Section A - Chapter 4
Water Quality Issues Related to Multiple Watersheds in the Catawba River Basin

4.1 Introduction

This section discusses regional issues that are pertinent to multiple watersheds in the Catawba River basin. It includes discussions on stormwater control, drought impacts, interstate agreements, and other issues broad in scope. It also highlights issues that threaten water quality everywhere and offers suggestions for reducing their impacts.

In this chapter:

4.2 Water Quality Issues Related to Drought

Water quality problems associated with rainfall events usually involve degradation of aquatic habitats because the high flows may carry increased loadings of substances like metals, oils, herbicides, pesticides, sand, clay, organic material, bacteria and nutrients. These substances can be toxic to aquatic life (fish and insects) or may result in oxygen depletion or sedimentation. During drought conditions, these pollutants become more concentrated in streams due to reduced streamflow. Summer months are generally the most critical months for water quality. Dissolved oxygen is naturally lower due to higher temperatures; algae grow more due to longer periods of sunlight, and streamflows are reduced. In a long-term drought, these problems can be greatly exacerbated and the potential for water quality problems to become catastrophic is increased. This section discusses water quality problems that can be expected during low flow conditions.

The frequency of acute impacts due to nonpoint source pollution (runoff) is actually minimized during drought conditions. However, when rain events do occur, pollutants that have been collecting on land surfaces are quickly delivered to streams. When streamflows are well below normal, this polluted runoff becomes a larger percentage of the water flowing in the stream.

Point sources may also have water quality impacts during drought conditions even though permit limits are being met. Facilities that discharge wastewater have permit limits that are based on the historic low flow conditions. During droughts these wastewater discharges make up a larger percentage of the water flowing in streams than normal and might contribute to lowered dissolved oxygen concentrations and increased levels of other pollutants.

As streamflows decrease, there is less habitat available for aquatic insects and fish, particularly around lake shorelines. There is also less water available for irrigation and for water supplies. The dry conditions and increased removal of water for these uses further increase strain on the resource. With less habitat, naturally lower dissolved oxygen levels and higher water temperatures, the potential for large kills of fish and aquatic insects is very high. These conditions may stress the fish to the point where they become more susceptible to disease and where stresses that normally would not harm them result in mortality.

These are also areas where longer retention times due to decreased flows allow algae to take full advantage of the nutrients present resulting in algal blooms. During the daylight hours, algae greatly increase the amount of dissolved oxygen in the water, but at night algal respiration and die off can cause dissolved oxygen levels to drop low enough to cause fish kills. Besides increasing the frequency of fish kills, algae blooms can also cause difficulty in water treatment resulting in taste and odor problems in finished drinking water.

Evidence of these effects was noted across the entire Catawba River basin during the last basinwide assessment period. A few examples include the increased duration and intensity of algal blooms in Lake Rhodhiss and Lake Hickory (Section A, Chapter 4, Part 4.7.2), the increased impact of point source dischargers on conductivity in the Lower Little River (Section B, Chapter 3, Part 3.1), and minor improvements in the bioclassification of Sugar Creek (Section B, Chapter 5, Part 5.1) due to reduced urban runoff.

4.3 Color Reduction Strategy

The South Fork Catawba River watershed (subbasins 03-08-35 and 03-08-36) was identified in previous basin plans as having a high concentration of NPDES permitted textile dischargers, along with public concerns and complaints regarding color from such discharges. According to state regulations [15A NCAC 02B.0211(3)(f)], colored effluent is allowed in "only such amounts as will not render the waters injurious to public health, secondary recreation, or to aquatic life and the wildlife or adversely affect the palatability of fish, aesthetic quality or impair the waters for any designated uses". This color standard is a narrative standard based on aesthetics and not a numeric standard. The advantage of a narrative standard is that it is flexible. The disadvantages are that it is subjective and difficult to enforce. The state has considered developing a numeric standard, but there are many challenges in doing so. Some of these challenges include knowing what the appropriate analytical approach is; what the appropriate numeric standard is; and if a different standard should be used for different regions in the state to reflect variations in background color. In addition, the practical application of this regulation must take into account the various ways in which color is perceived. No narrative definition of color impairment can be specified by a simple set of criteria because individuals under different circumstances perceive color subjectively.

It should be noted that to date, there are no data to show that the colored effluent is posing any human health threat or is the only source of impact on the aquatic life in the river. Color is usually not a toxicological problem. However, under certain conditions it can limit light penetration that may be essential for the growth and existence of instream organisms. All NPDES permitted dischargers with color waste are required to conduct toxicity testing on the effluent to assure the discharge will not adversely impact the organisms in the receiving stream. All of the color discharge facilities conducting toxicity testing have been in compliance with permit limits.

Status of Progress and 2004 Recommendations

Color Study Report Development

In August 1999, the Division met with selected color dischargers in the watershed to address the color issue. As a result of this meeting, eight color dischargers (Pharr Yarns, Delta Mills, Yorkshire, Cramerton, Lincolnton, Gastonia-Long Creek, Hickory and Cherryville) elected to form the South Fork Catawba River Water Quality Alliance and undertake a comprehensive color monitoring study to identify current color problem areas in the watershed. The color monitoring was conducted twice per month from April through November 2000 and included color monitoring of effluent, upstream and downstream stations, as well as reference sites. The study included analytical color measurement (ADMI units), visual observation and photographs. The study period included an extremely dry summer and should represent near worst case conditions. In addition, the study represents the most current assessment of color conditions in the watershed, given the changing nature of the textile industry across the state. The Alliance submitted individual reports to DWQ for each sampling event, as well as a Final Color Study Report (AWARE Environmental, Inc., March 2001). One color discharger in the watershed (City of Newton) elected to evaluate color independently from the Alliance members, using similar monitoring protocols.

Using the data contained in the Final Color Study Report along with field observations, DWQ developed a four-tier action plan to address the varying aesthetic color impacts to receiving waters through the NPDES permitting system. The Tier 1 facility showed no visible color plume during the color study. Tier 2 facilities showed minor color plumes at the outfall and limited downstream color impact. Tier 3 facilities showed significant color plumes at the outfall and at times greater downstream color impact. Finally, the Tier 4 facility showed significant plumes at the outfall and significant downstream color impacts.

Color Permitting Policy

Based on the tier groupings and public comment received at a hearing in August 2001, progressive permitting actions were developed for these facilities, ranging from color monitoring (Tier 1), pollution prevention studies (Tier 2), engineering cost studies for end-of-pipe treatment (Tier 3), and color reduction limits (Tier 4). Color monitoring will remain a baseline condition for all facilities, as long as color remains a component of the discharge. The specific color permitting requirements added to NPDES permit renewals and modifications during 2002-2003 are summarized in Table A-25. The City of Cherryville was removed from color permitting requirements after its only textile input ceased discharge in 2001. Similarly, two facilities (City of Gastonia – Long Creek WWTP and Crowders Creek WWTP) were downgraded to Tier 1 requirements following the termination of several textile inputs. Two facilities (Yorkshire and Delta Apparel) have contested their 2002 permit conditions and still operate in accordance with

their previous permit. Most of the subject color dischargers have NPDES permits that expire in 2005. During this permit renewal process, DWQ will reevaluate the color requirements.

Table A-25 NPDES Color Permitting Imposed During 2002 and 2003 for Catawba River Basin Dischargers in the South Fork Catawba River Watershed

Tier	Facility	Color Permitting Requirement
1	Pharr Yarns Gastonia - Long Creek WWTP Gastonia – Crowders Creek WWTP	Tier 1 facilities will receive color monitoring only, consisting of monthly effluent sampling, and summer only (April-October) instream monitoring (upstream, downstream). If observed, plume descriptions should be recorded. In addition, a Color Reopener Special Condition will be added that allows permits to be reopened and additional requirements imposed if color problems persist.
2	Cramerton Newton Yorkshire	Tier 2 facilities will receive Tier 1 requirements plus preparation of a Pollution Prevention (P2)/Best Management Practices (BMPs) report. This report will address the potential for the facility to reduce effluent color by incorporating P2 measures and/or BMPs prior to treatment. For example, the facility could investigate the dyeing process, looking at the potential for dye substitution, improved dyeing efficiency, etc. The facility could do this work independently with their dye supplier or other resource, or request voluntary assistance from the NC Division of Pollution Prevention and Environmental Assistance. The report will be submitted within 12 months of the permit effective date.
3	Hickory – Henry Fork Lincolnton	Tier 3 facilities will receive Tier 2 requirements plus preparation of a Color Reduction Study. The color reduction study will involve an end-of-pipe treatment evaluation to develop costs to reduce influent color by 75 percent and 90 percent. The reports will be submitted within 24 months of the permit effective date.
4	Delta Apparel	Tier 4 facilities will receive color reduction limits (90 percent color reduction between influent and effluent) to be implemented by the permit effective date.

4.4 South Fork Catawba River Watershed Toxics Review

Current Status and 2004 Recommendations

The South Fork Catawba River Watershed Toxics Review was a screening effort initiated from comments as noted in the 1995 Catawba River Basinwide Water Quality Plan regarding public concern for the river's health. The 1999 plan recommended DWQ evaluate the need for additional monitoring on the South Fork Catawba River and its tributaries.

During the last assessment period, ambient metal concentrations in the watershed did not exceed the state action level at most locations, the exception being Clark Creek. Benthic and fish community data are not available on the middle portion of the South Fork, but a site on the lower section received a Good-Fair bioclassification. Sample sites on two major tributaries, Clark Creek and Indian Creek, received Fair bioclassifications. These impacted biological communities and the presence of several permitted discharges in the general area of Lincolnton and High Shoals indicate that a biological community assessment is necessary in the middle portion of the South Fork between Clark and Long Creek. DWQ will sample this area during the next assessment period.

During the latest assessment period, DWQ began addressing metal toxicity in the watershed by starting the development of a copper Total Maximum Daily Load (TMDL) on Clark Creek. For more information on Clark Creek and the copper TMDL, refer to Section B, Chapter 6, Part 6.3. With regard to point source discharges, DWQ implements metal limits in NPDES permits when a statistical analysis of the effluent data indicates a potential to exceed allowable levels. Should modeling processes determine that a particular metal is a concern and is attributable to a point source, then a limit for that metal can be implemented. Additionally, DWQ currently has a procedure in place to determine if an NPDES limit is necessary for action level standards such as copper and zinc and this procedure is used for all dischargers. NPDES permits in the South Fork Catawba River are scheduled for the review/renewal process beginning in 2005.

4.5 Charlotte-Mecklenburg Utilities Agreement

The Charlotte-Mecklenburg Utilities Agreement applies to all or part of two subbasins: 03-08-34 and 03-08-38. For more information on other issues in these subbasins, refer to Section B, Chapters 5 and 9.

In the summer of 2001, the South Carolina Department of Health and Environmental Control (SCDHEC) filed a Petition for a Contested Case in the North Carolina Office of Administrative Hearings regarding the renewal of Charlotte-Mecklenburg Utilities Department's (CMUD) McAlpine Creek wastewater treatment plant. The primary complaint on the part of SCDHEC has been that the permit was renewed without a phosphorus limit. Several downstream waterbodies in the South Carolina portion of the Catawba River basin are listed as Impaired because total phosphorus (TP) concentrations exceed the South Carolina state standard for TP in lakes. Nearly all of South Carolina's municipal dischargers to the mainstem Catawba River (upstream of Lake Wateree) have been given phosphorus limits, generally equivalent to 1 mg/l. The McAlpine Creek WWTP permit had a phosphorus optimization study special condition that stipulated preparatory requirements for the facility to ready itself for the upcoming phosphorus TMDL.

Since summer 2001, SCDHEC, DWQ and CMUD have been working towards achieving consensus on an appropriate phosphorus limit for the McAlpine Creek WWTP. The parties are on schedule with actions necessary to complete the terms of the settlement agreement. The understanding has been that this decision will also affect DWQ's permitting strategy for three additional municipal permits: CMUD-Irwin WWTP, CMUD-Sugar Creek WWTP, and Union County-Twelvemile Creek WWTP. Construction of phosphorus reduction facilities is currently underway at McAlpine Creek WWTP.

The final settlement agreement includes four main points: phosphorus limits at all three CMUD facilities, a bubble limit, a mass cap, and a TMDL. The phosphorus limit corresponds to 1 mg/l at the permitted flow calculated on a 12-month rolling average. The bubble limit refers to a mass limit for total phosphorus that applies to the combined discharge of all three CMUD plants. This type of limit allows CMUD operational flexibility with regard to phosphorus removal. In order to be protective of water quality in the downstream lakes, SCDHEC requested a maximum combined limit to ensure optimized plant operation at all times. The maximum limit corresponds to a concentration limit of 2 mg/l at maximum permitted flow. In addition, the agreement includes a provision that will include DWQ and all affected NC entities in the TMDL process.

The University of South Carolina completed a Federal Clean Water Act Section 319-funded project in June 2003. The primary goal of this study was to provide a detailed quantitative analysis of data and model simulations to support development of an effective TMDL for phosphorus in the lower Catawba River basin of South Carolina. Simulations were based on the WARMF model, which incorporated phosphorus loadings in the Sugar Creek watershed tributaries, including Sugar Creek, Little Sugar Creek, McAlpine Creek and Irwin Creek.

At the time of this writing, the model is under review. SCDHEC is working closely with the USEPA and DWQ to evaluate its effectiveness. A series of management scenarios will be simulated to predict the effects of reductions in point sources and nonpoint sources on downstream reservoirs. Stakeholder meetings will be held after additional management scenario simulations are available.

4.6 Implementation of NCEEP Watershed Restoration and Local Watershed Plans

Current Status and 2004 Recommendations

For the Catawba River basin, the North Carolina Ecosystem Enhancement Program (EEP, formerly Wetlands Restoration Program) has integrated information normally found separately in EEP Watershed Restoration Plans into this basinwide water quality plan. A separate version of the watershed restoration plan for the Catawba River basin will be available online at the EEP website by the fall 2004. These plans identify Targeted Local Watersheds within which EEP will focus restoration efforts (http://h2o.enr.state.nc.us/wrp/).

DWQ will continue to integrate EEP restoration planning efforts into the basinwide process. An overview of the program is presented in Section C, Chapter 1, Part 1.3.2. Table C-3 lists all the Targeted Local Watersheds selected by the EEP, arranged by DWQ subbasins. This section also includes a description of the EEP Local Watershed Planning initiative. The EEP will continue to use a comprehensive, integrated watershed approach in the identification of high priority local watersheds in North Carolina's river basins. Also, the EEP hopes to expand their Local Watershed Planning efforts into more areas of the state, as additional compensatory mitigation resources become available.

4.7 Chain Lakes Management Challenges

One of the most prominent hydrologic features of the Catawba River basin is the series of hydropower impoundments along the river's mainstem, widely referred to as the Catawba River Chain Lakes (Figure A-14). This chain-like configuration presents a unique challenge to water quality management. The outflows from upstream reservoirs, as well as inputs from the surrounding watershed and direct discharges to the lakes themselves, influence the water quality in each impoundment. Therefore, water quality issues in a particular impoundment cannot be addressed without first considering the influence of watershed conditions, upstream water quality, and releases from upstream reservoirs. Downstream impacts must also be evaluated before any management decisions are implemented.

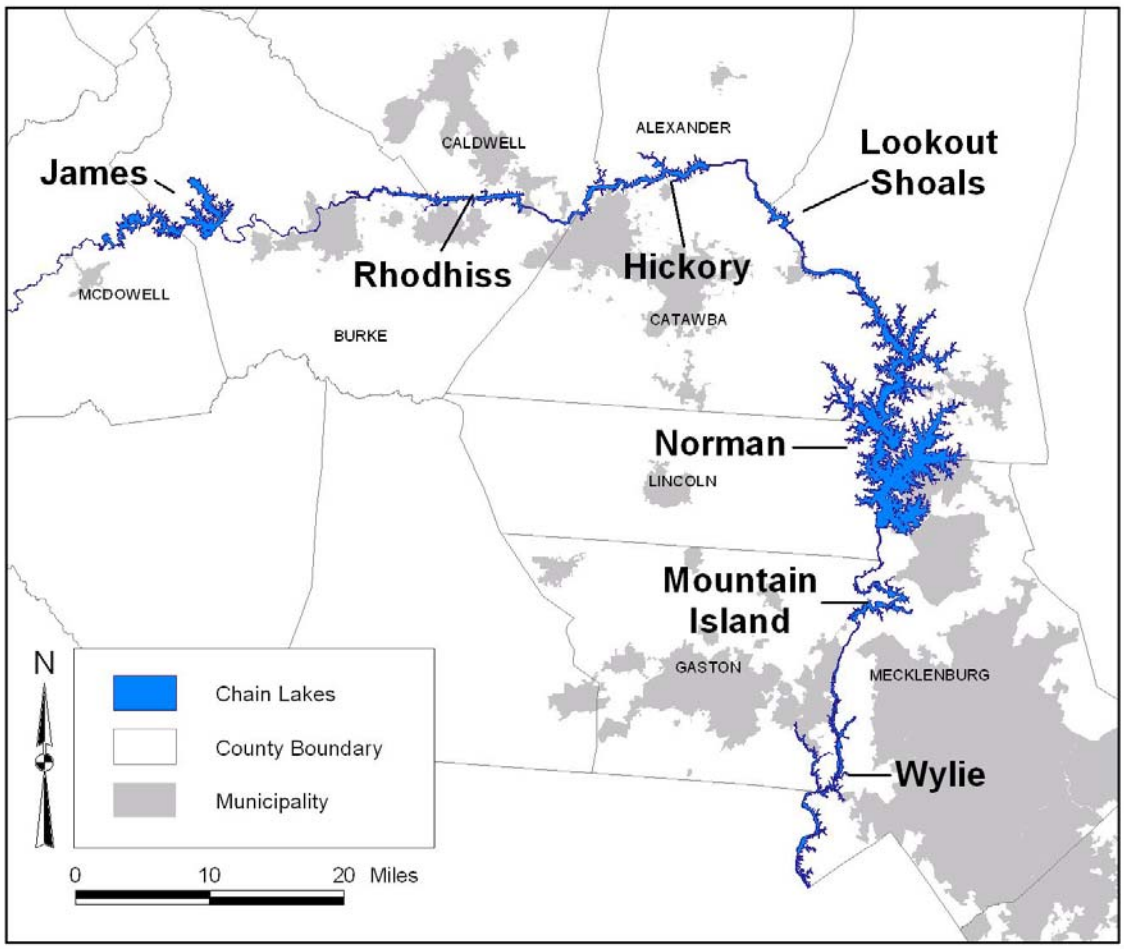

Figure A-14 Catawba River Chain Lakes

Impacts to water quality can also be magnified by the presence of a reservoir. Dams significantly slow the flow of water and create conditions not present in riverine systems. These conditions increase nutrient availability and give algae more time to grow. In theory, a reservoir may suffer the symptoms of excessive nutrient and sediment inputs, while a river receiving the same level of pollutants may not. In this case, the river may be moving pollutants quickly downstream, thus, preventing localized water quality problems. Similarly, two reservoirs receiving the same pollutant load may not exhibit the same symptoms. For example, one reservoir may have many small, isolated coves that allow algae to grow for extended periods of time, while another reservoir may simply act like a wide, slow-flowing portion of a river with a continuous exchange of water and little algal growth.

All seven of the Catawba River Chain Lakes (Catawba-Wateree Project) are owned by Duke Power Company and were created to generate electricity. The chain lakes were completed between 1904 and 1928 with the exception of Lake Norman, which was completed in 1963. These hydro projects provided much of the electrical power base needed to drive the industrial expansion (furniture, textile, etc.) seen in the first half of the 20th century. In some ways, the prosperity enjoyed by this area of North Carolina can be linked to the presence of these dams. In addition to renewable power generation, the lakes are popular recreational areas visited millions of time per year and provide drinking water to the local population. The lakes are also

contributing to a recent economic expansion as new residents seek lakefront housing and commercial developments relocate near reliable water supplies. For statistics on the lakes, see Table A-15.

The following sections describe the variety of management issues related directly to the Catawba River Chain Lakes. Table A-26 provides a summary of the many stressors in the lake chain. The entire lakes assessment methodology and results of the chain lakes analysis can be found in Appendix III. With the exception of hydropower relicensing, the following discussion focuses primarily on Lake Rhodhiss, Lake Hickory, Lookout Shoals Lake and Lake Wylie. These impoundments demonstrate more severe water quality stress and, not coincidentally, receive the most direct input from the largest urbanized watersheds.

Table A-26 Lake Stressor Summary

Assessment Parameter	Lake James	Lake Rhodhiss	Lake Hickory	Lookout Shoals	Lake Norman	Mountain Island	Lake Wylie
% Saturation DO	N	**Y**	**Y**	**Y**	N	N	**Y**
Algae	N	**Y**	**Y**	N	N	N	**Y**
Chlorophyll *a*	N	**Y***	N	N	N	N	**Y**
pH	N	**Y**	N	N	N	N	N
Sediment	N	**Y**	**Y**	N	N	**Y**	N
Taste & Odor	N	**Y**	**Y**	N	N	N	N
Macrophytes	**Y**	N	**Y**	**Y**	**Y**	**Y**	N

"**Y**" Indicates parameter is noted within the impoundment.
* Standard exceeded in less than 10% of readings.

4.7.1 Hydropower Relicensing

Part I of the Federal Power Act (FPA) requires that Duke Power's Catawba-Wateree Project has a license in order to operate. Relicensing is the process for obtaining a new license for a hydro project after the existing license expires. Duke Power's current license for the project was issued in 1958 and will expire in 2008.

The FPA provides the Federal Energy Regulatory Commission (FERC) exclusive authority to license all nonfederal hydro projects that are located on navigable waterways or federal lands. Licenses are normally issued for a period of 30-50 years and contain conditions that regulate project operations. To continue to operate project facilities after the expiration of an existing license, a licensee must obtain a new license for its project.

The conditions in the new license are expected to change the way these hydro stations and reservoirs are operated, primarily via rebalancing how the limited water supply is utilized. Changing how this finite resource is used will benefit some interests and negatively impact others. The final decision as to the terms and conditions of the new license is almost exclusively reserved to the FERC and certain government resource agencies, including DWQ through the

401 Certification process, with mandatory conditioning authority. However, there are many opportunities for other organizations, governmental entities and individual stakeholders to substantially influence these decisions. In the end, Duke Power hopes to obtain a new license to operate the project in a manner that comprehensively balances the use of the resource in the best overall public interest (Duke Energy Corporation, 2003).

The North Carolina Department of Environment and Natural Resources (NCDENR) and the North Carolina Wildlife Resources Commission (NCWRC) are actively involved in the relicensing effort. State agencies committed to the multiyear license negotiation process with Duke Power include the Division of Water Quality, Division of Water Resources, Division of Parks and Recreation, and the Wildlife Resources Commission.

NCDENR and NCWRC believe that the relicensing process is an important opportunity to examine environmental and public access issues associated with hydropower projects and to develop strategies to address these issues. Environmental impacts include water quality impairment or degradation as a result of flow release regimes, or issues associated with water availability during extreme weather conditions (i.e., drought and extreme wet weather years). Public access issues include the lack of access to reservoir shorelines for fishing and other recreation.

Duke Power has developed a stakeholder input process that will allow NCDENR and NCWRC, along with their South Carolina counterparts, to hear the ideas, concerns and interests of other stakeholders in the basin and to work collaboratively with others to develop strategies to address these issues. This framework consists of four Regional Advisory Groups (two in each state) and two State Relicensing Teams. The Regional Advisory Groups are intended to hear input on and negotiate management strategies for issues specific to their geographic region, while the State Relicensing Teams do the same for issues that affect the entire basin. NCDENR and NCWRC staffs are participating in both the State Relicensing Teams and the Local Advisory Teams as established by Duke Power.

NCDENR also has some regulatory authorities and requirements that will have to be met through the relicensing process. An example of these regulatory authorities is the 401 Water Quality Certification. The 401 Certification must accompany Duke Power's application for project renewal and contains many regulatory components. One such component requires that water quality standards (temperature, turbidity, dissolved oxygen levels, and the support of aquatic life) downstream of dam outfalls must be met. While the 401 Certification is non-negotiable (state mandatory authority), it should compliment the outcome of the negotiation process in several ways. For example, the 401 Certification will require that flow releases from dams are sufficient for supporting aquatic life standards, while the negotiation process can assure those releases occur at times that accommodate the needs of recreational boaters, fishermen and water supply users.

4.7.2 Lake Rhodhiss, Lake Hickory and Lookout Shoals Lake Watershed Protection

These lakes are perhaps the most closely linked in the lake chain and exhibit some of the most significant water quality trends in the basin. These are the first impoundments below the forested Blue Ridge and are heavily influenced by the urbanized corridor along Interstate 40. Although these lakes are relatively small in volume, compared to Lake James (upstream) and

Lake Norman (downstream), the land area draining to them is quite large. In effect, most of the pollution generated by the urban centers (Morganton, Hickory, Lenoir, etc.) and agricultural operations is concentrated in these reservoirs. The result is heavy inputs of nutrients and sediment. Each impoundment's response to this load is discussed immediately below, and a summary of noted impacts is presented in Table A-26.

DWQ advocates a broad scale management strategy be developed for these lakes collectively. At minimum, this strategy should build upon the local efforts discussed below and will attempt to facilitate regional cooperation among local stakeholders.

Current Status of Lake Rhodhiss

Lake Rhodhiss has been sampled by DWQ since 1981 and is usually found to be eutrophic. This is a run-of-the-river reservoir and has a mean hydraulic retention time of 21 days. Although there were high nutrient concentrations, algal blooms were often limited by the reservoir's short retention time. Drought conditions that increased retention times and nuisance algae (especially blue-greens) blooms were recorded in 2001 and 2002. Public complaints of taste and odor problems in processed lake water resulted in a special study to investigate the extent and nature of the algal blooms. The study determined the existence of 15 well-established algae communities; five of which are known to cause taste and odor problems. The study also stated that blooms would persist as long as conditions favoring growth (low flow, high light and nutrient rich waters) are in place (NCDENR-DWQ, 2001). The presence of algae that create taste and odor problems in treated drinking water made it necessary for water treatment plants to install (at significant cost) activated charcoal to make the water drinkable.

Lake Rhodhiss also receives heavy sediment and/or nutrient inputs from the Muddy Creek, Lower Creek and Johns River watersheds. Within the lake itself, Lake Rhodhiss receives nutrient inputs from the Morganton and Valdese wastewater treatment plants. The Town of Lenoir's wastewater treatment plant discharge enters Lake Rhodhiss via Lower Creek. Algal blooms, taste and odor problems, violation of the pH standard, and percent dissolved oxygen saturation values above 120 percent indicate the reservoir (1,848.5 acres) suffers from eutrophication and is Impaired for aquatic life.

In June 2003, the Western Piedmont Council of Governments, using a grant from NCDENR, published the results of a comprehensive modeling effort to predict sediment and nutrient loads in the Lake Rhodhiss watershed (WPCOG, June 2003). The study consisted of two model simulations, a baseline scenario representing conditions in 2000, and a year 2020 projection based on anticipated growth in the watershed. With regard to sediment, the model produced sediment export coefficients for each drainage area in the watershed that highlight areas with disproportionally high contributions to the overall sediment load to Lake Rhodhiss. The model predicts the overall sediment loads will remain the same or slightly decrease as agriculture land is converted to impervious surfaces.

The study's nutrient analysis revealed a very different trend than that of the sediment analysis. The model predicts that by 2020, nitrogen and phosphorus loads are expected to increase 23 and 43 percent, respectively. The model attempted to determine how much of the nutrient load was originating from point sources in the watershed and found that 21 percent of the nitrogen load and 48 percent of the phosphorus load in 2000 originated from just four point source dischargers.

The contribution of those dischargers to total nitrogen and phosphorus loadings by 2020 is expected to increase to 31 and 62 percent, respectively.

Caldwell County, in cooperation with the municipalities of Granite Falls, Hudson, Cajah Mountain, Sawmills and Gamewell, began development of an NPDES Phase II compliant stormwater management program. The county hired a professional engineer to oversee the program and formed a Stormwater Advisory Group (SWAG) to structure the emerging program and tailor it to the community's needs. Caldwell County has begun a Public Education Program that targets elected officials and civic leaders, the development community, and realtors. Caldwell County has also begun an inventory of its facilities and operations that could potentially have a detrimental impact on water quality.

Caldwell County's Environmental Engineer will be developing Stormwater Pollution Prevention Plans (SWPPP) for priority facilities. A preliminary draft of a Stormwater Quality Management and Discharge Control Ordinance will be reviewed by the SWAG in February and March 2004. The draft ordinance envisions post-construction controls that are more effective than the minimum requirements in the state's proposed permanent NPDES Phase II rules (15A NCAC 2H .0126 and 15A NCAC 2H .1014). It also includes provision for two-zone, 50-foot wide riparian buffers along perennial streams and 30-foot wide buffers along intermittent streams. Finally, Caldwell County staff will give a formal presentation to the Caldwell County Commissioners during 2004 seeking approval for local delegation of the Erosion and Sedimentation Control Program. Local delegation of that program, combined with the remainder of Caldwell County's stormwater management efforts, will ensure more effective review and enforcement, while potentially reducing both the time and expense currently required of Caldwell County's development community.

Burke County has instituted a water protection program since 1998 that protects the shorelines of Lake Rhodhiss and Lake Hickory against uncontrolled development. The program requires 60-75 foot forested buffers, soil and erosion control/ stormwater mitigation plans, and impervious surface limitations for any ground disturbing activity within 250 feet of Lake Rhodhiss, Lake Hickory, and the Catawba River mainstem. The Burke County Subdivision Ordinance also requires that any lot in the area not connected to public water and sewer utilities be at least two acres in size, greatly reducing the density of homes on the lake shorelines.

DWQ applauds the foresight and proactive response to potential water quality threats in Caldwell County, Burke County, and the entire Uni-Four area. These efforts should eventually realize water quality benefits to the lake and surrounding streams.

Current Status of Lake Hickory

Lake Hickory was most recently monitored by DWQ in 2002. Surface dissolved oxygen and pH values were elevated in May, indicating high algal productivity. Chlorophyll *a* values ranged from moderate to elevated but were not greater than the water quality standard (40 µg/l). The reservoir was evaluated as mesotrophic in May and July and eutrophic in August. Because of algal blooms, taste and odor problems, and dissolved oxygen percent saturation values greater than 120 percent, Lake Hickory (3,589 acres) is in danger of becoming Impaired by eutrophication.

A USGS study of Lake Hickory published in 1998 demonstrated the impact of the Lake Rhodhiss release on water quality in Lake Hickory. The majority of nutrients enter Lake Hickory through this discharge. Additionally, Lake Hickory is more sensitive to conditions in Lake Rhodhiss than conditions in its immediate watershed. However, when the model was adjusted to simulate runoff from built up urban streams (by increasing the nutrient input from Snow Creek), the maximum algal concentrations in the lake increased by 100 percent. This result illustrates Lake Hickory's sensitivity to urban development (Bales et al., 1998).

The Town of Hickory experienced taste and odor problems in their drinking water in 2002. Algal samples in May indicated the presence of filamentous blue-green algae, which may have contributed to the problems. Since elevated densities of blue-green algae were also present in Lake Rhodhiss, the problem persisted until the algae died back in both reservoirs.

Current Status of Lookout Shoals Lake

Lookout Shoals Lake, situated between Lakes Hickory and Norman, is one of the smaller Catawba River Chain Lakes. The watershed draining to the impoundment is relatively small, its largest tributary being the Lower Little River. The Lower Little River drains a predominantly forest and agriculture area and carries a significant sediment load. The lake's water quality is more reflective of releases from upstream impoundments (Lakes Hickory, Rhodhiss and James) than conditions in the immediate watershed.

Lookout Shoals Lake's primary water quality concerns are nutrient enrichment, indicated by increased photosynthetic activity and elevated dissolved oxygen levels recorded during 1997 sampling by DWQ, and a Parrot Feather (aquatic weed) infestation that is well established in the upper portion of the reservoir (see Part 4.7.4). Low dissolved oxygen was also observed at the upper end of the impoundment, likely due to low quality discharge from Lake Hickory.

2004 Recommendations for Lake Rhodhiss, Lake Hickory and Lookout Shoals Lake

The current conditions indicated above and the results of the WPCOG model evaluation demonstrate the variety of stressors in the Rhodhiss-Hickory-Lookout Shoals system and the corresponding management challenges. Additionally, they highlight the tight link between the water quality in Lake Rhodhiss to that observed in Lake Hickory and Lookout Shoals. Because of this link and the clearly degraded conditions in Lake Hickory and to a lesser extent, Lookout Shoals Lake, DWQ is concerned that they may too become Impaired if conditions in Lake Rhodhiss are not mitigated. DWQ has determined that a local watershed management planning initiative including input and cooperation at local, state and federal levels will be necessary to develop an achievable and cost-effective management strategy for the Rhodhiss-Hickory-Lookout Shoals system. Duke Power, the owner/operator of these hydropower developments must also be an active collaborator. The results of this initiative would compliment the development of a Lake Rhodhiss Watershed TMDL developed by DWQ. It is also possible that implementation of this initiative may improve conditions in Lake Rhodhiss and Lake Hickory to the point that impairment is reversed and a TMDL is not necessary. DWQ recommends that initiative should include at least the following objectives:

- NPDES Permit reevaluations: As part of DWQ permitting policy, no new nutrient loads from point sources will be allowed to nutrient Impaired waters until a TMDL is complete, and applications for new or expanding nutrient discharges to **all** mainstem reservoirs in the Catawba River basin must be accompanied by an analysis of nutrient

related impacts using a DWQ approved nutrient response model for the receiving reservoir.

- Optimization should occur at existing discharges with large nutrient loads.
- Plan for implementing BMPs at remaining agriculture operations.
- Plan for preservation and protection of intact riparian vegetation.
- Plan for restoration of severely impacted stream habitats.
- Integration with ongoing restoration activities including Lower and Muddy Creeks.
- Multiagency integration: local governments, DSWC, WRC, USFWS, DWQ, etc.
- Assistance for local Soil and Erosion Control ordinance development.
- Smart growth that incorporates Low Impact Development (LID) principles. See Section A, Chapter 4, Part 4.11.

The community-based efforts of Caldwell County, Burke County, the WPCOG Water Quality Committee and others (refer to Section C, Chapter 1, Part 1.4) offer excellent starting points for a watershed wide management plan. DWQ will support these efforts in whatever ways possible, but funding from a wide variety of sources must be made available to ensure their long-term success.

4.7.3 Nutrient Management for Lake Wylie

Lake Wylie is the most downstream reservoir in the Catawba River basin. The lake is operated by Duke Power and was formed by the impoundment of the Catawba River in 1904 by a hydroelectric dam located near Fort Mills, SC. There are more than 327 miles of shoreline, and the majority of the reservoir lies within South Carolina. The immediate watershed of Lake Wylie is being converted from forested and agricultural areas to more urban land uses.

Eutrophic conditions in Lake Wylie and several of its major tributaries have been evident for many years. To address eutrophication in Lake Wylie, DWQ and South Carolina DHEC developed a nutrient control strategy for the Lake Wylie watershed. In 1991, EPA approved the Lake Wylie TMDL, including the point source allocation included in the Lake Wylie Nutrient Management Plan. The Lake Wylie Nutrient Management Area is considered to be Lake Wylie and its tributaries including: the Catawba River and its tributaries below Mountain Island Dam and the South Fork Catawba River below its confluence with Long Creek.

Current Conditions and 2004 Recommendations

Data from the most recent lake assessment period indicate that nutrient enrichment continues to be a major concern in (both) the North and South Carolina portions of the lake. Out of 90 samples collected between 1997 and 2002, over 40 percent demonstrated elevated dissolved oxygen concentrations. Although elevated dissolved oxygen concentrations were noted lake-wide, the highest concentrations were located in the Crowders, Catawba and Allison Creek arms. Because of chlorophyll *a* standard violations, algal blooms and dissolved oxygen percent saturation values greater than 120 percent, Lake Wylie (4,020 acres, NC portion) is Impaired by eutrophication.

Continued eutrophication concerns within Lake Wylie suggest that the nutrient management strategy may not be sufficient to address the problem. Therefore, improvements to the strategy may be warranted. For example, in the original strategy, discharges above Long Creek (a South Fork Catawba River tributary) and, perhaps more significantly, nonpoint sources were not

included. In addition, a nutrient mass cap was not built into the discharge permits, allowing dischargers to increase their overall nutrient load as long as instantaneous concentration limits are not violated.

Over the next basinwide cycle, DWQ will appropriately place Lake Wylie in Section 4(a) of the *Integrated Report of Impaired Waters* to the EPA in order to reflect the existing TMDL. Given the continued evidence of nutrient enrichment problems, DWQ will also reevaluate the TMDL to determine if additional nutrient reductions or controls are needed. This reevaluation will occur on the standard 8 to13-year TMDL cycle. Until this TMDL is re-approved, no new nutrient loads from point sources will be allowed, as per DWQ's existing permitting policy to impaired waters. This policy includes the South Fork Catawba River watershed. Because this TMDL involves both North and South Carolina jurisdictions, both states will be involved in decision-making. In the meantime, DWQ supports and encourages the continued efforts of municipalities and county governments to identify and implement local nonpoint source reduction plans and wastewater treatment plant upgrades.

4.7.4 Aquatic Weed Infestation

During the assessment period, nuisance aquatic weeds rapidly established themselves in most of the Catawba River Chain Lakes. Introduction by boat trailers and intentional planting for sport fish habitat seem to be the most likely sources. The growth rate and probability of transporting are so great that in Lakes James, Norman and Mountain Island the occurrence of *Hydrilla* sp. and the potential for Parrot Feather, *Myriophyllum aquaticum*, infestation pose a more immediate threat to recreation, water supply use, and power generation uses in the lake than water quality standards violations.

Aquatic weeds present an additional and somewhat different management challenge than the nutrient reduction approach discussed in Parts 4.7.2 and 4.7.3 above. Nutrient enrichment certainly influences the growth rate of Parrot Feather, *Hydrilla* and other aquatic weeds, but the extent of that influence is not documented. It is a reasonable assumption that reducing nutrient loads will positively contribute to the effective management of infestations. In addition, control (reduction) of aquatic weed beds may reduce the rate at which sediment is deposited around them. Currently, however, biological control via grass carp, chemical treatment and habitat elimination via water level drawdowns are the most viable management options.

In addition to the management efforts led by Duke Power and NC Aquatic Weeds Council, all citizens must diligently reduce the probability of further infestations by removing weeds from boat props and trailers between launches and never disposing of ornamental pond/aquarium plants into the lakes. More information on aquatic weeds can be found at NCSU Crop Science Department's aquatic weed webpage at http://www.weedscience.ncsu.edu/aquaticweeds. Below is a summary of control efforts in the lakes to date.

LAKE JAMES: Duke Power discovered the nuisance aquatic plant, *Hydrilla*, in the Catawba River arm of Lake James in 1999. This plant has the potential of spreading rapidly throughout the lake, reducing available boating and swimming areas, and decreasing the lake's aesthetic appearance. In 2002, the NC Wildlife Resources Commission stocked 21,500 grass carp to control the spread of *Hydrilla*.

LAKE HICKORY: In 2001, Duke Power staff discovered Parrot Feather in the reservoir. Since 2001, the original ten-acre infestation has spread to 84 acres near the NC 321 bridge. Two drinking water intakes are located nearby and have the potential of becoming clogged by this plant. Businesses relying on water-based recreation are also concerned because the infestation can make boating and swimming impossible. Duke Power, along with stakeholders and DWQ, will work to develop and implement a Parrot Feather management program for the reservoir.

LOOKOUT SHOALS LAKE: To control the spread of Parrot Feather, Duke Energy drew down the water level to a target of 20 feet below full pool in November 2002. But due to rainfall in December, the water level rose to 14.3 feet below full pool in early January 2003. The pool level was brought to its normal operation level of three feet below full pool by February 2003 to accommodate annual fish spawning. Thus, the efficacy of the drawdown will probably be minor.

LAKE NORMAN: In 1999, Duke Energy staff discovered approximately 25 acres of *Hydrilla* in the reservoir. This invasive macrophyte has the potential for rapid growth with the subsequent loss of swimming and boating areas. It also has the potential to clog intakes of water treatment and power generation plants. A survey conducted in October 2002 by Duke Energy staff found *Hydrilla* as far upstream as the NC 150 bridge. There is also the potential for Parrot Feather to become established in Lake Norman via introduction from contaminated boat trailers or from plant fragments floating downstream from Lookout Shoals Lake. Grass Carp were stocked in Lake Norman as part of a joint effort between the Lake Norman Marine Commission, Duke Power, NC DWQ, and Charlotte-Mecklenburg Utilities Department to control the spread of *Hydrilla*.

MOUNTAIN ISLAND LAKE: *Hydrilla* sp. was first noted in the reservoir in 2000 and now covers more than 625 acres (Bonham, 2001). The exotic macrophyte was observed in the upper end of the reservoir in 2002. Grass carp were first stocked in 2000 as a possible biological control agent for this plant. In 2002, an additional 20,000 fish were stocked and maintenance stocking continues.

4.8 The Importance of Local Initiatives

As the Basinwide Planning Program completes its third cycle of plan development, there are many efforts being undertaken at the local level to improve water quality. The Division of Water Quality encourages local agencies and organizations to learn about these efforts and determine how similar programs may be implemented in their own watersheds. Funding organizations are also encouraged to seek out these programs and support them whenever possible.

Local people making decisions that affect change in their own communities is an important benefit of local initiatives. There are a variety of limitations local initiatives can overcome through collaboration including: restrictive budgets, staff resources, insufficient regulations, and North Carolina's rule-making process, among others.

These local organizations and agencies are able to combine professional expertise and local knowledge not present at the state and federal level. This allows groups to holistically understand the challenges and opportunities of local water quality concerns. Involving a wide array of people in water quality projects also brings together a range of knowledge and interests

and encourages others to become involved and invested in these projects. Working in cooperation across jurisdictional boundaries and agency lines opens the door to additional funding opportunities and eases the difficulty of generating matching or leveraged funds. This will potentially allow local entities to do more work and be involved in more activities because their funding sources are diversified. The most important aspect of these local endeavors is that the more localized the project, the better the chances for success.

The collaboration of these local efforts is key to water quality improvements, and DWQ applauds the foresight and proactive response by locally based organizations and agencies to potential water quality problems. There are many excellent examples of local agencies and groups using these cooperative strategies throughout the state. Please refer to Section C, Chapter 1, Parts 1.4 and 1.5 for a discussion of local initiatives already underway in the Catawba River basin.

4.9 Biological Criteria for Assessment of Aquatic Life

DWQ strives to properly evaluate the health of aquatic biological communities throughout the state. Swamp stream systems, small streams and estuarine waters have presented unique challenges for benthic macroinvertebrate evaluation, while nonwadeable waters and trout streams have done the same for fish community evaluations. This section discusses some of the challenges in assessing benthic macroinvertebrate communities in small streams. Refer to Appendix II for further information.

The benthic macroinvertebrate community of small streams is naturally less diverse than the streams used to develop the current criteria for flowing freshwater streams. The benthic macroinvertebrate database is being evaluated, and a study to systematically look at small reference streams in different ecoregions is being developed with the goal of finding a way to evaluate water quality conditions in such small streams.

Presently, a designation of Not Impaired may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of Supporting. However, DWQ will use the monitoring information from small streams to identify potential impacts to small streams even in cases when a use support rating cannot be assigned.

DWQ will use this monitoring information to identify potential impacts to these waters even though a use support rating is not assigned. DWQ will continue to develop criteria to assess water quality in small streams.

4.10 Fish Consumption Advice

The presence and accumulation of mercury in North Carolina's aquatic environment are similar to contamination observed throughout the country. Mercury has a complex life in the environment, moving from the atmosphere to soil, to surface water and into biological organisms. Mercury circulates in the environment as a result of natural and human (anthropogenic) activities. A dominant pathway of mercury in the environment is through the

atmosphere. Mercury that has been emitted from industrial and municipal stacks into the ambient air can circulate across the globe. At any point, mercury may then be deposited onto land and water. Once in the water, mercury can accumulate in fish tissue and humans. Mercury is also commonly found in wastewater.

The NC Department of Health and Human Services issues fish consumption advisories and advice for those fish species which have median and/or average methyl mercury levels at 0.4 mg/kg or greater. These fish include shark, swordfish, king mackerel, tilefish, as well as largemouth bass, bowfin (or blackfish) and chain pickerel (or jack) in North Carolina waters south and east of Interstate 85. See *Fish Consumption Advice* below. As a result of this guidance and the natural movement of fish back and forth across the I-85 boundary, DWQ considers all waters draining to the Catawba River below I-85 Impaired in the fish consumption use support category. Refer to Appendix III for more information regarding use support ratings and assessment methodology.

Fish Consumption Advice

Fish is an excellent source of protein and other nutrients. However, several varieties of freshwater fish may contain high levels of mercury, which may pose a risk to human health. These guidelines will help you make healthy food choices. A "meal" is defined as six ounces of cooked fish for adults and children 15 years or older and two ounces of cooked fish for younger children.

FDA and EPA Advisory

On March 19th, 2003, the Food and Drug Administration and EPA issued a joint consumer advisory about mercury in fish and shellfish. The advice is for women who might become pregnant, women who are pregnant, nursing mothers, and young children. Aside from being issued jointly by two federal agencies, this advisory is important because it emphasizes the positive benefits of eating fish and gives examples of commonly eaten fish that are low in mercury. In the past, FDA issued an advisory on consumption of commercially caught fish, while EPA issued advice on recreationally caught fish.

By following these three recommendations for selecting and eating fish or shellfish, women and young children will receive the benefits of eating fish and shellfish and be confident that they have reduced their exposure to the harmful effects of mercury:

- **Do not eat** shark, swordfish, king mackerel or tilefish because they contain high levels of mercury.
- Eat up to 12 ounces (2 average meals) a week of a variety of fish and shellfish that are lower in mercury.
- Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock and catfish.
- Another commonly eaten fish, albacore ("white") tuna has more mercury than canned light tuna. So, when choosing your two meals of fish and shellfish, you may eat up to 6 ounces (one average meal) of albacore tuna per week.
- Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers and coastal areas. If no advice is available, eat up to 6

ounces (one average meal) per week of fish you catch from local waters, but do not consume any other fish during that week.

For more detailed information, visit EPA's internet site at http://www.epa.gov/waterscience/fish/ or visit http://www.cfsan.fda.gov/seafood1.html or call the FDA's food information line toll-free at 1-888-SAFEFOOD.

NCDHHS Advice

The NC Department of Health and Human Services updated the following advice on April 16th, 2002.

Women of Childbearing Age (15-44 years), Pregnant Women, Nursing Women and Children under 15:

- **Do not eat** shark, swordfish, tilefish or king mackerel; or blackfish (bowfin), largemouth bass or jack fish (chain pickerel) caught in North Carolina waters south and east of Interstate 85. These fish are often high in mercury.
- Eat up to two meals per week of other fish.

Other Women, Men, and Children 15 years and older:

- **Eat no more than one meal* per week** of shark, swordfish, tilefish or king mackerel; or blackfish (bowfin), largemouth bass or jack fish (chain pickerel) caught in North Carolina waters south and east of Interstate 85. These fish are often high in mercury.
- Eat up to four meals per week of other fish.

* A meal is 6 ounces of cooked fish for adults and 2 ounces of cooked fish for children under 15.

For more information and detailed listing of site-specific advisories, visit the NC Department of Health and Human Services website at http://www.schs.state.nc.us/epi/fish/current.html or call (919) 733-3816.

2004 Recommendations

Improved Ambient Sampling Techniques

DWQ aims to stay abreast of new technology and sampling techniques to ensure that water quality data are accurate, precise and of highest value. In 2000, DWQ started training water quality sampling staff on the new EPA Method 1631 technique. Current monitoring using a higher detection limit (EPA Method 245.1) has consistently yielded non-detected values, and DWQ aims to use the 1631 Method to allow detection levels three orders of magnitude lower than EPA Method 245.1.

NC Eastern Regional Mercury Study

In an effort to better manage state waters that may have methyl mercury issues, DWQ initiated a study using grant funding from EPA Region IV. The study aims to provide information that may be used in water quality standard and TMDL development. The study goals include:

- Determining levels of ambient mercury in the surface water system.
- Estimating site-specific total mercury: methyl mercury translators to evaluate water quality criteria.
- Develop site-specific water to fish bioaccumulation factors.
- Determine levels of mercury in treatment plant effluent.

DWQ aims to complete this study in 2003, and results will be available to the public. For more information, contact the DWQ Planning Branch Modeling/TMDL Supervisor at (919) 733-5083.

DWQ Mercury Workgroup

DWQ is committed to characterizing methyl mercury exposure levels and determining if NPDES sources need to be controlled. DWQ formed an internal Mercury Workgroup to improve communication from all programs that directly affect mercury issues (i.e., Pretreatment, Environmental Sciences, Basinwide Planning, etc.). The workgroup meets as needed to share information and determine next steps in addressing mercury issues associated with the aquatic environment.

DWQ will continue to host an internal workgroup to stay abreast of current mercury issues. The public has voiced concerns that DWQ should be working on the ecological components and consequences of mercury bioavailability to biota in these areas and the biogeochemical cycling and production of methyl mercury from associated wetlands along these streams.

DWQ will continue to monitor concentrations of various contaminants in fish tissue across the state and will work to identify and reduce wastewater contributions of mercury to surface waters. The Division of Air Quality (DAQ) evaluates mercury levels in rainwater on a regular basis through the EPA Mercury Deposition Network. Pollution prevention efforts are being investigated on a state and federal level to reduce mercury emissions.

NPDES Mercury Requirement, Implementation of EPA Method 1631

NPDES permittees have worked with the state to reduce potential risks from this pollutant, including tasks associated with collecting and reporting more accurate data. The most commonly used laboratory analysis for total mercury (EPA Method 245.1) has a method detection level of 0.2 µg/l, while the current water quality standard is an order of magnitude lower at 0.012 µg/l. Thus, true compliance with the water quality standard could not be judged. A more recently approved laboratory method (EPA Method 1631) has a detection level below the water quality standard (0.0005 µg/l), which would allow the Division to assess potential water quality impacts from dischargers more accurately.

A total of 155 facilities statewide will be required to use EPA Method 1631 (or subsequent low level mercury methods approved by EPA in 40 CFR 136) when analyzing for total mercury beginning September 1, 2003. These facilities are subject to this new requirement because of either criteria: 1) the facility has a current total mercury limit in its NPDES permit that is <0.20 µg/l; or 2) the facility has limited instream dilution (i.e., the instream waste concentration (IWC) is >6 percent). This requirement complies with 15 A NCAC 2B.0505(e)(4), which requires that "test procedures must produce detection and reporting levels below the permit discharge requirements".

The State of North Carolina alone cannot eliminate the atmospheric deposition of mercury over surface waters. Actions for reducing atmospheric mercury will also be needed at the national and international levels. The Mercury Report to Congress (EPA, 1997) lists initiatives under the Clean Air Act that may reduce atmospheric mercury emissions from industrial sources. The most significant initiative is emission limits for municipal waste combustors and medical waste incinerators.

4.11 Managing the Impacts of Growth and Development and Stormwater Runoff

Introduction

Urban growth poses one of the greatest threats to aquatic resources than any other human activity. The impacts on rivers, lakes and streams as development surrounding metropolitan areas consumes neighboring forests and fields can be significant and permanent if stormwater runoff is not controlled. Greater numbers of homes, stores and businesses require greater quantities of water. Growing populations not only require more water, but they also lead to the discharge and runoff of greater quantities of waste and pollutants into the state's streams and groundwater. Thus, just as demand and use increases, some of the potential water supply is lost (Orr and Stuart, 2000).

In addition, as watershed vegetation is replaced with impervious surfaces in the form of paved roads, buildings, parking lots, and residential homes and driveways, the ability of the environment to absorb and diffuse the effects of natural rainfall is diminished. Urbanization results in increased surface runoff and correspondingly earlier and higher peak streamflows after rainfall. Flooding frequency is also increased. These effects are compounded when small streams are channelized (straightened) or piped and storm sewer systems are installed to increase transport of drainage waters downstream. Bank scour from these frequent high flow events tends to enlarge urban streams and increase suspended sediment. Scouring also destroys the variety of habitat in streams, leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 1999).

Most of the impacts result in habitat degradation (Section A, Chapter 4, Part 4.13), but urban runoff also carries a potentially toxic cocktail including oil and grease from roads and parking lots, street litter and pollutants from the atmosphere. Cumulative impacts from developing and urban areas can cause severe impairment to urban streams.

4.11.1 Effects of Growth and Development in the Catawba River Basin

The above effects are perhaps more evident in the Catawba River basin than any other basin in the state. A cursory look at population in the Catawba River basin reveals that approximately 10 percent of the state's population resides within its boundaries, and fully four of 11 counties experienced growth rates in excess of 20 percent in the last decade of the 20th century. The total projected population density in 2030 of the counties in the lower Catawba River basin ranges from 525 persons/square miles in Catawba County to more than 2,000 persons/square miles in Mecklenburg County. The current effects of this growth on water quality can be seen in the map of Impaired streams in the Catawba River basin (Figure A-3). The sparsely developed watersheds of the northwestern portion of the basin generally contain streams with high water

quality, excellent aquatic species populations, and Supporting use support ratings. Water quality declines dramatically in streams in the central and southern watersheds, where urbanization is focused around urban centers and interstate corridors. It is no surprise then the greatest concentration of Impaired streams lies in the areas of Gaston, Mecklenburg and Union counties around Charlotte and the urbanizing corridors along interstate highways.

In the past, the Catawba River basin was blessed with an abundance of surface water that supported the industrial expansion of the mid-20th century and the current domestic expansion. Even today, there is sufficient water to serve its diverse domestic, agricultural, industrial, energy production and recreational needs except in periods of severe drought. But, it is those periods of drought that point to the impending threats to the availability of good quality water. Clean water can likely be provided in sufficient quantity to supply the future needs of the basin, but only with inspired foresight, planning and management.

4.11.2 The Role of Local Governments

A summary of necessary management actions needed by local authorities is provided here, followed by discussions on large, watershed management issues. These actions are necessary to address current sources of impairment and to prevent future degradation in all streams. The intent of these recommendations is to describe the types of actions necessary to improve stream conditions, not to specify particular administrative or institutional mechanisms for implementing remedial practices. Those types of decisions must be made at the local level.

Because of uncertainties regarding how individual remedial actions cumulatively impact stream conditions and in how aquatic organisms will respond to improvements, the intensity of management effort necessary to bring about a particular degree of biological improvement cannot be established in advance. The types of actions needed to improve biological conditions can be identified, but the mix of activities that will be necessary – and the extent of improvement that will be attainable – will only become apparent over time as an adaptive management approach is implemented. Management actions are suggested below to address individual problems, but many of these actions are interrelated (NCDENR-DWQ, June 2003).

Actions one through five are important to restoring and sustaining aquatic communities in a watershed, with the first three recommendations being the most important.

1. **Feasible and cost-effective stormwater retrofit projects should be implemented throughout the watershed to mitigate the hydrologic effects of development** (increased stormwater volumes and increased frequency and duration of erosive and scouring flows). This should be viewed as a long-term process. Although there are many uncertainties, costs in the range of $1 million per square mile can probably be anticipated.
    a. Over the short-term, currently feasible retrofit projects should be identified and implemented.
    b. In the longer term, additional retrofit opportunities should be implemented in conjunction with infrastructure improvements and redevelopment of existing developed areas.
    c. Priorities should include evaluating the retrofit potential of existing instream impoundments.

    d. Grant funds for these retrofit projects may be available from EPA initiatives, such as Section 319 funds or the North Carolina Clean Water Management Trust Fund.

2. **A watershed scale strategy to address toxic inputs should be developed and implemented, including a variety of source reduction and stormwater treatment methods.** As an initial framework for planning toxicity reduction efforts, the following general approach is proposed:
    a. Implementation of available BMP opportunities for control of stormwater volume and velocities. As recommended above to improve aquatic habitat potential, these BMPs will also remove toxics from stormwater.
    b. Development of a stormwater and dry weather sampling strategy in order to facilitate the targeting of pollutant removal and source reduction practices.
    c. Implementation of stormwater treatment BMPs, aimed primarily at pollutant removal, at appropriate locations.
    d. Development and implementation of a broad set of source reduction activities focused on: reducing nonstorm inputs of toxics; reducing pollutants available for runoff during storms; and managing water to reduce storm runoff.
3. **Stream channel restoration activities should be implemented in target areas, in conjunction with stormwater retrofit BMPs, in order to improve aquatic habitat.** Before beginning stream channel restoration, a geomorphologic survey should be conducted to determine the best areas for stream channel restoration. Additionally, it would probably be advantageous to implement retrofit BMPs before embarking on stream channel restoration, as restoration is probably best designed for flows driven by reduced stormwater runoff. Costs of approximately $200 per foot of channel should be anticipated (Haupt et al., 2002; and Weinkam et al., 2001). Grant funds for these retrofit projects may be available from federal sources, such as EPA's Section 319 funds or state sources including North Carolina Clean Water Management Trust Fund.
4. Actions recommended above (e.g., stormwater quantity and quality retrofit BMPs) are likely to reduce nutrient/organic loading and its impacts to some extent. Activities recommended to address this loading include the identification and elimination of illicit discharges; education of homeowners, commercial applicators, and others regarding proper fertilizer use; street sweeping; catch basin clean-out practices; and the installation of additional BMPs targeting BOD and nutrient removal at appropriate sites.
5. Prevention of further channel erosion and habitat degradation will require effective post-construction stormwater management for all new development in the study area.
6. Effective enforcement of sediment and erosion control regulations will be essential to the prevention of additional sediment inputs from construction activities. Development of improved erosion and sediment control practices may be beneficial.
7. Watershed education programs should be implemented and continued by local governments with the goal of reducing current stream damage and preventing future degradation. At a minimum, the program should include elements to address the following issues:
    a. redirecting downspouts to pervious areas rather than routing these flows to driveways or gutters;
    b. protecting existing woody riparian areas on all streams;
    c. replanting native riparian vegetation on stream channels where such vegetation is absent; and
    d. reducing and properly managing pesticide and fertilizer use.

4.11.3 Maintain and Develop Riparian Buffers

The presence of intact riparian buffers and/or wetlands in urban areas can reduce the urban impacts. Establishment and protection of buffers should be considered where feasible, and the amount of impervious cover should be limited as much as possible. Wide streets, large cul-de-sacs, and long driveways and sidewalks lining both sides of the street are all features of urban development that create excess impervious cover and consume natural areas.

Catawba River Basin Buffer Rules
On July 7, 2003, the Environmental Management Commission completed a stakeholder process to protect mainstem riparian habitat on the Catawba River by finalizing the "Catawba River Basin Buffer Rules" (§15A NCAC 02B.0243). The temporary rule became permanent in August 2004.

The Catawba River basin buffer rules apply to a 50-foot wide riparian buffer directly adjacent to surface waters along the Catawba River mainstem below Lake James and along mainstem lakes in the Catawba River basin. The rules create a two-zone protection area that allows for all existing uses that were in place on June 30, 2001. As long as the current land use was in place on that date, the Catawba River basin buffer rules do not apply. Otherwise, zone one is the 30-foot wide strip closest to the waterline that must remain generally undisturbed. Zone two constitutes the remaining 20 feet of buffers and allows for grading and revegetating as long as the health of zone one is not impacted. There are many exemptions and activities that are allowable with mitigation inside the buffer zone. Those include, but are not limited to, access roads, view corridors and timber harvesting. For a complete copy of the rule and the list of all exemptions, please refer to §15A NCAC 02B.0243 http://h2o.enr.state.nc.us/admin/rules/. For more discussion on the process used to develop the rule, visit the webpage at http://h2o.enr.state.nc.us/nps/catawba.htm.

In addition to the rules discussed above, several other programs are implemented in the basin to protect riparian habitat. Protective zoning ordinances are in effect in all or part of Burke, McDowell and Mecklenburg counties. In addition, special protection is given to riparian habitat in water supply watersheds, high quality waters, outstanding resource waters, and trout waters throughout the basin (see Section A, Chapter 3, Part 3.2).

4.11.4 Protect Headwater Streams

The Catawba River basin buffer rules described above are an effective way to reduce nonpoint pollution impacts to the mainstem river and lakes, but is only part of a holistic, basinwide management approach. Many streams in a given river basin are only small trickles of water that emerge from the ground. A larger stream is formed at the confluence of these trickles. This constant merging eventually forms a large stream or river. Most monitoring of fresh surface waters evaluates these larger streams. The many miles of small trickles, collectively known as headwaters, are not directly monitored and in many instances are not even indicated on maps. However, impacts to headwater streams can (and do) affect the larger stream or river.

Headwater areas are found from the mountains to the coast along all river systems and drain all of the land in a river basin. Because of the small size of headwater streams, they are often overlooked during land use activities that impact water quality. All landowners can participate

in the protection of headwaters by keeping small tributaries in mind when making land use management decisions on the areas they control. This includes activities such as retaining vegetated stream buffers and excluding cattle from streams. Local rural and urban planning initiatives should also consider impacts to headwater streams when land is being developed.

For a more detailed description of watershed hydrology, please refer to EPA's Watershed Academy website at http://www.epa.gov/OWOW/watershed/wacademy/acad2000/watershedmgt/principle1.html.

Planning Recommendations for New Development

- Minimize number and width of residential streets.
- Minimize size of parking areas (angled parking & narrower slots).
- Place sidewalks on only one side of residential streets.
- Minimize culvert pipe and hardened stormwater conveyances.
- Vegetate road right-of-ways, parking lot islands and highway dividers to increase infiltration.
- Plant and protect natural buffer zones along streams and tributaries.

4.11.5 Reduce Impacts of Future Development

Proactive planning efforts at the local level are needed to assure that development is done in a manner that maintains water quality. These planning efforts will need to find a balance between water quality protection, natural resource management and economic growth. Growth management requires planning for the needs of future population increases, as well as developing and enforcing environmental protection measures. These actions are critical to water quality management and the quality of life for the residents of the basin.

Areas adjacent to the high growth areas of the basin are at risk of developing Impaired biological communities. These biological communities are important to maintaining the ecological integrity in the Catawba River basin. These streams will be important as sources of benthic macroinvertebrates and fishes for reestablishment of biological communities in nearby streams that are recovering from past impacts or are being restored.

To prevent further impairment to aquatic life in streams in urbanizing watersheds local governments should:

1. Identify waters that are threatened by development.
2. Protect existing riparian habitat along streams.
3. Implement stormwater BMPs during and after development.
4. Develop land use plans that minimize disturbance in sensitive areas of watersheds.
5. Minimize impervious surfaces including roads and parking lots.
6. Develop public outreach programs to educate citizens about stormwater runoff.

Action should be taken at the local level to plan for new development in urban and rural areas. For more detailed information regarding recommendations for new development found in the text box (above), refer to EPA's website at www.epa.gov/owow/watershed/wacademy/acad2000/protection, the Center for Watershed Protection website at www.cwp.org, and the Low Impact Development Center website at www.lowimpactdevelopment.org. Additional public education is also needed in the Catawba River basin in order for citizens to understand the value of urban planning and stormwater management. DWQ recently developed a booklet that discusses actions individuals can take to reduce stormwater runoff and improve stormwater quality entitled *Improving Water*

Quality In Your Own Backyard. To obtain a free copy, call (919) 733-5083, ext. 558. For an example of local community planning, visit the website at http://www.charmeck.org/Home.htm for more information on the Town of Huntersville's water quality ordinance and other programs in the Charlotte-Mecklenburg area.

4.12 DWQ Stormwater Programs

Introduction

There are many different stormwater programs administered by DWQ. One or more of these programs affect many communities in the Catawba River basin. The goal of the DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. Those programs try to accomplish this goal by controlling the source(s) of pollutants. These programs include NPDES Phase I and II, HQW/ORW stormwater requirements, and requirements associated with the Water Supply Watershed Program. Local governments that are or may be affected by these programs are presented in Table A-27.

4.12.1 NPDES Phase I

Current Status and 2004 Recommendations

In the Catawba River basin, only the City of Charlotte has a Phase I stormwater permit. Phase I of the EPA stormwater program started with Amendments to the Clean Water Act (CWA) in 1990. Phase I required NPDES permit coverage to address stormwater runoff from medium and large stormwater systems serving populations of 100,000 or more people. Phase I also had requirements for ten categories of industrial sources to be covered under stormwater permits. Industrial activities which require permitting are defined in categories ranging from sawmills and landfills to manufacturing plants and hazardous waste treatment, storage or disposal facilities. Construction sites disturbing greater than five acres are also required to obtain an NPDES stormwater permit under Phase I of the EPA stormwater program.

Throughout the Catawba River basin, various types of activities with point source discharges of stormwater are required to be permitted under the state NPDES stormwater program. These include industrial discharges related to manufacturing, processing and materials storage areas, and construction activities with greater than five acres of disturbance. Most of those areas requiring permits must develop Stormwater Pollution Prevention Plans (SPPP) to minimize and control pollutants discharged from their stormwater systems. Refer to Section A, Chapter 2, Part 2.6 for more information on permitting policy and procedure.

DWQ recommends continued implementation of the current stormwater programs as well as implementation of the Phase II requirements. Many of the Impaired stream miles in the Catawba River basin are Impaired at least in part because of runoff from urbanized areas. Development and implementation of local programs that go beyond the minimum requirements will be needed to restore aquatic life to these streams.

4.12.2 NPDES Phase II

Current Status and 2004 Recommendations

Thirty municipalities and seven counties (Table A-27) in the basin are automatically required (1990 and 2000 US Census designated Urban Areas) to obtain a NPDES stormwater permit under the Phase II rules. Local governments designated on the 1990 US Census were required to submit applications for NPDES stormwater permits by March 2003. Those designated based on the 2000 US Census had until May 2004 to submit applications.

The Environmental Management Commission (EMC) previously adopted temporary and permanent rules addressing implementation of the Phase II stormwater program in North Carolina. However, in January 2004, the Rules Review Commission (RRC) objected to and returned the permanent rules to the EMC. The EMC and other parties have challenged the RRC's decision.

The RRC's return of the permanent stormwater management rules caused the earlier temporary rules to expire and prevented the permanent rules from becoming effective. This left the state with no formal program outlining the requirements for implementation of the federally mandated NPDES stormwater Phase II program.

On July 12, 2004, the North Carolina General Assembly ratified Senate Bill 1210 (S1210) - Phase II Stormwater Management. The Governor signed the bill on August 2, 2004. This bill addresses implementation of the federal NPDES Phase II stormwater program in North Carolina. The following is a summary of the bill's major points. Updates on the Phase II program will be posted as they become available at http://h2o.enr.state.nc.us/su/Hot_Topics.htm.

Senate Bill 1210 Summary

Permit Applications. The bill provides that Phase II permit applications received from a local government according to the schedule established by the EMC in its rule making will be considered timely received. It requires the federally designated Phase II communities to develop, implement and enforce a stormwater management program approved by DENR. The programs must include the six minimum measures set out in the federal Phase II stormwater rules. The post-construction stormwater standards to be applied are those set out in the temporary rule adopted by the Environmental Management Commission except as modified in some minor respects by the legislation. The bill exempts municipalities with populations less than 1,000 from the Phase II permit requirement unless shown to be contributing to water quality impairment.

County Coverage. New development in the unincorporated areas surrounding federally designated Phase II municipalities must meet stormwater management requirements if the development is located:

1. In an area that is considered an "urbanized area" under the federal Census.
2. Within the potential extraterritorial jurisdiction (ETJ) of a Phase II municipality (the area outside the city limits in which the city may exercise planning and zoning authority).

A city's potential ETJ will extend 1-3 miles beyond its boundaries, depending on the population of the city. If the municipality is not actually exercising its planning and zoning authority throughout the entire area allowed by statute, then DENR is to implement the stormwater management requirements in the area not regulated by the municipality.

If the combination of area covered by Phase II municipalities, potential extraterritorial jurisdiction and urbanized areas totals at least 85% of the entire area of the county, then stormwater requirements apply to new development in the entire county. As additional cities come into the Phase II program by state designation, the EMC may require stormwater controls in unincorporated areas surrounding those cities. Only unincorporated areas falling within a designated city's potential ETJ may be added; newly urbanized areas outside a designated city's potential ETJ would not be regulated except to the extent that they are served by a storm sewer system that is required to obtain a permit. The decision to regulate some or all of the potential ETJ must be based on finding that stormwater discharges from the area will harm water quality or result in a significant contribution of pollutants to sensitive waters. The bill directs DENR to implement the Phase II stormwater program in the delineated unincorporated areas, but counties may voluntarily accept delegation of the program from DENR. If a county takes on implementation of the program, the county may apply stormwater standards only in the delineated areas or may chose to apply those standards throughout the county.

Overlapping stormwater programs. In cases where conflicting or overlapping stormwater requirements are in effect, the more stringent standards will apply. (An example would be a Phase II municipality located in a county subject to the EMC's coastal stormwater rules.) The bill authorizes the Secretary to settle disputes over application of overlapping requirements.

General Permit. The Bill directs the EMC to develop and implement a general permit for Phase II stormwater coverage. The bill provides that the general permit requirements for post-construction stormwater control may be no more stringent than those set out in the temporary rule adopted by the EMC (as modified by the bill). A local government may choose to be covered under the general permit rather than an individual permit.

Permitting. The Bill directs DENR to send a draft NPDES stormwater permit to public notice by November 1, 2004 for all applications from municipal separate storm sewer systems located in cities and counties designated under the 1990 census. It also requires that DENR send a draft permit to public notice by May 1, 2005 for applications from those located in cities and counties designated under the 2000 census. The permitted storm sewer systems must implement post-construction stormwater requirements within 24 months after receiving the NPDES permit. Municipalities (or other public entities) regulated later under the state designation process must implement post-construction stormwater requirements within 36 months after receiving an NPDES stormwater permit.

State Designation and Petition Process. Federal rules require that the state consider regulating additional publicly owned storm sewer systems under Phase II based on water quality impacts. The bill basically incorporates the process adopted by the EMC in the Phase II rule making. The major difference is that the bill does not provide for state designation of counties. Designation would be focused on cities (or other publicly owned or operated storm sewer systems); delineating areas around the newly designated cities for regulation would add unincorporated areas. Federal rules also allow any person to petition the state to require a Phase II stormwater

permit for an unregulated storm sewer system or for an individual stormwater discharge. The bill sets out the process for receiving and acting on petitions as required by the federal rules, codifying the process adopted by the EMC in the final Phase II rule.

Model Ordinance and Design Manual. The bill directs the EMC to develop a model stormwater ordinance and an updated stormwater design manual by July 1, 2005.

Federal and State Development Projects. The bill provides that state and federal agencies may apply to DENR for an NPDES stormwater permit covering all of the agency's activities or for a specific development project. To the extent a state or federal agency receives an NPDES stormwater permit, it will not be subject to additional regulation under stormwater programs implemented by local government under Phase II. State and federal activities or projects that are not covered by an NPDES stormwater permit are subject to stormwater requirements of the bill, as implemented by DENR or a permitted local government.

Interpretation, Effective Date and Sunset. The bill provides that the act should not be interpreted to alter the authority of the EMC or a local government, affect pending litigation, or give effect to any rules. The bill also states that it is not intended to affect vested rights or the delegation of powers or duties to the EMC or DENR as established under existing law. Agriculture and forestry exemptions from NPDES stormwater regulation apply. The bill will be effective when it becomes law and sunset on October 1, 2011. The provisions of the bill will not be codified.

4.12.3 State Stormwater Program

Current Status and 2004 Recommendations

The State Stormwater Management Program was established in the late 1980s under the authority of the North Carolina Environmental Management Commission (EMC) and North Carolina General Statute 143-214.7. This program, codified in 15A NCAC 2H .1000, affects development activities that require either an Erosion and Sediment Control Plan (for disturbances of one or more acres) or development draining to Outstanding Resource Waters (ORW) or High Quality Waters (HQW).

The State Stormwater Management Program requires developments to protect these sensitive waters by maintaining a low density of impervious surfaces, maintaining vegetative buffers, and transporting runoff through vegetative conveyances. Low density development thresholds vary from 12-30 percent built-upon area (impervious surface) depending on the classification of the receiving stream. If low density design criteria cannot be met, then high density development requires the installation of structural best management practices (BMPs) to collect and treat stormwater runoff from the project. High density BMPs must control the runoff from the 1 or 1.5-inch storm event (depending on the receiving stream classification) and remove 85 percent of the total suspended solids.

Table A-27 shows the four counties in the Catawba River basin where permits may be required under the state stormwater management program under HQW or ORW stormwater rules. All development requiring an Erosion and Sediment Control Plan (for disturbances of one or more acres) must obtain a stormwater permit.

DWQ will continue implementing the state stormwater program with the other NCDENR agencies and local governments. Local governments should develop local land use plans that minimize impervious surfaces in sensitive areas. Communities should integrate state stormwater program requirements, to the extent possible, with other stormwater programs in order to be more efficient and gain the most water quality benefits for protection of public health and aquatic life. For example, the Mecklenburg County Water Quality Program in cooperation with the City of Charlotte and towns has initiated a stakeholders' process that began in April and will continue through December 2004 with the goal of developing a post-construction ordinance for new development that will be considered for adoption by elected officials in the city, county and towns in the spring of 2005. The purpose of the ordinance will be to control and manage stormwater runoff and associated negative water quality impacts resulting from post-construction stormwater discharges through the use of a combination of structural and non-structural best management practices (BMPs). The ordinance will fulfill the following objectives:

- Achieve compliance with the Phase I and Phase II NPDES Stormwater Permit requirements for post-construction pollution control, as applied to the respective jurisdictions.
- Satisfactorily address the stormwater pollution control criteria specified by the NC Wildlife Resources Commission (NCWRC) and the US Fish and Wildlife Services (USFWS) for the Rocky River watershed.
- Satisfactorily address the causes of water quality impairment associated with stormwater runoff in Charlotte-Mecklenburg.
- Satisfactorily address detention measures for the control of stormwater volumes and peaks associated with new construction.

Local governments facing rapid development should follow the lead of towns like Huntersville and develop zoning ordinances that augment and enhance the effect of regional programs by requiring the use of Low Impact Development (LID) technologies that replicate predevelopment runoff characteristics (Section B, Chapter 4, Part 4.3.1).

4.12.4 Water Supply Watershed Stormwater Rules

Current Status and 2004 Recommendations

The purpose of the Water Supply Watershed Protection Program is to provide a proactive drinking water supply protection program for communities. Local governments administer the program based on state minimum requirements. There are restrictions on wastewater discharges, development, landfills and residual application sites to control the impacts of point and nonpoint sources of pollution. The program attempts to minimize the impacts of stormwater runoff by utilizing low density development or stormwater treatment in high density areas.

There are 23 surface water supply watersheds in the Catawba River basin. Local governments that have land use jurisdiction within these watersheds are responsible for the adoption, implementation and enforcement of the state's water supply watershed minimum requirements. Table A-27 is a list of the local governments responsible for a WSWP Program in the Catawba River basin.

Local governments can adopt and enforce more stringent water supply watershed protection ordinances if they choose. For example, the state's rules require the use of a 30-foot vegetated

buffer (for low density development) along all waters in the water supply watershed that appear as solid blue lines on USGS 1:24,000 scale topographical maps. The state's rules allow the buffer's vegetation to consist entirely of grass rather than natural vegetation. However, a local government can require a larger and undisturbed (natural vegetation) buffer. If a local government adopts a more stringent ordinance, the state cannot require the local government to enforce anything more stringent than the state's minimum requirements. However, the state does have statutory authority to assess civil penalties for local governments or developers for not administering the state's minimum requirements.

DWQ is currently reviewing local water supply watershed protection programs. This entails conducting site visits to local governments, assessing their land use ordinances and checking compliance with stormwater management, such as installation and maintenance of engineered stormwater control ponds, buffers and built-upon surface area. DWQ staff also continues to provide technical assistance through site visits, website (http://h2o.enr.state.nc.us/wswp/index.html), newsletter and correspondence.

DWQ recommends continued implementation of local water supply protection ordinances to ensure safe and economical treatment of drinking water. Communities should also integrate water supply protection ordinances with other stormwater programs, to the extent possible, in order to be more efficient and gain the most water quality benefits for both drinking water and aquatic life.

Table A-27 Communities in the Catawba River with Stormwater Requirements

	NPDES		TR Water Requirements	State Stormwater Program	Water Supply Watershed Stormwater Requirements
Local Government	Phase I	Phase II*			
Municipalities					
Belmont		**X**			**X**
Bessemer City		**X**			**X**
Blowing Rock			**X**		
Cajah Mountain		**X**			**X**
Catawba					**X**
Charlotte	**X**				**X**
Claremont		**X**			**X**
Connelly Springs		**X**			**X**
Conover		**X**			**X**
Cornelius		**X**			**X**
Dallas		**X**			**X**
Davidson		**X**			**X**
Drexel		**X**			**X**
Gamewell		**X**			**X**
Glen Alpine		**X**			**X**
Grandfather Village			**X**		

Granite Falls		X			X
Hickory		X			X
High Shoals					X
Hildebran		X			X
Hudson		X			X
Huntersville		X			X
Lenoir		X			X
Linville			X		
Lincolnton					X
Longview		X			X
Lowell		X			X
Maiden		X			X
Mooresville					X
Morganton		X			X
Mt. Holly		X			X
Old Fort			X		
Newton		X			X
Ranlo		X			X
Rhodhiss		X			X
Rutherford College		X			X
Sawmills		X			X
Stanley		X			X
Sugar Mountain			X		
Troutman					X
Valdese		X			X
Counties					
Alexander		X	X		X
Avery			X	X	X
Burke		X	X	X	X
Caldwell		X	X	X	X
Catawba		X			X
Cleveland					X
Gaston		X			X
Iredell					X
Lincoln					X
McDowell			X	X	X
Mecklenburg	X	X			X
Rutherford					X
Union		X			X

* More local governments may be designated, once designation criteria are developed, in addition to those that may be automatically designated based on 2000 Census.

4.12.5 Trout Stream Protection

Current Status and 2004 Recommendations

Many of the coldwater streams in the Catawba River basin's mountainous areas are home to healthy trout populations. DWQ gives supplemental trout (Tr) classification to those streams that are capable of supporting natural trout reproduction and survival of stocked trout. In order to protect the high quality water found in these streams, DWQ and the Division of Land Resources (DLR) enforce special regulations. For example, turbidity and dissolved oxygen standards are more stringent in trout waters than in Class C waters. DLR also requires a 25-foot, undisturbed vegetated buffer between the streambank and any land-disturbing activity (grading). In addition to these requirements, DWQ recommends developers and contractors diligently maintain erosion control structures when building near trout streams and encourages local citizens to report erosion problems to regional DWQ and DLR offices. The contact information for these offices can be found in Appendix VI, and North Carolina's surface water classification system is described in detail in Section A, Chapter 3.2.

4.13 Habitat Degradation

Instream habitat degradation is identified in the use support summary (Appendix III) where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour. Good instream habitat is necessary for aquatic life to survive and reproduce. Streams that typically show signs of habitat degradation are in watersheds that have a large amount of land-disturbing activities (construction, mining, timber harvest and agricultural activities) or a large percentage of impervious surfaces. A watershed in which most of the riparian vegetation has been removed from streams or channelization has occurred also exhibits instream habitat degradation. Streams that receive a discharge quantity that is much greater than the natural flow in the stream often have degraded habitat as well.

Some Best Management Practices

Agriculture

- No till or conservation tillage practices
- Strip cropping and contour farming
- Leaving natural buffer areas around small streams and rivers

Construction

- Using phased grading/seeding plans
- Limiting time of exposure
- Planting temporary ground cover
- Using sediment basins and traps

Forestry

- Controlling runoff from logging roads
- Replanting vegetation on disturbed areas
- Leaving natural buffer areas around small streams and rivers

Determining the cause and quantifying amounts of habitat degradation is very difficult in most cases. To assess instream habitat degradation in most streams would require extensive technical and monetary resources and perhaps even more resources to restore the stream. Although DWQ and other agencies are starting to address this issue, local efforts are needed to prevent further instream habitat degradation and to restore streams that have been Impaired by activities that cause habitat degradation. As point sources become less of a source of water quality impairment, nonpoint sources that pollute water and cause habitat degradation need to be addressed to further improve water quality in North Carolina's streams and rivers.

4.13.1 Sedimentation

Introduction

Soil erosion, transport and redeposition are among the most essential natural processes occurring in watersheds. However, land-disturbing activities such as the construction of roads and buildings, crop production, livestock grazing and timber harvesting can accelerate erosion rates by causing more soil than usual to be detached and moved by water. If best management practices (BMPs) are not used effectively, accelerated erosion can strip the land of its topsoil, decreasing soil productivity and causing sedimentation in streams and rivers (NCDENR-DLR, 1998). Sedimentation is the process by which eroded soil is deposited into waters. Sediment that accumulates on the bottom of streams and rivers smothers aquatic insects that fish feed upon and buries fish habitat that is vital to reproduction. Sediment filling rivers and streams decreases their storage volume and increases the frequency of floods (NCDENR-DLR, 1998).

Suspended sediment can decrease primary productivity (photosynthesis) by shading sunlight from aquatic plants, affecting the overall productivity of a stream system. Suspended sediment also has several effects on various fish species including avoidance and redistribution, reduced feeding efficiency, and therefore, reduced growth by some species, respiratory impairment, reduced tolerance to diseases and toxicants, and increased physiological stress (Roell, June 1999). Suspended sediment also increases the cost of treating municipal drinking water.

During 1999 basinwide monitoring, DWQ aquatic biologists reported streambank erosion and sedimentation throughout the Catawba River basin that was moderate to severe. Lower bioclassification ratings were assigned because of sedimentation; bottom substrate was embedded by silt and/or pools were partially filled with sediment. Unstable and/or undercut (eroding) streambanks were also noted in explanation of lower ratings (NCDENR-DWQ, June 2003).

Land Clearing Activities

Erosion and sedimentation can be controlled during most land-disturbing activities by using appropriate BMPs. In fact, substantial amounts of erosion can be prevented by planning to minimize the (1) amount and (2) time the land is exposed. DWQ's role in sediment control is to work cooperatively with those agencies that administer sediment control programs in order to maximize the effectiveness of the programs and to protect water quality. Where programs are not effective, as evidenced by a violation of instream water quality standards, and where DWQ can identify a source, then appropriate enforcement action can be taken. Generally, this entails requiring the landowner or responsible party to install acceptable BMPs.

As a result of new stormwater rules enacted by EPA in 1999, construction or land development activities that disturb one acre or more are required to obtain a NPDES stormwater permit. An erosion and sediment control plan must also be developed and approved for these sites under the state's Sedimentation Pollution Control Act (SPCA) administered by the NC Division of Land Resources. Site disturbances of less than one acre are required to use BMPs, but a plan is not required.

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (G.S. Chapter 113A, Article 4 referred to as "SPCA"). However, forestry operations may be exempted from the permit requirements in the SPCA, if the operations meet

compliance standards outlined in the *Forest Practices Guidelines Related to Water Quality* (15A NCAC 1I .0101-.0209, referred to as "FPGs") and General Statutes regarding stream obstruction (G.S. 77-13 and G.S. 77-14). Detailed information is available on the Water Quality Section of the DFR's website at http://www.dfr.state.nc.us.

For agricultural activities which are not subject to the SPCA, sediment controls are carried out on a voluntary basis through programs administered by several different agencies (see Appendix VI for further information).

Stronger Rules for Sediment Control

The Division of Land Resources (DLR) has the primary responsibility for assuring that erosion is minimized and sedimentation is reduced. In February 1999, the NC Sedimentation Control Commission adopted significant changes for strengthening the Erosion and Sedimentation Control Program. The following rule changes were filed as temporary rules, subject to approval by the Rules Review Commission and the NC General Assembly (NCDENR-DLR, July-September 1999):

- Allows state and local erosion and sediment control programs to require a preconstruction conference when one is deemed necessary.
- Reduces the number of days allowed for establishment of ground cover from 30 working days to 15 working days and from 120 calendar days to 90 calendar days. (Stabilization must now be complete in 15 working days or 90 calendar days, whichever period is shorter.)
- Provides that no person may initiate a land-disturbing activity until notifying the agency that issued the plan approval of the date the activity will begin.
- Allows assessment penalties for significant violations upon initial issuance of a Notice of Violation (NOV).

Additionally, during its 1999 session, the NC General Assembly passed House Bill 1098 to strengthen the Sediment Pollution Control Act of 1973 (SPCA). The bill made the following changes to the Act (NCDENR-DLR, July-September 1999):

- Increases the maximum civil penalty for violating the SPCA from $500 to $5000 per day.
- Provides that a person may be assessed a civil penalty from the date a violation is detected if the deadline stated in the Notice of Violation is not met.
- Provides that approval of an erosion control plan is conditioned on compliance with federal and state water quality laws, regulations and rules.
- Provides that any erosion control plan that involves using ditches for the purpose of dewatering or lowering the water table must be forwarded to the Director of DWQ.
- Amends the General Statutes governing licensing of general contractors to provide that the State Licensing Board for General Contractors shall test applicants' knowledge of requirements of the SPCA and rules adopted pursuant to the Act.
- Removes a cap on the percentage of administrative costs that may be recovered through plan review fees.

For information on North Carolina's Erosion and Sedimentation Control Program or to report erosion and sedimentation problems, visit the new website at http://www.dlr.enr.state.nc.us/ or you may call the NC Division of Land Resources, Land Quality Section at (919) 733-4574.

Recent Review of Sediment Control Research

The two most popular sediment control devices are silt fences and sediment basins. In 2001, DWQ staff conducted a review of peer-reviewed research publications and consulted with experts at NC State University (NCSU) to investigate the effectiveness of current sediment and erosion control practices. In addition, engineering calculations have been conducted to obtain theoretical effectiveness of sediment basins and silt fences. Research conducted in North Carolina showed that construction sites in North Carolina produce 10-188 tons per acre per year of sediment. Such wide variation might be attributed to the significant spatial and temporal differences in rainfall intensity and duration, soil characteristics, slope, and the type of soil cover. DLR currently uses the assumption that (on average) construction sites produce 84 tons/acre-year. For comparison, erosion in undisturbed natural systems is only 0.1-0.2 tons/acre-year.

Currently, sediment basins are designed to have 1,800 cubic feet of storage space for each acre of disturbed land. Based on the reference review and consultation, DWQ has concluded that these basins have numerous deficiencies, including:

1. Insufficient volume. [Pennsylvania requires 5,000 cubic feet; Maryland and Virginia require 3,600 cubic feet.]
2. Inadequate cleaning frequency. [In many cases, effectiveness of the basins is significantly reduced because they are only cleaned once a year.]
3. Short-circuiting. [In many cases, inlet and outlet in basins are constructed in very close proximity, which results in a shorter than predicted retention time.]
4. Water is not being removed from the surface where concentration of the sediment is the lowest.
5. Basins are designed with consideration of only cleared land. [In many cases, basins are treating runoff from the entire drainage area, which is significantly larger than that of cleared land.]

A sedimentation basin that is ideally designed and constructed is only able to capture 55 percent of all sediment in runoff. As a result, each acre of cleared land will deliver 38 tons of sediment to the waterways each year. After six months of operation, the effectiveness of the sediment basin will be reduced to 33 percent and the loss of sediment will approach 56 tons/acre-year.

Silt fences are even less effective. A typical silt fence can capture only 22 percent of all particles in runoff. Very often, they are improperly installed and receive inadequate maintenance that results in further reduction in their effectiveness.

New research indicates that use of new technologies such as installation of baffles in the sediment basins, application of flocculents, and use of skimmers can significantly increase efficiency of sedimentation basins. Experiments conducted at NCSU demonstrated that the current turbidity standard of 50 NTU (for waters not classified Tr) can be achieved in runoff if these devices are used. However, the most important factor in reducing sedimentation is timely cover of cleared land with mulches or use of the flocculent solutions to prevent erosion. It has been conclusively proven that use of ground cover (temporary or permanent) dramatically reduces erosion rates.

4.13.2 Loss of Riparian Vegetation

During 2002 basinwide sampling, DWQ biologists reported degradation of aquatic communities at numerous sites throughout the Catawba River basin in association with narrow or nonexistent zones of native riparian vegetation. Riparian vegetation loss was common in rural and residential areas as well as in urban areas (NCDENR-DWQ, June 2003).

Removing trees, shrubs and other vegetation to plant grass or place rock (also known as riprap) along the bank of a river or stream degrades water quality. Removing riparian vegetation eliminates habitat for aquatic macroinvertebrates that are food for trout and other fish. Rocks lining a bank absorb the sun's heat and warm the water. Some fish require cooler water temperatures as well as the higher levels of dissolved oxygen cooler water provides. Trees, shrubs and other native vegetation cool the water by shading it. Straightening a stream, clearing streambank vegetation, and lining the banks with grass or rock severely impact the habitat that aquatic insects and fish need to survive.

Livestock grazing with unlimited access to the stream channel and banks can cause severe streambank erosion resulting in degraded water quality. Although they often make up a small percentage of grazing areas by surface area, riparian zones (vegetated stream corridors) are particularly attractive to cattle that prefer the cooler environment and lush vegetation found beside rivers and streams. This concentration of livestock can result in increased sedimentation of streams due to "hoof shear", trampling of bank vegetation, and entrenchment by the destabilized stream. Despite livestock's preference for frequent water access, farm veterinarians have reported that cows are healthier when stream access is limited (EPA, 1999).

Establishing, conserving and managing streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. Forested buffers in particular provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife (NCDENR-DWQ, February 2002). To obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

4.13.3 Loss of Instream Organic Microhabitats

Organic microhabitat (leafpacks, sticks and large wood) and edge habitat (root banks and undercut banks) play very important roles in a stream ecosystem. Organic matter in the form of leaves, sticks and other materials serve as the base of the food web for small streams. Additionally, these microhabitats serve as special niches for different species of benthic macroinvertebrates, providing food and/or habitat. For example, many stoneflies are found almost exclusively in leafpacks and on small sticks. Some beetle species prefer edge habitat, such as undercut banks. If these microhabitat types are not present, there is no place for these specialized macroinvertebrates to live and feed. The absence of these microhabitats in some streams in the Catawba River basin is directly related to the absence of riparian vegetation (refer to Part 4.13.2 above). Organic microhabitats are critical to headwater streams, the health of which is linked to the health of the entire downstream watershed.

4.13.4 Channelization

Channelization refers to the physical alteration of naturally occurring stream and riverbeds. Typical modifications are described in the text box. Although increased flooding, bank erosion and channel instability often occur in downstream areas after channelization has occurred, flood control, reduced erosion, increased usable land area, greater navigability and more efficient drainage are frequently cited as the objectives of channelization projects.

Typical Channel Modifications

- Removal of any obstructions, natural or artificial, that inhibit a stream's capacity to convey water (clearing and snagging).
- Widening, deepening or straightening of the channel to maximize conveyance of water.
- Lining the bed or banks with rock or other resistant materials.

Direct or immediate biological effects of channelization include injury and mortality of benthic macroinvertebrates, fish, shellfish/mussels and other wildlife populations, as well as habitat loss. Indirect biological effects include changes in benthic macroinvertebrate, fish and wildlife community structures, favoring species that are more tolerant of or better adapted to the altered habitat.

Restoration or recovery of channelized streams may occur through processes, both naturally and artificially induced. In general, streams that have not been excessively stressed by the channelization process can be expected to return to their original forms. However, streams that have been extensively altered may establish a new, artificial equilibrium (especially when the channelized streambed has been hardened). In such cases, the stream may enter a vicious cycle of erosion and continuous entrenchment. Once the benefits of a channelization project become outweighed by the costs, both in money and environmental integrity, channel restoration efforts are likely to be taken.

Channelization of streams within the continental United States is extensive and promises to become even more so as urban development continues. Overall estimates of lost or altered riparian habitats within US streams are as high as 70 percent. Unfortunately, the dynamic nature of stream ecosystems makes it difficult (if not impossible) to quantitatively predict the effects of channelization. Channelization has occurred historically throughout the Catawba River basin and continues to occur in some watersheds, especially in small headwater streams.

4.13.5 Recommendations for Reducing Habitat Degradation

In March 2002, Environmental Management Commission (EMC) sent a letter to the Sedimentation Control Commission (SCC) expressing seven recommendations for improving erosion and sedimentation control, based on a comprehensive performance review of the turbidity standard conducted in 2001 by DWQ staff. Specifically, the recommendations are that the EMC and SCC:

1. Evaluate, in consultation with the Attorney General's Office, whether statutory authority is adequate to mandate temporary ground cover over a percentage of the uncovered area at a construction site within a specific time after the initial disturbance of the area. If it is found that statutory authority does not exist, then the EMC and SCC should prepare resolutions for the General Assembly supporting new legislation to this effect.

2. Prepare resolutions supporting new legislation to increase the maximum penalty allowed in the Sedimentation Pollution Control Act from $5,000 to $25,000 for the initial response to a noncompliant site.
3. Jointly support a review of the existing Erosion and Sediment Control Planning and Design Manual by DLR. This review should include, but not be limited to, a redesign of the minimum specifications for sedimentation basins.
4. Evaluate, in consultation with the Attorney General's Office, whether the statutory authority is adequate for effective use of the "Stop Work Order" tool and, if found not to be adequate, to prepare resolutions for the General Assembly supporting new legislation that will enable staff to more effectively use the "Stop Work Order" tool.
5. Support increased research into and experimentation with the use of polyacrylamides (PAMs) and other innovative soil stabilization and turbidity reduction techniques.
6. Jointly support and encourage the awarding of significant monetary penalties for all activities found to be in violation of their Stormwater Construction General Permit, their Erosion and Sediment Control Plan, or the turbidity standard.
7. Hold those individuals who cause serious degradation of the environment through excessive turbidity and sedimentation ultimately responsible for restoration of the area.

DWQ will continue to work cooperatively with DLR and local programs that administer sediment control in order to maximize the effectiveness of the programs and to take appropriate enforcement action when necessary to protect or restore water quality. However, more voluntary implementation of BMPs is needed for activities that are not subject to these rules in order to substantially reduce the amount of widespread sedimentation present in the Catawba River basin.

Additionally, more public education is needed basinwide to educate landowners about the value of riparian vegetation along small tributaries and the impacts of sedimentation to aquatic life. Funding is available through numerous federal and state programs for landowners to restore and/or protect riparian buffer zones along fields or pastures, develop alternative watering sources for livestock, and fence animals out of streams (refer to Section C). EPA's *Catalog of Federal Funding Sources for Watershed Protection* (Document 841-B-99-003) outlines some of these and other programs aimed at protecting water quality. A copy may be obtained by calling the National Center for Environmental Publications and Information at (800) 490-9198 or by visiting the website at http://www.epa.gov/OWOW/watershed/wacademy/fund.html. Local contacts for various state and local agencies are listed in Appendix VI.

4.14 Fecal Coliform Bacteria

Fecal coliform bacteria live in the digestive tract of warm-blooded animals (humans as well as other mammals) and are excreted in their waste. Fecal coliform bacteria do not actually pose a danger to people or animals. However, where fecal coliform are present, disease-causing bacteria may also be present, and water that is polluted by human or animal waste can harbor other pathogens that may threaten human health.

The presence of disease-causing bacteria tends to affect humans more than aquatic creatures. High levels of fecal coliform bacteria can indicate high levels of sewage or animal wastes which could make water unsafe for human contact (swimming) or the harvesting and consumption of shellfish. Fecal coliform bacteria and other potential pathogens associated with waste from

warm-blooded animals are not harmful to fish and aquatic insects. However, high levels of fecal coliform bacteria may indicate contamination that increases the risk of contact with harmful pathogens in surface waters. There are many waters that have high levels of fecal coliform bacteria associated mostly with stormwater runoff in urban areas. To view the list of DWQ ambient monitoring stations showing high concentrations of fecal coliform bacteria, refer to Section A, Chapter 3, Part 3.3.6. DWQ is currently developing TMDLs (see Appendix IV) for waters that are on the 303(d) list of Impaired waters.

Pathogens associated with fecal coliform bacteria can cause diarrhea, dysentery, cholera and typhoid fever in humans. Some pathogens can also cause infection in open wounds.

Under favorable conditions, fecal coliform bacteria can survive in bottom sediments for an extended period (Howell et al., 1996; Sherer et al., 1992; Schillinger and Gannon, 1985). Therefore, concentrations of bacteria measured in the water column can reflect both recent inputs as well as the resuspension of older inputs.

Reducing fecal coliform bacteria in wastewater requires a disinfection process, which typically involves the use of chlorine and other disinfectants. Although these materials may kill the fecal coliform bacteria and other pathogenic disease-causing bacteria, when they are introduced to the natural environment, they also kill bacteria essential to the proper balance of the aquatic environment, and thereby, endanger the survival of species dependent on those bacteria.

Water quality standards for fecal coliform bacteria are intended to ensure safe use of waters for recreation and shellfish harvesting (refer to Administrative Code Section 15A NCAC 2B .0200). The North Carolina fecal coliform standard for freshwater is 200 colonies/100ml based on the geometric mean of at least five consecutive samples taken during a 30-day period and not to exceed 400 colonies/100ml in more than 20 percent of the samples during the same period.

Sources of Fecal Coliform in Surface Waters

- Urban stormwater
- Wild animals and domestic pets
- Improperly designed or managed animal waste facilities
- Livestock with direct access to streams
- Improperly treated discharges of domestic wastewater, including leaking or failing septic systems and straight pipes

A number of factors beyond the control of any state regulatory agency contribute to elevated levels of disease-causing bacteria. Therefore, the state does not encourage swimming in surface waters. To assure that waters are safe for swimming indicates a need to test waters for pathogenic bacteria. Although fecal coliform standards have been used to indicate the microbiological quality of surface waters for swimming and shellfish harvesting for more than 50 years, the value of this indicator is often questioned. Evidence collected during the past several decades suggests that the coliform group may not adequately indicate the presence of pathogenic viruses or parasites in water.

The detection and identification of specific pathogenic bacteria, viruses and parasites such as *Giardia*, *Cryptosporidium* and *Shigella* are expensive, and results are generally difficult to reproduce quantitatively. Also, to ensure the water is safe for swimming would require a whole suite of tests for many organisms, as the presence/absence of one organism would not document

the presence/absence of another. This type of testing program is not possible due to resource constraints.

4.15 Addressing Waters on the State's Integrated 305(b) and 303(d) Report

Introduction

Section 303(d) of the federal Clean Water Act requires states to develop a 303(d) list of waters not meeting water quality standards or which have Impaired uses. States are also required to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. In the last few years, the TMDL program has received a great deal of attention as the result of a number of lawsuits filed across the country against EPA. These lawsuits argue that TMDLs have not been developed by states or the EPA. As a result of these lawsuits, EPA issued a guidance memorandum in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list. The schedules for TMDL development, according to this EPA memo, are to span 8-13 years.

Current Status and 2004 Recommendations

In 2002, per EPA guidance, DWQ submitted required information on a format similar to that specified in the *2002 Integrated Water Quality Monitoring and Assessment Report* (EPA, 2001b). This integrated report is considered a hybrid report, incorporating elements of old and new EPA guidance on 305(b) and 303(d) reporting. EPA confirms this report satisfies Clean Water Act (CWA) requirements for both the 2002 Section 305(b) water quality report and the 2002 Section 303(d) priority ranking of Impaired waterbodies, commonly referred to as the Section 303(d) list. DWQ has now submitted and is waiting EPA approval on the *2004 Integrated Report*.

The rigorous and demanding task of developing TMDLs for each of these waters during an 8 to 13-year time frame will require the focus of much of the water quality program's resources. Therefore, it will be a priority for North Carolina's water quality programs over the next several years to develop TMDLs for 303(d) listed waters. The waters in the Catawba River basin that are on this list are presented in the individual subbasin descriptions in Section B and in Table A-24. Waters listed as Impaired for the first time in this report will be listed in the *2006 Integrated Report*. For information on listing requirements and approaches, refer to Appendix IV.