

The North Carolina Department of Environment and Natural Resources: Clean Land, Water, and Air for Healthy People and Communities

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The North Carolina Department of Environment and Natural Resources works with communities and other agencies to sustain clean air, water, and land. Sustainability efforts include protecting air quality through community design, community enhancement through brownfields revitalization, community development strategies to protect water resources, and the integration of natural resource conservation.

North Carolina is a large, diverse state with a rich variety of resources, from its people and vibrant cultural amenities to its environment and natural resources. The North Carolina Department of Environment and Natural Resources (DENR) is the state's lead stewardship agency whose mission is to protect the air, water, and land quality in the state. Clean air, drinkable water, and abundant outdoor recreational opportunities are important for peoples' health and well-being, and they allow North Carolina to remain competitive by attracting world-class companies and skilled workers. As North Carolina grows, maintaining its environmental quality and protecting its natural resources will be one of the state's most important challenges.

One way that DENR has embraced these challenges is by adopting a strategy of environmental sustainability. The agency chairs the Sustainable Communities Task Force (SCTF), a statewide stakeholder group working to provide educational, technical and financial assistance to communities to encourage healthy and equitable development that meets the needs of our growing and changing demographics in the most cost-effective manner. The SCTF has developed a community practices assessment tool that not only helps build capacity by providing examples of the six livability principles but also provides a self-assessment scoring system to help communities gauge their current sustainability status and benchmark it for tracking improvements over time [1]. An important focus of the SCTF is to develop recommendations to better align state investments and policies with local development and conservation decisions. In addition to the SCTF, DENR is involved in a number of other programs aimed at enhancing the efforts of North Carolina communities to become more livable places that encourage physical activity.

Protecting Air Quality Through Better Community Design

The reduction of pollution is one of DENR's most important roles. Where air quality is concerned, the US Environmental Protection Agency establishes National Ambient Air Quality Standards (NAAQS) to protect human health and the environment. In North Carolina, ozone and fine particulate matter are pollutants, and thus standards, of major concern. Exposure to high concentrations of either ozone or fine particulate matter can adversely affect human health, especially respiratory and cardiovascular systems. Individuals particularly sensitive to these pollutants include children, people with heart and lung disease, and older adults [2].

Ozone is formed by a complex set of chemical reactions involving volatile organic compounds and nitrogen oxides. Fine particulate matter is made up of airborne particles (such as those found in smoke or haze) that are 2.5 μm in diameter or smaller. These pollutants can be emitted directly into the environment by combustion processes such as those used by industry and by tailpipe emissions from motor vehicles, or they may result from evaporation that occurs during activities such as gasoline refueling or painting.

The department is responsible for developing plans to ensure that air quality standards are met. DENR has worked with the North Carolina General Assembly to develop legislation such as the North Carolina Clean Smokestacks Act of 2002 [3], which required emissions reductions from electric utilities, and the Ambient Air Quality Improvement Act of 1999 [4], one provision of which required annual emissions testing of motor vehicles in certain counties. Testing is now required in 48 counties (which are considered the most populated of the 100 counties).

Additionally, DENR works with the North Carolina Department of Transportation (DOT) to help select projects to be funded through the Congestion Mitigation and Air

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Quality Improvement (CMAQ) Program. Many of the CMAQ projects support sustainable communities by funding sidewalks, bike paths, and transit. DENR also partners with the DOT and with local governments to ensure that roadway projects in urban areas do not affect the ability of those areas to comply with air quality standards. Additionally, DENR administers grants that reduce emissions from motor vehicles. Among the funded projects that support sustainable communities are bike racks (mounted) on transit buses, cleaner school buses, neighborhood electric vehicles, and hybrid electric refuse haulers.

Through the North Carolina Air Awareness Program, the department provides outreach to the community by educating members of the public on ways of reducing their environmental impact. Because motor vehicles are a significant source of air pollution, reducing vehicle miles traveled (VMT) is one way that people can reduce their impact on the environment. Sustainable communities make it easier for residents to reduce their VMT by designing the built environment so that it supports the ability to bike, walk, or take public transit to shopping, schools, and work.

DENR also advises local governments and communities on ways of promoting a healthier environment. One way local governments can promote a sustainable community is with ordinances that require sidewalks to be included in new developments. Sustainable communities reduce emissions that contribute to air quality issues in North Carolina and provide a healthier environment that promotes walking, biking, and a greater sense of community.

Community Enhancement Through Brownfields Revitalization

The department's Brownfields Program encourages the redevelopment of blighted abandoned properties that contain environmental contaminants. The US Government Accountability Office estimates that there are 450,000 to 1 million brownfield properties nationwide [5]. Prospective developers of these properties and their lenders used to shy away from purchasing them because of uncertain environ-

mental liability [6]. This left many abandoned properties that were not only not aesthetic, but also presented potential public health risks. Under the Brownfields Program, a prospective developer's environmental liability is limited to and defined by that which makes the property safe for the reuse a prospective developer proposes. The North Carolina program has prepared more than 200 agreements with developers that have encouraged an estimated capital investment of more than \$8.2 billion in redevelopment of brownfield properties [7]. Many of these projects are in urban areas, and the redevelopment of brownfields is a key component of recent trends toward smart growth, infill, and walkable communities that encourage physical activity instead of vehicle use. Redevelopment of brownfields brings public health benefits by cleaning up the environment and reducing exposure to contaminants. Such redevelopment also improves the quality of life in local communities. Recycling these properties also reduces sprawl and saves green space from development.

One prime example is the Gateway redevelopment in Winston-Salem—a redevelopment costing an estimated \$60 million built on various abandoned or idle industrial properties in the city's Old Salem area [8]. One element of the redevelopment project is the Gateway YWCA (Figure 1), which houses a state-of-the-art aquatic center. It is a premier wellness facility in the Southeast, with programs and an infrastructure designed to promote healthy lifestyles for all ages. The Gateway project also includes a mixed retail residential redevelopment known as The Summit at Gateway and the medical offices of Gateway Family Practice, all of which have helped create a healthier, walkable urban community. Without a brownfields agreement to define and address environmental liabilities, these properties would likely have remained abandoned and could have exposed trespassers to various hazards.

Some of these revitalization projects improve overall quality of life and public health in unexpected ways. Many low-income communities in urban areas have little or no access to healthy foods or food markets, and there is concern that these areas may have higher incidences of diabetes

FIGURE 1.
The Gateway YWCA in Winston-Salem



A community resource now occupies land that was once a brownfield. (Photo courtesy of the Downtown Winston-Salem Partnership)

FIGURE 2.
Vegetated Streamside Buffers (Riparian Buffer)



The Water Supply Watershed Protection Program requires that streamside vegetated buffers be protected. Buffers help stormwater runoff infiltrate the soil, reducing the quantity of pollutants entering streams and rivers. (Photo courtesy of the Division of Water Quality, North Carolina Department of Environment and Natural Resources)

and other food-related health consequences [9]. Referred to as *food deserts*, these low-income communities face a serious public health problem [10]. In a Winston-Salem neighborhood near the Gateway YWCA, 2 separate community groups advocating for seniors and others without transportation cited a supermarket as a specific need of their community. The neighborhood was a predominantly low-income area that had been deemed a *food desert* (where people have low access to a grocery store) by the USDA [11]. The community groups strongly supported a brownfields redevelopment project that brought a Food Lion supermarket to Waughtown Street [12], bringing healthy foods to the area and helping to make it less of a food desert.

Community Development Strategies to Protect Water Resources

The department is charged with protecting water quality in North Carolina and ensuring that citizens have safe water for drinking, fishing, swimming, and other recreational activities. Clean water is a fundamental and critical component of healthy, sustainable communities.

Polluted stormwater runoff is the most prevalent source of water-quality impairment in our state and the nation. *Stormwater runoff* is the term for rainfall that “runs off” of impervious (or hardened) surfaces such as rooftops, parking lots, and roadways. As the water flows along, it picks up pollutants in its path. Once the runoff reaches storm drains, it flows to the nearest creek or stream, bypassing treatment plants. However, in many areas of North Carolina, state stormwater programs require that the effects of stormwater be mitigated in some fashion. Common stormwater pollutants include sediment, nutrients, bacteria, oil, and toxic substances such as metals, pesticides, and herbicides.

Stormwater runoff can affect aquatic life and human recreational activities and can pose threats to human health and

safety. Large volumes of stormwater can cause floods that damage property and cause unsafe conditions for people. Stormwater also carries the nutrients phosphorus and nitrogen, which promote an overabundance of aquatic plants and algal blooms. These contribute to problems that affect recreational areas, such as weeds around boat propellers, fouled swimming areas, and fish kills. Algal blooms also contribute to taste and odor problems with drinking water, increasing treatment costs. People with open cuts or other health problems who come into contact with untreated stormwater risk possible infection from bacteria carried by it.

DENR’s Water Supply Watershed Protection Program aims to protect drinking water sources by limiting the impact of development, a major contributor to stormwater runoff pollution. The program sets mandatory standards for development in the watersheds of drinking water sources. These standards include limiting the amount of surface area that may be covered by impervious substances, managing stormwater volume, controlling pollutant loading, and protecting streamside vegetated buffers (Figure 2). In water supply watersheds, new wastewater treatment facilities and landfills are prohibited or are required to have additional controls.

In recent years, DENR has started encouraging the use of low-impact development (LID), a planning and design approach that improves water quality protection by mimicking natural hydrology. Through the use of best management practices, LID design slows the flow of stormwater runoff, allowing it to infiltrate the soil onsite, unlike traditional designs, which result in discharges to surface waters. Elements of LID design include rain gardens, permeable pavers (Figure 3), rain barrels, and cisterns. Implementing LID practices and principles improves water quality and reduces the overall impact of development.

Green infrastructure practices, such as maintaining *riparian buffers* (areas of vegetated or forested land border-

FIGURE 3.
Permeable Interlocking Pavers



Low-impact development encourages the use of permeable pavers to allow stormwater to infiltrate the soil. (Photo courtesy of the Department of Biological and Agricultural Engineering, North Carolina State University)

ing a body of water, which stabilize the stream bank), open spaces, and greenways, can also be used to support the principles of LID. In addition to improved water quality, flood mitigation, water conservation, and improved air quality, green infrastructure provides greater recreational opportunities to the community.

Looking to the future, DENR is a member of a new statewide partnership formed to address the ever-growing need for clean drinking water. The North Carolina Source Water Collaborative includes representatives from government, academia, and nonprofit organizations, as well as other stakeholders. The group seeks to identify and develop tools that can be used by local communities to promote good stewardship of the state's drinking water sources, with an ultimate goal of protecting the quality and quantity of drinking water for future generations.

Integrating Natural Resource Conservation

State land-conservation programs can protect air and water quality and offer recreational opportunities. Green infrastructure planning is becoming a key component of community development, along with traditional gray infrastructure planning (for roads, sewer, water, and other utilities) [13]. Green infrastructure is an interconnected green space network that includes natural areas, public and private conservation land, and working (agricultural) land. Several collaborative efforts support green infrastructure planning and management as a means of enhancing natural and human communities. The department's Conservation Planning Tool, funded by the Natural Heritage Trust Fund, identifies important natural heritage areas, critical surface waters, farm and forest lands, and wildlife habitat corridors [14]. This information is publicly available and is used by local and regional planners, nonprofit organizations, the DOT, other state agencies, and private developers. For example, DENR is collaborating with the DOT on its statewide bicycle and pedestrian master plan using this tool to assist in linking key conservation areas with bicycle and pedestrian corridors.

DENR also partners with the North Carolina Department of Agriculture and Consumer Services (DACS). Through the North Carolina Agriculture Development and Farmland Protection Trust Fund and other DACS programs, the state works to assist farmers. Agricultural data is provided to DENR and incorporated into the Conservation Planning Tool; then the tool is available to DACS to assist in its program prioritization. Agriculture and agribusiness (food, fiber, and forestry) is still the No. 1 industry in North Carolina; in 2009, it provided nearly \$70 billion of value-added income in the state [15]. Protecting the viability of agricultural land is critical for the economy. Such land can also serve as wildlife habitat and provide wildlife corridors, and it is part of the overall green infrastructure.

In addition to the Natural Heritage Trust Fund and the North Carolina Agriculture Development and Farmland

Protection Trust Fund, the state has 2 other sources of funding for natural resource conservation. The Clean Water Management Trust Fund (CWMTF) provides funding to assist local governments and conservation nonprofits in protecting riparian buffers for streams and greenways, while and the Parks and Recreation Trust Fund provides matching funds for local parks and recreation projects. Open space and parks provide opportunities for physical activity. According to a recent study of the parks and recreation system of Mecklenburg County conducted by the Trust for Public Land [16], the health savings resulting from physical activity in that county's park system in 2009 exceeded \$81 million. The report documents that the parks and recreation system has also increased property values, increased tourism, and enhanced the county's ability to deal with the environmental challenges of stormwater management and air pollution.

In summary, it is vitally important to protect North Carolina's air and water quality and to provide recreational opportunities for its citizens. Doing so will result in healthier, more sustainable communities that will better position the state for economic success. **NCMJ**

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