervious surface in new development. This can be done through a) large-scale planning, b) promoting compact and infill development that protects open space, as well as on the scale of any individual development, and c) minimizing the paved footprint of houses, roads, driveways, and other manmade structures.

Treating polluted runoff is inherently more expensive and difficult to implement than programs that prevent runoff at the outset. Regardless, runoff controls and smart growth programs require a commitment of funding to achieve the objective of reducing runoff.

To address runoff pollution, findings indicate that North Carolina will need a five-point strategy.

An examination of federal, state, and local laws reveals that regulatory authority already exists to achieve many of the above strategies, but work needs to be done to strengthen the state's recently enacted polluted runoff regulations to ensure that the state's water quality is protected.

- **Maximize Natural Areas To Limit Runoff**
- **Minimize Impervious Surface in New Development**
- **Implement Structural Management Controls To Treat Polluted Runoff**
- **Strengthen the State's Phase II Regulations**
- **Ensure Adequate Staff and Funding for Programs That Help Rein in Runoff**

3.1 Maximize Natural Areas That Help Limit or Manage Runoff

In addition to establishing a permanent, dedicated source of funding to preserve at least one million acres of open spaces by 2010, the state should target funding to preserve wetlands that provide natural services in controlling and filtering runoff pollution.

The effects of polluted runoff can be minimized if nature is left to do its job. Maximizing the natural areas that are left intact is a key method for controlling runoff. Natural areas can be maintained by preserving open spaces, implementing land use planning and zoning laws to limit development and protecting stream buffers.

Preserve Open Space

Million Acres Initiative

At current development rates, 383 acres of open space are being bulldozed and developed each day—an area equivalent to nearly 350 football fields.[72] Without additional protections, this development is likely to damage the state's remaining forests, wetlands, and other pristine natural areas. Furthermore, each acre developed is likely to result in the loss of natural ecosystem benefits—like water filtration—leading to additional runoff pollution that will have an acute impact on water quality.

The most basic commitment state leaders can make to protecting open space in North Carolina is maintaining the funding necessary to meet the state's Million Acre Promise—maintaining 2% per year of the state budget through 2010 to purchase and permanently protect 1 million acres of open space.

Although North Carolina law committed to this goal in 2000,[73] the level of funding to date has not been sufficient to achieve the goal.[74] In fiscal year 2004, the state's Clean Water Management Trust Fund received $38 million less than state law requires, the Farmland Preservation Trust Fund received no funding at all, and the Natural Heritage Trust Fund had to turn down projects that would have protected nearly 10,000 acres from development.[75]

For the first time ever, state lawmakers approved $100 million for the Clean Water Management Trust Fund, the state's premier open space conservation program, for the 2005-2006 fiscal year. As part of its effort to meet the million acre goal, the state should target funding to preserve wetlands that provide natural services in controlling and filtering runoff pollution.

Remove Subsidies for Sprawl

Local governments would benefit from additional tools to protect water by protecting land. The Growth Management Act of 1999 would have authorized towns and counties to assess impact fees to provide for the acquisition of ecologically important land.[76]

Use Land Use Zoning to Limit Development That Would Lead to Runoff

Even if the state allocates funding to fulfill the Million Acre Promise, there will never be enough money available to buy up all the lands along waterways that help prevent runoff from harming water quality.

Most surface waters are public resources, and the public has a right to protect them through government regulation. In order to achieve protection from runoff, local governments will need to use their authority in land use deci-

sion-making to set limits on development in key places.

The creation of urban growth boundaries could play an important role in minimizing sprawling infrastructure. For example, a bill proposed in 1999 known as the Growth Management Act would have enabled towns and counties to establish such boundaries to limit expansion of water and sewer services to rural areas, protecting open space without costly government land purchases.[77]

Short of establishing an urban growth boundary, towns and counties anticipating a development spurt can set a limit on the amount of paved land that will be permitted within a given planning area. Development proposals and subdivisions must then be reviewed to ensure they do not exceed the established "impervious" cap. Scientists recommend limiting impervious surface within a watershed to 10% of total surface—a recommendation that the North Carolina Wildlife Resources Commission has forwarded.[78]

This kind of zoning can be established across a whole region, or targeted in areas considered to have particular importance. For example, local and regional governments can establish zoning that

North Carolina's Water Supply Watershed Protection Program

North Carolina's Water Supply Watershed Protection Program requires local governments with land use jurisdiction in water supply watersheds to develop ordinances to protect water quality in the streams and water bodies receiving runoff. These ordinances can include restrictions on development density, requirements for storm water management, and vegetated buffers along waterways. While local governments develop and administer the management programs, the Environmental Management Commission must approve them.[81]

These programs afford different levels of protection based on the classification of waterways. Under the federal Clean Water Act, states are required to classify waterways based on designated use. In North Carolina, these designations range from WS-I (for water supplies in natural and undeveloped watersheds) to WS-V (for water supplies in less pristine watersheds), through freshwater classes B and C based on the designated uses for fishing, recreation, aquatic life, and wildlife uses. In the process, states must identify a set of pristine watersheds for highest protection, according to the anti-degradation clause of the Clean Water Act.[82]

By classifying more watersheds at higher levels of protection, the state in turn gives local governments more authority to adopt stronger runoff controls. Designating additional "high quality" waters under the federal Clean Water Act can help localities establish land use requirements that can minimize the creation of new runoff. Currently, North Carolina has provisions for the designation of waters with excellent water quality as either "High Quality Waters" or "Outstanding Resource Waters."[83] Although these designations take important steps towards protecting water quality, there is still room for these statewide protections to be strengthened. For example, New Jersey recently adopted 300-foot buffer zones around high quality waters, while North Carolina's requirement for High Quality Waters is only 30 feet.[84] North Carolina also needs to take steps towards applying these designations to the appropriate waterways. There are approximately 75 rivers and streams statewide with excellent water quality lacking protective designations.[85]

applies specifically in the watersheds of rivers prized for their value as community water supplies or recreational fishing spots. State law has authorized impervious caps in critical areas.[79]

Currently not all counties have comprehensive zoning plans. In North Carolina as of 2002, 30 counties had no countywide zoning plans. These counties tend to be less developed than the state average. Twenty-two of the unzoned counties have population densities under 75 persons per square mile.[80]

Stream Buffers

One of the most critical components of protecting waterways from runoff pollution as rural areas of North Carolina are converted to suburban residential development is the creation of buffer zones. Buffer zones maintain areas of mature vegetation along rivers and streams.

Buffers are instrumental in removing pollutants from runoff before the pollutants contaminate a waterway. Vegetation in buffers traps sediment and other pollution, slowing the flow of water and thereby allowing it to filter back into the ground.

Guidelines developed by biologists at the North Carolina Wildlife Resources Commission recommend the maintenance or establishment of a minimum 100-foot native forested buffer along each side of perennial streams and 50-foot native forested buffer along each side of intermittent streams and wetlands.[86]

In 1999, the Coastal Resources Commission adopted a rule requiring structures to be built at least 30 feet from the water on property along rivers, streams, sounds, marshes and other navigable waters in the 20 coastal counties.[87] These rules are grounded in the authority of the Coastal Area Management Act (see box). However, expanding the size of buffer zones in coastal counties and extending buffer rules to other counties could play an important role in protecting waterways in all seventeen of the state's watersheds.

Coastal Area Management Act

The Coastal Area Management Act (CAMA) of 1974 was enacted to ensure the wise growth and protection of North Carolina coastal areas. The act establishes guidelines for state and local governments to collaborate in land use planning decisions, requiring each of 20 coastal counties to prepare land use plans and update these plans every five years, and creates development standards.

3.2 Minimize Impervious Surface in New Development

Smarter greener infrastructure

Counties have significant authority to create a framework for new development that minimizes runoff. Zoning laws can be established to reduce the overall amount of developed area, or reduce the amount of impervious surface created within the developed area. Runoff from roofs and paved surfaces can be directed over vegetated surfaces, permitting infiltration before it reaches the drainage conveyance system.

In addition to implementing buffers, developers can be required to improve permeability of infrastructure by building open-graded street pavements, soft shoulders, graveled common driveway lanes, and incorporating "wet roofs" in building to minimize runoff.

Runoff From Roads

Roads and parking lots can account for more than 60% of a low-density development's impervious area.[88] Towns can pass ordinances with guidelines to minimize road widths. However, the state must play a role as well in limiting runoff from roads.

North Carolina has the second largest state-maintained highway system in the nation. The total paved road network includes more than 75,000 miles, conservatively estimated to cover 320,000 acres of impervious surface.[89] This is equivalent to 1% of the surface area of the entire state, an area roughly equivalent to the size of an average county in North Carolina.

North Carolina's roads are the single most important source of urban nonpoint source pollution.[90] These roads and their associated drainage systems collect large volumes of runoff, which includes high concentrations of phosphorous, suspended solids, bacteria, and metal contaminants.

3.3 Implement Structural Controls to Treat Runoff

Although land use practices that create less runoff will be key to addressing runoff in undeveloped areas, all development must be accompanied by controls to mitigate and treat the resulting runoff.

Design and control standards can be set to require onsite treatment of runoff to remove sediment and other contaminants. This can involve building storage structures for site runoff, such as wet ponds and other structures that catch water and allow sediments to settle to the bottom. It also may include systems to filter pollutants out of runoff, including grassed swales (gently sloping, densely vegetated channels that collect and carry runoff and reduce the temperature of the water), bioretention cells, sand filters, filter strips, and infiltration basins and trenches.

Erosion and Sediment Control Program

Construction sites are among the most critical places to target with structural controls. Loose dirt and gravel at these sites are prime contributors of sediment to state waterways.

Technologies that can be used during construction to minimize sedimentation include temporary and permanent vegetation, sediment or silt fences or dams on property borders, and grass-covered drainage ditches.

North Carolina's sedimentation control law prohibits visible off-site sedimentation from any land-disturbing activity. As early as 1973, the North Carolina legislature took steps to address runoff by passing the Sedimentation Pollution Control Act.[91] In the past decade, the state has adopted stronger controls for agricultural runoff to reduce erosion resulting from land-disturbing activities (e.g., construction.)[92]

In 1999, the General Assembly strengthened the Sedimentation Pollution Control Act by increasing the maximum fine for violations from $500 to $5,000 per day, and appropriating funding to add 10 inspectors to the program.[93]

However, the program remains significantly under funded and understaffed. Thirty inspectors are responsible for

Figure 6. Construction site with inadequate sedimentation[95]

monitoring over seven thousand sites. Infrequent inspections by overburdened staff result in unchecked violations and, in turn, unchecked degradation of North Carolina's waterways.[94]

In addition to having controls in place while construction is on going, it is also important to have post-construction controls in place. Post-construction controls reduce or eliminate pollutants in run-off and remain in place after the construction phase is completed. (For more information on the post construction controls required by Phase II rules, see Appendix C.) Instead of being a one size fits all solution, these controls need to vary depending on whether a project is low density or high density.

Low-density projects are those that contain no more than 24% built upon area. This threshold should be lowered to 12% built upon area for projects that are within one half mile of and draining to sensitive shellfish waters. High-density projects are those that exceed the low-density thresholds. Because low and high-density developments contain different amounts of developed surfaces, they should be subject to different standards. High-density projects involve more paved surfaces, meaning more run-off; therefore, high-density projects need to implement greater runoff controls than low-density projects.

Chapter 4. Strengthen the State's Phase II Regulations

The federal Clean Water Act requires state and local governments to control water pollution from new development in rapidly urbanizing cities and counties. The intent of these Phase I and II NPDES Stormwater Rules is to protect the integrity of our waterways, specifically the health of sensitive receiving areas, waters classified as high quality, outstanding resources, shellfish, trout, nutrient-sensitive waters, or waters designated as critical habitat for federally-listed aquatic species.[96]

4.1 Phase II Rules in North Carolina

The "Phase I" stormwater rules were issued in 1990, and applied to North Carolina's biggest urban areas: Raleigh, Durham, Charlotte, Winston-Salem, Greensboro, and Fayetteville. These local governments have already established strong programs to combat runoff pollution.[97] In 1999, the EPA issued "Phase II" rules for rapidly growing communities—in North Carolina, 33 counties and 123 cities, nearly one-third of the state. Phase II also includes power plants, mining and manufacturing operations, wastewater treatment facilities and landfills, all of which have a significant impact on the quantities of pollutants in storm-water runoff.[98] (For more background on Phase II and the urbanizing areas designated, see Appendix A and B.) With the population growth and subsequent sprawl in North Carolina over the last decade, it is no surprise that a number of communities are affected by the Phase II Rules.

For five years, the state worked to draft rules implementing the federal requirements. The Environmental Management Commission (EMC) issued a final rule in July 2003 and revised it in December. In January 2004, the Rules Review Commission (RRC), heavily lobbied by developers, blocked the rules, leaving the Phase II cites in violation of the federal Clean Water Act.[99] In order to bring cities into compliance, in July 2004 the legislature passed polluted runoff regulations that fail to adequately protect water quality. These regulations do not provide the protections needed for areas of future growth

and for sensitive waters such as fragile shellfish waters. Meanwhile, after the RRC rejected the EMC's stormwater rules, the EMC filed a lawsuit against the RRC. The court found in favor of the EMC, meaning that the rules will now again go before the RRC and the EMC, creating the opportunity for rulemakers to make meaningful changes to the rules.

4.2 The Importance of Runoff Controls in Areas of Future Growth

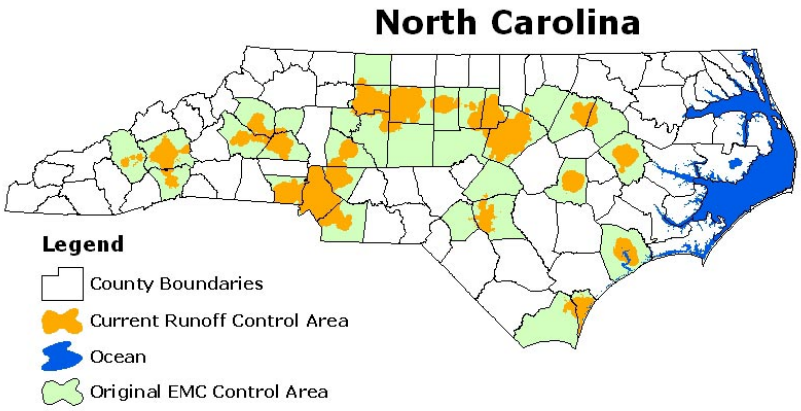
While it is important to make sure that mechanisms developed to control polluted runoff are adequate, it is imperative that the controls actually be implemented where they are needed most. The state's current runoff regulations do not control polluted runoff in the parts of the state where pressure from development is the greatest. The rules initially proposed by the EMC sought to provide coverage for entire counties deemed urbanizing.[100] The current law, however, only provides coverage for urbanizing cities and buffers 1-3 miles surrounding the cities, leaving large sections of rapidly growing counties without polluted runoff controls. Another problem with the current law is that the types of entities that can brought in under Phase II rules through the "designation" process has been narrowed. It is important that this designation process be broadened, reflecting the EMC's initial rules, so that more entities can be regulated as development increases and water quality suffers.

Polluted runoff is the largest source of water pollution in the state, and the essence of Phase II stormwater requirements, as delineated by the Clean Water Act, is to control this pollution by implementing runoff controls for future development.[101] The state's current Phase II regulations, however, rely on outdated census data and fail to capture development in rapidly growing areas.

The current regulations will not go into effect until 2006 and applies to areas considered urbanizing under the 2000 census. At the rapid rate at which North Carolina loses forests and farmland each day (the majority in and around urbanizing areas)[102] , by 2006 most of the new development from which the bill aims to limit pollution will have already occurred. None of the new development between 2000 (when the census was taken) and 2006 will have to control polluted runoff; and after 2006, the places most likely to be developing won't have stormwater control requirements. A reliable means of accurately capturing development in these rapidly growing areas is to require post-construction runoff controls for any development in the state over one acre, instead of limiting coverage to municipalities and their 1-3 mile buffer areas. Without this threshold, large development can continue to occur just outside city bounds without having to control run-off pollution.

Figures 7 and 8 illustrate the different amounts of area covered between the state's current Phase II regulations and the EMC's previous proposal. As seen in Figure 7, the EMC proposal encompassed all areas within the borders of urbanizing counties, highlighted in green. This countywide coverage would apply to all new developments within the county, thereby protecting all watersheds and future development "hot-spots." The orange areas display the reduced area of coverage for polluted runoff protection under the program recently passed by the legislature. Notice the diminished total area of coverage and that the runoff protection lies only around large and rapidly expanding municipalities, but does not

Figure 7. North Carolina counties with current polluted runoff control areas and previously proposed EMC polluted runoff control areas



Source: North Carolina Center for Geographic Information & Analysis, updated 2003.

capture areas outside of these municipalities where future development is most likely to take place.

The fact that current regulations fail to provide countywide coverage is significant because of the rapid population increase in North Carolina overall, but specifically in rapidly growing counties. Figure 8 displays one such county, Brunswick County. Fortunately, Brunswick County officials are concerned enough with water quality in their county that they are voluntarily implementing Phase II controls, although it is not required. The following, however, illustrates the impact a lack of post-construction stormwater controls would have in counties growing as rapidly as Brunswick County.

The estimated growth rate for the state is 17.3%, but for Brunswick County the estimated population growth is 31.2%, an increase of 22,820 people. This projected growth is reasonable in light of current growth from 1990 to 2000, when North Carolina grew 21.4% but Brunswick County grew by 43.5%.

As displayed in Figure 8, the current polluted runoff control area only covers three cities: Navassa, Leland and Belville. These cities are currently expanding at a tremendous rate, through a combination of both annexed growth and urban growth. The current regulations, however, fail to provide coverage for Boiling Spring Lakes, which had no annexed population and grew 11.27%.[103] Taking into account the lack of any polluted runoff protection and the proximity to the ocean, new development in Boiling Spring Lakes would have a significant impact on water quality.

As these maps illustrate, the state's current Phase II rules do not take the steps necessary to protect water quality. Current regulations not only fail to provide coverage for developing areas beyond rapidly urbanizing municipalities, but fail to provide any coverage for some of the state's fastest growing counties. Phase II regulations need to be revisited and revised to provide coverage for future growth and for the sensitive waters that the rules were meant to protect.

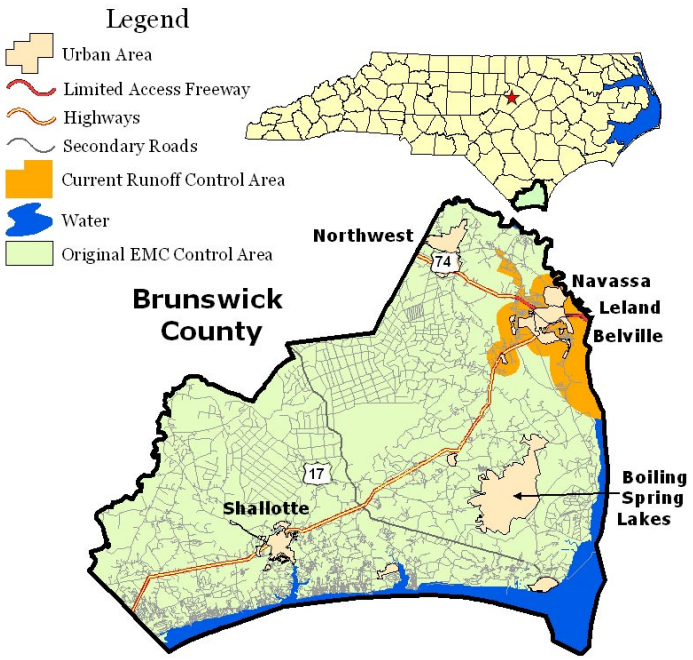


Figure 8. Brunswick County displaying current polluted runoff control areas, roads and municipalities. Only three cities are covered under the current plan, whereas the EMC plan would have covered the entire county.

4.3 Impaired and Sensitive Waters

Federal regulations require urbanized and urbanizing areas to develop stormwater runoff management plans. However, state law can set specific guidance for policies that should be a part of these runoff management plans.

One approach has been to establish stricter standards in watersheds that are already considered impaired due to polluted runoff. For example, in 1997, the North Carolina Environmental Management Commission approved a comprehensive set of rules for controlling nutrients in the Neuse River Basin; an area that had been protected by special regulations since fish kills and algal blooms in the 1980s built awareness of nutrient impairment. Ten municipalities (Cary, Durham, Garner, Goldsboro, Havelock, Kinston, New Bern, Raleigh, Smithfield, and Wilson) and five counties (Durham, Johnston, Orange, Wake and Wayne)—the fastest-growing areas in the Neuse River Basin—are covered by these rules.[104] Steps need to be taken, however, to protect sensitive waters before they become impaired.

One area where stricter runoff standards are needed is shellfishing waters. Fecal coliform contamination has even led to shellfish closures in waters considered among North Carolina's most pristine; more that 1,000 acres of state waters designated as Outstanding Resource Waters have been closed to shellfishing in recent years. This is particularly troublesome because the Outstanding Resource Waters designation is limited to those waters showing a very high level of water quality and because once the designation is in place, state regulations protect these waters from pollutants more stringently than most other state waters.[105]

Thresholds for post-construction measures for development located within one half mile of and draining to shellfish waters need to be lowered to no more than 12% built-upon area from the 25% cur-

rently in place for all waters. Best management practices need to be used that will control the sources of fecal coliform. These controls should include a pet waste management component, and an on-site domestic wastewater treatment system component to ensure the proper operation of wastewater systems. Finally, new or expanded points of discharges, including discharges from swales, into shellfish waters must be prohibited.

A second highly sensitive category of water is trout waters. Trout waters are especially sensitive to the changes in dissolved oxygen levels as well as water temperature. In areas draining to trout waters, development must incorporate best management practices that do not increase the temperature of receiving waters. Added controls should include on-site runoff treatment devises including infiltration areas, bioretention areas, and level spreaders.

The state's sensitive waters need to be given expanded protections from polluted run-off. Waters with excellent water quality require management strategies that ensure water quality and use classifications are not impaired, while waters containing endangered species habitat need specific management plans that protect the livelihood of the species present. Every river and stream is unique, having its own value and its own sensitivities. It is important for the health of our waters that development be regulated on a case-by-case basis in sensitive watersheds so that additional measures can be taken, as they are needed.

In addition to protecting waters that are already impaired, it is important to protect sensitive waters that will suffer the most from the effects of polluted run-off. High quality waters, outstanding resource waters, shellfishing waters, trout waters, nutrient sensitive waters, and waters that are home to threatened and endangered species especially need to be protected from polluted runoff. Polluted run-off has devastating effects on the quality of our waters and the species living in them, especially sensitive shellfish habitats. North Carolina's current regulations do not provide the protections these sensitive waters need.

Chapter 5. Ensure Adequate, Stable Funding For Minimizing Runoff

Once mechanisms are in place for protecting water quality, the top priority for ensuring the success of clean water programs is to establish an equitable, adequate, and stable source of program funding.

5.1 Why Dedicated Funding is Crucial

At the moment, state funding for clean water programs is hard won and lags behind program needs. As new programs are added, new funding is not always allocated. In the current fiscal note for the recently passed Phase II polluted runoff regulations, for example, North Carolina fiscal staff wrote:

> Although state costs have been estimated for this fiscal analysis, no additional state funds are anticipated at this time. The staff time and cost of rule implementation will be absorbed within existing budgets.[106]

In an environmental program budget with little fat to trim, "absorbing" the costs of Phase II is not a viable option. With fewer federal government grant resources available than in the past, and stiff competition for general funds, North Carolina must establish additional funding sources to ensure that the polluted runoff program doesn't run out of steam.

Scramble for State General Funds

General funds (derived from general tax revenues) are currently the most common funding option for maintenance and operation of the stormwater infrastructure. In North Carolina, general funds will undoubtedly be an important source of revenue to start up statewide administration of the Phase II polluted runoff program and maintain other clean water programs. However, a major disadvantage of relying heavily on general funds is the stiff competition for limited resources when the economy is weak. In the fight for general funds during times of budget cuts, polluted runoff programs and public infrastructure usually lose. Because state general funds are not a feasible option, local governments will have to fund Phase II programs.

5.2 Strategies to Enhance Funding for Runoff Controls

North Carolina can fund needed runoff controls using a variety of programs and methods, including:

- Protecting and increasing state open space and clean water trust funds
- Establishing fees to fully cover clean water program costs
- Holding developers and new development responsible for their own runoff

The following section discusses this menu of options in greater detail.

Protect and Increase Natural Resource Trust Funds

Four trust funds will play a critical role in achieving the goals of the Million Acre Initiative while protecting water quality: The Clean Water Management Trust Fund, the Parks and Recreation Trust Fund, the Natural Heritage Trust Fund, and the Farmland Preservation Trust Fund.

These funds have protected more than 470,600 acres of forests, farmland, and other open space, and 1,500 miles of river and stream banks for less than $620 million.[107]

For FY04-05, the Clean Water Management Trust Fund received a 38% cut from its original allocation, while the Farmland Preservation Trust Fund received no funds at all. With incoming revenue standing a chance to fall short of projections, future funding of these programs will remain uncertain. In 2005, the General Assembly award the Clean Water Management Trust Fund full funding for the first time in the fund's existence. It is important that this level of funding be continued.

To fully fund the demand upon the trust funds for land acquisition and management would require an additional $1.2 billion over the next seven years, or $176 million each year.[108]

Recently, a new coalition formed aimed at guaranteeing funding to protect open spaces. Land for Tomorrow, a diverse partnership of businesses, preservationists, farmers, environmental groups, health professionals and community groups, is seeking legislative support for a five-year plan designed to preserve and protect areas critical to clean water and other resources across the state. The coalition recommended passage of a 2006 bond initiative that would generate $200 million per year for five years to expand preservation of critical lands and historic places, provide jobs, and strengthen communities. Approval of this bond would be an important step in conserving lands important in the protection of waters statewide.

Establish Fees to Fully Cover Clean Water Program Costs

Fees should be used to cover the costs of implementing and enforcing clean water programs. This can be accomplished by charging the necessary amounts for NPDES permits fees, municipal permit fees, industrial permit fees and stormwater utilities fees.

Raise Permit Fees

Clean water programs require an investment to administer and enforce. Perhaps the single biggest impediment to ensuring adequate funding for Clean Water programs in North Carolina is a restriction in state law that prevents North Carolina from funding more than 30% of environmental permitting and compliance programs with permit fees.[109]

Ideally, permit fees could be set at a level to recover the full costs of processing, monitoring, enforcing, and administering NPDES permits. Wisconsin and Washington are two states that adopted such an approach to fund their runoff programs, and New Jersey guidance encourages such full-cost recovery in all its clean water programs.[110]

However, North Carolina state law currently prohibits the department from using permit fees to collect more than 30% of the funds necessary to run these programs.[111]

Municipal permit fees

Phase II permit fees, assessed annually, could range from several hundred dollars for the smallest municipalities, to up to $10,000 for the largest towns, public complexes, and general permits.[112]

Assessing a permit averaging 20 cents per resident/user in each municipality automatically covered by Phase II could raise over $600,000 for state administration of the program. Municipalities could in turn pay for this program assessing a user fee through established or new municipal stormwater utilities. A recent poll has shown that people support polluted runoff regulations even if they result in consumers paying fees.[113]

Industrial permit fees

Effluent discharge fees can be assessed on permits for pollutant discharges based on the volume and type of pollutant. For example, Wisconsin has adopted a fee system for its water program to recover total direct and indirect program costs. These fees are assessed for a range of sources and users, including concrete manufacturers, swimming pools, petroleum storage terminals, water treatment plants, and dredging projects involving uncontaminated sediments.[114]

Local user fees: Stormwater Utility Fees

A stormwater utility fee can be established to recoup the costs of runoff services ranging from storm drainage repair to floodplain management and runoff controls. There is ample precedent for such utilities—all of North Carolina's larger cities (Charlotte, Greensboro, Durham, Winston-Salem, Fayetteville and Wilmington) have already established stormwater utilities.[115]

Phase II municipalities that have not already done so can establish stormwater utilities to pay for both the capital and operational costs of the rule. Stormwater utility fees allocate costs through user fees to property owners—often, the more runoff a piece of land generates (calculated by impervious cover), the higher the fee.

The national average monthly stormwater utility charge is just under $3.00 per household.[116] In North Carolina, these fees range from $1.00 per month for residential users in Fayetteville to up to $5.32 per month in Charlotte.

Stormwater utilities can base their rate structures on a number of factors affecting runoff levels, including soil types, depth to groundwater, and types of land use. Most often, these fees are calibrated to the amount of impervious cover for residential development. In Greensboro, for example, the utility assesses a fee of $2.85 for every 2,000 square feet of impervious cover.[117]

Table 3. Fees in North Carolina Municipalities with Stormwater Utilities.[118]

Charlotte:	$4.15 or 5.32/month
Durham:	$1.80 or 2.70/month
Fayetteville:	$1.00/month
Greensboro:	$2.85/month
Wilmington:	$4.75/month
Winston-Salem:	$3.00/month

Such a fee has the distinct advantage from permit fees in that it can recoup ongoing inspection and maintenance costs, critical parts of runoff control programs that could easily be neglected. Furthermore, by providing a source of dedicated funding, government entities would gain the ability to leverage bond money for capital projects necessary to retrofit or fix existing problems.

Stormwater utilities also can play an important role in attracting matching funds from federal and state agencies. As the City of Raleigh reports on their website, "The revenue from the stormwater fee provides a stable funding source that makes the City of Raleigh a contender for various outside financial opportunities."[119]

Hold Developers and New Development Responsible for Their Own Runoff

Impact fees paid by developers on new development can fund runoff abatement programs while discouraging inappropriate development. Impact fees are one-time charges that place the financial burden for runoff controls on those causing the impact. Typically, only local governments are authorized to levy impact fees, but local governments have to ask the state legislature for permission to raise fess, and to adopt most local ordinances.[120]

Since 1987, 16 states have passed impact fee-enabling legislation.[121] In North Carolina, the city of Raleigh obtained special permission from the legislature to charge residential developers impact fees to help finance greenways and other parks. However, for municipalities to use this as a land use planning tool and revenue source, they have to ask for permission from the state legislature.

Development impact fees spring from the premise that since new development creates new runoff and threatens water quality, those who prosper from such de-

Table 4. Comparison of General Fund and Stormwater Utility Fee Mechanism

General Fund Revenues	Stormwater Utility	Permit Fees
State administration	Authorized for municipal and county governments	
Must compete with other programs for allocation of limited funds	Dedicated fee for services imposed on those who create the need for the services	Limited to covering 30% of program costs
	Utilities must be established in many communities	

velopment should help pay the bill for runoff control systems.

Impact fees transfer the costs of new infrastructure services necessitated for private development, such as polluted runoff treatment, directly to the developers. These costs are then indirectly transferred to those who purchase the property. Throughout the nation, localities use such fees to pay for a range of services, including police, fire, water, natural resources, and wastewater services.

By allocating permit fees based on amount of impervious surface, developed area, and type of development, costs can be attributed equitably across polluters, based on their impacts. Ideally, permit fees could be set at a level to recoup all the costs of polluted runoff mitigation from new development.

The limitation of this fee is that it can be used to recoup costs of new development, but rarely can be used to recoup the costs of ongoing maintenance over the life of a project.

Chapter 6. Conclusion

Effectively managing runoff from urban and suburban development will require effort from the state, counties, and local municipalities over the coming decade. Without a strategy to ensure that polluted runoff is controlled in rapidly developing areas, significant negative consequences for the quality of the state's drinking water, recreation, tourism, and fisheries. North Carolina's current runoff regulations provide a workable framework from which a comprehensive, effective set of rules needs to be developed.

North Carolina's current Phase II regulations must be reexamined and revised so that they provide the water quality protections needed. A program needs to be developed that minimizes the amount of runoff created by new development and protects waterways from an unsustainable influx of runoff. North Carolina is growing at a rapid rate and without stormwater regulations in place that adequately capture new development, stormwater will continue to be the leading cause of the state's water quality problems.

In addition to strengthening runoff regulations, the state needs to utilize its range of options to raise funds for managing runoff. Fostering funding to protect our waters from polluted runoff can be accomplished by funding the state's conservation funds to the maximum extent possible and holding polluters financially accountable for their actions.

Regardless of where the funding comes from, it is clear that the state must first institute a strong, comprehensive polluted runoff program. Strong polluted runoff controls benefit our health, our environment, and our economy by creating the following:

- Cleaner drinking water: Improved water quality in drinking water sources benefits public health and can avert expensive filtration requirements.
- Fewer damaging floods: Runoff controls that minimize impervious surface also limit the quantity of

runoff and prevent flooding associated with increased urbanization.

- Higher property values: Development along healthy waterways is significantly more valuable than similar development along degraded water bodies.
- Better commercial fishing: The health and quantity of these natural resources will increase as contamination of fisheries and shellfish beds is prevented.
- More recreational opportunities: Cleaner water is more desirable for swimming, boating, and recreational and subsistence fishing.
- Enhanced wildlife habitat: Wetlands, buffers, and other open spaces protected for runoff management purposes allow natural ecosystems to flourish.

Such public benefits merit a public investment. Revising state regulations to ensure that new development controls its runoff costs less and protects our health, our water quality, and our quality of life.

Appendix A.
Phase II Municipalities and Counties

Municipalities

Table 5 lists North Carolina municipalities expected to develop polluted runoff management plans as part of Phase II as well as counties that would have received coverage under the EMC initial rules.[122]

1990 Census		2000 Census	
Apex	High Point	Alamance	Lake Park
Archdale	Hildebran	Ayden	Laurel Park
Asheville	Hope Mills	Bermuda Run	Lenoir
Belmont	Indian Trail	Bethania	Lewisville
Belville	Jacksonville	Cajah's Mountain	Maiden
Bessemer City	Jamestown	Canton	Marvin
Biltmore Forest	Kannapolis	Carolina Beach	Monroe
Black Mountain	Landis	Claremont	Morganton
Brookford	Leland	Clyde	Morrisville
Burlington	Long View	Connelly Springs	Nashville
Carrboro	Lowell	Cornelius	Navassa
Cary	Matthews	Davidson	Oak Ridge
Chapel Hill	Mcadenville	Dortches	Pleasant Garden
China Grove	Mebane	Drexel	Red Oak
Clemmons	Mint Hill	Flat Rock	Rhodhiss
Concord	Montreat	Fuquay-Varina	Rolesville
Conover	Mount Holly	Gamewell	Rutherford College
Cramerton	Newton	Glen Alpine	Salisbury
Dallas	Pineville	Granite Falls	Sawmills
Elon College	Ranlo	Green Level	Simpson
Fletcher	Rocky Mount	Harrisburg	Spencer Mountain
Garner	Rural Hall	Hemby Bridge	Stanley
Gastonia	Spring Lake	Hendersonville	Summerfield
Gibsonville	Stallings	Hillsborough	Swepsonville
Goldsboro	Thomasville	Holly Springs	Tobaccoville
Graham	Walkertown	Hudson	Trinity
Greenville	Weaverville	Huntersville	Valdese
Haw River	Wilmington	Kernersville	Wake Forest

1990 Census		2000 Census	
Hickory	Winterville	King	Waynesville
	Woodfin	Knightdale	Weddington
	Wrightsville Beach	Kure Beach	Wesley Chapel
			Youngsville
Alamance County	Mecklenburg County	Alexander County	
Brunswick County	Nash County	Caldwell County	
Buncombe County	New Hanover County	Chatham County	
Burke County	Onslow County	Davie County	
Cabarrus County	Orange County	Franklin County	
Catawba County	Pitt County	Haywood County	
Davidson County	Randolph County	Hoke County	
Durham County	Rowan County	Stokes County	
Edgecombe County	Union County		
Forsyth County	Wake County		
Gaston County	Wayne County		
Guilford County			
Harnett County			
Henderson County			

Appendix B. Phase II History

In North Carolina, the cities of Raleigh, Charlotte, and Greensboro, Durham, Fayetteville, and Winston-Salem developed polluted runoff management plans under Phase I of the federal polluted runoff program, which covered large cities (with populations exceeding 100,000), construction sites greater than 5 acres, and a number of industrial sectors.

In December 1999, US EPA finalized the rules for Phase II, the second phase of the polluted runoff program, applicable to smaller municipalities, construction sites between 1 and 5 acres, and other urbanized areas that had not been targeted in phase I.

These rules apply nationally to all municipalities in "urbanized areas"—defined by the most recent census as having a population of at least 50,000 and a density of 1,000 people per square mile. The 2000 census identifies 17 urbanized areas in North Carolina, comprising all or part of 123 municipalities and 33 counties (See Table 6).[123]

Table 6. North Carolina Urbanized Areas [124]

Asheville	Goldsboro	Kannapolis
Burlington	Greensboro	Raleigh
Charlotte	Greenville	Rocky Mount
Durham	Hickory	Wilmington
Fayetteville	High Point	Winston-Salem
Gastonia	Jacksonville	

Appendix C. Phase II Requirements

Polluted Runoff Management Plans Under Phase II

Under Phase II, local governments in these areas must adopt a set of minimum measures to control runoff pollution. These six "minimum control measures" are required elements of a comprehensive strategy for achieving runoff pollution reductions, and include:

Table 7. Minimum Measures under Phase II

1. Public education
2. Public notice
3. Illicit discharge detection and elimination
4. Construction controls
5. Post-construction controls
6. Pollution prevention

Of these measures, the post-construction control measure has been the focus of heated debate in North Carolina.[125]

The Environmental Management Commission proposed rules that require towns and counties to adopt an ordinance requiring "post-construction controls" for polluted runoff at all new development and redevelopment projects. The ordinance would set a number of requirements of "Best Management Practices" to achieve prescribed pollutant load reductions. Table X lists a range of post-construction controls local governments may choose to use to reduce runoff pollution. Note that runoff management controls include buffers, growth boundaries, protections for sensitive areas, and other policies to minimize impervious surfaces—all discussed earlier in this report.

Table 8. Examples of Post Construction Controls [126]

- Requirements and standards directing growth to identified areas
- Protections for sensitive areas (e.g., wetlands and riparian areas)
- Policies or standards that maintain and/or increase open space (including a dedicated funding source for open space acquisition)
- Mandatory buffers along sensitive water bodies
- Policies or standards that minimize impervious surfaces
- Policies or standards that minimize disturbance of soils and vegetation
- Policies or ordinances that encourage infill development in higher density urban areas, and areas with existing storm sewer infrastructure
- Education programs for developers and the public about project designs that minimize water quality impacts (coordinate with public education minimum control measure)
- Source control measures often thought of as good housekeeping, preventive maintenance and spill prevention for new development as part of the regulatory controls
- Storage practices such as wet ponds and extended detention outlet structures
- Filtration practices such as grassed swales, bioretention cells, sand filters and filter strips
- Infiltration practices such as infiltration basins and infiltration trenches
- Design and control standards to address on site treatment for total suspended solids removal of 85%
- Standards for density of development limitations to reduce impervious coverage
- Plans for long-term operation and maintenance of any structural BMPs required by the program

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