Executive Summary

The State of the Environment report, required by G.S. 143B-279.5.[1], provides an opportunity for the N.C. Department of Environmental Quality, or DEQ, to detail its accomplishments in improving North Carolina's air, land and water quality. DEQ's primary mission is to protect the environment and natural resources for the benefit and enjoyment of everyone living in or visiting our state, and we are proud of the tremendous advancements we have made in recent years. In this report, we will also define our plans for attaining further improvements and highlight the challenges ahead.

North Carolinians are breathing cleaner air today than at any time since the Clean Air Act was enacted in 1970. During the past 15 years, North Carolina has slashed its toxic air pollutant emissions by more than 80 percent and cut its criteria pollutant emissions in half. For the first time in almost two decades – and in spite of stricter standards and a growing population – the entire state meets all federal air quality standards. In July 2015, the U.S. Environmental Protection Agency, or EPA, officially recognized North Carolina's last nonattainment area, the Charlotte metropolitan area, as complying with the 2008 federal air quality standard for ozone, a milestone that capped years of improvements in air quality across North Carolina. All of the state's air quality monitors are in compliance with the more protective 2015 ozone standard that EPA announced on Oct. 1, and local air monitoring programs in Buncombe, Forsyth and Mecklenburg counties also show compliance. North Carolina has also reduced carbon dioxide emissions from fossil fuel combustion by more than 20 percent since 2005 and is on track to reach a 30 percent reduction by 2030.

North Carolina has improved and protected water quality so effectively that most of the state's lakes, rivers, streams and estuaries now meet their designated use. Our state ranks first in the Southeast and is one of the top five of the 30 coastal states in beach water quality[2]. North Carolina has the second largest and one of the most productive estuarine systems on the East Coast. A 50 percent increase in the number of viable coastal fish stock from 2014 to 2015 demonstrates the success of North Carolina's management strategies.

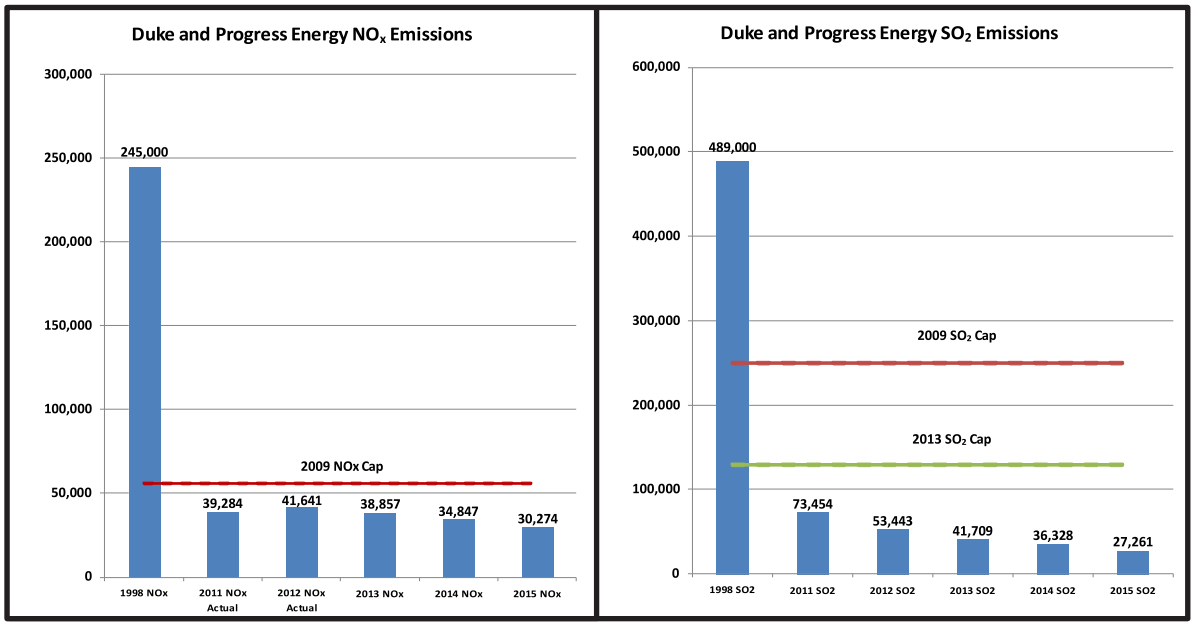
Air Quality

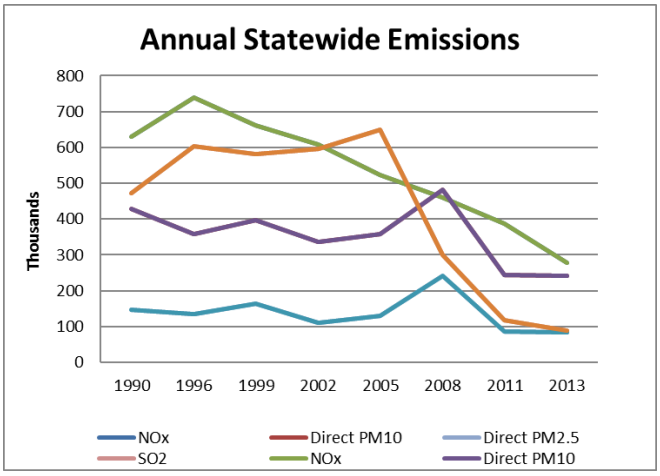
North Carolinians are breathing cleaner air today than any time in decades. State leaders, agencies, public utilities and private industries have taken significant steps in recent years to address air quality concerns – notably ozone and particle pollution – and this work is achieving impressive results. For example, harmful emissions from coal-fired power plants operating in North Carolina have been drastically cut following the passage of the N.C. Clean Smokestacks Act in 2002. Equipped with 21st century control technology, the state's coal-fired power plants are among the most efficient and least polluting coal fleet in the nation.

[1] The report shall include identification and analysis of current environmental protection issues and problems; air and water resource trends; pollution inventories; efforts and resources needed to study, identify, and implement solutions to solve potential problems; natural resource protection goals and strategies; and suggested legislation, if necessary.

[2] The ranking was conducted by the National Resources Defense Council.

Clean Smokestacks Act Emissions Reductions



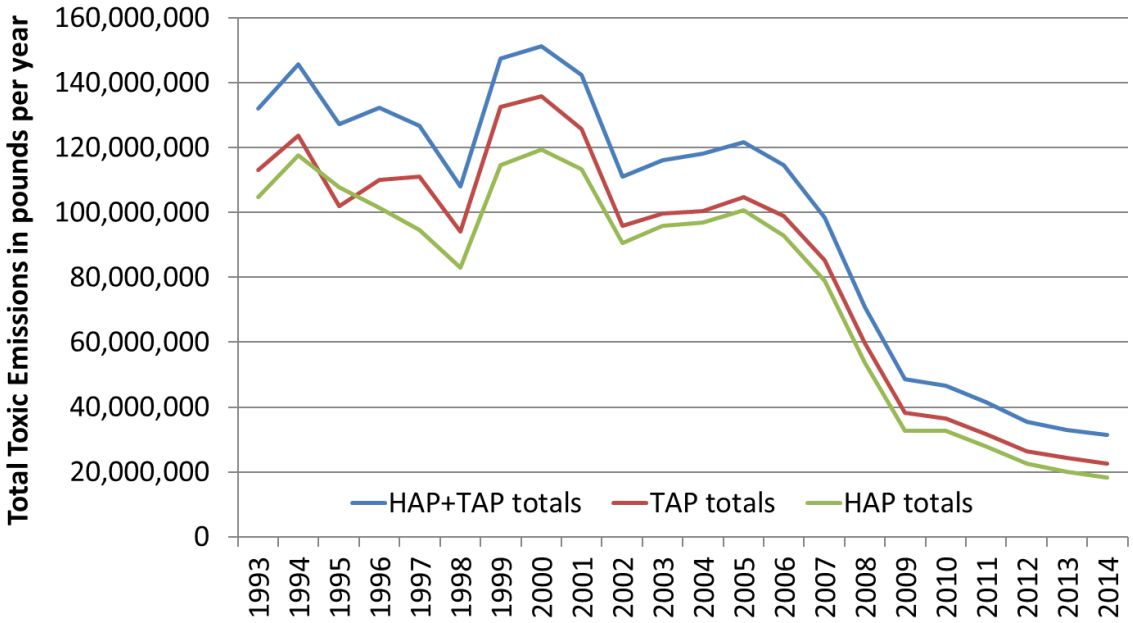


Ambient Air Measurements

Air quality and visibility have improved substantially in North Carolina. In the past, extensive portions of North Carolina had ozone levels exceeding the health-based standard, and the areas once officially designated by the EPA as not meeting air quality standards included more than 30 counties in the Charlotte, Fayetteville, Rocky Mount, Triad and Triangle metro areas as well as the Great Smoky Mountains National Park. Today all areas of the state qualify as meeting the national air quality standards established by EPA for the protection of public health and the environment. The following charts show measured levels of air toxics, carbon monoxide, lead, ozone, particle pollution (PM), sulfur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide and visibility.

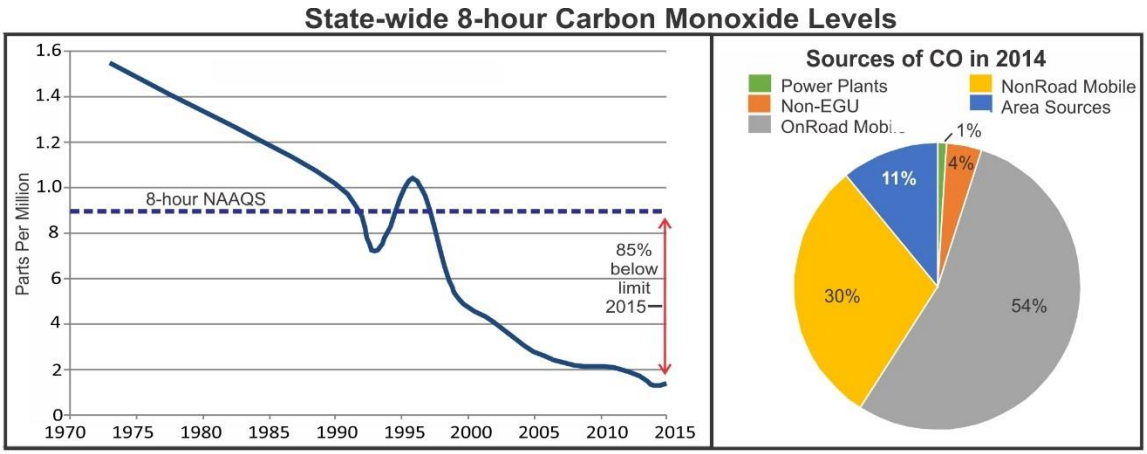
Air Toxics

Industry has taken many measures to reduce its hazardous air pollutants (HAP) emissions. These include upgrading processes, reformulations to non-hazardous chemicals, fuel switching and the application of state-of-the-art air pollution control technology.



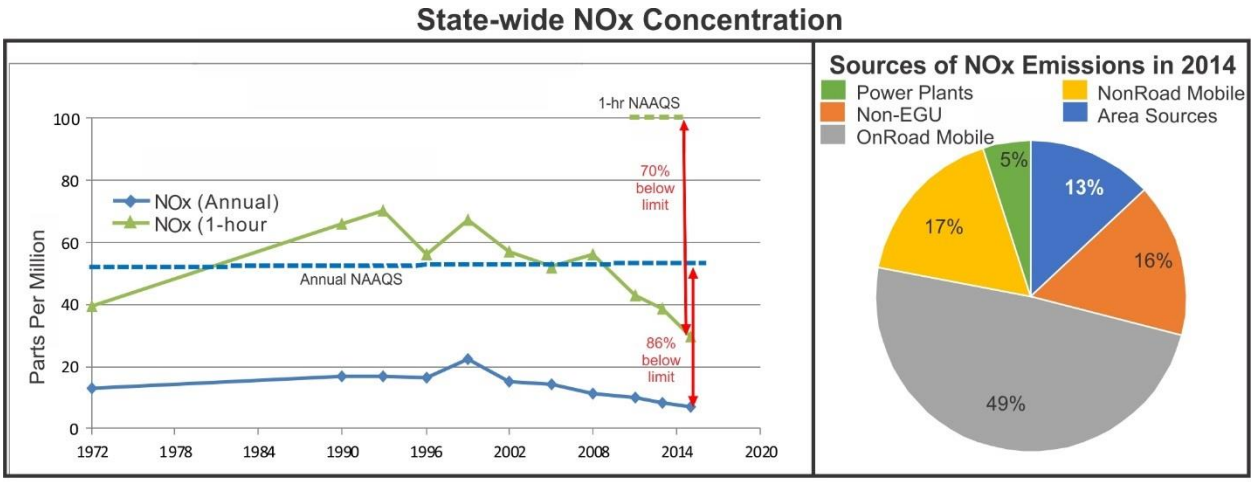
Carbon Monoxide

Improvements in exhaust controls, catalyst design and fuel control systems have contributed to significant reductions in ambient carbon monoxide (CO) concentrations and other pollutants. The E P A finds that new cars, trucks and off-road vehicles are about 99 percent cleaner for common pollutants (such as carbon monoxide, nitrogen oxides (NOx), particulates and hydrocarbons) as compared to 1970 vehicle models.



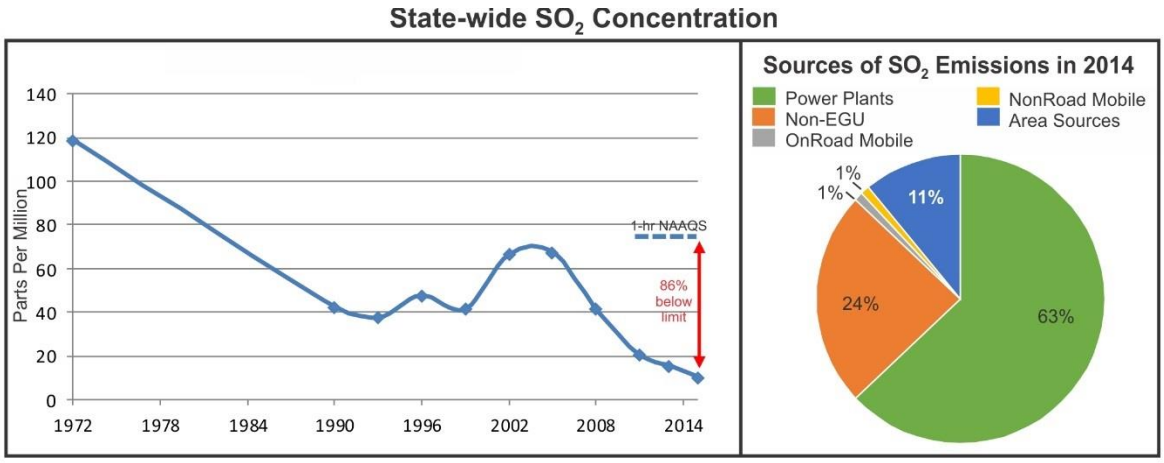
Nitrogen Dioxide

Improved vehicle standards, fuel efficiencies, ultra-low NOx burners and selective catalytic reduction emissions controls have contributed to substantial reductions in NOx emissions. For example, coal-fired power plants in North Carolina have installed control devices that capture up to 90 percent of the nitrogen oxide emissions, relative to uncontrolled levels.



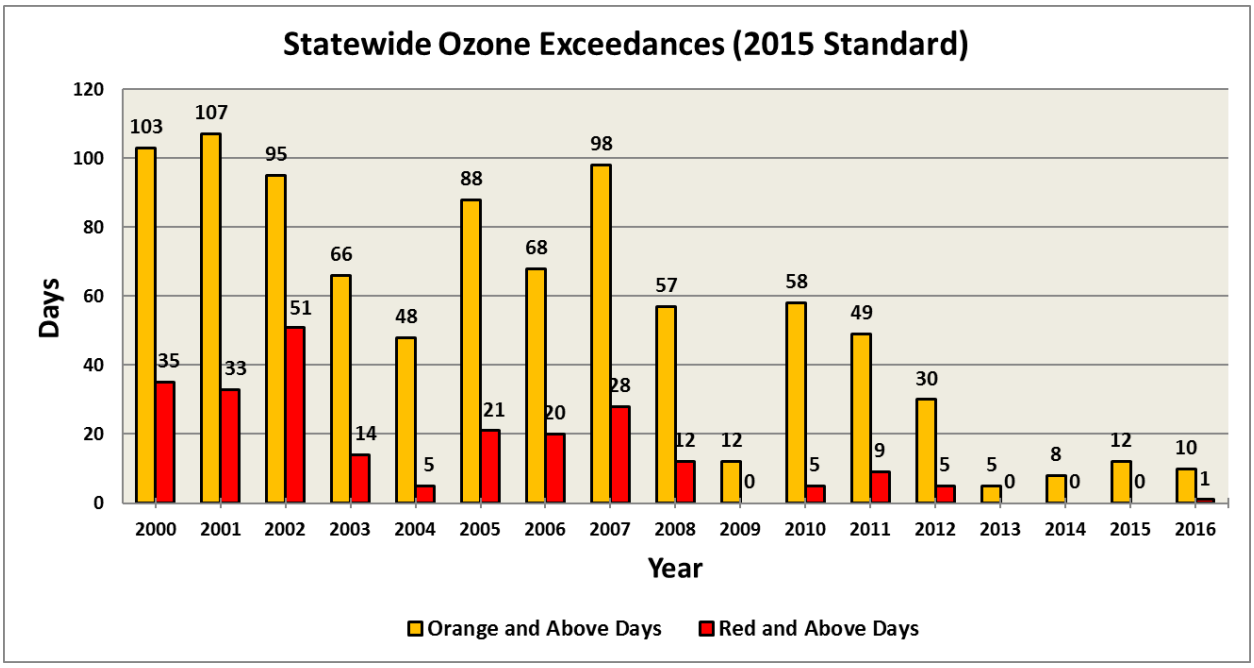
Sulfur Dioxide

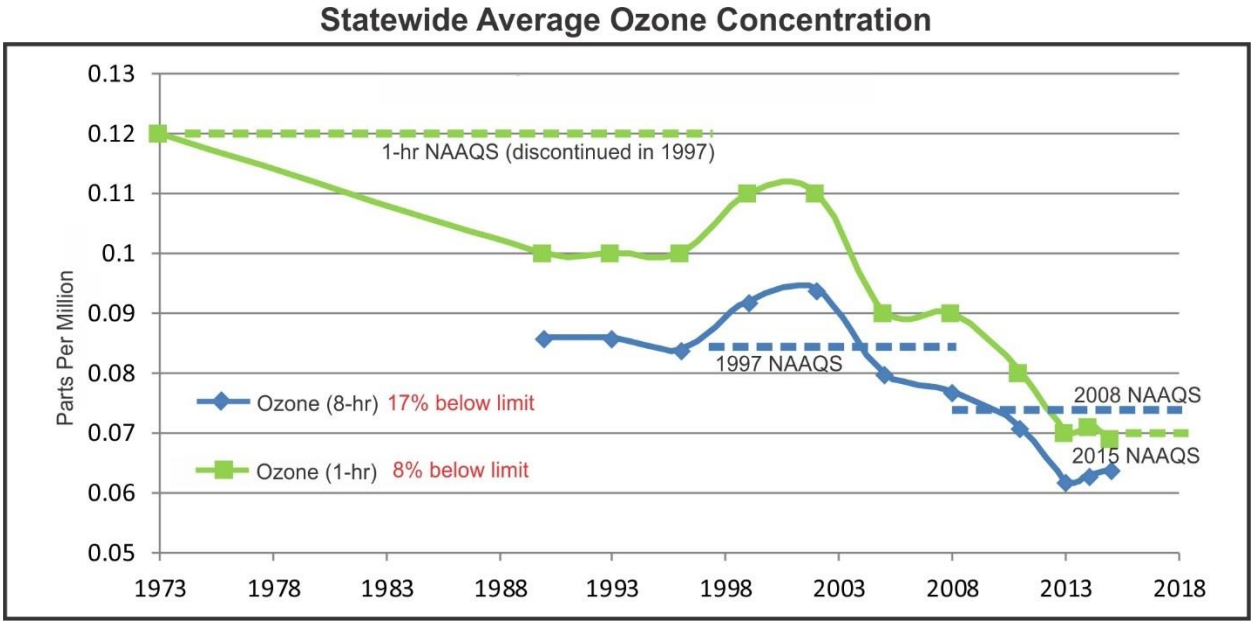
Lower sulfur content in fuel, state-of-the-art scrubbers and the increasing use of natural gas for electricity generation have led to substantial drops in sulfur dioxide (SO2) emissions. Additional work is ongoing to ensure short-term SO2 impacts near specific sources are being abated.



Ozone

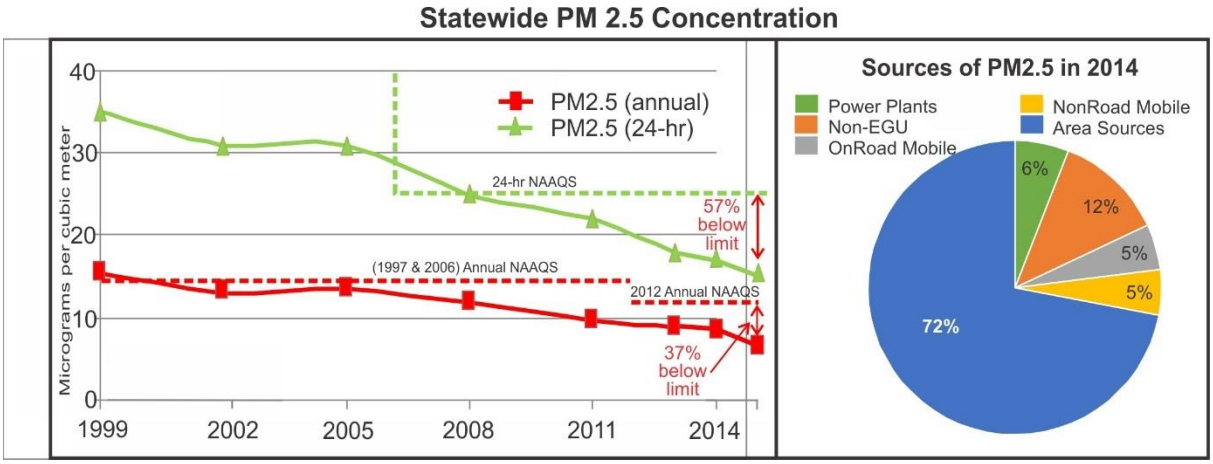
Reductions in NOx emissions have markedly reduced the formation of ground level ozone. In fact, ozone levels in North Carolina were the lowest on record during the past four years, with the entire state now meeting the 2015 ozone standard. The following chart shows statewide ozone exceedances for each year since 2000.





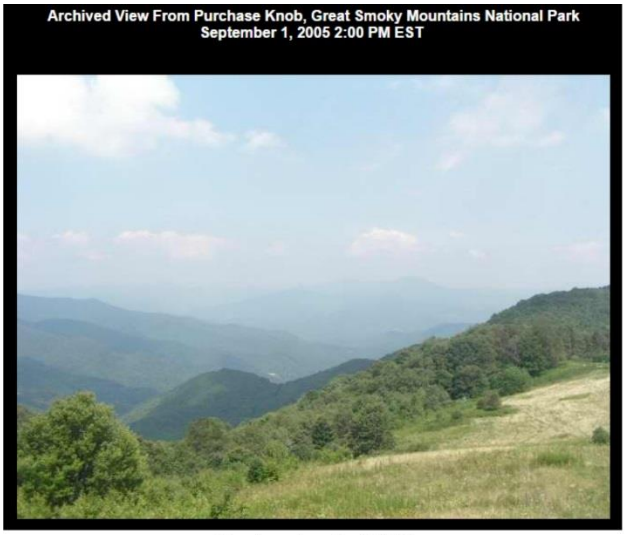
Particle Pollution

Large reductions in direct particulate matter and nitrogen oxide and sulfur dioxide emissions from fossil fuel-fired power plants and mobile sources have led to significantly lowered ambient particulate matter levels. The chart below illustrates the decline of fine particle or “PM2.5” (those particles 2.5 micrometers or smaller in diameter) concentrations in North Carolina.



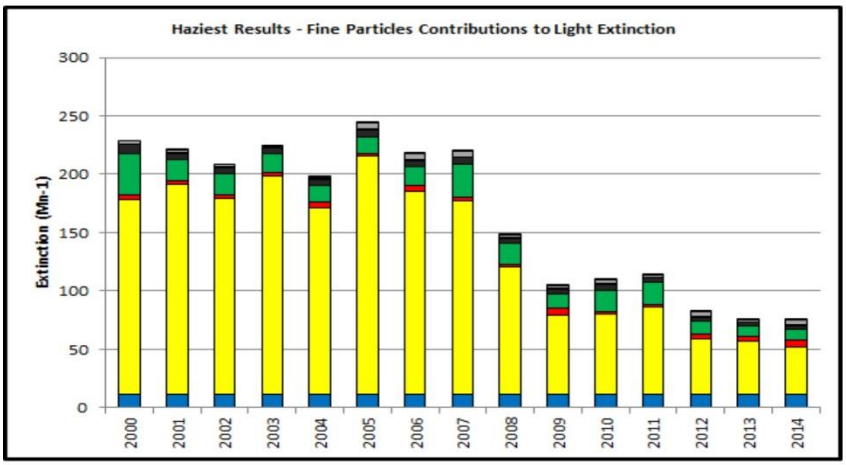
Visibility

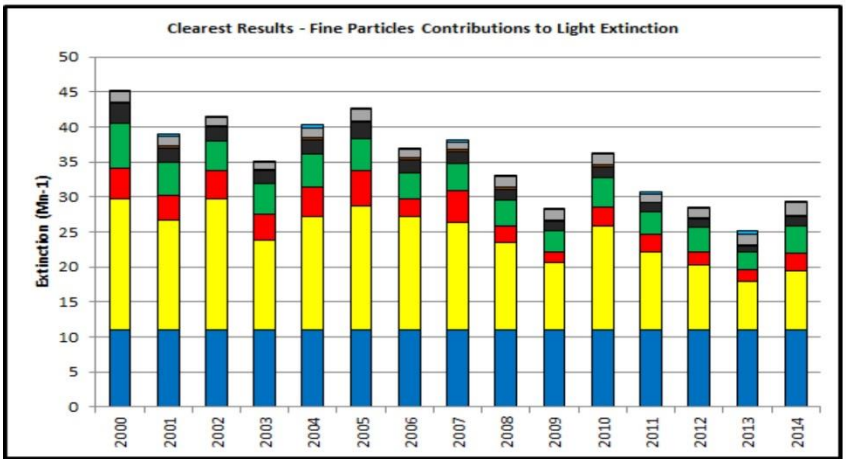
The scenic panoramas in our national and state parks are clearer due to reductions in sulfur dioxide emissions and other air pollutants that scatter or absorb light. During hazy days, most of light extinction is caused by ammonium sulfate particles. However, these fine particles have been significantly reduced resulting in better visibility. The photos below, which capture the clearest day of the month, show an increase in visibility distance from 2005 to 2015.

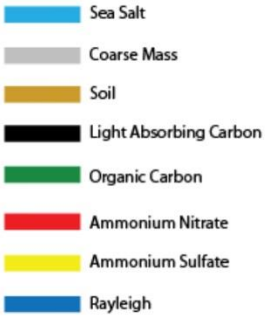


September1, 2005

August 28, 2015







The standard visual mile range on the haziest days
1996: 10 miles
2014: 33 miles

The standard visual mile range on the clearest days
1996: 54 miles
2014: 89 miles

Emerging Challenges

The EPA issued a new 8-hour ozone standard on Oct. 1, 2015. The new standard is set at 70 parts per billion (the 2008 ozone standard was set at 75 parts per billion). As part of the ozone standard implementation process, on Sept. 30, 2016, the state submitted a recommendation for designation of areas in North Carolina to EPA. Under the Clean Air Act, the designations can be attainment (monitor shows compliance with the new standard), nonattainment (monitor shows a violation with the new standard) or unclassifiable (not enough data to determine whether monitor complies with the standard or not). Three years of data are needed to evaluate whether a monitor complies with the new standard. The DEQ recommended that all areas of North Carolina be designated attainment, considering the three years of complete, quality-assured data from 2013 to 2015, and the preliminary data for 2014-2016. The recommendation can be found at the following link:

https://ncdenr.s3.amazonaws.com/s3fspublic/Air%20Quality/planning/ozone/2015_Ozone_DEQ_Designation_Recommendation.pdf

The EPA is scheduled to finalize designations by Oct. 1, 2017, so the 2017 ozone season is an important one for the Charlotte area (current design value is attaining at 70 parts per billion, or ppb). National requirements to reduce the sulfur content in fuel to 10 parts per million, or ppm, began on Jan. 1, 2017. Less sulfur in fuel will result in less fouling of catalytic converters, which helps restore or preserve the effectiveness of the controls in reducing NOx – the most

important precursor to ozone formation. These emissions reductions in the mobile sector should help the Charlotte area continue to comply with the new ozone standard.

Water Quality

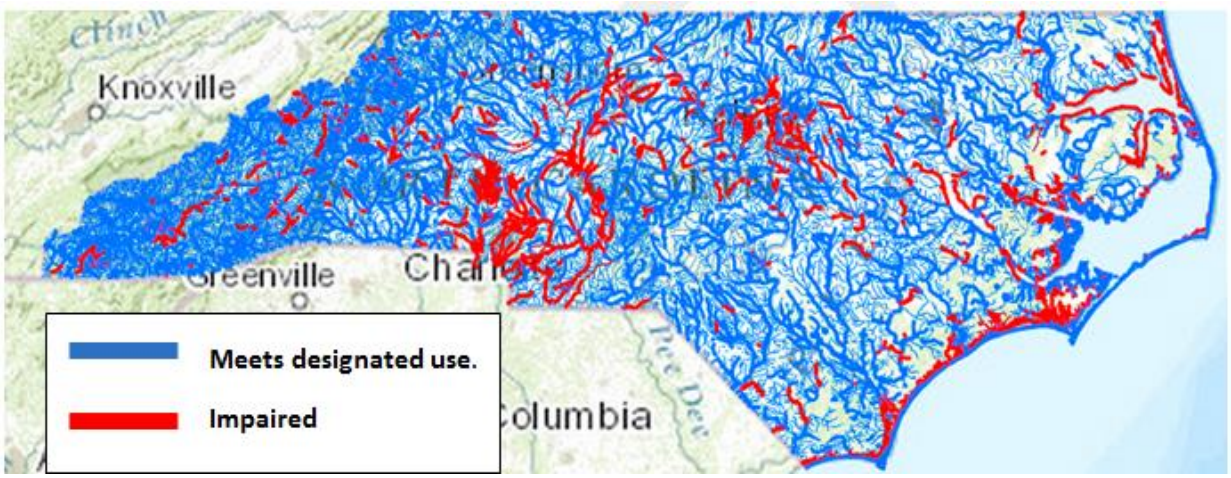
Clean water is essential in supporting the natural environment, public health and a vibrant economy. Much progress has been made during the past four decades to improve the quality of North Carolina's water supply. When the Clean Water Act passed in 1972, two-thirds of the nation's waterways were unsafe for swimming or fishing.[3] Today, the majority of monitored surface waters in North Carolina support their intended uses and are classified as being in good to excellent condition. Yet many challenges remain. Thirty-five percent of the state surface waters contain at least one parameter indicating high turbidity, or biological or chemical pollution, and a statewide mercury fish consumption advisory has been in place since 2008. A Statewide Mercury Total Maximum Daily Load (TMDL) was completed in 2012 to address this issue.

Surface Water

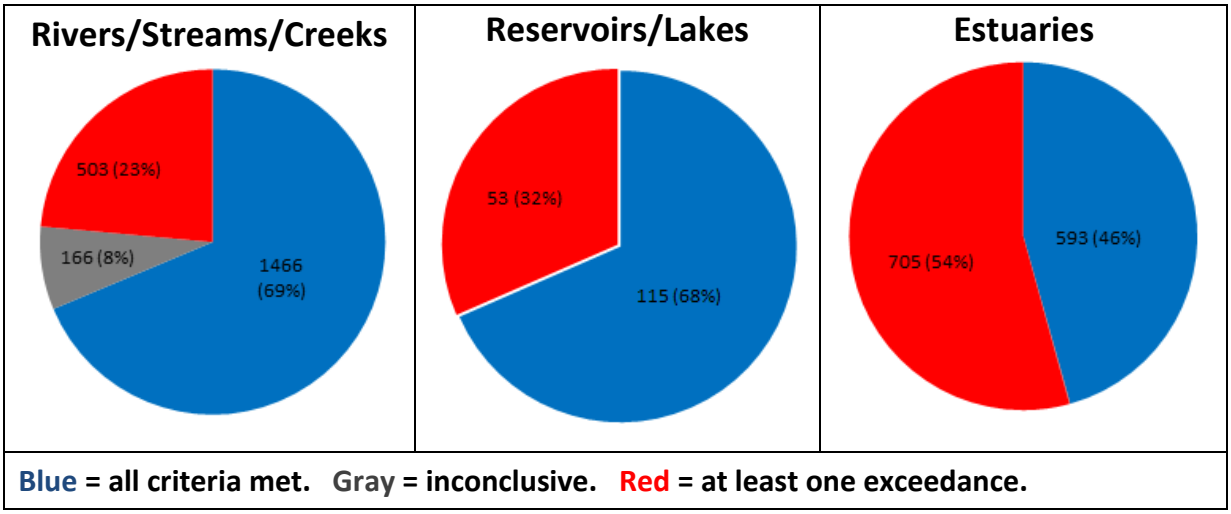
All rivers, streams and lakes have been classified by their designated "best uses" and are subject to standards established to protect and maintain those uses. Biological, chemical and habitat assessments are conducted to determine if these waters are meeting standards. The assessment of water quality in North Carolina is required under Sections 303(d) and 305(b) of the Clean Water Act and is to be reported every two years. This assessment is also known as the Integrated Report. The most recently completed 2014 Integrated Report was finalized in February 2015 (note the state is currently in the process of finalizing the 2016 Integrated Report). Data used for the 2014 assessment covered calendar years 2008 through 2012, and included information from nearly 7,000 monitoring stations. Sources of data include the Division of Water Resources' Ambient Monitoring System, NPDES Discharge Monitoring Coalitions, DWR's Biological Assessment Unit, DWR's Stream Fish Community Program, the state Division of Marine Fisheries, the N.C. Department of Health and Human Services' Division of Public Health, and the United States Geological Survey, as well as other third party entities, including local governments, as well as environmental, industry, municipal and university groups.

Assessments result in a determination as to whether the water body is meeting water quality criteria (indicating there is not a water quality problem) or exceeding criteria (indicating there is a water quality problem, also known as impairment). Data collected also may be inconclusive as to whether there is an impairment. The North Carolina Environmental Management Commission establishes the Assessment Methodology, which sets the process used to determine if a parameter is exceeding the criteria. Assessment criteria are based on frequency of exceedance of numeric and narrative water quality standards. All parameters collected in a waterbody or assessment unit (a spatially-defined portion of a waterbody) are assessed independently of each other so a single assessment unit can have a mixture of results, with some that are meeting, exceeding or inconclusive. A snapshot of the 2014 water quality assessment interactive map, which identifies the supporting and impaired waters, is shown below.

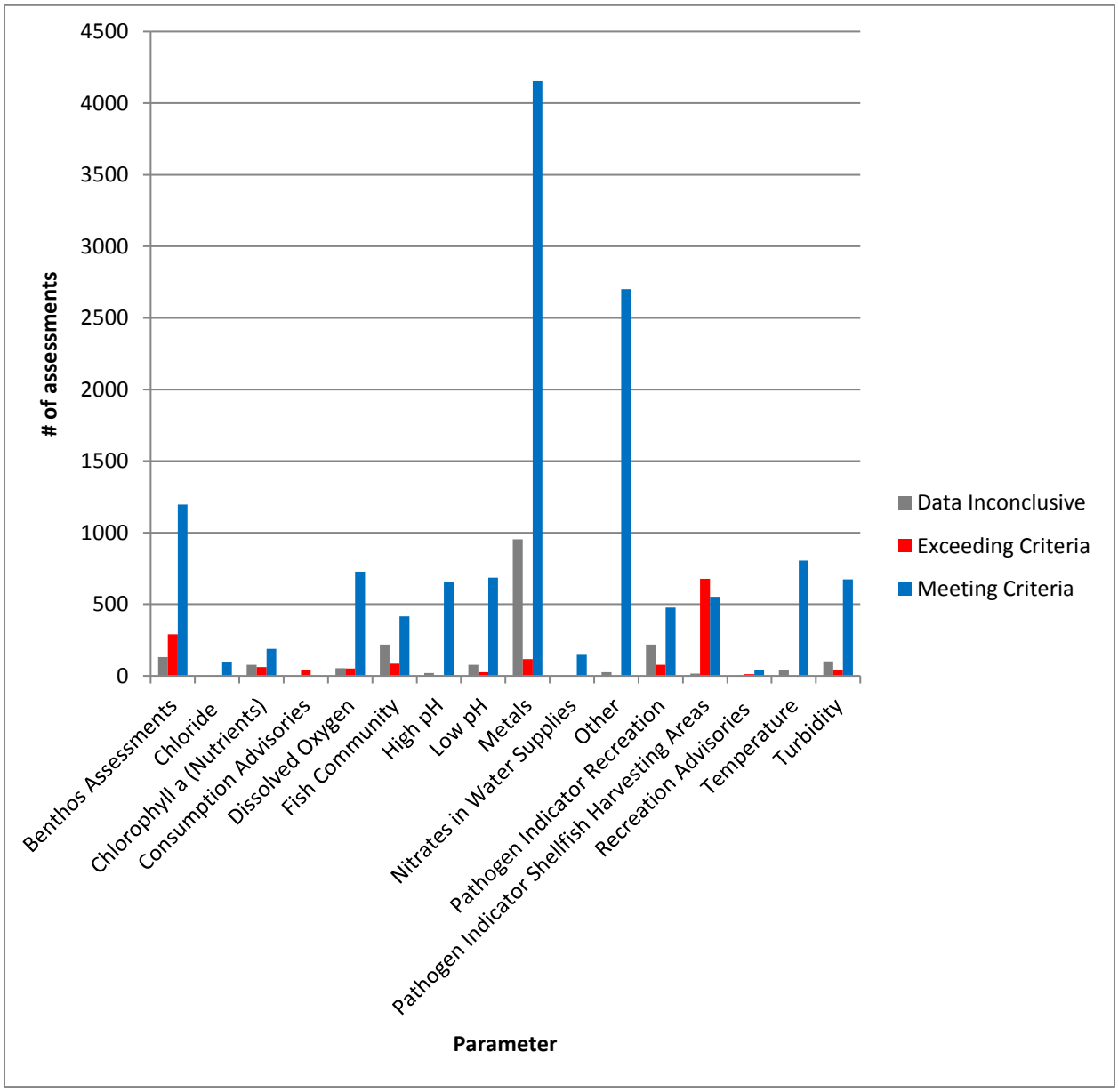
[3] Stoner, Nancy. "Celebrate the 40th Anniversary of the Clean Water Act." U.S. Environmental Protection Agency. http://blog.epa.gov/blog/2012/10/cwa40/



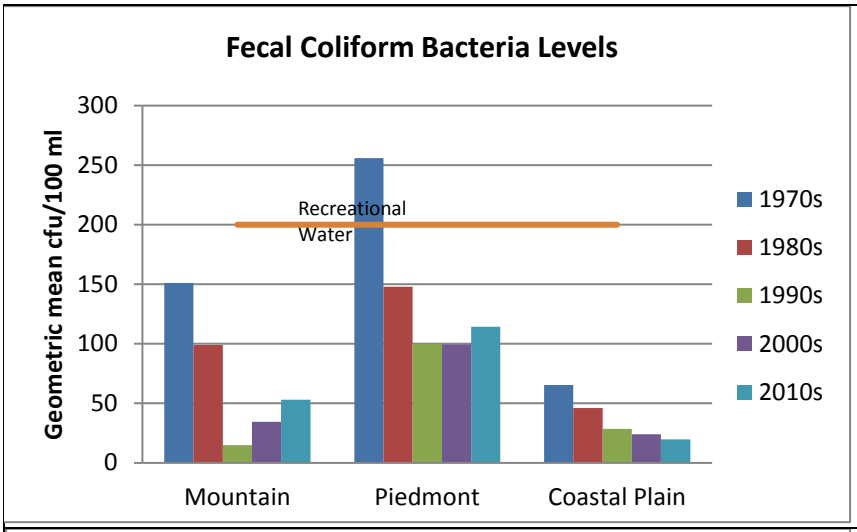
For the 2014 North Carolina Integrated Report required under Sections 303(d) and 305(b) of the federal Clean Water Act, 17,438 water quality assessments were made in 27 percent of the state's 13,344 waterbodies. Of these assessments, 80 percent met criteria, 9 percent exceeded at least one criterion, and 11 percent were deemed inconclusive. Sixty-one percent of the assessment units themselves had no parameters exceeding criteria, and 35 percent had at least one parameter exceeding criteria, indicating a water quality concern. Assessment results are summarized for the three waterbody types in the pie charts below.



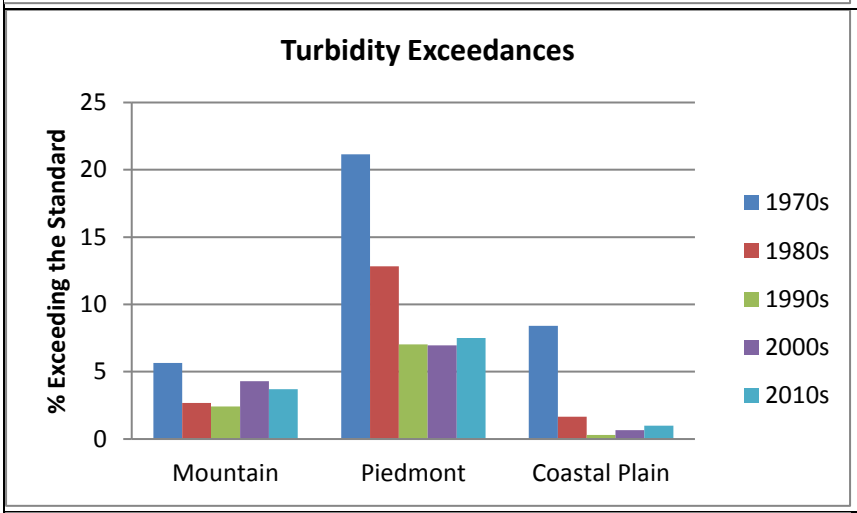
The following is a summary of parameters assessed during the 2014 water quality assessment. Pathogen indicators in shellfish harvesting waters have the most assessments exceeding criteria with 678 followed by benthos with 290.



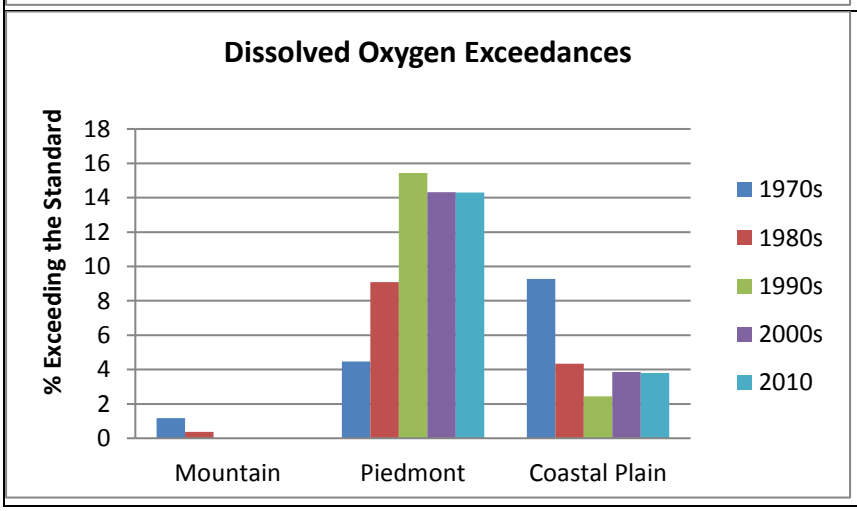
Water quality differences have been observed across the Mountain, Piedmont and Coastal Regions of the state. Impairments are most prevalent in the Piedmont region. The distribution of impairments for fecal coliform, turbidity and dissolved oxygen across the regions are summarized in the charts below.



Fecal coliform bacteria indicate that water is polluted with human or animal waste. Discharge and runoff water containing human or animal waste increase the bacteria levels. Failing septic systems can be a source of contamination.



Turbidity measures suspended solids in water. Turbid conditions impair water clarity, plant and animal growth, the usefulness of the water body as a drinking water source and hinder the ability of trout to reproduce. High turbidity is generally the result of erosion and stormwater runoff.



Dissolved oxygen in water is necessary for aquatic life to survive. Water turbulence, wind and plant respiration increase dissolved oxygen while wastewater contaminants, aquatic organisms and other conditions may consume dissolved oxygen. It generally declines with depth of water.

North Carolina's Nutrient Management Strategies

Nutrient pollution, which is generally comprised of nitrogen and phosphorus compounds, remains one of North Carolina's most challenging water quality issues. Nutrients come from sources such as wastewater treatment plants, stormwater that flows over rooftops, roads, lawns and farm fields. Nutrients are required for plant life to grow, but in excess they can lead to potentially toxic algae blooms and a host of related water quality problems including fish kills, skin irritation for swimmers, and drinking water taste and odor issues.

In response, the state Division of Water Resources leads the development, implementation and oversight of regulatory nutrient management strategies to restore North Carolina's most valuable waters. Comprehensive and customized strategies are in place to restore the Tar-Pamlico and Neuse estuaries as well as Falls and Jordan lakes. These strategies are designed to equitably reduce nutrient loading from different regulated sectors and eliminate existing chlorophyll *a* impairments, the yardstick for excessive algal growth.

Table 1: Summary of nutrient management strategy goals and implementation

Nutrient Strategy	Baseline Year	Launch Year	Subwatershed	Nutrient Reduction Goal (from baseline)
Falls Lake	2006	2011	Upper Falls	40% N, 77% P
			Lower Falls	20% N, 40% P
Jordan Lake	1997-2001	2009	Upper New Hope	35% N, 5% P
			Lower New Hope	No increase, N & P
			Haw	8% N, 5% P
Neuse	1991-1995	1997	-	30% N
Tar-Pamlico	1991	2000	-	30% N, no increase P

Lake Strategies

Despite the challenges associated with meeting Falls Lake's aggressive nutrient reduction goals, the state Division of Water Resources and regulated stakeholders continue to work together and the Falls Lake nutrient strategy remains on track. Since the advent of the strategy in 2011, much of the lower lake has been removed from North Carolina's impaired waters list. A more thorough examination of the strategy and its various elements was provided in a 2016 status report. Also, the Division of Water Resources and the Upper Neuse River Basin Association have invested considerable financial and staff resources to evaluate, assign credit for, and make available many nutrient-reducing practices. Approval of these practices will ultimately result in more regulatory compliance options for local governments in the watershed.

In contrast, several pieces of legislation have halted implementation of key elements of the Jordan Lake strategy. Wastewater, buffer and agricultural regulations remain in place, but rules designed to reduce stormwater pollution impacts from new and existing development have been put on hold by the legislature and are not being implemented. Jordan Lake was also a test site to examine whether solar-powered epilimnetic mixers could reduce algal growth in the lake. After two field seasons, water quality benefits were not observed and the devices were removed in 2016.

S.L. 2016-94 contained several provisions related to the Jordan and Falls lakes' nutrient strategies. Among its provisions, rule re-adoption efforts in the Jordan and Falls lakes watersheds are delayed until a multi-year nutrient study is completed by the recently formed N.C. Policy Collaboratory.

High Rock Lake is the next waterbody slated for nutrient strategy development. The state Division of Water Resources finalized the lake model in 2016, marking a major milestone. However, the nutrient-related water quality standards that must be attained in High Rock Lake are under review pursuant to a federal directive to states. As criteria recommendations are developed for High Rock Lake, the state Division of Water Resources will begin engaging stakeholders throughout the region to develop a tailored nutrient strategy approach.

Estuary Strategies

The Neuse and Tar-Pamlico Estuary management strategies have been in place for 20 and 17 years, respectively. They have resulted in some modest successes, including nitrate loading reductions in both river basins despite significant population increases. However, while all regulated sectors continue to meet their obligations in these watersheds, full restoration of these estuaries has not been attained and total nutrient loads have been trending upwards. Therefore, a reevaluation of these estuarine strategies by the state agency is underway in concert with the statutorily-required rules re-adoption process.

Animal Feeding Operation Program

The Animal Feeding Operations (AFO) program oversees and permits those animal facilities required by statute to obtain a permit. The program administers permits for approximately 2,300 Concentrated Animal Feeding Operations (CAFOs). Permits authorize the land application of animal wastes generated from swine (2,100 facilities), cattle (182 facilities), and poultry (18 facilities) facilities that meet or exceed threshold animal populations. Most poultry facilities distribute dry poultry waste (litter) for disposal under a permitted by rule allowance in the administrative code, and the AFO program does not receive waste disposal information on these facilities. Statutes requires the Division of Water Resources to inspect every permitted facility at least once per year. Also, staff respond to complaint calls and weather-related events at permitted sites.

The AFO program was established in 1996 by Senate Bill 1217 and began issuing permits in January 1997. A moratorium on new/expanding swine operations that use lagoon/sprayfield systems was put in place in 1997 and made permanent in 2007 with the passage of Senate Bill 1465. Senate Bill 1465 established that any new or expanding swine operation must have a treatment system that satisfies five environmental performance criteria to be permitted. There is only one swine operation that has a permit to expand its operation. The 2007 Senate Bill 3 requires utilities to generate/purchase a scheduled amount of energy generated from swine and poultry wastes. There are about 12 permitted swine facilities with energy generating systems and more are in development.

There is an ongoing Environmental Justice (EJ) Complaint concerning the AFO permits specifically related to the location of permitted swine facilities near areas of low socio-economic status. The state Department of Environmental Quality, the EPA, and the complainants are engaged in discussion to resolve the complaint.

Hurricane Matthew's Effect on Water Quality

Following Hurricane Matthew, which impacted eastern North Carolina on Oct. 8, 2016, the state Division of Water Resources conducted water quality monitoring in affected areas. Due to the enormous amount of rainfall that occurred across the Upper Coastal Plain and Sandhills regions, flood conditions developed and created waste lagoon inundation, wastewater treatment facility flooding and shutdowns, and large areas of municipal flooding. Initial monitoring priorities were based on accessibility. Site visits started from western portions of river basins, then progressed towards the Interstate 95 corridor and then east as flooding receded. Phase 1 monitoring efforts took place within three weeks of

the storm. Sites were chosen based on current Ambient Monitoring Program locations and included additional parameters to identify problems associated with wastewater treatment facilities, livestock operations, sources of fuel spills and subsequent loading to estuaries. These sites will provide comparative data from past storms similar in magnitude as well as long term normal flow conditions.

For the first-round monitoring effort, physical and chemical samples were collected in 24 counties, seven river basins (Cape Fear, Neuse, Lumber, White Oak, Tar-Pamlico, Roanoke and Chowan), and 30 monitoring sites. A total of 396 samples were collected. The first-round effort was completed Oct. 20, 2016. Evaluations of physical and chemical samples collected —after Hurricane Matthew indicate overall low levels of various pollutants. Many of the areas impacted by the floods are exhibiting lower dissolved oxygen and pH levels. This is to be expected after large rainfall events such as hurricanes that effectually flush backwater areas along rivers and streams that normally do not flow. The results from the second round of sampling are under review.

Emerging Contaminants

The state monitors and regulates pollutants if scientific research concludes that such regulation is necessary to protect public health and the environment. As such, new, or emerging contaminants can include constituents found in surface and groundwater personal care products, cleaning products and modern medicines. Some of these contaminants are under evaluation by the U.S. Environmental Protection Agency for potential inclusion as state water quality standards.

Pharmaceuticals and Personal Care Products (PPCPs) represent a variety of chemicals from products such as human-prescribed drugs and hormones, over-the-counter medications, anti-microbial products, sunscreen products, veterinary medicines and growth hormones. Analytical advancements have made it possible to detect these chemicals in natural waters and scientific studies show that these chemicals occur in the nation's surface waters. Aquatic life exposed to these chemicals may suffer a variety of adverse health effects such as reproductive failure and the production of intersex offspring. North Carolina does not have water quality standards for PPCPs and they are not part of routine water quality monitoring. PPCPs are also not always removed from industrial and wastewater effluents using standard treatment technologies.

1,4-dioxane is an organic compound that readily dissolves in water at all concentrations. It has been identified by the EPA as a potential contaminant of concern in public drinking water and was recently monitored in selected finished drinking water supplies nationwide under the EPA's Third Unregulated Contaminant Monitoring Rule (UCMR3). The UCMR3 data set is used to determine the extent of contamination in water supplies and in consideration of new federal drinking water regulations. The EPA characterizes 1,4-dioxane as "likely to be carcinogenic to humans." It is a commonly-used industrial solvent and byproduct of many chemical operations, is persistent in the environment, and is difficult to remove through standard wastewater treatment processes.

The state Division of Water Resources is monitoring bromide and 1,4-dioxane in selected surface waters that are used as public drinking water supply sources. The effort enables the state agency to better protect the approximately 6,000 public water systems in North Carolina that serve about three-fourths of the state's population, including homes, businesses, schools, restaurants and other public facilities. The state Division of Water Resources' monitoring will help identify potential sources of these contaminants so they can be regulated, as necessary, in National Pollutant Discharge Elimination System (NPDES) permits.

Bromide in surface water has been associated with industrial and agricultural chemicals and coal ash facilities. It is a health concern due to its contribution to the formation of trihalomethanes (THMs). THMs are disinfection byproducts resulting

from chlorine disinfection treatment of drinking water. Trihalomethanes are probable human carcinogens and are regulated under the federal Safe Drinking Water Act as maximum contaminant levels (MCLs).

Chromium and Hexavalent Chromium (Chromium VI) The toxicity of chromium varies with its chemical form in the environment. There are a number of ongoing investigations by the EPA and other federal agencies to determine an appropriate level of safety. DWR is carefully following these federal actions and expects additional toxicity information to be published later this year.

The federal MCL for Total Chromium is based upon a non-carcinogenic endpoint of Chromium VI toxicity. This standard is the effective drinking water standard for use at all public water systems in the state. There is currently no published federal MCL for Chromium VI and an established North Carolina groundwater standard for Chromium is based upon the same EPA published information on the toxicity of Chromium VI.

Cyanobacteria (commonly known as blue-green algae) are frequently found in freshwater systems, estuarine and marine waters. Freshwater cyanobacterial blooms that produce highly potent **Cyanotoxins** are known as cyanobacterial "harmful algal blooms" (cyanohabs or HABs). While not a new problem, HABs are becoming increasingly problematic in other states where algal colonies increase to the point of causing fish kills, disrupting recreational opportunities and affecting safe drinking water supplies. Recognizing that these blooms are tied to increases in human impacts due to higher **Nitrogen** and **Phosphorus** deposition from numerous sources, the EPA has published: health advisories for drinking water supplies; draft cyanotoxin criteria for recreational use protection, and is poised to publish **Numeric Nutrient Criteria** to protect aquatic life. The N.C. Department of Environmental Quality is working with a Scientific Advisory Council established to investigate the potential for establishing numeric and/or narrative nutrient criteria for several water body types in the state. The state has a public plan, known as the Nutrient Criteria Development Plan, agreed upon with the EPA, to examine nutrient standards for all waterbodies.

Ammonia is a nutrient-related contaminant that may enter surface waters via municipal discharges, agricultural runoff, animal waste, atmospheric deposition, and the fixation of atmospheric nitrogen by naturally occurring bacteria. Excessive amounts of ammonia are considered toxic to aquatic life. Accumulation of ammonia in the tissues of aquatic organisms may result in several harmful physiological changes. Fish may experience gill tissue damage and disruption of osmoregulatory and circulatory activity. Bivalves and gastropods (snails) are particularly sensitive to ammonia toxicity and may suffer from reduced opening of valves for respiration and feeding, reduced ciliary action, and impaired secretion of byssus threads (used to anchor the bivalve to the sediment). Ammonia is of concern because North Carolina is home to a variety of freshwater bivalves, some of which are threatened or endangered, and aquatic snails. Many wastewater facilities have regulated allowable discharges of ammonia to prevent toxicity. Federal regulations have come out that will require North Carolina to consider an in-stream water quality standard to protect aquatic life. Ammonia toxicity is directly related to water temperature and pH. As temperature and pH increase, toxicity to aquatic life increases. Increases in average global temperature will increase the magnitude and frequency of toxic exposures related to ammonia in surface waters.

Public Water Supply

Public water systems range from large municipalities to country stores and churches that serve a minimum of 25 individuals for 60 days per year. The complexity of the federal Safe Drinking Water Act (SDWA) can make compliance difficult to achieve for many small systems. Of the 5,751 regulated public water systems, 88 percent serve a population of less than 500. The Division of Water Resources' Public Water Supply Section (PWS Section) is the primary agency responsible for assuring that the people of North Carolina are provided safe drinking water from public water systems.

In 2015 (compliance determinations for 2016 are underway), 97.2 percent of the state's residents served by public water systems were served by systems meeting all health-based standards. This is otherwise known as residents served by community public water systems having no maximum contaminant level (MCL) violations. This was an improvement from the previous year's compliance rate of 95.5 percent. Compliance can vary from year-to-year based on which contaminants are monitored in a given year; one large system with an MCL exceedance can impact the statewide statistics. Table 2 shows the compliance rates for the past six years, as well as the baseline measure from 1999.

Table 2: Population Served by Compliant Community Public Water Systems

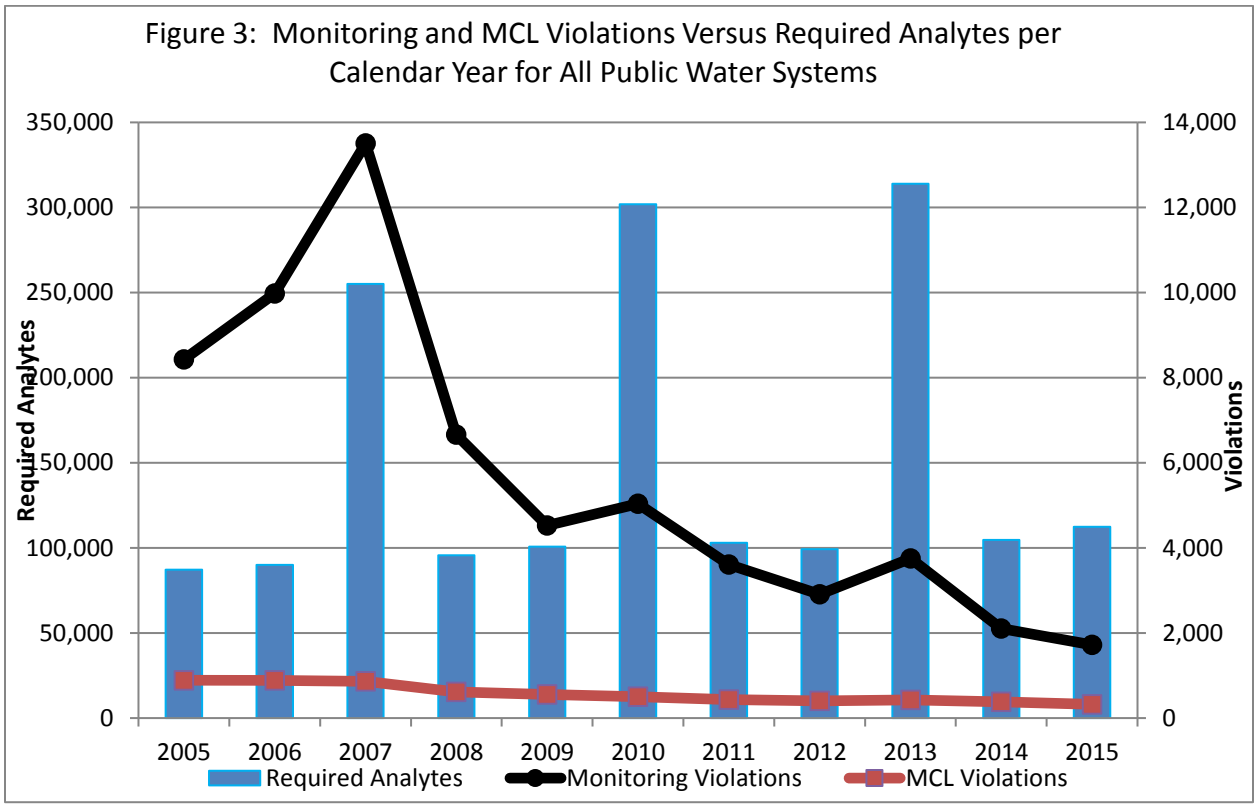
Year	Citizens Served by Community Public Water Systems having No MCL* Violations		Citizens Served by Community Public Water Systems having No MR† Violations		Total Service Population
	Population±	Percent	Population±	Percent	
1999 (baseline)	6,475,188	97.5	5,806,471	87.4	6,641,864
2010	7,666,833	96.9	7,238,449	91.5	7,913,896
2011	7,781,640	96.9	7,508,972	93.5	8,027,685
2012	7,934,690	98.0	7,792,635	96.3	8,093,809
2013	7,861,037	96.1	7,322,188	89.5	8,180,600
2014	7,913,670	95.5	7,332,811	88.5	8,289,739
2015	8,114,838	97.2	6,290,530	75.4	8,344,870

* *"MCL"* means a violation with regards to the maximum permissible contaminant level in water delivered by a public water system.

† *"MR"* means a failure to monitor for required water quality tests as defined by federal and state regulations and for 1999 through the first half of 2005 includes systems that failed to report on time.

± 1999 population data is based on last available record prior to Oct. 1, 2005.

Another way to look at the safety of drinking water is to compare the number of violations issued against the number of samples which were to be collected and analyzed. Figure 3 shows the number of annual MCL and monitoring and reporting violations compared to the number of required analytes. Monitoring can be required monthly, quarterly, each six-months, every year, and every three years, depending on the contaminant and system type. The figure also shows the effect that contaminants monitored every three years have on compliance rates. As expected, during a year in which more monitoring is required, more violations occur. The figure also shows that monitoring compliance improved dramatically between the triennial monitoring end years of 2007, 2010 and 2013. The number of MCL violations issued continues a downward trend. This demonstrates that more systems are performing the required monitoring with fewer exceedances of the MCLs.



Drinking Water Protection Program

The Public Water Supply Section continued to improve and implement North Carolina's Drinking Water Protection (DWP) Program during 2016. The DWP Program evaluates the susceptibility to contamination and initiates protective strategies for the state's public drinking water resources. Activities include delineation and assessment, wellhead and surface water protection, coordination with other state agencies and outreach designed to support local protection efforts. Water systems that participate in proactive measures are less susceptible to contamination and may realize advantages regarding financial and technical capacity. Studies by EPA have demonstrated that it is cheaper to protect a drinking water source than to treat water from a source that has become contaminated.

The DWP Program promotes and provides technical expertise to assist communities with local source water protection planning. A seven-step process has been used successfully statewide to protect ground and surface water sources. To date, the PWS Section has approved 10 local surface water protection plans that protect drinking water for approximately 384,000 consumers. The SWP planning process empowers local stakeholders to identify and achieve long-term, proactive drinking water protection goals.

The DWP Program has also continued in the development and implementation of a Wellhead Protection (WHP) Program for systems using groundwater as a source of supply. This effort involves the review and approval of local WHP Plans developed by water systems with technical assistance from the N.C. Rural Water Association. The total number of water systems with an approved WHP Plan is 162. These 162 systems comprise 930 wells that serve 951,335 consumers.

Hot Topics

After the lead problems in Flint, Mich., national attention has been placed on lead in drinking water supplies. Lead is regulated in North Carolina under 15A NCAC 18C .1507, in accordance with federal regulations. Because most lead found in drinking water is due to reactions of the water with lead-containing plumbing in the home, the rule focuses on ensuring that the waters delivered by the public water systems are not overly corrosive. A public water system is in compliance if the 90th percentile of sample results is below the EPA's action level of 15 parts per billion, the water system is determined to have addressed corrosivity of the water supply and the individual property owners are left to address issues within their personal plumbing.

One consequence of the Flint, Mich. Incident is that the EPA has dramatically increased oversight of state drinking water programs and wants to maintain current status lists in addition to quarterly database uploads that already occur. The EPA is now periodically providing spreadsheets to the states to update the status of any system that has had a lead exceedance between 2012 and 2015. Of the 12 systems on North Carolina's list at the end of 2016, eight have sampling confirming lead levels have been successfully reduced, two are still in process of installing corrosion control, and two have penalties pending for failure to install treatment.

Sedimentation and Stormwater Management

Sediment is the largest single nonpoint source pollutant and a primary factor in the deterioration of surface water quality in the state. Sediment deposits destroy fish spawning beds, reduce the useful storage volume in reservoirs, clog streams, and require costly filtration for municipal water supplies. Suspended sediment can also reduce in-stream photosynthesis, alter a stream's ecology, and may carry toxic chemicals.

North Carolina has worked to minimize sediment runoff since the North Carolina Sedimentation Act was passed in 1973. All land-disturbing activities of 1 acre or greater in size must have an approved erosion and sedimentation control plan before work begins. From July 2015 through June 2016, DEQ's Land Quality Section reviewed more than 2,071 erosion and sedimentation control plans and 627 revised plans, and conducted 12,120 site inspections. DEQ included an expansion budget request to add more full-time equivalents to this program as part of the 2017-2019 biennium budget. More resources are needed to address the growing demand in new control plans and site inspections.

In addition, North Carolina implements post-construction stormwater control programs in about 65 percent of the state. These programs require long-term stormwater control for new development activities to offset the impacts of added built-upon area on the landscape. These programs are implemented by the state in some areas and by nearly 400 local governments in the remaining areas.

DEQ promotes low-impact development, or LID, that maintains and restores the hydrologic regime by creating a landscape that mimics the natural hydrologic functions of infiltration, runoff and evapotranspiration. A development is considered LID when the volume of runoff leaving the site after development matches the volume of runoff before development with adequate flows to the streams and wetlands on the site rather than piping stormwater to a single low point. In April 2014, DEQ made available a calculation and permitting tool to help guide LID.

Ground Water

About 5 million North Carolinians rely on ground water as their primary drinking water source through private wells or public water systems. Groundwater is found primarily in aquifers located in fractured, igneous and metamorphic rocks in the Mountain and Piedmont regions and within the sediments and sedimentary rock layers in the Coastal Plain. In some areas, this groundwater contains elevated naturally occurring constituents. In comparison with rivers and streams, groundwater tends to move slowly and with little turbulence. Once a contaminant reaches the groundwater, little dilution or dispersion normally occurs. The level of water quality indicators in many older private wells is unknown.

North Carolina requires all new drinking water wells constructed since 2008 to be tested for bacterial and chemical contaminants within 30 days of the well completion. This information alerts the private well owner of potential concerns and enhances the state's ground water monitoring database. Between 5,000 and 10,000 new private wells are installed each year. Quality data from private wells in 2010 reveals naturally-occurring iron and manganese are the most prevalent constituents present in groundwater above the state standards.

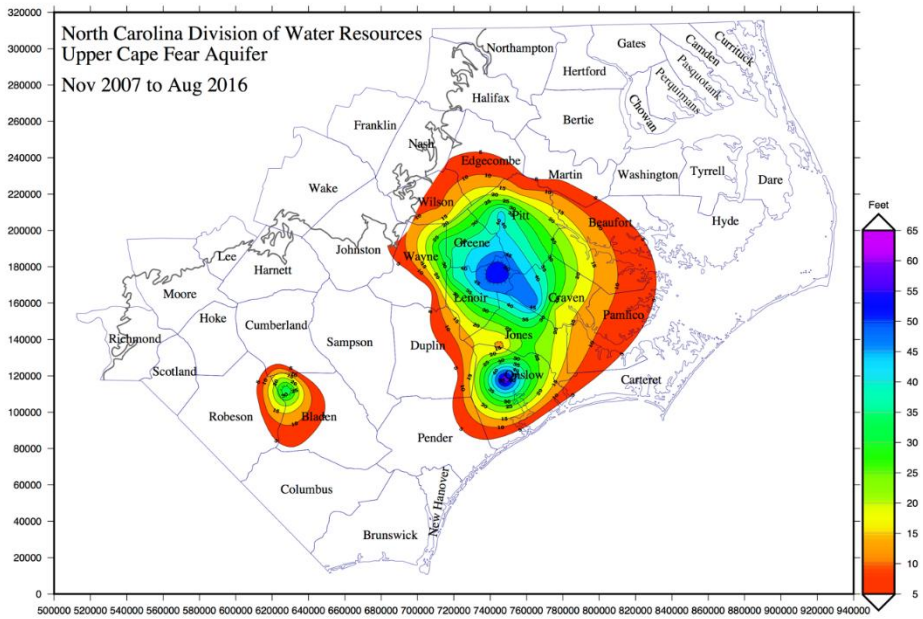
Parameter	Wells sampled in 2010	State Standard	State Standard Exceedances
Arsenic	4,870	10 µg/l	2.4%
Chromium	4,892	10 µg/l	1.5%
Iron	4,896	300 µg/l	58%
Manganese	4,900	50 µg/l	40%
Nitrates	4,100	10 mg/L	0.7%
pH	4,901	6.5 to 8.5	18% < 6.5
Data provided by county health departments			

DWR monitors a network of about 700 wells throughout the state, placed in areas of geographic and geological importance. These wells serve to monitor groundwater quantity, and track aquifer withdrawals, drought conditions, and saltwater intrusion.

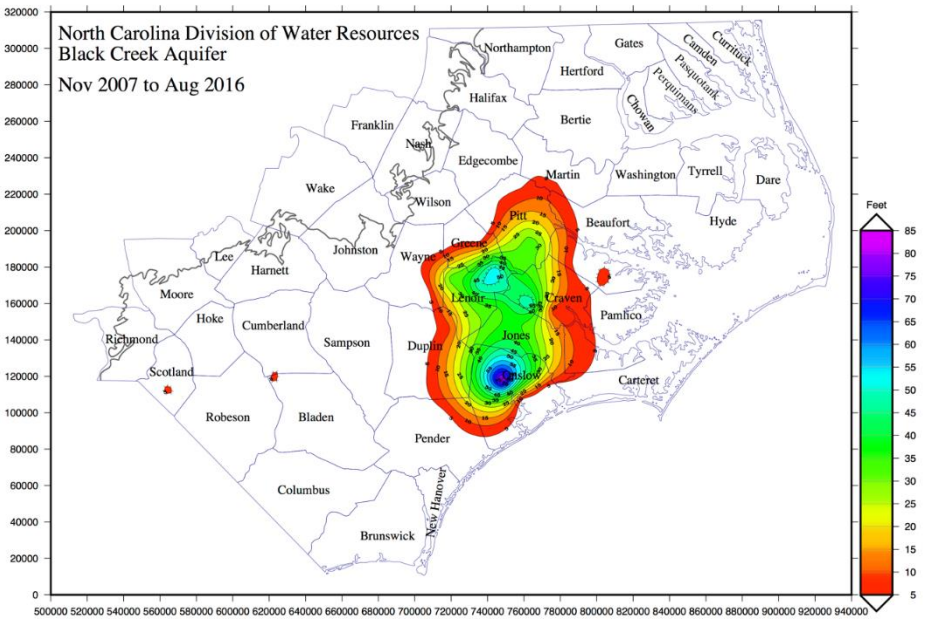
A program to monitor a larger number of groundwater quality parameters in the DWR network wells began in late 2015. At current staffing levels, it will take many years to sample each well at least once. Systematic and more frequent sampling of the DWR network wells would provide a better understanding of ambient groundwater conditions throughout N.C., providing a context and framework for data obtained from private wells. Where private wells are sampled one time, and there is no way to monitor water quality trends geographically, resampling the DWR network wells on a regular basis would provide some insight into changes over time.

Central Coastal Plain Capacity Use Area Rules

The Central Coastal Plain Capacity Use Area, or CCPCUA, is a 15-county region in the coastal plain where groundwater is the primary water supply. During the past century, groundwater was withdrawn at ever increasing rates resulting in more than 200 feet of water level declines. Water was withdrawn from the deep confined aquifers at a rate that was greater than the natural recharge, which led to dewatering and saltwater intrusion. If this situation had been allowed to continue, the aquifers could have become permanently damaged, impairing their ability to function as a water supply. Managed withdrawals have helped replenish the aquifers by limiting pumping to more sustainable rates. The following aquifer recovery maps of the Upper Cape Fear and the Black Creek Aquifers show that ground water levels rose by up to 55 feet (blue) and 80 feet (purple), respectively, from November 2007 to August 2016.



DWR has worked with water users in the central coastal plain to reduce the reliance on these limited groundwater sources and develop alternative water supplies. By 2016, 41 percent of local governments in the area had new water sources or connectivity with the other water systems, improving the ability of those communities to sustain population growth and economic development.



Planning for Future Water Supply

The state's population has been growing faster than the national average for a number of years. The North Carolina Office of Budget and Management's population projections revised in 2016 projects a 16 percent increase in North Carolina's population between 2015 and 2030 (from 10,056,683 to 11,643,181). That population growth will place an increased

demand on the state's water supplies. Widespread and severe droughts between 1998 and 2002 and again in 2007 had a significant impact on water supplies for several major cities including Greensboro, Raleigh and Durham. After the 2007 drought, the state took steps to improve water shortage response and then focused on longer term water supply planning. Units of local government that supply water to the public are now required to submit a water shortage response plan as part of their local water supply plans. DEQ's Division of Water Resources has continued to work on hydrologic modeling of the state's 17 major river basins. The hydrologic models provide a picture of water availability and water demand in each river basin, making it possible to more accurately predict how water supply varies under different hydrologic and demand conditions.

The availability of hydrologic models for five of the most populous river basins in the state provided the Division of Water Resources the ability to determine that most cities have sufficient drinking water sources to meet projected growth in water demand during normal conditions. Some communities may face water shortages during extreme drought conditions. Communities can deal with drought related shortages by managing water demand with an effective water shortage response plan.

Some public water systems rely on run-of-river water intakes or small reservoirs that are particularly vulnerable when drought conditions cause stream flows to drop. These water systems need to improve water efficiency and develop back-up plans (such as additional water storage or an emergency connection to another water system) for extreme drought periods. Some regions of the state have plentiful water supplies, but the water sources are not located in the most populated areas. In those areas, the challenge is getting the water to the population centers. Access to dependable water supplies for some communities is limited by the elevated priority of local stakeholders over the scientific evaluation of potential environmental impacts of proposed surface water transfers.

To avoid water shortages that could put drinking water supplies, industrial recruitment and agricultural production at risk, the state needs to approach water supply issues from several directions. First, the state needs to continue work on water supply planning tools, including completion of hydrologic models for all 17 river basins and identification of stream flows required to support fish and wildlife. The information provided by river basin hydrologic models and ecological flow studies will be critical to planning for new water supply sources and managing increased competition for water – between communities and between different groups of water users. Encouraging more efficient water use and greater reuse of treated wastewater also will be important to the state's future water security. Finally, public water systems will need infrastructure funding and technical assistance to address aging water distribution systems, expansion of water service, and development of new water supply sources.

Recent accomplishments related to water supply include the development of local Water Shortage Response Plans to improve the state's drought response; recovery of the aquifers in the Central Coastal Plain as a result of the Central Coastal Plain Capacity Use Area rules; and increased collection of groundwater data. The Ecological Flows Science Advisory Board issued its recommendations for estimating the level of flows necessary to maintain ecological integrity in North Carolina's rivers and streams in November 2013. Implementation of the recommendations has been inhibited because of confusing language in the authorizing legislation. The Cape Fear River Surface Water Supply Evaluation, released in December 2016, indicated that, with a couple of exceptions during extreme droughts, all local government water systems using surface water from this basin are not expected to experience quantity related shortages during the next couple decades.

The Division of Water Resources has developed allocation recommendations of the water supply pool in Jordan Lake that will provide dependable water supplies for communities in the Research Triangle region sufficient to meet their expected water demands through 2045.

Water Infrastructure

The development of water infrastructure over more than 100 years by local, state and federal governments is a great accomplishment, but that success can be placed at risk when our water infrastructure is not maintained or modernized.

Water and wastewater infrastructure needs for North Carolina during the next 20 years have been quantified by the UNC Environmental Finance Center as follows:

- $10 billion – 15 billion over the next 20 years for drinking water infrastructure
- $7 billion – 11 billion over the next 20 years for wastewater infrastructure

The Division of Water Infrastructure was created by the North Carolina state legislature in 2013 to address North Carolina's water infrastructure needs by consolidating the administration of several programs that provide financial assistance for projects that improve water quality. The division includes funding programs previously administered by the state Division of Water Quality, state Division of Water Resources, and the state Department of Commerce.

The nine-member State Water Infrastructure Authority was also created by the North Carolina General Assembly in 2013 through North Carolina General Statute 159G-70, to assess and make recommendations about the state's water and wastewater infrastructure needs and the funding programs available to the state's local governments and utilities. The authority is an independent body with primary responsibility for approving and awarding federal and state funding for water and wastewater infrastructure projects. The state Division of Water Infrastructure serves as staff to the authority and the division director serves as chair of the authority.

Programs within the division fund many types of projects, including wastewater collection and treatment systems, drinking water distribution systems, water treatment plants, stormwater management systems, and stream restoration. The division provides low-interest loans and grants for local governments and certain other non-profit entities for water infrastructure through a number of programs:

- *Clean Water State Revolving Fund* (CWSRF): Provides low-interest loans to local government units to fund wastewater collection and treatment facilities as well as programs associated with estuary and non-point sources.
- *Drinking Water State Revolving Fund* (DWSRF): Provides low-interest loans to local government units and certain non-profit water corporations for projects to provide safe drinking water.
- *Community Development Block Grant-Infrastructure (CDBG-I)*: Provides grants to local government units to address water and wastewater infrastructure needs in HUD-qualified low-to-moderate income communities.
- *State Wastewater & Drinking Water Reserve Programs*: Provides loans and grants for construction of critical needs for wastewater collection systems, wastewater treatment works, and public water system projects.
- *Asset Inventory and Assessment Grant Program*: Provides grants for developing asset inventories, condition assessment of critical assets, and other components of a comprehensive asset management program.
- *Merger/Regionalization Feasibility Grant Program*: Provides grants for studies to evaluate the potential consolidation of two or more systems into one system, partial consolidation/shared services, and the potential physical interconnection with another system for regional wastewater treatment or regional water supply.

The division and the authority offer multiple funding sources under one process, resulting in the ability to offer the best available funding without multiple applications or delays in starting projects while applicants seek alternate funding.

The authority's 12 powers and duties defined in North Carolina General Statute 159G-71 can be grouped into four primary areas:

- Distribute loan and grant funds
- Define water infrastructure needs and funding; develop a State Water Infrastructure Master Plan
- Assess emerging practices in utility planning and management
- Assess need for a “troubled system” protocol

Distribute loan and grant funds

Since funding programs were combined in July 2013 in the Division of Water Infrastructure, the division, in conjunction with the State Water Infrastructure Authority, has provided just under $1 billion ($998 million) in water infrastructure funding.

During the next two fiscal years, including the additional funds provided by the Connect North Carolina Bond funds passed in 2016 for water infrastructure, approximately $700 million will be available through funding programs administered by the Division of Water Infrastructure.

The authority awarded a total of $251 million in grant and loan funds in FY 2015-2016:

- CWSRF loan funds – $180 million ($180 million requested)
- DWSRF loan funds – $47 million ($49 million requested)
- CDBG-I grant funds – $14 million ($62 million requested)
- State Reserve loan and grant funds for both water and wastewater – $4.2 million ($34 million requested)
- Asset Inventory and Assessment grant funds – $5.13 million ($20 million requested)
- Merger/Regionalization Feasibility grant funds – $490,000 ($490,000 requested)

In FY 2015-2016, the General Assembly appropriated $7.4 million in grant funds to be dispensed through the State Reserve program. Additional funds were made available by allowing the division to move excess matching funds not needed for the two SRF programs into the state reserve program for grants. This, along with reconciliation of closed grant projects, made $8.69 million available for the spring 2016 funding round.

Applications received in FY 2015-2016 for loans and grants totaled $345 million; the authority awarded $251 million. The funds available through the loan programs met most of the loan requests. As in previous years, the total requests for grant funds outpaced the total availability.

Define water infrastructure needs and funding; develop a State Water Infrastructure Master Plan

In December 2016, the authority completed and adopted a master plan that summarizes and presents recommendations about the state’s water and wastewater infrastructure needs. “North Carolina's Statewide Water and Wastewater Infrastructure Master Plan: The Road to Viability” presents a roadmap for developing and maintaining viable water and wastewater utilities that safeguard public health, protect the environment, encourage economic development and support vibrant communities.

The master plan applies broadly to owners and operators of water and wastewater utilities and systems that serve the public. Local elected officials, town and county managers, utility governing boards, customers and stakeholders, and the public all have key roles in achieving viable utilities.

The state’s role is to foster the long-term viability of individual water and wastewater utilities by providing access not only to capital for pipes, pumps and tanks, but also to resources to address organizational and financial management challenges that may contribute to physical infrastructure limitations. North Carolina will best be able to meet its water infrastructure needs by ensuring that individual utilities are, or are on a path to be, viable systems.

A viable system is one that functions as a long-term, self-sufficient business enterprise, establishes organizational excellence, and provides appropriate levels of infrastructure maintenance, operation and reinvestment that allow the utility to provide reliable water services now and in the future.

Viable systems are robust in these three integrated focus areas:

- Infrastructure management through proactive measures that consider risk and life-cycle costs, and enable utilities to provide reliable water services now and in the future.
- Organizational management through resources and tools that are already available, many at no cost, to create a culture that places value on addressing infrastructure challenges in a comprehensive and realistic way.
- Financial management through operating as a self-sufficient business enterprise for the long-term.

Assess emerging practices in utility planning and management

There is a significant demand for the Asset Inventory and Assessment (AIA) grants and the Merger/Regionalization Feasibility (MRF) grants, which were enacted in 2015. To date, 107 awards have been made in the AIA program and 13 awards in the MRF program. The purpose of these grants is to encourage utilities to become more proactive in the management and financing of their systems, so they can ultimately end long-term reliance on grant funding. The number of requests for these grants indicates the need for these types of state programs to help foster the long-term viability of utilities.

Assess need for a "troubled system" protocol

It is recognized that many utilities throughout the state are probably within a range between *viable* and *troubled.* The new grant program to analyze the benefits of a voluntary merger/regionalization opportunity might be an appropriate first step to investigate potential solutions for troubled units. The authority and the Local Government Commission are working to develop scalable strategies and practices to assist troubled systems, with the goal of seeking permanent solutions to their water infrastructure issues.

Next steps

In the coming year, the authority will explore the following issues:

- Monitoring and evaluating recent changes in funding programs and levels.
- Strengthening resource partnerships in planning, training and communications.
- Developing a troubled system protocol.

The authority will continue to research and monitor longer-term subjects for future study. These may include communication resources, regional coordination, managing other types of water resources, partnership solutions, and improved procurement policies. The division will continue to develop partnerships that facilitate implementation of the master plan, increase outreach and use new methods of communicating the message of the master plan.

Stormwater

The state Environmental Management Commission (EMC), through the N.C. Department of Environmental Quality (DEQ), implements state and federal programs to control the water quality impacts of stormwater runoff from development activities and urban and developing areas. These programs include the federal National Pollutant

Discharge Elimination System (NPDES) program for stormwater discharges that require permits for point source discharges of stormwater from industrial activities (including construction) and from certain municipal entities in urbanizing and developing areas. This program is a requirement of the federal Clean Water Act. In addition, the EMC and DEQ implement state post-construction stormwater permitting programs that are designed to control stormwater runoff from new development and certain redevelopment activities occurring near sensitive areas such as Water Supply Watersheds, High Quality and Outstanding Resource Waters, Nutrient Sensitive Waters, Coastal Waters, and post-construction activities adjacent to regulated municipal NPDES areas. These state stormwater programs may be implemented on the state level or on the local level by delegated cities and counties. Overall, post-construction stormwater programs apply in about 65 percent of the state. These various stormwater management programs are designed for the protection of surface waters and their intended uses and involve requirements overseen by the state Division of Energy, Mineral, and Land Resources and the state Division of Water Resources.

More than 14,000 projects are covered under state post-construction permits. In addition, nearly 400 local governments implement post-construction programs and are responsible for stormwater requirements for projects in their jurisdictional areas. The division has oversight of these local programs through several regulatory requirements. The division provides technical assistance and outreach to staff, local programs and the regulated community. During the last two years, extensive effort has been made to complete a review of the stormwater program rules. The updated rules became effective on January 1, 2017. For the review process, the Division of Energy, Mineral and Land Resources used input from two stakeholder teams through a series of more than 20 stakeholder meetings (beginning in March 2014) and three public hearings on the proposed rule set. The post-construction stormwater programs often require the use of engineered stormwater controls, and the division provides technical guidance on stormwater control measures through its Stormwater Design Manual available online at: http://deq.nc.gov/about/divisions/energymineral-land-resources/energy-mineral-land-permit-guidance/stormwater-bmp-manual. With the changes to the post-construction rules, the design manual is being updated. Staff are working with N.C. State University to provide workshops statewide on the new rules and design manual.

Federal Stormwater NPDES Programs

Through the federal NPDES stormwater programs, DEMLR oversees permits for Municipal Separate Storm Sewer Systems (MS4s) and for certain industrial activities. Permits under the MS4 program currently regulate 117 local governmental entities across the state, along with the N.C. Department of Transportation and four Department of Defense military bases. The division provides outreach and information to these entities through various meeting opportunities. This outreach is provided, in part, through an ongoing audit program the division implements to assess portions of the permitted communities each year. The audit process for MS4s is coordinated with audits for other existing programs such as the Water Supply Watershed Protection program, which requires local implementation of requirements for approximately 280 local government entities statewide to protect surface waters used for drinking water supplies. The division works with nearly 400 local governments that are responsible for their local stormwater management programs in the state. In recent years, the division has implemented new audit options to more effectively use limited staff resources to stay in contact with local programs. Division staff have been involved with the development of approaches to establish more sustainable audit/inspection programs for the MS4 program area. These efforts have been in conjunction with local government groups, including representatives with the N.C. American Public Works Association and the Stormwater Association of North Carolina. The MS4 Sustainable Management program will develop and build a network of stormwater support across multiple municipalities through peer reviews and sharing of information on best practices and program implementation.

In the industrial stormwater NPDES permitting program, the division has permit oversight for about 4,200 industrial facilities in the state and about 12,000 active construction sites. The Environmental Protection Agency finalized rules at the end of 2015 that require electronic submittal of information associated with several federal permitting areas, including NPDES permits. The requirements for electronic submittal will come on line during the next five years. In the long run, this will be a benefit to the program, but there will be a need for funds up front to establish the necessary

electronic procedures. These efforts will divert limited staff resources toward ensuring that the procedures are developed in an effective manner.

Coastal and Estuarine Quality Indicators

- **In 2016, 14 of 37 evaluated fish stocks were rated as viable, two as recovering, 13 as concern and four as depleted.**
- **With few exceptions, monitoring has shown excellent water quality for North Carolina's ocean beaches in 2015 and 2016.**
- **Coastal habitat enhancement programs managed by the Division of Marine Fisheries provide $4 in benefits for every $1 invested in the coastal region.**

North Carolina has some of the most scenic, biologically diverse and productive coasts in the world. Each year, more than 12 million tourists visit the North Carolina coast to enjoy the beaches, dining, fishing and other activities.[4] But as development increases along beaches and estuaries, issues such as shoreline erosion, severe storms, climate change and sea level rise have captured public attention. Numerous state agencies work cooperatively to protect coastal habitats, encourage sustainable development and nurture state industries such as commercial fishing and tourism that rely on the environmental quality of the shoreline and sea. Within DEQ, coastal issues are most often addressed through the state Division of Coastal Management (DCM) and the state Division of Marine Fisheries (DMF).

The state Division of Coastal Management manages public trust resources in the 20 coastal counties through the N.C. Coastal Area Management Act, the N.C. Dredge and Fill Law and the federal Coastal Zone Management Act of 1972 under rules and policies of the N.C. Coastal Resources Commission (CRC). This division is responsible for several programs, including permitting and enforcement activities; CAMA land-use planning; public beach and waterfront access; and the North Carolina Coastal Reserves. During FY 2015-2016, the Division of Coastal Management regulatory staff continued to monitor permitted projects, conduct routine aerial surveillance flights, and provide compliance assistance support to the public. During this period, more than 2,800 compliance monitoring inspections were performed.

The Division of Marine Fisheries' mission is to ensure sustainable marine and estuarine fisheries and habitats for the benefit and health of North Carolinians. This is accomplished through monitoring the abundance and health of fish, shellfish and water quality, monitoring fishery landings and effort, protecting and enhancing fish habitat, enforcing statutes and rules governing fishing in coastal waters, and encouraging public responsibility through public outreach and technical assistance.

Coastal and Estuarine Fisheries

Just off Cape Hatteras, the warm waters of the Gulf Stream collide with the colder waters of the Labrador Current, creating a marine fisheries mixing zone with a diversity of catch like no other state. North Carolina is the southern-most migratory range of many northern species of fish, such as tautog and summer flounder, and the northern-most range of many tropical species, such as gag grouper and tarpon.

[4] 2015 North Carolina Regional Travel Summary, Visit North Carolina, a unit of the Economic Development Partnership of North Carolina.

North Carolina is one of the nation's leading coastal fishing states, ranking sixth on the East Coast and first among South Atlantic states in pounds of marine fish sold commercially.[5] Recreational anglers catch more fish in North Carolina's coastal waters than in any other state, except Florida.[6] More than 90 percent of North Carolina's commercial fisheries and more than 60 percent of the recreational harvest (by weight) are comprised of species that depend on estuarine waters for some portion of their life cycle. Some of the most valuable commercial species include blue crab, shrimp and southern flounder, while sought after recreational species include spotted seatrout, red drum, flounder and striped bass.

DMF strives to achieve sustainable fisheries and habitats through a combination of biological sampling, collection and monitoring of landings and effort, management decisions based on sound data and objective analyses of data, implementation of science-based rules, outreach and enforcement of the rules.

The Fishery Management Section monitors fishery resources through biological sampling, fisheries research studies and environmental data collection. Biological data is collected through DMF fishery independent and dependent monitoring programs as well as from commercial trip level reporting and recreational survey data. In fiscal 2016, staff collected roughly 11,600 samples from fishery-independent sampling. This data is used in stock assessments, fishery management plans, coastal habitat protection initiatives, coastal habitat enhancement and other DMF management endeavors to ensure sustainable coastal fisheries.

In determining the status of fishery stocks, DMF considers a combination of factors, including fishing mortality, natural mortality at larval, juvenile, and adult life stages, environmental conditions, and habitat conditions. DMF annually categorizes the status of marine finfish, shellfish, shrimp and crabs as either viable, recovering, concern, depleted or unknown. The stock status serves as a barometer of the overall health of the state's fishery resources, and is used to prioritize development of fishery management plans.

A stock is considered "viable" when it exhibits stable or increasing trends for a number of biological factors associated with healthy populations, such as population size, a normal distribution of sizes, ages and spawning-age females or when it has met biological targets for sustainable harvest. A "recovering" stock shows marked and consistent improvement in the criteria listed for a "viable" stock, but has not yet reached its target. Stocks can be designated as "concern" either with or without an approved stock assessment or fishery management plan. Conditions leading to this designation can result from increased fishing pressure, a decline in landings, lack a normal age distribution or negative impacts by environmental factors that cannot be controlled. Once listed as "concern" the stock status will not change until it meets the definition of "recovering," "viable" or "depleted." A "depleted" stock is a population in which there are too few spawning females to support an active fishery. Factors that can contribute to this status include overfishing, poor water quality, habitat loss, larvae survival and disease. This status determination is based on an approved stock assessment or fishery management plan. A stock is classified as "unknown" when there is not sufficient data to determine trends in fishing pressure, landings or biological factors. Stocks designated as unknown are often prioritized for further research.

In 2016, 14 of 37 evaluated stocks were rated as viable, two as recovering, 13 as concern and four as depleted. This was a decline from 2016 when there were 15 stocks rated as viable. Changes from the previous year included reclassifying summer flounder from viable to concern.

[5] National Marine Fisheries Service, Fisheries of the United States 2015, https://www.st.nmfs.noaa.gov/Assets/commercial/fus/fus15/documents/FUS2015.pdf

[6] Ibid

The status of all evaluated stocks is listed in the Table 1 below and more detail is provided on the DMF website (http://portal.ncdenr.org/web/mf/stock-status-reports).

2016 Stock Status Report												
Species	Stock Status					Species	Stock Status				
	V	R	C	D	U		V	R	C	D	U
Black Sea Bass – North of Hatteras			X			Atlantic Menhaden	X				
Black Sea Bass – South of Hatteras	X					Striped Mullet	X				
Striped Bass – Albemarle/ Roanoke			X			Spotted Seatrout	X				
Striped Bass – Atlantic Ocean	X					Scup	X				
Striped Bass – Central/ Southern			X			American Shad			X		
Bluefish	X					Hickory Shad					X
Atlantic Croaker			X			Sharks			X		
Dolphin	X					Sheepshead					X
Black Drum	X					Snapper Grouper			X		
Red Drum		X				Spiny Dogfish	X				
American Eel				X		Spot			X		
Southern Flounder			X			Atlantic Sturgeon				X	
Summer Flounder			X			Weakfish				X	
Gag Grouper		X				Hard Clam					X
River Herring – Albemarle Sound				X		Blue Crab			X		
River Herring – All Other Areas					X	Eastern Oyster			X		
Kingfishes	X					Bay Scallop			X		
King Mackerel	X					Shrimp	X				
Spanish Mackerel	X					V = Viable (14) R = Recovering (2) C = Concern (13)			D = Depleted (4) U = Unknown (4)		

Coastal and Estuarine Habitat Health

Protection of fish habitat is a critical component of managing fisheries. DMF has several programs that aid in identification, protection and enhancement of fish habitat, particularly shellfish resources, which are both a habitat and a fishery. Mapping provides baseline information to assess changes in habitat distribution and abundance.

Shellfish comprise a valued fishery in North Carolina but are even more important for the habitat and ecosystem functions they provide, including critical habitat for important commercial and recreational fisheries. In North Carolina, 40 species have been documented to use oyster reefs for refuge and foraging. In addition to providing direct benefits, shellfish improve water quality through the filtration of suspended solids, phytoplankton and pollutants. Modeling studies have shown that a modest increase in oyster biomass can reduce suspended sediment concentrations by an order of magnitude. The presence of shell bottom can therefore be an indicator of the health of our coastal waters and ecosystem.

The Habitat and Enhancement Section's Bottom Mapping Program maps benthic habitat in shellfish producing waters, and in 2016, 642 acres were mapped with a coastwide total of approximately 591,000 acres of estuarine bottom mapped. The mapping, which is approximately 98 percent complete, indicates there are about 21,221 acres of shell bottom within the mapped area. In the future, subsequent mapping will allow DEQ to measure changes in the distribution and abundance of shell bottom.

Another indicator of habitat health is oyster survival and reproduction. Survival of oysters and larvae are affected by low dissolved oxygen, extremes in salinity and water temperature, disease, predation and harvest pressure. The amount of spatfall (juvenile oysters) on newly deployed shell provides an annual indicator of the availability of larval oysters and recruitment potential. Other monitoring of natural reefs is done to assess health, size and abundance of oysters. High levels of recruitment indicate there are sufficient spawning adults to sustain or enlarge existing oyster reefs and that environmental conditions were favorable. Larval recruitment has been increasing since the late 1990s (Figure 8). Spatfall has continued to increase or remain stable since 2011.

Extreme environmental conditions, such as unusually high or low salinity, low dissolved oxygen (DO) or poor water quality, can induce stress in oysters, making them more susceptible to parasitism and diseases. Stressful environmental conditions can occur because of natural and human-induced causes. The oyster parasite *Perkinsus marinus*, also known as Dermo disease, has been responsible for major oyster mortalities in North Carolina during the late 1980s to mid-1990s.

During 1990, the southern estuaries and Pamlico County had high numbers of high intensity Dermo infections, with the heaviest mortalities in Pamlico County and northern Carteret County. Since then, mortality associated with Dermo has declined. In 2016, 70 percent of sampled oysters had low infection, 7 percent had medium infection, 7 percent had high infection, and 16 percent had no infection.

Another stressor to oysters is the boring sponge (*Clionia* spp). Boring sponge is a bio-eroder of calcareous structure such as oyster reefs. These sponges encrust and weaken the shell, leading to mortality from predators. Recent research found that as salinities increased, infestations of boring sponge increased and subtidal reefs disappeared.

Low dissolved oxygen (DO) levels are often attributed to excessive nutrients because under certain environmental conditions, the nutrients stimulate the growth of algal blooms. As the algae die and decompose, oxygen is consumed, lowering oxygen levels in the water. If oysters are subjected to little or no oxygen for long periods, mortality occurs. This has been observed on the deep water oyster reefs in the lower Neuse and Pamlico rivers, particularly in high rainfall summers. Even moderately low dissolved oxygen levels not normally associated with the death of oysters or fish can stress the immune systems of oysters, making them more susceptible to the Dermo disease.[7]

[7] The Chesapeake Bay Foundation "On the Brink: Chesapeake's Native Oysters" 2010. http://www.cbf.org/document.doc?id=523 accessed 12/3/2012

Because nutrient pollution can intensify the low oxygen events, which can cause direct or indirect mortality to oysters, efforts to reduce nitrogen and phosphorus pollution would be beneficial to the recovery of oysters.

DMF also enhances shellfish habitat through placement of shell in estuarine waters (cultch plantings) throughout North Carolina's coast and creation of oyster sanctuaries in Pamlico Sound. Oyster sanctuaries act as seed sources for other areas where harvesting is permitted and provide subtidal oyster habitats throughout the sound for finfish and invertebrates. Sanctuary work is concentrated in the Pamlico Sound due to the large historic losses that were known to occur in this area. As of 2016, the state Division of Marine Fisheries had constructed 14 oyster sanctuaries and two additional sites were in the planning stages. In 2014, more than 232,000 bushels of cultch material were deployed to create oyster habitat.

Economic Analysis of the Costs and Benefits of Restoration and Enhancement of Shellfish Habitat and Oyster Propagation in North Carolina

Results of a study published in April 2016 show that coastal habitat enhancement programs managed by DMF provide $4 in benefits for every $1 invested in the coastal region.[8]

The Albemarle-Pamlico National Estuary Partnership contracted with RTI International to study the benefits and costs of three programs under DMF. The study focused on how the Shellfish Rehabilitation, Oyster Sanctuary and Artificial Reef programs benefit and contribute to communities in the region.

According to the report, the programs generate economic benefits in numerous categories. Between 2010 and 2015, with just over $20 million in government and private investments, North Carolina restoration and habitat enhancement activities supported more than 500 acres of habitat and provided benefits that included commercial fishing, shellfish harvesting, recreational fishing, water quality improvements and shoreline stabilization. Cost-benefit analyses showed returns that ranged from $2 to more than $12 for every dollar invested.

During the same period, increases in commercial fishing alone supported 696 jobs, generated $32 million in revenue to North Carolina businesses and added $13 million to household income.

Recreational fishermen also benefit from the increased opportunity to target and catch reef-associated species, such as black drum, southern flounder, spotted seatrout, red drum, sheepshead and striped bass. The study showed a monetized benefit (expressed in terms of money) of $31 million to recreational fishing in 2015.

Additionally, previous studies show that grant funding of just over $5 million for coastal restoration in oyster sanctuary sites created more than 50 jobs, generated $7.9 million in revenue to North Carolina businesses and added $1.9 million to household income.

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[8] *Economic Analysis of the Costs and Benefits of Restoration and Enhancement of Shellfish Habitat and Oyster Propagation in North Carolina, RTI International, April 2016,* http://portal.ncdenr.org/c/document_library/get_file?uuid=cb8a2348-f68f-47e2-a356-da8ff43c902f&groupId=61563

Table 2: Excerpted from Economic Analysis of the Costs and Benefits of Restoration and Enhancement of Shellfish Habitat and Oyster Propagation in North Carolina, RTI International, April 2016.

Present Value of the Benefits and Costs of Habitat Enhancement Activities (3 percent discount rate; million 2015 dollars) through 2040

ENHANCEMENT ACTIVITY	COMMERCIAL FISHING	RECREATIONAL FISHING	WATER QUALITY	TOTAL
Oyster cultch planting	$17.2	$20.2	$17.7	$55.1
Oyster sanctuaries	$4.2	$6.7	$5.5	$16.4
Artificial reefs	$2.7	$4.2	$3.5	$10.3
Total monetized benefits	**$24.1**	**$31.1**	**$26.6**	**$81.8**
Total costs				**$20.2**
Benefit-Cost Ratio: Over 25 years, every $1 invested produces benefits of				**$81.8 ÷ $20.2 = $4.05**

Submerged Aquatic Vegetation

In the near future, another indicator of aquatic habitat health may be the amount and distribution of Submerged Aquatic Vegetation (SAV). SAV are submerged grass beds that provide valuable aquatic habitat. In addition to producing dissolved oxygen, these grasses filter pollution and provide food and shelter for fish, shellfish and crustacean species. They are also important to resident and migratory waterfowl. In 2007, state and federal agencies with authority for managing and protecting SAV in various parts of the coast, as well as universities and non-profit environmental groups, came together to leverage expertise, funding and staff resources to map the distribution of SAV coastwide.

The coast was remapped by region from 2013 – 2016 using aerial photography in the high salinity areas, and sonar technology in the low salinity waters, such as the Albemarle Sound, and the Neuse and Tar rivers. Analysis of the data is underway but SAV appears to be increasing in southern portions of the coast since about 2005. In the low salinity sounds and rivers, SAV was increasing in distribution from about the same period, but appears to have decreased in some areas in 2015-2016. Grass beds behind the Outer Banks occupy the same area, but appear to be getting patchier in some locations. In 2016, DEQ conducted its most recent size estimate of SAV and found the vegetation covered about 150,000 acres. Change in the distribution of SAV is important since this habitat is considered an indicator of water quality conditions and provides critical nursery habitat. As such, changes in the extent of grass beds show whether efforts to improve the water quality in coastal areas are working. For the first time, managers will be able to map and measure changes in the extent of these grasses on a broad scale.

Coastal Water Quality

Clean and healthy coastal waters are essential to sustain marine life, including fish and shellfish populations, and coastal recreation such as swimming, fishing and boating. DEQ divisions have implemented actions to identify threats and take steps to protect coastal water quality.

The Coastal Habitat Protection Plan (CHPP), was adopted in 2004 by the Coastal Resources, Environmental Management and Marine Fisheries commissions and was most recently updated in 2016. The CHPP summarizes the environmental conditions required to sustain all coastal aquatic habitats, the beneficial services they provide to aquatic organisms and the environment, their status and trends, the major threats affecting them, and recommendations to protect, restore and enhance their condition. The CHPP identifies research and management needs for each habitat, providing a tool to guide university research. The plan is updated on five-year cycles, and two-year implementation plans are developed by

DEQ divisions to achieve the recommendations of the plan. The full plan and latest annual report is available at DMF's website: http://portal.ncdenr.org/web/mf/habitat/chpp/downloads.

According to the latest CHPP from 2016, some of the greatest threats to coastal habitats in North Carolina are habitat loss and land use changes that increase nonpoint source pollution, degrade water quality, and alter flows. A review of threats by habitat found that most threats affect more than one habitat and all habitats were affected by multiple threats.

To more effectively focus restoration and protection efforts, the 2016 CHPP recommended focusing on four priority issues: increasing oyster restoration; encouraging greater use of living shoreline methods for erosion control; investigating and addressing sedimentation in estuarine waters; and establishing metrics to monitor trends in habitat condition and management effectiveness. A full chart of potential habitat threats is provided below.

Table 3: Threat sources, impact severities (both measured and potential), and documented interactions with habitats. Shading = relative severity of impact, based on qualitative information; 0% = no impact/unknown, 25% = minor, 50% = moderate, 75% = major.

Threat category	**Source and/or impact**	**Water column**	**Shell bottom**	**SAV**	**Wetlands**	**Soft bottom**	**Hard bottom**
Physical threats	Bottom disturbing fishing gear				-	-	
	Dredging (navigation channels, boat basins)						
	Estuarine shoreline stabilization						-
	Ocean shoreline stabilization	-	-	-	-		
	Jetties and groins		-	-	-		-
	Mining		-	-			-
Hydrological alterations	Obstructions (dams, culverts, locks)		-	-		-	-
	Water withdrawals		-	-		-	-
	Channelization		-	-		-	-
Water quality degradation	Nonpoint - Development (buildings, roads, non-discharge sewage systems)						-
	Nonpoint - Agriculture (crop and animal)						
	Nonpoint- Forestry					-	-
	Water-dependent development (marinas, docks, boating)				-		-
	Point source discharges				-		-
	Marine debris		-	-	-	-	-
	Microbial contamination			-	-	-	-
	Nutrients and eutrophication						
	Suspended sediment and turbidity				-		-
	Toxic chemicals						
	Ocean acidification			-	-	-	
Other	Disease and microbial stressors	-			-	-	-
	Non-native, invasive or nuisance species						

	Weather events					-	-

Since 2005, the CHPP has been a significant part of the decision-making process of DEQ's divisions and commissions. All three commissions and their DEQ agencies use the CHPP and its recommendations as guidance. The CHPP has been successful in implementing several recommendations, most of which were non-regulatory. Accomplishments include:

- Increased outreach and education.
- Improved communication between agencies.
- New mapping and research.
- Oyster and fish passage restoration.
- Compliance with existing regulations.

Shellfish and Beach Quality

The Shellfish Sanitation and Recreational Water Quality Program (SSRWQ) monitors, surveys and evaluates the quality of coastal shellfishing and recreational waters to protect the public health of shellfish consumers and recreational bathers, and classifies coastal waters for the safe harvest of shellfish.

In 2016, staff collected 5,076 water samples to classify shellfish growing areas. There were also 2,004 water samples collected to assess water quality for temporary openings or reopenings after temporary closures. Harvest of shellfish is prohibited from closed shellfish harvest areas. Elevated bacteriological levels have been shown to be correlated with increased impervious surfaces associated with development. The proper handling of shellfish is ensured by permitting and inspecting shellfish and crustacean processors statewide.

Table 4 shows the number of coastal water acres open and closed to shellfish harvest. The number of acres closed between 2007 and 2014 shows only a slight increase relative to the total number of acres. It is important to note that many of those additional closures occurred in productive shellfish areas. It also should be noted that more than 314,000 acres were closed administratively in 2015 due to budget cuts that deleted monitoring in those areas.

Table 4: Acres of Shellfish Harvest Areas Open and Closed by Year 2007-2016

Year	Open	Closed	Approved	Conditionally Approved Open	Conditionally Approved Closed	Prohibited
2007	1,777,523	441,449	1,734,339	43,184	12,512	428,936
2008	1,777,473	441,527	1,734,192	43,281	12,788	428,739
2009	1,777,776	441,342	1,734,245	43,531	12,551	428,724
2010	1,777,992	441,032	1,734,938	43,054	12,551	428,413
2011	1,777,992	441,032	1,734,938	43,054	12,551	428,413
2012	1,777,487	441,543	1,732,887	44,559	12,708	428,835
2013	1,777,350	441,684	1,733,067	44,282	11,832	429,852
2014	1,776,932	442,106	1,733,130	43,801	11,827	430,279
2015	1,462,222	756,908	1,418,373	43,849	11,739	745,169
2016	1,462,222	756,908	1,418,373	43,849	11,739	745,169

The SSRWQ staff monitors 204 areas along the ocean beaches, sounds and coastal rivers, and notifies the public when water quality does not meet standards for recreational use. In 2016, staff collected more than 6,200 samples to assess water quality. The water is tested for the bacteria *Enterococci.* While it may not cause illness itself, its presence is used

as an indicator that other disease or illness-causing organisms could be present. Swimming advisories and signs are posted when results exceed swimming water standards.

The DMF program is extremely popular among beach-goers and vacationers because people want to know the quality of the water at the beach before going swimming. The program's work received national attention in 2011 when the National Resources Defense Council ranked North Carolina's recreational water quality third in the nation. This recognition complements North Carolina's efforts to promote beach tourism. However, the program is at risk of losing Beach Environmental Assessment and Coastal Health (BEACH) Act funding that supports the program. The proposed budget of the federal government terminates funding to the Environmental Protection Agency for the BEACH Act grants.

Without the BEACH Act grant, the Recreational Water Quality Program's ability to monitor coastal waters will be reduced to less than half of what it is with the current funding. Unless another funding source is identified, North Carolina may lose a successful program that supports local economies and protects the public health of beachgoers.

Figure 1 shows the number of swimming advisories for each year and the total days for all swimming sites under advisory. In 2003, the increase in both advisories and advisory days is due to a change in criteria for classifying recreational waters and the unusual amount of rainfall for that year. Most of the swimming advisories occur at sound-side beaches and approximately 10 of these sites have recurring advisories and are responsible for many of the advisory days depicted in the graph. Stormwater runoff, pets, marinas, wildlife and birds all contribute to these sound-side swimming advisories.

The increase in advisories in 2010 is a result of increased rainfall and a larger number of days under advisory. A relatively low number of advisories occurred between 2011 and 2013. Other than a few exceptions, monitoring has shown excellent water quality for North Carolina's ocean beaches. An interactive map and data are available showing the location and advisory status of recreational water quality monitoring at: http://portal.ncdenr.org/web/mf/testing-sites.

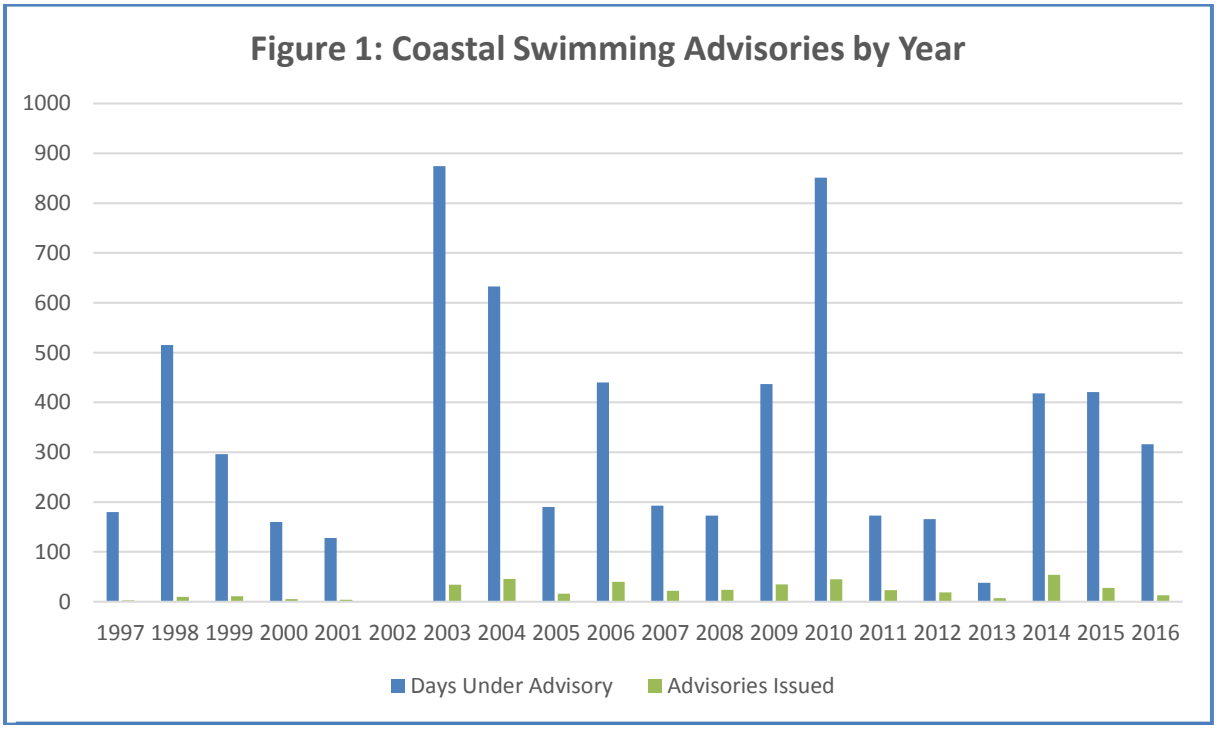


Figure 1: Coastal swimming advisories and number of days closed, by year.

Coastal Recreational Fishing License Grants

To learn more about fish stocks, potential habitat threats and other coastal issues, priority research needs identified in the CHPP and FMPs are funded through the Coastal Recreational Fishing License (CRFL) Grant Program. The grant program has been in place since 2007, with funding originating from coastal recreational fishing license receipts.

The CRFL grants are administered through a Marine Fisheries Commission committee and the amount of funding available varies annually based on recreational fishing license sales. The overall goal for the use of CRFL grant funds is to manage and enhance the marine resources of North Carolina based on sound science and strategies. The grant program has enabled DMF to gain critical information needed for management of fishery and habitat resources.

In the 2016 cycle, 15 grants totaling $1.79 million were awarded. Funded fishery research included a comprehensive evaluation of the North Carolina red drum juvenile abundance index. Funded habitat projects included investigating rates of sedimentation in tidal creeks and resulting impacts on fishery production in primary and secondary nurseries. Funding also was provided for acquisition of retired marine vessels to establish artificial reefs in Onslow Bay.

Current Coastal Issues

Marine Aquaculture

Legislative action and public interest in expanding shellfish aquaculture (and developing marine finfish aquaculture) is a potential growth industry for the North Carolina coast. To be sustainable, the siting, review, management and marketing of aquaculture operations must have a solid foundation to prevent potential conflicts with traditional public trust uses and property interests.

DMF produced a Shellfish Aquaculture Recommendation report as required by the N.C. General Assembly in early 2016. North Carolina has great potential to increase commercial shellfish production by expanding an existing but traditionally small scale marine shellfish aquaculture program. DMF recommended that the key to moving ahead and to be similar to states such as Virginia and Maryland was the development and implementation of a state aquaculture plan that identifies changes needed to streamline processes while minimizing environmental impacts and use conflicts. The success of the Virginia and Maryland industries is rooted in a well-organized collective of state regulatory and industry representatives that make up advisory committees and aquaculture boards.

Statutory changes are needed to streamline and improve the shellfish leasing process. Direct support to industry in the form of extension, marketing and seed product supply are also critical. It will be important to develop an aquaculture plan, and possibly an aquaculture board or oversight authority, to mirror our successful, neighboring states.

N.C. Wildlife Federation Petition for Rulemaking

The Southern Environmental Law Center has submitted a petition to the Marine Fisheries Commission on behalf of the North Carolina Wildlife Federation calling for habitat protections that would impact shrimp trawling in most state waters.

The petition proposes rules to designate all coastal fishing waters not otherwise designated as nursery areas (including the Atlantic Ocean) as special secondary nursery areas; opening shrimp season once the shrimp count in Pamlico sound reaches 60 shrimp per pound (heads on); limiting the total trawl head rope to 90 feet in internal waters and 110 feet in state ocean waters; limiting tow times to 45 minutes in special secondary nursery areas; limiting shrimp trawling to three days a week in internal waters and four days a week in state ocean waters; limiting trawling to the daytime only in special secondary nursery areas; requiring all fishermen to use two DMF-certified bycatch reduction devices when trawling in state waters; and establishing size limits for possession of spot and Atlantic croaker.

The Marine Fisheries Commission voted to approve the petition Feb. 16, 2017. The DMF staff will work with the commission to move forward with the necessary fiscal analysis to support the approval of the petition and the necessary rulemaking under the Administrative Procedures Act.

Possible review of the Fisheries Reform Act and Commercial Fishing License Criteria

Leadership of the House Select Committee on Wildlife Resources has stated their interest in comprehensively re-examining North Carolina marine fisheries issues, including possible revisions to components of the Fisheries Reform Act and changes in requirements for different types of fishing licenses, in the upcoming legislative session. Legislators met with various stakeholders to discuss these issues in mid-September.

At its Nov. 16-18, 2016 meeting, the state Marine Fisheries Commission agreed to send several recommendations to the General Assembly related to licensing and fisheries management for consideration. Most of the recommendations need to be further developed and would require legislative action. However, there are a few recommendations that the commission has the authority to undertake via rulemaking.

Protected Species

Sea turtles, marine mammals and Atlantic sturgeon interactions occur in fishing and agency activities (sampling programs, cultch planting, reef construction, etc.) throughout coastal North Carolina. Interactions with these federally-protected species are illegal unless the activity is permitted for allowed interactions under either the federal Endangered Species Act or the Marine Mammal Protection Act.

North Carolina operates its estuarine gill net fisheries under federal permits that limit the number of endangered species that may be incidentally caught by fishing activities. When the interactions approach or reach the number allowed by federal permit, the fishery must be closed to remain in compliance. Obtaining permits from the federal government is a challenging and lengthy process, which impacts the implementation of sampling programs and the operation of fisheries. The adverse economic impact this places on commercial fishermen, and the requirement for onboard, at-sea DMF observers, have made protected species regulations and resulting closures highly controversial.

Although North Carolina has federal incidental take permits for sea turtles and Atlantic sturgeon for the estuarine gill net fisheries, it has experienced numerous closures resulting from allowed takes either being approached or reached. Other candidate species considered for listing under the Endangered Species Act include river herring and American eel. Additional listings would require additional monitoring requirements if fishing or agency activities interact with those species.

Resource Constraints

The DMF's certified state appropriated budget for fiscal 2015-2016 was permanently reduced by 1.92 percent ($216,340). State appropriations have been reduced annually since FY 2009-2010. Over that period, the DMF has lost $6,813,142 (44.18 percent) and 38.5 positions (23.5 eliminated and 15 fund shifted). Reduction and fund shifting staff and operations limit the DMF's ability to meet many mandate, needs, new initiatives, compliance to fishing regulations and Fishery Management Plan research needs. The DMF must ensure core mission functions are prioritized.

Clean Marina and Clean Boater Programs

The state Division of Coastal Management works to protect coastal water quality through two voluntary programs – North Carolina Clean Marina and North Carolina Clean Boater.

The Clean Marina program illustrates how marina operators can help safeguard the environment by using management and operation techniques that exceed environmental requirements. To earn the certification, the marina's owners prepare spill prevention plans and conduct safety and emergency planning. Marina operators also control boat maintenance activities to protect water quality. Marinas must complete the recertification process every three years to retain their certification as a North Carolina Clean Marina. In 2016, DCM certified three new Clean Marinas in coastal North Carolina and recertified 16 marinas as part of the division's continuing efforts to protect coastal water quality by assisting marinas and boatyards in protecting our environment through the use of best management and operation practices. There are 41 Clean Marinas on the North Carolina coast.

Created in 2011, the division's Clean Boater Program educates boaters on the importance of protecting the state's waterways by adopting environmentally-friendly practices, including proper trash management, boat maintenance, use of marine sewage pumpout facilities, and good recycling habits. Boaters are encouraged to take the Clean Boater Pledge and educate other boaters on the importance of protecting the environment. The division has registered more than 200 Clean Boaters, and continues to promote the program as a companion to the Clean Marina Program. Both programs are strictly voluntary, but show that marinas and boaters are committed to preserving coastal water quality and marine habitats.

Sea-Level Rise Policy Development

As required by Session Law 2012-202, the Coastal Resources Commission (CRC) directed their science panel to prepare an update to the 2010 NC Sea Level Rise Assessment Report. The law instructed the science panel to consider all scenarios of sea level change, including rise, no change, and fall. The panel was required to report regional rates, and not report a single rate for the entire coast. The law also instructed the CRC to study the economic and environmental costs and benefits of adopting, or not adopting, sea level rise policies or regulations. A public hearing and comment period was required after March 31, 2015, and the final report was due to the General Assembly by March 1, 2016. The law made the CRC the only state body that could adopt rates of sea level rise for regulatory purposes, but prohibited them from doing so prior to April 2016.

The CRC asked the science panel to limit the projections to 30 years into the future (to the year 2045), instead of to the end of the century. The CRC also secured Drs. James Houston and Robert Dean to serve as expert reviewers of the draft report. The science panel held monthly meetings, open to the public, in the latter half of 2014, to produce the draft report. The panel employed a combination of methodologies to produce the projections, including statistical analyses of the five ocean-tide gauges in the state, investigations into vertical land movement along different sections of the coast, and consideration of oceanic currents and dredging activities that could impact water levels. The panel combined these analyses with the latest assessment report from the Intergovernmental Panel on Climate Change to produce possible ranges of sea level rise at the five tide gauges that represent the status quo, a low-emissions scenario, and a high-emission scenario. The table below, copied from the executive summary of the science panel's final report, summarizes the projections.

Station	Tide Gauge Projections	IPCC RCP 2.6 + VLM	IPCC RCP 8.5 + VLM
	RSLR in 30 years	RSLR in 30 years	RSLR in 30 years

	(inches)		(inches)		(inches)	
	Mean	**Range**	**Mean**	**Range**	**Mean**	**Range**
Duck	5.4	4.4-6.4	7.1	4.8-9.4	8.1	5.5-10.6
Oregon Inlet	4.3	2.7-5.9	6.3	3.9-8.7	7.3	4.7-9.9
Beaufort	3.2	2.8-3.6	6.5	4.2-8.7	7.5	5.0-10.0
Wilmington	2.4	2.0-2.8	5.8	3.5-8.0	6.8	4.3-9.3
Southport	2.4	1.9-2.8	5.9	3.7-8.2	6.9	4.4-9.4
***Note: Projections were rounded to the nearest tenth of an inch.**						

Table ES1. Three relative sea level rise (RSLR) scenarios by 2045 using published tide gauge rates (NOAA 2014a), and IPCC scenario projections RCP 2.6 and RCP 8.5 (Church et al. 2013) representing the lowest and highest greenhouse gas emission scenarios, combined with local vertical land movement (VLM) at each tide gauge.

The science panel delivered the draft report to the CRC on Dec. 31, 2014, which then underwent two rounds of review and revision with Drs. Houston and Dean. The CRC held a public hearing on the draft in April 2015, and made the draft available for public comment from April to December 2015. At the end of the public comment period, the science panel reviewed the public comments and finalized the report, which was transmitted to the CRC and the General Assembly.

Upon receipt of the final report, the CRC indicated that they intend for the report to be used as a resource for local governments and state agencies.

Estuarine Shoreline Management

The management of estuarine shorelines has been an ongoing focus of the state Division of Coastal Management (DCM) and the N.C. Coastal Resources Commission (CRC).

Through a partnership with East Carolina University, the division recently completed the first-ever digital map of North Carolina's more than 12,000 miles of estuarine shoreline and associated structures. Using the most recently available aerial photography for each county, the estuarine shoreline for all 20 coastal counties was digitized using GIS software, and structures such as bulkheads, piers and docks were identified. The maps can be used by DCM and other agencies to inventory shorelines and structures, study the relationships of shoreline structures and shoreline type, monitor future trends of shoreline development, and better understand the cumulative effects of development on the estuarine environment. DCM has produced a report that includes an in-depth analysis of the shoreline, including calculating the length of five distinct shoreline types, length of the types of modified shoreline, and the number of modified structures; identifying regional development trends; and analysis of the distribution of coastal structures.

In recent years, the CRC and DCM have explored the use of living shorelines, and marsh sills in particular, as alternatives to vertical stabilization measures. "Living Shorelines" include a suite of options for shoreline erosion control that maintain existing connections between upland, intertidal, estuarine and aquatic areas necessary for maintaining good water quality, ecosystem services and habitat values. Unlike vertical stabilization measures such as bulkheads, living shoreline techniques typically use native materials such as marsh plants and oyster shells and sometimes, minimal amounts of structural materials (e.g. stone), to stabilize estuarine shorelines, minimize erosion and enhance habitats.

Non-vertical approaches to estuarine shoreline stabilization have been supported by the N.C. Coastal Resources Commission (CRC) and have also been included as a recommendation of the N.C. Coastal Habitat Protection Plan (CHPP 2015).

Marsh sills are one type of living shoreline approach that has been used in North Carolina, with more than 60 such structures constructed along the state's estuarine shoreline. Marsh sills are shore parallel structures sited in low-to-moderate wave energy environments to enhance, or create a marsh grass fringe between the sill and the upland to reduce wave energy, minimize erosion, improve water quality, and provide habitat for fish, birds and other species. The offshore sill is usually constructed of rock, oyster bags or loose shells, and is designed to dissipate wave energy.

Historically there has not been widespread use of living shorelines or marsh sills in North Carolina. Reasons include unfamiliarity on the part of marine contractors and property owners with the techniques and their efficacy as well as costs compared to more traditional shoreline stabilization methods such as bulkheads. DCM has undertaken substantial efforts to advance living shoreline alternatives to vertical estuarine shoreline stabilization methods. These efforts have included the development of a General Permit (15A NCAC 7H .2700), hosting workshops for property owners and marine contractors, developing an Estuarine Shoreline Stabilization Guide for property owners, and conducting a multi-agency assessment of 27 permitted marsh sills in North Carolina. The N.C. Division of Marine Fisheries (DMF) has also included information on the effects of bulkheads on fish habitat as part of the CHPP, and has funded living shoreline research through the Coastal Recreational Fishing License (CRFL) grant program. Discussions among the agencies and partners led to the development of a Living Shorelines Strategy. The Living Shoreline Strategy contains multiple short- and long-term actions related to outreach and education, marine contractors training, investigation of other funding sources/cost-share programs, marsh sill research, and other topics.

Coastal Hazards and Storms

The state Division of Coastal Management plays a significant role in addressing natural hazards, especially in planning for and responding to coastal storms. The division has developed an emergency general permit that allows property owners to replace some storm-damaged structures very quickly. The emergency general permit also waives permit fees for those rebuilding projects. Most recently, the division helped coastal residents recovering from Hurricane Matthew by issuing CAMA emergency permits for rebuilding docks, piers, boathouses, bulkheads and other structures as well as the rebuilding of dunes. Recognizing many property owners were unable to complete repairs by the designated date due to difficulties in securing contractors or insurance settlements, the department has allowed one year (until Oct. 17, 2017) for permits to be received and all work completed.

In addition, N.C. Hwy. 12, which runs along the Outer Banks from Corolla in Currituck County to Ocracoke Island in Hyde County, along with the aging Bonner Bridge over Oregon Inlet, continue to be the subject of considerable interagency planning and emergency response efforts following significant coastal storms.

The department continues to participate on various interagency teams (NEPA/404 Merger Teams) to weigh long-term options for N.C. Hwy. 12 along the Outer Banks, and works closely with the state Department of Transportation on emergency repairs due to storm damage. Permits have been issued and construction is underway on the replacement of Bonner Bridge over Oregon Inlet and on an interim Pea Island Bridge that will replace a temporary bridge that was constructed on N.C. Hwy. 12 to restore traffic following a breach caused by Hurricane Irene in 2011. Additional coordination efforts are underway on a 2.4-mile bridge project that will elevate a portion of N.C. 12 onto a 2.4-mile bridge that extends from the southern end of the Pea Island National Wildlife Refuge over the Pamlico Sound into Rodanthe. This stretch of highway has frequently been breached and overwashed by several hurricanes and significant winter storms (nor'easters) in recent years, causing significant damage to the roadway. The department is also working

closely with the N.C. Department of Transportation on the development of short and long-term options to alleviate issues at the Buxton Canadian Hole "hot spot" in the Buxton community, the Hatteras Village "hot spot" in Hatteras Village, and the Ocracoke Island "hot spot" on Ocracoke Island.

Officials with DCM and the state Department of Transportation are working together to maintain lines of communication, streamline permitting, and avoid delays in reopening transportation routes to and from communities impacted by coastal storms.

Beach and Inlet Management

Several session laws during the past four years have directed the CRC to conduct several studies and to amend regulations related to beach and inlet management. These studies have included Inlet Hazard Areas, Beach and Inlet Management, Beach Erosion and Beach Nourishment. The CRC has adopted rules that provide alternative management strategies for beachfront development, updated its rules related to its oceanfront jurisdictional area, addressed grandfathering certain existing beachfront development, and management of sandbags as temporary erosion control structures.

In 2011, the General Assembly amended the N.C. Coastal Area Management Act (CAMA) to make an exception to the state's prohibition on the use of hard erosion control structures (such as seawalls, jetties and groins) on ocean and inlet shorelines. This exception allows for the construction of up to four terminal groin projects in the state's inlets. In 2013, the state legislature modified the terminal groin language in CAMA to allow for construction of other design features, such as L-heads, in association with a terminal groin, and clarified portions of the existing terminal groin legislation dealing with project funding, financial assurances, and monitoring and mitigation requirements. The law was further amended in 2015 to allow for the construction of an additional two terminal groins.

To date, DCM has issued two permits for terminal groins: one permit for the Village of Bald Head Island, which completed construction in 2015; and one permit for the town of Ocean Isle Beach, which was issued in November 2016. An additional four communities have expressed interest in pursuing a terminal groin project, or have begun the process of satisfying the requirements of G.S. 113A-115.1 (Figure Eight Island Homeowners Association, Holden Beach, North Topsail Beach and Carteret County).

The Coastal Resources Commission has also been focused on the beneficial use of dredged material associated with the current federal Dredged Material Management Plan (DMMP) for the State Port at Morehead City. The CRC has initiated discussions with the U.S. Army Corps of Engineers (USACE) and other stakeholders, to develop memorandums of agreement (MOAs) that could ensure beach-compatible dredged materials remain in the active nearshore, beach or inlet shoal system. Two efforts underway to create MOAs related to the beneficial use of dredged material associated with N.C. Ports dredging projects. Carteret County has been interested in pursuing a MOA between the DEQ and the USACE that would facilitate beneficial use through federal, state and local cost-sharing. Pursuant to Section 14.6(d) of the State's 2015 Appropriations Act, and N.C. State Ports is negotiating a separate MOA with the USACE.

Flooding, Saltwater Intrusion and Agricultural Drainage

In November 2012, the N.C. Coastal Resources Commission, Coastal Resources Advisory Council, Division of Coastal Management staff, and several partner organizations held a meeting in Plymouth, N.C., and toured areas in Hyde County to learn more about agricultural issues and opportunities unique to coastal regions. Sea level rise, "tailwater recovery"/restoration of historical hydrological flows, saltwater intrusion, opportunities for regulatory reform, and comprehensive water resource management were discussed including installation and maintenance of agricultural

drainage ditches and canals that lead into estuarine waters, flood gates and pump systems, storm dikes, and other management approaches.

DCM has convened an Agricultural Drainage Issues Steering Committee and, based on input from the Steering Committee, is developing a set of recommendations for consideration by the county. The Stakeholder Committee includes DCM staff as well as representatives from key partner organizations and stakeholder groups. The recommendations will address opportunities for non-regulatory approaches to improved water resource management, sea level rise adaptation, regulatory streamlining for routine agricultural practices, and/or financial assistance for habitat restoration projects.

Waste Management

The mission of the N.C. Division of Waste Management, or DWM, is to safeguard the public and the environment from the potential harmful effects of waste transport, storage and treatment, underground petroleum storage, and existing contamination, while facilitating the productive reuse of contaminated properties.

In North Carolina, as in all states, properties have been contaminated by petroleum products, solvents, pesticides and other environmentally harmful and toxic substances. Much of the contamination is a legacy of activities -- both public and private -- that occurred before the adoption of state and federal environmental standards. In many cases, soil and groundwater contamination resulted from waste disposal, including trash collected by local governments for disposal and chemicals used in manufacturing. Leaking petroleum underground storage tanks deteriorated over time and leaked petroleum product into the soil and groundwater. These contaminated sites can pose a threat to public health and the environment, particularly when contamination affects drinking water supplies. The presence of environmental contamination also inhibits the sale and redevelopment of property, hindering economic development.

Several DEQ programs assess, remediate and redevelop contaminated property. The N.C. Division of Waste Management (DWM) implements most of those remediation programs and regulates all forms of waste disposal. DWM and the Division of Environmental Assistance and Outreach also provide technical assistance and incentives related to recycling and waste reduction to businesses, industries, local governments and residents.

N.C. Gen. Stat. §150B-21.3A, adopted in 2013, requires state agencies to review existing rules every 10 years on a schedule established by the Rules Review Commission (RRC), and to then re-adopt all rules which are determined to be necessary. In April 2017, DWM will be seeking the approval of the RRC for the review of subchapters 13A, 13B, and 13C in Title 15A of the N.C. Administrative Code, which include rules on Solid and Hazardous Waste Management and Inactive Hazardous Substance or Waste Disposal Sites. DWM will then begin the process of readopting the necessary rules in those subchapters on a schedule to be determined by the RRC. The rule re-adoption will be a transparent and collaborative process with open dialogue between DWM representatives and external stakeholders, including local governments, private industry, and environmental groups, to update and amend rule language.

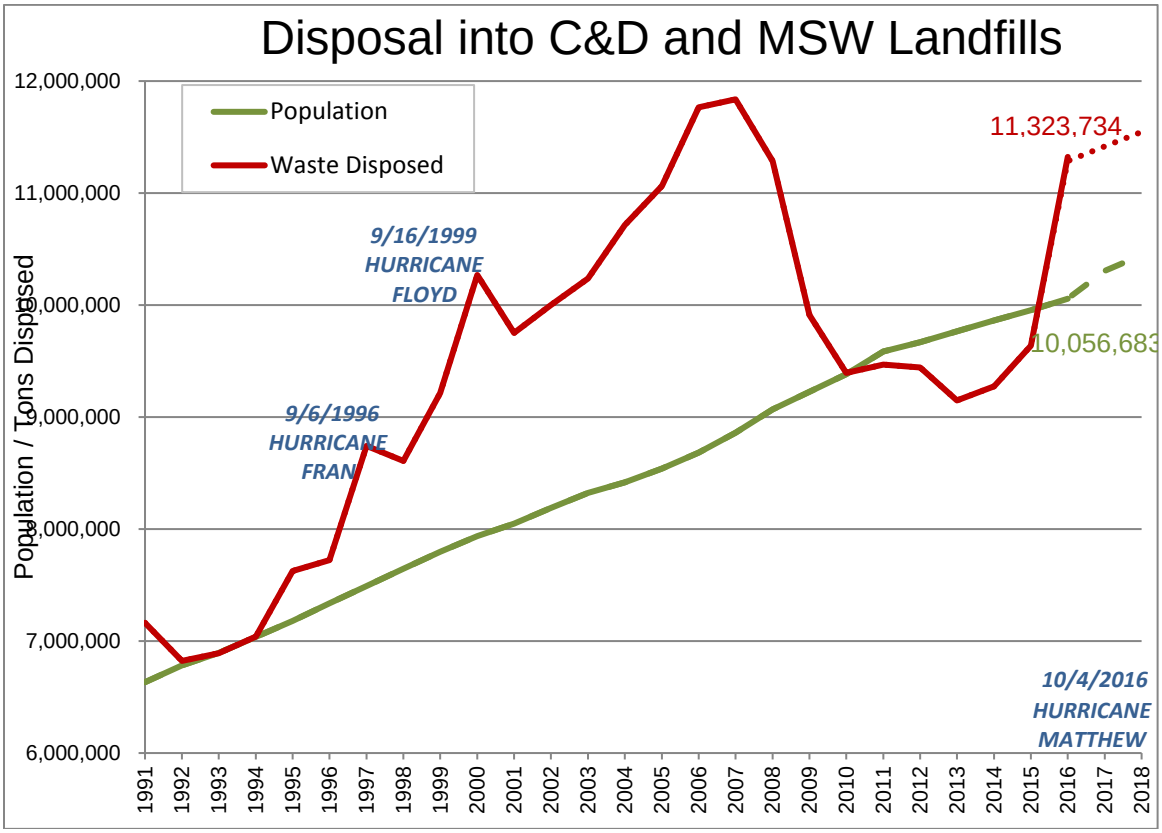
Solid Waste Management

Waste types handled at North Carolina facilities include municipal solid waste, industrial waste, construction and demolition waste, land-clearing waste, scrap tires, medical waste, compost and septage. Solid waste consists of everyday items we consume and discard. It predominantly includes food wastes, yard wastes, containers and product packaging, and other miscellaneous inorganic wastes from residential, commercial, institutional and industrial sources. Inorganic wastes include appliances, clothing, boxes, disposable tableware, furniture, wood pallets and rubber tires.

Waste has historically been generated from the residents of North Carolina as household or industrial waste and generally has grown in volume as the population rises. Increasingly, waste from cleanup of decades-old industrial sites or other contaminated sites has resulted in inflated generation of the wastes disposed of in landfills. Much of the increase in waste disposal is due to the quantities of coal combustion residuals (CCR) that have been excavated from impoundments managed by Duke Energy so the residuals could be safely disposed of in lined municipal solid waste and

industrial landfills, as required by the Coal Ash Management Act of 2014. Coal combustion residual waste generated in North Carolina, both production ash and cleanup ash, from electrical plants is disposed into industrial and municipal solid waste (MSW) landfills in North Carolina and other states. Other post-industrial or business cleanups that are going to safe disposal into lined MSW landfills include petroleum contaminated soils from leaking storage tanks, as part of the Division of Waste Management's Underground Storage Tanks Section, and wastes from development at industrial facilities, as part of the Division of Waste Management's Brownfield Program.

In past years, the cleanup from hurricanes Fran and Floyd, created noticeable spikes in the waste disposed into landfills; it is expected that a similar waste increase will be reported due to the debris cleanup after Hurricane Matthew.



The chart above displays the history of disposal since 1991. For each fiscal year, it represents the material generated during that year that entered disposal facilities.

As of January 2017, the total remaining capacity of all North Carolina MSW landfills measures approximately 394 million cubic yards, equating to about 245 million tons, an increase from last year. This estimate was calculated using 0.62 tons of waste per cubic yard of air space. The capacity does not include waste exported to out-of- state landfills. The state capacity equals 29 years of waste disposal if North Carolina's rate of landfill use remains steady at approximately 8 million tons per year. Continued efforts to increase recycling and material diversion should help the state maintain a strong landfill capacity. Much of the state's capacity is not available statewide due to permit conditions, franchise arrangements, service areas and distances. Although overall state capacity is sufficient, some regions have limited waste disposal capacity. Those areas may experience higher disposal costs and possible disruptions in service as facilities close or fuel costs make transport of waste to distant facilities prohibitive.

Environmental Monitoring at Solid Waste Facilities

Landfills contain numerous substances which, if released, could pose a significant threat to human health and the environment. These substances leaking from permitted landfills can migrate horizontally and vertically, presenting a threat to the public and the environment.

The rate at which groundwater and landfill gas contamination occurs is a function of many factors. Most importantly, it is based on the depth to groundwater, the type of soils between the bottom of the landfill and groundwater, precipitation rates at the landfill, and final landfill caps. As such, the time needed to identify a release varies from one landfill to another. Therefore, over time, the number of landfills with contaminated groundwater and landfill gas exceedances are expected to increase.

The quantity, variety and complexity of groundwater and landfill gas monitoring systems has also grown at all permitted landfills, and as a result, alternate source demonstrations, assessments, and remediation have been required at numerous lined and unlined landfills where groundwater monitoring well systems have detected contamination, and landfill gas monitoring well systems have detected landfill gas generation and migration.

The Solid Waste Section continues to develop and manage the Environmental Monitoring Database for groundwater and surface water analytical data. The total number of lined and unlined landfills with groundwater monitoring systems is 300. There have been groundwater standard exceedances reported at 238 of the 300 landfills (79 percent) with groundwater monitoring systems, and 58 landfills are implementing corrective action.

Some of the unlined landfills do not have adequate monitoring systems so the Solid Waste Section is reassessing the groundwater monitoring well networks and landfill gas monitoring well networks at the unlined landfills. The Solid Waste Section is also reassessing conditions at the compliance boundary related to groundwater standard exceedances and landfill gas concentrations at unlined landfills. The potential for off-site migration of groundwater contaminants and landfill gas is also being evaluated.

The Solid Waste Section also continues to provide oversight and assistance for landfills to achieve compliance by performing complex and often critical technical compliance reviews of landfills with emphasis on the potential impact of landfill gas migration and the potential impact of hazardous substances to the vadose zone, groundwater and surface water within different geologic conditions across the State.

Special Waste Management - Tires, White Goods, Electronics and Biodegradables

Special handling is required in the disposal of tires, white goods, televisions, and computer equipment, which are banned from disposal in North Carolina's landfills and incinerators. Other wastes such as yard, food, biosolids and wood are increasingly diverted from the landfill waste stream through composting, turning waste into a valuable product.

Tires are a fire hazard or can be a health hazard if allowed to become a breeding ground for disease-carrying mosquitoes and must be collected by counties for processing or proper scrap tire disposal. White goods, including appliances which contain environmentally hazardous refrigerants, must also be collected by county governments to have refrigerants removed before recycling of metals or proper disposal. Televisions and computer equipment, including laptop and desktop computers, monitors, computer peripherals, printers and scanners, often contain components which contain hazardous and valuable materials, and must be recycled or disposed of properly.

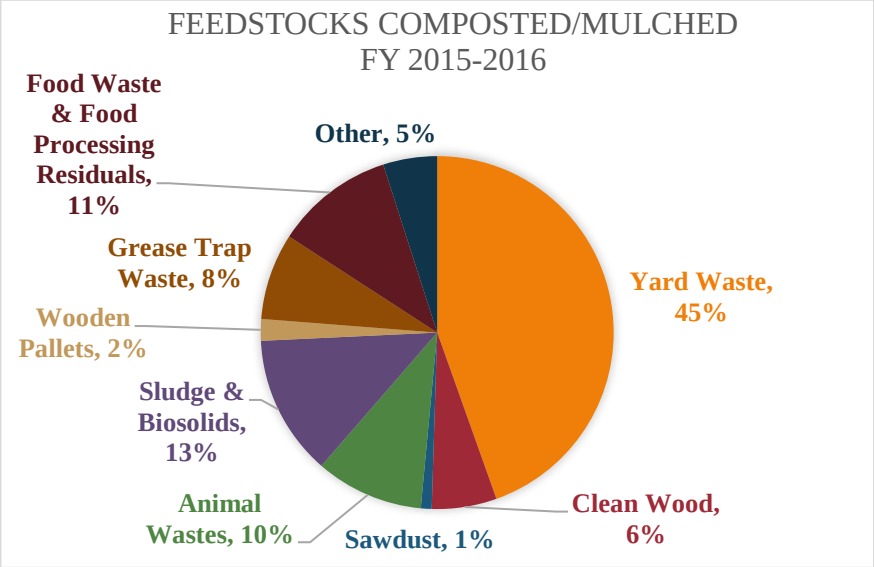
North Carolina counties are required by statute to provide collection of tires and white goods. Tax revenue from the sale of new tires and white goods is distributed directly to counties on a per capita basis. Funds are also provided to the counties from the Scrap Tire Disposal Account or the White Goods Management Account, managed by the state Division of Waste Management, for cost overruns stemming from costs exceeding their distributions from the state Department of Revenue. Funding also is provided from these two accounts for capital improvements to county infrastructure, such as concrete pads and forklifts needed to collect the large heavy white goods. Funding is also used on a continual basis for the cleanups of tire dumps and (less frequently) white goods dumps. Grants of approximately $800,000 from the White Goods Management Account and $1 million were distributed last year to county governments.

Legislative changes to the scrap tire and white goods program were made according to Session Law 2013-360. The N.C. Department of Revenue sent the portion of the tax distributed to the DEQ and all forfeited funds to the General Fund. All distributions from the N.C. Department of Revenue to county governments continue to be made quarterly. The scrap tire program receives through appropriations $820,000 annually for aid to county governments. The White Goods Program does not receive any income but will continue to function as it has in the past, awarding grants as needed for cost overruns, capital improvements, and cleanups until funding is exhausted or until June 30, 2017.

North Carolina has established a robust electronics recycling collection system that gives the public the opportunity to recycle practically every piece of electronic equipment they purchase and use. This collection system diverts more than 19,000 tons of electronic equipment from landfills each year, delivering those materials to a largely in-state primary processing infrastructure that then distributes the products and commodities into a larger, global marketplace. In total, local government and manufacturing programs have diverted almost 90,000 tons of electronics from disposal since fiscal 2009-10. Local governments also choose to provide electronics collection services in most North Carolina counties and many cities. Funding, generated from registration and annual fees charged to manufacturers of computer equipment and televisions, is provided to counties and cities for administration of local government electronics recovery and recycling programs. The distributions are made annually from the Electronics Management Fund, managed by the N.C. Division of Waste Management, to local governments who have an approved electronics collection program. The program funds are used by local government programs only for the collection, recycling, reuse, education and public awareness and to ensure that the programs only use recyclers that are e-Steward or R2 certified (an internationally recognized standard of socially and environmentally responsible management of electronics). Fund distributions equaling $700,000 in February of 2017 will be going to 81 counties and two cities.

Compost facilities continue to divert organics from the municipal solid waste stream. Fifteen solid waste compost facilities accept tons of food waste, biosolids, yard waste, wood waste and other wastes from industrial food processors, municipalities and institutions.

Facilities report that they process more than 480,000 tons of feedstocks to create compost and mulch annually. Although food waste diversion continues to grow in importance, it currently only makes up 11 percent of feedstocks being reported as processed at facilities, an increase of 2 percent from last year. There is significant opportunity in North Carolina to continue to increase food waste diversion.



Disaster Response and Preparation

The department works with local governments to foster the message that disaster preparedness is essential, given the history of storm destruction in North Carolina. The department evaluates potential sites for the temporary storage of vegetative and demolition debris following an emergency or disaster until waste can be properly disposed of. In the fall of 2016 through the end of the year, the department dedicated significant staff time and resources to preparation, response, and cleanup for Hurricane Matthew, including working to update and improve the GIS map of approved sites. That map was provided to officials with the N.C. Division of Emergency Management.

Hazardous Waste Management Program

Hazardous waste is waste that poses substantial actual or potential threats to public health or the environment. Hazardous waste includes materials known to have traits such as flammability, reactivity, corrosivity or toxicity. The many types of businesses that generate hazardous waste include dry cleaners, automobile repair shops, hospitals and exterminators. Larger industrial sources of hazardous waste include chemical manufacturers and electroplating companies. Because hazardous wastes are dangerous, they cannot be disposed in the same manner as common household waste.

The purpose of North Carolina's hazardous waste program is to protect human health and the environment from risks presented by the mismanagement of hazardous industrial waste and through the permitting of hazardous waste treatment, storage and disposal facilities. North Carolina's Hazardous Waste Section, organizationally located in the state Division of Waste Management, is authorized by the EPA to implement the federal hazardous waste statute, known as the Resource Conservation and Recovery Act (RCRA). EPA provides federal funding to support the program, for which the state is required to provide a minimum of 25 percent matching funding. Fees paid by the regulated community provide the state-match funding. No taxpayer funds are appropriated by the General Assembly to support program activities.

EPA oversees the state's implementation of the program to ensure it is consistent with and as stringent as the federal RCRA program in protecting human health and the environment. The federal RCRA statute can be found at 42 USC 6901 *et seq*. North Carolina's implementing statute can be found at NCGS 130A-294 and the implementing regulations can be found at 15A NCAC 13A.

The primary activities of the section include treatment, storage and disposal facility permitting and oversight of soil and groundwater remediation; compliance assistance, inspection and enforcement; and information and financial management.

Hazardous waste received in North Carolina by facilities in state fiscal 2015-16 amounted to 22,554 tons. Hazardous waste generated in North Carolina by facilities in state fiscal 2015-16 totaled about 86,000 tons of hazardous waste. For this year's report, hazardous waste generated data is from Easitrak/RCRAInfo and the hazardous waste received data is from the N.C. Resident Inspector Program. Inspection, compliance assistance and enforcement activities at hazardous waste facilities resulted in the safe management of an estimated 1,745 gallons and 70.1 tons of hazardous waste, 4,040 gallons and 4.26 tons of non-hazardous waste, 43,440 gallons of used oil and 106 pounds of universal waste. Mismanagement of the waste could have presented potential health or environmental risks.

Also, the program continues to make significant progress in cleaning up contamination at permitted hazardous waste management facilities. The EPA has set two environmental indicator goals and two additional remediation goals for facilities that are in the RCRA Corrective Action Universe. There are 90 facilities in the North Carolina RCRA corrective action universe. The EPA environmental indicator goals are to have 95 percent of the facilities with human exposures controlled and 95 percent of the facilities with contaminated groundwater under control by federal fiscal 2020. North Carolina has achieved 94 percent of the facilities with human exposures controlled and 92 percent of the facilities with contaminated groundwater under control. North Carolina will meet EPA's 95 percent goal for these two environmental indicators before fiscal 2020. The national goal is for final remedies to be constructed and fully operational at 95 percent of these facilities by 2020, although this does not necessarily mean remediation will have been completed. In North Carolina, 67 percent of the facilities have a remedy constructed. The last goal is to have more than 25 percent of the facilities in the universe with all remedies completed. North Carolina has 24 percent of the facilities with all remedies completed.

Generator Inspections and Enforcement Program

The Generator Inspections and Enforcement Program continually works to advance the safe management of hazardous waste. The program provides comprehensive audits of on-site waste streams, hazardous waste management practices and recordkeeping procedures for all generators and handlers of hazardous waste. In addition, education and outreach programs provide facilities with the information needed to achieve regulatory compliance. Direction and technical support are provided during emergency situations involving hazardous waste. In addition, the program responds to citizen complaints arising from questionable manufacturing practices, criminal activity and/or accidental releases of hazardous wastes by businesses. This program includes the Resident Inspector Program and the Mercury Switch Recovery Program, described in later sections.

There are 7,576 hazardous waste handlers in North Carolina. For fiscal 2015-16, inspectors completed 567 inspections at these handlers. Program compliance was 93 percent.

The program works with the N.C. Manufacturer's Alliance to offer training to large quantity generators each year at multiple sites in the state. The program conducted five large quantity generator workshops statewide, reaching 484 attendees. Attendees are advised they may request a compliance assistance visit from the program at any time to ensure they are in compliance for their next inspection.

Additionally, the program developed a self-certification checklist and guidance document for small quantity generators, to help them achieve and maintain compliance. A total of 1,750 Small Quantity Generators (SQG) were sent the checklist, of which 1,080 (62 percent) have been returned.

Resident Inspector Program

The Resident Inspector Program was established "... to enhance the ability of the department to protect the public health and the environment by providing the department with the authority and resources necessary to maintain a rigorous inspection and enforcement program at commercial hazardous waste facilities" [G.S. 130A-295.02(f)]. Commercial hazardous waste facilities are facilities that take hazardous waste from other generators for proper treatment or disposal. The program monitors all aspects of commercial hazardous waste facilities in North Carolina, provides facility support through assistance and education, assures compliance with laws and rules administered by the

N.C. Department of Environmental Quality and may include enforcement of laws or rules administered by any other state agency through a memorandum of agreement.

During fiscal 2015-16, the Resident Inspector Program staff conducted 530 multimedia inspections at North Carolina's 10 commercial hazardous waste treatment and storage facilities. Program compliance was 97 percent.

Mercury Switch Recovery Program (MSRP)

The Hazardous Waste Section in DEQ's Division of Waste Management implemented a program that requires the removal and recycling of mercury-containing convenience light switches from scrap automobiles known as "end of life" vehicles in 2005. Revised by the General Assembly in 2007, this program required auto recyclers and scrap metal processors to remove mercury switches before the vehicles are crushed, shredded and recycled into the manufacture of steel. The vehicle recyclers and scrap metal processors received $5 for each switch that was removed, collected and sent for recycling. Removal of the switches prior to recycling greatly reduces mercury emissions during the steelmaking process.

For fiscal 2015-16, 19,394 mercury switches were removed from vehicles by North Carolina vehicle dismantlers/recyclers, vehicle crushers and scrap processing facilities and sent to the End of Life Vehicle Solutions Corp. (ELVS), which manages the nationwide National Vehicle Mercury Switch Recovery Program and properly recycles the recovered mercury to keep it out of the global environment. A total of 42.67 pounds of mercury (from the 19,394 switches) has been prevented from being released to the environment in North Carolina as a result of mercury switches removed from vehicles this year. Also, North Carolina has held the top spot in the nation based on the mercury recovery performance ratio (pounds of mercury recovered from switches in the state in a calendar year divided by the estimated number of pounds of mercury available to be recovered from mercury switches from the state in the same calendar year) each year but one since 2009. In the 11 years that this program has been ongoing, a total of 1,154 pounds of mercury to date has been prevented from being released into the environment in North Carolina from metal processing and smelting of scrap vehicles.

N.C.S.L. 2016-94, ratified on July 1, 2016 and signed by the governor on July 14, 2016, modified the sunset date of the Mercury Switch program from Dec. 31, 2017, to June 30, 2017 and ended program funding. All activities of the program in North Carolina, including education, assistance, inspections and switch reimbursements, will cease as of June 30, 2017. Vehicle processing sites are still required to send the mercury containing switches to ELVS for recycling, but they will receive no incentives.

Brownfields Program

Brownfields are abandoned, idled or underused properties where environmental contamination hinders redevelopment due to concerns about environmental liability. The Brownfields Property Reuse Act removes barriers to redevelopment by protecting prospective developers from liability for contamination they did not cause. The N.C. Brownfields Program, in partnership with the EPA, has been successful in revitalizing and promoting safer use of brownfields properties in North Carolina. The program also supports other community goals, such as preservation of green space and reduction of urban and suburban sprawl, and making urban development more economically efficient. For each brownfield property redeveloped, a green space is saved.

Since the Brownfields Program began in 1997, 423 properties (representing more than 6,600 acres) have received completed brownfields agreements. The brownfields agreements that facilitated these redevelopments has resulted in at least $14 billion in private capital investment since the program started.

As the economy has continued its recovery from the recession of 2008 there has been a huge upturn in demand for the program. The program completed a record number 56 brownfields agreements in federal fiscal 2016, which is 17 more than were completed in the previous year. These projects facilitated well over $1 billion in private investment in brownfields redevelopment while ensuring the resultant redevelopments are safe for the intended reuse proposed. The challenge faced by the program is to continue to grow to meet the continued rising demand. There were a record 95 applications for new projects received in federal fiscal 2016 (a number that has been steadily increasing from 66 applications three years ago).

The program is a national model for how brownfields programs can yield positive economic development results simultaneously with environmental and public health protection. Furthermore, it does so in a self-sustaining way that its truly a public-private partnership. Any increase in program capacity to meet the increased demand has come from fee receipts from developers themselves as its federal funding from EPA has seen continual cuts for many years now. Though the program has never received any state funding appropriations since its inception, the impact to the state's economy is measured in thousands of jobs created and billions of dollars in private investment.

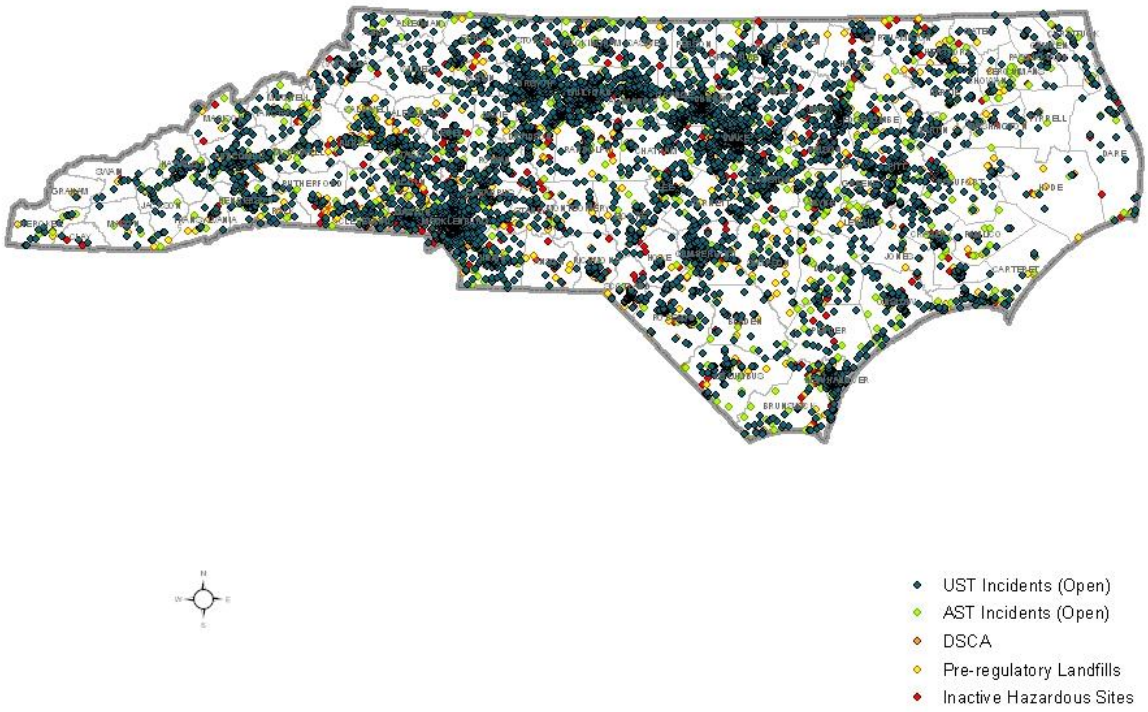
Underground Storage Tank Program

Leaking petroleum underground storage tanks and other petroleum release sources can contaminate groundwater, which often is used as a source of drinking water. DWM's Underground Storage Tank (UST) Section helps owners and operators of USTs comply with state and federal laws and regulations. This section also oversees the administration of state trust funds for the reimbursement of cleanup costs associated with UST releases and manages permanent closure activities of UST systems. Since 1988, more than 22,881 UST releases have been remediated. The state has approximately 7,468 additional releases that still need to be cleaned up and received approximately 701 new releases (commercial & noncommercial USTs) in fiscal 2016.

Additionally, 3,527 petroleum releases from sources other than USTs have been assessed and remediated as well. Aboveground tanks, transportation accidents and pipeline ruptures can cause significant contamination issues. Approximately 1,942 releases remain active awaiting cleanup. These sites have no trust fund mechanism and can be difficult to move through the regulatory process.

Discharges or releases of petroleum are reported to DEQ regional offices and added to an incident management database. Incidents closed out in any year are not necessarily the ones reported in that year – many releases take years to clean up and close. Note that in fiscal 2012, the program closed more incidents than were reported -- a trend that decreases the backlog of UST contaminated sites that have not been fully addressed. Many new releases are discovered during real estate transactions and construction projects. The UST program has been able to increase the number of incidents being addressed based on availability of resources in the Commercial Cleanup Fund. Progress toward cleaning up and closing out petroleum contaminated sites of both types could be accomplished faster with additional resources.

A present, 5,365 commercial UST incidents have yet to be closed out. Although responsible parties continue to have a statutory duty to cleanup petroleum releases, Session Law 2004-124 limits the amount of cleanup work that DEQ can direct at any one time to the amount that can be reimbursed by the state trust funds within 90 days. This approach was taken to eliminate the negative balances in both the Commercial Fund and the Noncommercial Fund (which no longer exists). Low per-tank Financial Assurance resources coupled with Session Law 2004-124 resulted in a backlog of properties waiting to be cleaned up. While the UST program works to clean up and close existing incidents, new (or newly discovered) releases are also being reported. There continues to be steady decrease in the number of new commercial UST releases reported each year. Two hundred seventy-one releases were identified in fiscal 2016 which is 11.5 percent below the previous 10-year average.



This map depicts approximately 13,000 contaminated sites across North Carolina by DWM program type.

Inactive Hazardous Sites Program

The Division of Waste Management's (DWM) Inactive Hazardous Sites Branch implements the Inactive Hazardous Sites Response Act of 1987 (IHSRA). The IHSRA requires DWM to maintain a catalog of inactive hazardous substance or waste disposal sites. The program has cataloged 2,435 chemical spill sites and 677 old unlined landfills. Of these, 564 sites now have all work completed and are assigned "No Further Action" status. Twenty-three completed all work and were assigned "No Further Action" status in FY 2015-16. A total of 37 new sites were added this past fiscal year and two sites were reopened.

Pre-Regulatory Landfill Program

The Pre-Regulatory Landfill Program addresses the 677 Inactive Hazardous Sites that were used as uncontrolled municipal solid waste dumps before solid and hazardous waste permitting regulations existed. These landfills received all community wastes, including industrial hazardous wastes, and are unlined. Approximately 80 percent of the sites have a water supply well, residence, school, church, day care or park on or within 1000 feet of the disposal and thus pose higher risks. The program receives a portion of a statewide solid waste disposal tax to work on the landfills in order of risk priority. The program contracts environmental engineering firms to conduct the assessment and remediation work. There are eight firms engaged for this work. Local governments are also allowed to conduct contaminant assessments at these sites and be reimbursed if the program reviews the work. There are 48 contractor and nine local government site characterizations ongoing and 33 sites with remediation underway. Now that sites are moving into

remediation, the fund's expenditure rate is accelerating. The fund balance is expected to decline significantly in the next few years as expenditures exceed income. The fund balance is approximately $30 million.

In addition to the program's eight remediation contracts, DWM has started a pilot study at four landfills to test whether independent decision-making by two firms recently awarded turn-key, site-specific engineering contracts will result in lower costs and expedited cleanup.

Risk-Based Remediation of Contaminated Sites

In 2015, the state legislature adopted amendments to G.S. 130A 310.68 through 310.77 that expanded the optional use of risk-based cleanups of contaminated sites to include virtually all regulated sites (except those subjects to remediation pursuant to the Coal Ash Management Act of 2014 and the requirements of animal waste management systems). As a result, remediating parties now have a choice to clean up their sites to an unrestricted-use level, or to develop site-specific cleanup levels designed to protect public health and the environment. These risk-based levels consider site conditions and the future use of the property and rely on engineering and/or institutional controls to address risks. Such remedies require that affected property owners concur with the risk-based remedy and with any needed land-use restrictions.

Whereas virtually all sites have always had the option for risk-based soil cleanup levels and vapor mitigation levels, groundwater cleanup at most sites historically had to meet the 15A North Carolina Administrative Code (NCAC) 02L .0202 Groundwater Standards (15A NCAC 02L Standards).

DEQ has developed documents that explain administrative procedures (forms, consents, fees, etc.) and that provide technical guidance aimed at effective and timely remedies, and that make cleanup programs more consistent across the department. DEQ also created a publication (required under SL 2015-286) to inform owners of contaminated off-site properties of their rights and responsibilities under environmental cleanup and real estate laws.

Short-Term Exposure Risks for Trichloroethylene Vapor Intrusion

Volatilization of soil and groundwater contaminants causing vapors to enter structures (vapor intrusion or VI) has become an important issue in the last several years. Our agency's focus on this risk is now heightened due to recent toxicological studies that indicate trichloroethylene (TCE) poses risks to a developing fetus during the first trimester of pregnancy, even upon short term exposure at low levels. The state Division of Waste Management, in coordination with the Division of Public Health, EPA Region 4 Superfund and public stakeholders, is developing guidance and a public communication strategy to ensure that immediate proactive measures for risk management take place. These measures include: 1) contacting DEQ program staff within 24 hours of discovery so the programs and their partner agencies are aware of the hazard and can assist with any necessary communications; 2) informing the sensitive populations about the risks; and 3) eliminating the exposures from indoor air inhalation.

Cleanup and Environmental Restoration at the Kerr-McGee Chemical Corp NPL Site

The cleanup at this site in Navassa (Brunswick County), is funded by a nationwide bankruptcy settlement between EPA and states and Kerr-McGee's successor companies. A total of $92.5 million is being used to clean-up the Navassa site under the oversight of the state's Department of Environmental Quality and the EPA. An additional $23 million will be used to restore damaged ecosystems under the direction of DEQ, the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration. This site was part of the largest environmental settlement in our nation's history, which will result in the cleanup of more than 300 former Kerr-McGee sites nationwide.

The 251-acre former creosote-based wood treating facility has contaminated soil, wetlands and groundwater. Site contamination does not currently threaten people living and working near the site. The EPA, DEQ and the court-appointed Multistate Environmental Response Trust are conducting the remedial investigation of the site and working with Navassa, local community groups and residents to develop the framework and vision for the redevelopment and reuse of the site.

Dry-Cleaning Solvent Cleanup Act (DSCA) Program

The Dry-Cleaning Solvent Cleanup Act (DSCA) of 1997 and its amendments created a fund for assessment and cleanup of dry-cleaning solvent environmental contamination at dry-cleaning and wholesale distribution facilities and also authorized the program to develop and enforce rules relating to the prevention of dry-cleaning solvent releases at operating facilities.

Since the start of the DSCA program, 439 sites with known or suspected dry-cleaning solvent contamination have been reported to DEQ's Division of Waste Management. Of these, 379 have been certified into the DSCA Program. DSCA's fiscal 2015-16 accomplishments include:

- Issuing No Further Action (NFA) Notices for 13 remediated sites, with 32 additional sites identified as ready for No Further Action status.
- Providing municipal water to three residences, and temporary bottled or filtration systems to five residences.
- Installing vapor mitigation systems for one residence and four businesses to protect occupants from contaminant vapor intrusion risks.
- Implementing four groundwater remedies and two soil remedies at six DSCA sites.
- Conducting 552 full compliance inspections at 538 active dry-cleaners.
- Performing outreach visits at 27 facilities to educate and assist new business owners/operators with environmental compliance.
- Delivering approximately 440 compliance calendars to assist dry-cleaners with record-keeping requirements.

The DSCA Fund had an end-of-fiscal 2015-16 fund balance of approximately $5.6 million and encumbered funds totaling $2.8 million. The small decrease in the fund balance during the last year is attributed to an increase in expenditures to address the increased number of sites, to assess vapor intrusion and mitigate as needed, and to continue to assess and remediate certified sites to ensure the protection of human health. Control measures are being implemented to help ensure that funds are available to address sites that pose greater potential risks. Based on North Carolina-specific and national data on site cleanup costs, cleaning up the 379 sites that have been certified in DSCA will cost an estimated $125 million. DEQ estimates there may be as many as 1,500 contaminated dry-cleaning sites in North Carolina. Projected costs to cleanup 50 percent of those sites are expected to exceed $250 million.

The Bernard Allen Emergency Drinking Water Fund

The Bernard Allen Emergency Drinking Water Fund (Fund), administered by the N.C. Division of Waste Management, was created in 2006 by the General Assembly to improve the state's response to groundwater contamination and provide low-income households with a safe drinking water supply. The fund has three authorized uses: 1) pay for notice to persons whose wells were at risk from groundwater contamination; 2) pay for the costs of testing private wells; and 3) provide an alternate drinking water supply to well owners affected by the contamination.

The fund continues to provide critical services for many residents of North Carolina through well testing, providing emergency bottled water and assisting in permanent waterline connections or point-of-entry treatment systems for wells. In fiscal 2015-16, the fund's resources focused primarily on providing alternate water to affected residents and investigating potentially contaminated wells in the state through sampling. Eleven households received alternate water

this fiscal year using the Bernard Allen Emergency Drinking Water Fund. To date, 133 households have received alternate water through this fund.

Federal Superfund (CERCLA) Cleanups in North Carolina

Under the statutory basis of CERCLA the Federal Remediation Branch (FRB) of the Superfund Section works with EPA and, where appropriate, the U.S. Department of Defense (DOD) to investigate, assess and remediate sites where uncontrolled and unregulated hazardous wastes have been or may be released into the environment. Once discovered, sites are placed on EPA's CERCLA inventory (CERCLIS) and assessed by FRB staff to determine their relative risk to public health and the environment. CERCLIS sites are screened for the National Priorities List (NPL). Evaluation of these sites are based on the likelihood of their potential impacts on target populations and sensitive environments. Site assessment leads the branch to refer some sites to EPA for emergency actions to address imminent threats to human health or the environment, and also refer other sites to the Superfund Section's Inactive Hazardous Sites Branch for cleanup under that program.

A small percentage of evaluated sites, 39 sites to date in North Carolina, qualify to be listed on the National Priority List (NPL) for long-term remedial action. NPL cleanup actions are financed either by a federal trust fund with a 10 percent state cost share or by potential responsible parties. When the federal trust fund is used, CERCLA requires the state to provide 100 percent of certain types of operation and maintenance (O&M). The Federal Remediation Branch manages that operation and maintenance after the NPL remediation process has been completed.

The Federal Remediation Branch also works with the Department of Defense to investigate and remediate sites on DOD installations and at non-installation sites once used by DOD (Formerly Used Defense Sites, or FUDS). DOD finances long term remedial action at these federal military sites through the Defense Environmental Restoration Program (DERP).

Dam Safety

North Carolina has among the largest number of dams under state jurisdiction of any state in the nation (3,000), particularly high hazard potential dams (1,200) that would endanger lives and property if they failed. The Dam Safety Law was amended in 2009 to give the Dam Safety Program jurisdiction over the 50 or so mostly high hazard dams (equivalent to 270 inspectable dam safety units) associated with fossil fuel power plants. Many of these power plant dams are quite large and pose a significant potential threat to public safety and the environment if they fail.

DEMLR's Dam Safety Program has approximately 18 full-time equivalent positions statewide to inspect more than 3,000 jurisdictional dams, review several hundred plans for new construction, modification, repair and breach, review more than 1,500 emergency actions plans, and provide technical guidance and assistance to staff, dam owners, engineers, and the public. While some resources were provided to the program to process dam safety applications related to coal ash management, addressing coal ash-related issues and legislative directives has also involved the program's other engineering staff, resulting in further delays in application review and approval. In addition, through the Coal Ash Management Act of 2014, the Dam Safety Law was amended to require that owners of all dams classified as high and intermediate hazard must prepare and submit to DEMLR and the N.C. Division of Emergency Management an Emergency Action Plan (EAP) for review and approval. Although temporary two-year funding was granted in 2015 for EAP review and dam owner technical assistance, such funding was not sufficient to address DEMLR's ongoing obligations under the EAP provisions in the legislation. To address the strain on existing dam safety resources, DEMLR has requested that the Dam Safety Program be expanded by adding four full-time positions (two Journey Engineers, one Environmental

Program Consultant and one GIS Technician). These positions are needed to manage and conduct the annual reviews of Emergency Action Plans (EAP) and associated dam safety inspections and technical assistance for the 1,559 Intermediate and High Hazard dams as required by Part 5 of SL2014-122 (S729). This and subsequent session laws amended the Dam Safety Law of 1967 (GS 143-215.31) to require that Intermediate and High Hazard dam owners develop an EAP for their dams by Dec. 31, 2015, and update those EAPs annually. Besides EAP coordination, review, approval, inspections, testing and technical assistance and outreach, these positions will be primarily responsible for developing and updating a memorandum of agreement with the N.C. Division of Emergency Management. Lastly, these positions will serve as the division's primary Emergency Operations Center contacts with the state Division of Emergency Management staff to ensure that dam safety emergency response teams are deployed in the field, and central office engineering staff are assigned telephone duties at the EOC to efficiently and effectively process and respond to dam failures and emergency response situations that may arise across North Carolina. These efforts are funded on a two-year temporary basis at $250,000/year with non-recurring funds from budget cycle 2015-17 and will end June 30, 2017. The request for these four full-time equivalent positions is included in the governor’s budget proposal for 2017-2019.

North Carolina is frequently impacted by significant rain events, particularly hurricanes, which elevate the threat to the public from dam failures. Dams in poor operating condition are at the greatest risk of failure. Conventional enforcement actions are not always effective or expedient when dam failure is imminent, particularly for private dam owners who often lack adequate resources.

During Hurricanes Fran and Floyd, 40 dams breached, some of which were under ongoing enforcement actions requiring the owners to repair or breach the dams. During Hurricane Matthew, 22 dams breached and 46 additional dams were damaged, some of which were under similar ongoing enforcement actions. Millions of dollars of damage occurred during this storm due to the partial or total failure of dams. There is a particular dam that was under ongoing enforcement actions that experienced partial failure and came extremely close to total failure, which most likely would have resulted in loss of life and extreme damage to private property, the environment, state roads, multiple military bases, schools, businesses, government buildings, a police station and other valuable infrastructure. This dam would likely have failed had DEMLR, FEMA and the National Guard not taken immediate steps on behalf of the owner to sand bag the spillway and install and operate numerous pumps to drain the lake in a timely and controlled manner. Although a catastrophe was avoided and the lake is currently drained, and despite DEMLR’s efforts under a Dam Safety Order to compel the owners to immediately complete repairs or temporarily breach the dam, the owner has failed to respond leaving the dam in a precarious condition in which it could impound during another significant storm event and fail causing almost certain loss of life and significant property damage downstream.

In order to address this and similar situations in the future, DEMLR has proposed amendments to the Dam Safety Law of 1967 to establish a Dam Safety Emergency Fund which would have a minimum appropriation of $1 million into an interest-bearing account to cover emergency dam safety remedial plan design and implementation costs incurred by the department (implement an emergency breach for the safety of the downstream public and property). The department currently has the jurisdiction to implement an emergency dam safety remedial plan but has never been provided the appropriated funds/account to implement such a plan. The additional funds would help alleviate the burden to the private dam owners that do not have the resources or funds to implement an emergency dam safety remedial plan as well as help the Department to better protect the public against a dam failure that could result in loss of life or significant property and environmental damage downstream.

Mining

DEMLR’s Mining Program consists of approximately 5.3 full time equivalent positions to process more than 300 applications for new, modified, transferred and renewed mining permits per year, conduct detailed compliance

inspections of more than 800 active and inactive mines with appropriate follow up/enforcement action, investigate and respond to complaints, and provide technical assistance and guidance to mine operators, design professionals, and the general public. In that insufficient staff resources are available to properly implement the N.C. Mining Act of 1971 as directed by the General Assembly and the Mining Commission, the governor's budget includes the four full-time equivalents in the 2017-2019 biennium budget proposal.

Coal Ash Management

Since the February 2014 Dan River coal ash spill, DEQ is diligently working to implement the safe excavation and disposal of coal ash at Duke Energy's 14 facilities in North Carolina. The ongoing implementation of coal ash management is accomplished by the coordinated efforts of staff members of the state Division of Water Resources, the state Division of Waste Management and the state Division of Energy, Minerals and Land Resources. A summary of the ongoing work by these divisions follows.

The spill prompted the N.C. General Assembly to pass a law, the Coal Ash Management Act of 2014, or CAMA, requiring Duke Energy to close its coal ash ponds statewide by 2029. As part of the bill, Duke Energy must also provide permanent drinking water to residents whose well water may be compromised because of coal ash contaminants. The N.C. General Assembly subsequently passed Session Law 2016-95 which amended certain portions of CAMA.

Drinking Water Supply Well Survey

Sampling of the water supply wells within 1,000 feet of compliance boundaries at Duke Energy sites began in January 2015. Sampling of the water supply wells within 1,500 feet began in April 2015. DWR has also sampled wells out to ½ mile from the facilities' compliance boundaries if a well owner expressed concern about their well quality and requests the sample. To evaluate potential health concerns associated with the sample results, DWR submitted the laboratory results to the Division of Public Health, Epidemiology Section, Occupational and Environmental Epidemiology Branch (OEEB) for a health risk evaluation (HRE). The laboratory results along with the HREs were then sent to the well owners. More than 400 well owners were sent their results along with the health risk evaluation. This number includes well results sent to well owners for initial well tests and results sent to well owners who had their wells retested as per a recommendation from the OEEB.

Drinking Water Supply Well Survey – Limited Study

In April 2015, DWR initiated a limited study of concentrations of parameters near three coal ash facilities: Allen, Buck and Marshall. The areas selected for study were situated at locales positioned across surface and groundwater divides at least one mile from the facilities and along the same geologic units that underlie the facilities. Letters were sent in late April to selected well owners in these areas to ask if they would like their wells sampled as part of the study. DWR contracted with Pace Analytical Services, Inc. (Huntersville, NC) to perform the sampling. Thirty-four wells were sampled as part of this initiative.

Comprehensive Site Assessments

Duke Energy submitted comprehensive site assessment (CSA) reports for all 14 facilities by September 2015. Duke Energy also provided Supplemental CSA reports by September 2016. DEQ is in the process of preparing a letter to Duke Energy informing them of the deficiencies of the reports and will request revised final reports be submitted.

Corrective Action Plans

Duke Energy submitted corrective action plan reports for its 14 facilities in late 2015 and early 2016. In October 2016, DEQ began receiving monthly groundwater, soil, and other media data submittals from Duke Energy. This information will be useful to staff to help evaluate site conditions, proposed corrective actions and proposed provisional background concentrations.

Accelerated Remediation Plans

As part of a settlement agreement, Duke Energy submitted accelerated remediation plans for potential offsite impacts at the Asheville Steam Electric Plant, Belews Creek Steam Station, H. F. Lee Energy Complex and L. V. Sutton Energy Complex. In April 2016, Duke Energy supplied revised accelerated remediation plans titled "Interim Action Plans" to the DEQ. Department staff have reviewed the plans, and an approval letter, which stipulated certain conditions, was sent to Duke Energy on July 22, 2016. Duke Energy submitted initial Basis of Design Reports for Asheville Steam Electric Plant, H. F. Lee Energy Complex and a final report L. V. Sutton Energy Complex.

Dam Safety

Concerns about the structural integrity of the coal ash impoundments came to national attention in 2008 after a serious dam failure at a coal ash impoundment in Tennessee. In response to this potential danger, the General Assembly amended the state's Dam Safety Law in 2010 to include all dams located at fossil fuel electric power generation plants across the state. This provision increases the safety oversight of coal combustion residual ponds by requiring dams to be inspected every two years by DENR's Dam Safety Program.[9] Staff inspected 50 dams during the initial round of inspections performed in 2010. Seven of these dams were determined to be deficient and in need of repair. All seven of these dams have now been repaired and the inspection cycle is repeated every two years to ensure that any new deficiencies are discovered and addressed.

Prioritization of Facilities

On July 14, 2016, Session Law 2016-95, Section 3(a) revised the Coal Ash Management Act of 2014. Asheville Steam Electric Plant, Dan River Combined Cycle Station, Riverbend Steam Station, and L. V. Sutton Energy Complex remained designated as high-risk.

The legislation designated three coal ash impoundments as intermediate-risk: H.F. Lee Steam Station, Cape Fear Steam Station and Weatherspoon Steam Station. In accordance with Section 3(b) of the law, these three sites are required to close no later than Aug. 1, 2028.

According to 130A-309.213(d), DEQ must issue a final classification for the remaining impoundments no later than Oct. 15, 2018. For low-risk classifications, the impoundment owner must provide permanent water supplies to each household that has the following:

- a drinking water supply well located within a half-mile radius from the established compliance boundary of a coal combustion residuals impoundment, and
    - is not separated from the impoundment by the mainstem of a river or
    - any other body of water that would prevent migration of contaminants through groundwater.
- a drinking water supply well that is expected to be impacted by constituents related to coal combustion residuals as demonstrated by modeling or site investigations.

Additionally, the impoundment owner must rectify the deficiencies of any dam safety order issued by the N.C. Environmental Management Commission, as detailed in 130A-309.213(d)(1)b.

Closure Plans

Duke Energy submitted Site Analysis and Removal Plans (SARPs) to DEQ for the four high-priority facilities (Asheville Steam Electric Plant, Dan River Combined Cycle Station, Riverbend Steam Station, and L. V. Sutton Energy Complex) as part of a

[9] "Perdue signs bill on stricter controls of coal ash ponds," *Salisbury Post,* July 31, 2009.

June 1, 2016 court order. DEQ reviewed the SARPs for compliance with the court order and for the CAMA-required closure plans under 130A-309.214(a)(4). DEQ has sent a letter to Duke Energy informing them of the SARPs deficiencies with CAMA's Closure Plan requirements.

Waste Disposal of Coal Ash

A significant new development in waste disposal is the first major instance of large-scale excavation of previously-generated coal combustion waste from surface impoundments and the disposal of that material into lined municipal solid waste landfills, as required by the Coal Ash Management Act of 2014. As excavation activities likely continue over time, and as that material makes use of MSW landfill capacity in and out of state, its impact on overall disposal should be recognized. Industrial landfills primarily accommodate the disposal of CCR at power plants and pulp mill sludges at paper plants. In North Carolina this past year more than 2 million tons of waste from on-site industrial complexes went into adjacent landfills. These disposal units, while historically used for waste coming out of production facilities, are increasingly used for waste as part of the massive coal ash excavation projects required by law at energy producing facilities' coal ash impoundments.

Recycling efforts to divert large quantities of industrial waste include:

- Flue gas desulphurization residuals, or synthetic gypsum, is a byproduct of the power industry. Gypsum is the primary ingredient in drywall. Often the drywall industry is located proximal to the power plant which produces the residuals.
- Gypsum was mined from the Belews Creek Industrial Landfill in Surry County for reuse. Coal combustion residuals in the form of ash is predominantly reused as an ingredient in cement.
- The Coal Ash Management Act as revised in Session Law 2016-95 required that the power industry provide ash beneficiation projects capable of processing 300,000 tons of ash for cementitious products reclaimed from disposal surface impoundments.
- Duke Energy has specified that the sites will be located at the Buck Steam Station (Spencer, N.C.) and H.F. Lee Station (Goldsboro, N.C.). By July of 2017, another suitable site must be identified for a reuse project.
- More than 1 million tons of coal combustion products (CCP) were used for permitted mine reclamation at a structural fill.

As part of CAMA, NCGS 130A-309 provides the provisions for comprehensive management of coal combustion residuals and provides for the permitting, construction, operation and closure of structural fills in open pit mines. In November 2014, Green Meadow, LLC and Charah, Inc. submitted applications for mining permit modifications and structural fill reuse permits to the Division of Energy, Mineral, and Land Resources (DEMLR) and the Division of Waste Management (DWM), respectively, as allowed under CAMA. On Jan. 23, 2015, the state approved a request to transfer mining permit #53-05 for the Colon Mine in Lee County, and permit #19-25 for the Brickhaven #2 Tract A in Chatham County to Green Meadow, LLC. This was a needed first step in moving the permitting process for these two sites forward. These two projects must also obtain 401 Water Quality Certifications from the Division of Water Resources.

Three ash beneficiation projects were mandated under the Coal Ash Management Act GS 130A-309.216 to be constructed in order to recycle ash from the CCR surface impoundments. Duke designated two facilities for the beneficiation projects, Buck Station (Spencer, N.C.) and H.F. Lee Station (Goldsboro, N.C.). A third site must be designated by July 1, 2017. Each site must process 300,000 tons of ash minimum per year. Beneficiation is needed to supply product to the cement industry. The sites must be operational within two years of permit issuance.

Coal Ash Management Rulemaking

Session Law 2016-95 requires that the Environmental Management Commission adopt rules in conformance with the federal EPA coal ash rules. DEQ has been working with the Environmental Management Commission to draft coal ash

management rules to address North Carolina's coal ash management issues. Such issues are related to disposal (landfills and structural fills), groundwater and surface water protection, dam safety operational and decommissioning considerations, among other aspects, to ensure protection of the environment and residents of the state. The EPA finalized the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule) under Subtitle D, the solid waste or non-hazardous waste provisions of RCRA on Dec. 14, 2014. The CCR Rule was further amended and became effective Oct. 4, 2016. The U.S. Congress passed the Water Infrastructure Improvements for the Nation Act or the WIIN Act on Dec. 18, 2016. Section 2301 of the Act provides for the Approval of State Programs for Control of Coal Combustion Residuals. The DEQ is evaluating the best approach for North Carolina to follow in incorporating the requirements of the state legislation, the existing state rules and the federal rule and will be presenting the options to the EMC in at the May 2017 for guidance on how to proceed with this important rulemaking process.

Hurricane Matthew

In October 2016, Hurricane Matthew impacted eastern North Carolina with heavy rainfall, wind damage and flooding. The H. F. Lee Energy Complex sustained impacts to the cooling pond, a portion of the active ash ponds, and inundation of some of the inactive ash ponds. The Washington Regional Office immediately requested and received a Plan of Action from Duke Energy. A final Plan of Action and a Sampling Plan were approved and are currently being implemented.

Hurricane Matthew also impacted the W. H. Weatherspoon Power Plant. The Fayetteville Regional Office requested and received a Plan of Action from Duke Energy to address potential impacts to the cooling pond. The Plan of Action was approved and is currently being implemented.

Federal Funding Concerns

President Donald Trump's proposed rollback of funding to the EPA is certainly something that as a state environmental agency we are closely following. Specifically, the proposed cuts to grants that help DEQ carry out the core environmental programs is a concern and an area that the agency will continue to watch closely.

In the meantime, DEQ will continue to work in partnership with the EPA staff to carry out the core missions of the Clean Water Act, Clean Air Act, RCRA and all the programs central to the agency's mission of environmental protection.

Of DEQ's approximately 1,500 full-time employees, 341 are funded through the EPA. The agency received last year about $146.9 million in EPA funds, all of which came from two sources – environmental program grants and state revolving fund loans. This funding is critical to the agency's ability to achieve the core program mission.