A River in Jeopardy

The Yadkin and Pee Dee Rivers of North Carolina

By Brad Carpenter, Scott Jackson and Hope Taylor-Guevara

Clean Water for North Carolina

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EXECUTIVE SUMMARY

The Yadkin River flows east from the northwestern part of North Carolina, turns south and flows into South Carolina, where it empties into Winyah Bay near Georgetown. Along the way, the South Yadkin River and the Uwharrie River, the two largest of many tributaries, join. Other major tributaries include the Mitchell River, Ararat River, Rocky River, Reddies Creek, Dutchmans Creek, and Abbot Creek. Together, these flows form the second-largest river basin in North Carolina (7,213 square miles). Below the confluence of the Yadkin and the Uwharrie, the river is called the Pee Dee. The rivers and streams of the Yadkin-Pee Dee basin play a major part in the lives of the people in the Western Piedmont of North Carolina. In 1990, 1.2 million people lived in the basin. Recent trends of 10% population gains per decade are expected to continue until at least 2020. Between 1982 and 1992, urbanized land in the basin increased by 38% (NC Division of Water Quality, 1998). The river and its tributaries provide drinking water, agricultural and industrial water sources, and recreational opportunities in 22 counties.

The Yadkin-Pee Dee River faces threats from several directions. Population growth and sprawl are underlying causes of water quality problems. Sediment in muddy runoff comes from road and home construction, from the increased velocity of flow in urban areas, and also from agricultural and timbering operations. Nutrients come mainly from wastewater treatment plants, fertilizer, and animal wastes. Harmful bacteria are frequently associated with the nutrients. Toxic substances come from industrial sources, as do waste materials that add color to the water.

Sediment, soil that is eroded from the land and washed into the water by rain or floodwaters, is the main threat to water quality in the Yadkin (and in North Carolina as a whole). Sediment in the water, and settling in bottom of rivers, damages the ecosystem, reducing or eliminating fish and their habitat. It also greatly increases drinking water treatment requirements and related costs for downstream users. Existing technology and natural riparian buffers can easily and affordably reduce sediment problems in the basin.

Excess nutrients in the river unnaturally fertilize aquatic plants, especially algae. This leads to overgrowth, green water and fish kills, especially in slow and still waters. Nutrients come from wastewater treatment plants, fertilizer runoff (applied to lawns and agricultural fields), animal wastes, leaky septic systems and sewer pipes, and atmospheric deposition. Large-scale hog farms are a particular concern, since they release large amounts of nutrients under normal conditions and can release truly huge amounts of nutrients when waste lagoons fail. Reservoirs are more susceptible to nutrient problems than are free-flowing streams. Several reservoirs along the Yadkin-Pee Dee River have nutrient problems. Nutrients from mammalian sources are associated with bacteria and parasites that can harm human health.

Along the watershed's over 6,000 miles of flowing water, there are many point source polluters. Point source discharges are those that enter the water from discrete sources, such as pipes or ditches. In contrast, non-point sources are those that contaminate rainwater as it flows diffusely into streams and rivers, or percolates into groundwater. All point source dischargers are required by the Clean Water Act to have permits to discharge to surface water. The two main types of dischargers are industries and wastewater treatment plants. The effluent that enters streams and rivers through these pipes may contain both nutrients and toxins.

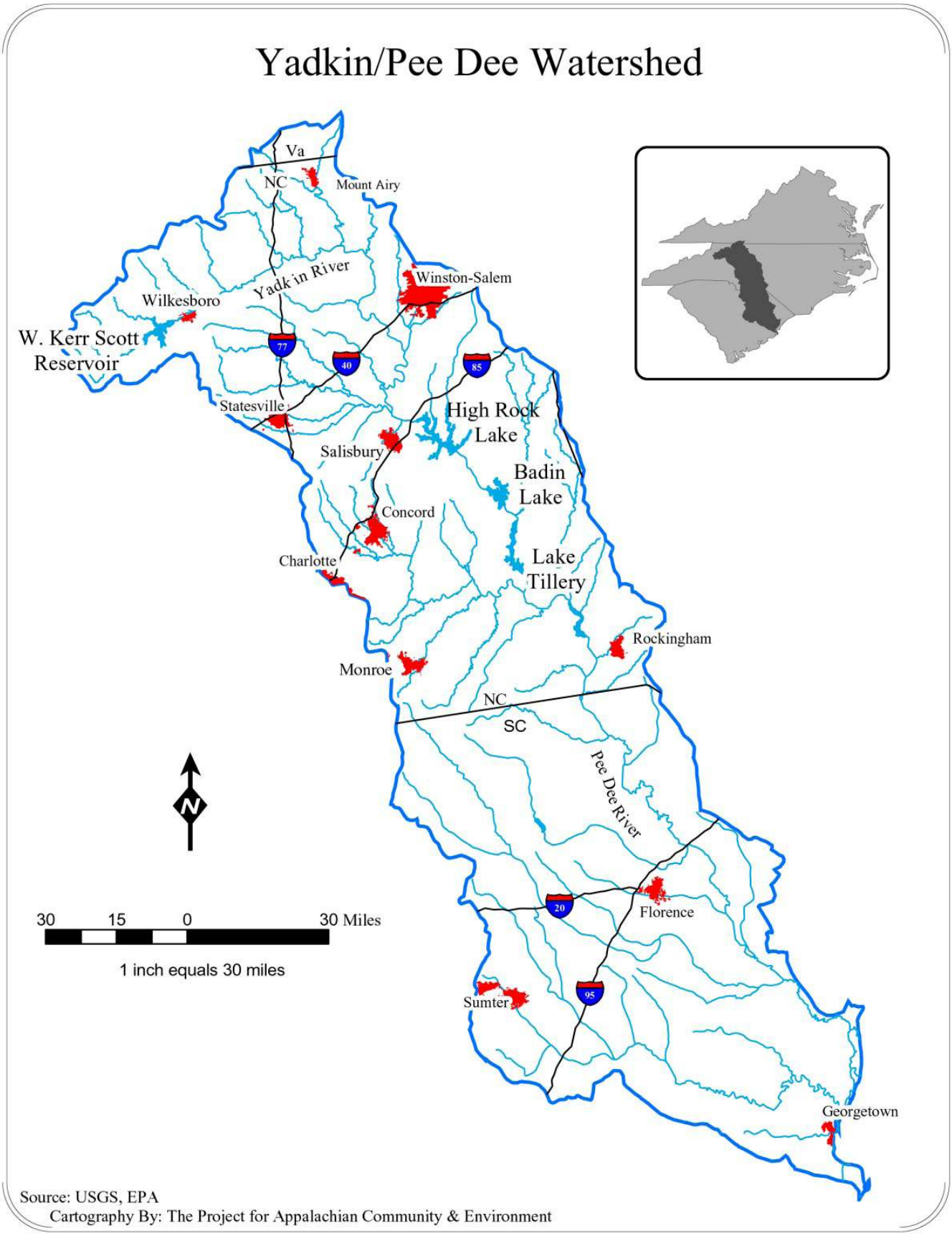
Facilities in the watersheds release great quantities of pollutants. These may be industrial facilities or municipal wastewater treatment plants. There are 345 facilities within the Yadkin basin permitted to release toxic chemicals into the air or water. 326 facilities (many duplicated from the toxic release category mentioned above) are permitted to discharge wastewater into the Yadkin. In 1998, these 326 facilities were permitted to discharge a total of over 130 million gallons of wastewater per day, carrying nutrients, bacteria and toxic waste directly into surface waters. The total amount of toxic substances these facilities released or transferred to air, water, and land declined from an estimated 28,210,767 pounds in 1990 to an estimated 18,227,964 pounds in 1998, a difference of almost 10 million pounds. This reduction is great news for the river, but the amount of pollution entering its waters remains too high. Pollution from wastewater treatment plants consists mostly of nitrogen, phosphorous, oxygen-demanding wastes and bacteria, with industrial discharges responsible for most of the toxics. In addition to directly releasing about 290,000 pounds of toxic waste directly to waters in the basin, industries transferred over 190,000 pounds of toxic waste to public wastewater treatment plants.

As we explore the impact human activity has on the Yadkin-Pee Dee watershed, we will examine the watershed in three parts, the Upper Yadkin, the South Yadkin, and the Lower Yadkin. The Upper Yadkin River is the northernmost portion of the drainage. The South Yadkin River enters the Yadkin River at High Rock Lake. Downstream of High Rock Lake is the Lower Yadkin River.

RECOMMENDATIONS

Clean Water for North Carolina believes that it is in the interest of all North Carolinians, including future generations, to protect and restore the health of the Yadkin-Pee Dee River, for protection of public health, the environment, and our economic future. To that end, we call for:

- Substantial improvement in non-point source pollution control, particularly sediment. This will require economic incentives for farmers and developers, strict enforcement of sedimentation and erosion regulations for all sectors, and serious regional transportation and development planning to prevent further rapid degradation of the Yadkin's waters and quality of life in the basin.
- Continuous reductions for toxic releases in all air, water, and land application or landfill permits in the Yadkin-Pee Dee basin.
- Elimination of concentrated animal feeding operations within the basin.
- Rigorous enforcement of all regulations and permit requirements, and implementation of Special Orders by Consent by the regional offices of the Department of Environment and Natural Resources that have jurisdiction in the watershed (Fayetteville, Mooresville, and Winston-Salem offices).
- Strong initiatives in stormwater management and treatment, beginning with urban and rapidly developing areas of the basin.
- No new dam construction within the basin.
- Close monitoring of upcoming dam relicensing processes.
- Establishment of a Yadkin-Pee Dee watershed watchdog group that would provide monitoring of river conditions, public environmental education, and advocacy for the river.
- Development of regulations to ensure that water quantity is protected, including requirements on large water withdrawals, both of surface water and groundwater.
- Cooperation within the basin to implement and maintain significant water conservation measures.


Yadkin/Pee Dee Watershed
Va
NC
Mount Airy
Yadkin River
Winston-Salem
Wilkesboro
W. Kerr Scott Reservoir
77
40
85
Statesville
High Rock Lake
Salisbury
Badin Lake
Concord
Charlotte
Lake Tillery
Rockingham
Monroe
NC
SC
Pee Dee River
N
30 15 0 30 Miles
1 inch equals 30 miles
20
Florence
95
Sumter
Georgetown
Source: USGS, EPA
Cartography By: The Project for Appalachian Community & Environment

INTRODUCTION

"Lazy river, muddy water.

Mother Nature's silent daughter.

Leaving life blood as you go.

Leaving everything you know."

Lazy River- Dave Katz

"The Muddy Yadkin" is a common nickname that many North Carolinians have given to the Yadkin River, which drains the state's second-largest watershed. Running from Wilkes County to Rowan County in North Carolina, the Yadkin River splits the state in half, as it drains a small bit of Virginia and flows south into South Carolina. After it joins with the Uwharrie River on the Montgomery-Stanly county line, the river is called the Pee Dee. The Yadkin has a drainage area of 7213 square miles, making it the second-largest watershed in North Carolina. Many lakes, streams, and rivers form tributaries in the basin. In addition to the South Yadkin River and the Uwharrie River, other major tributaries include the Mitchell River, Ararat River, Rocky River, Reddies Creek, Dutchmans Creek, and Abbot Creek. Over 1.2 million people live in the watershed. By 2020, the population is predicted to increase 30% from 1990 levels (NC Division of Water Quality, 1998). Many of the residents are in the Upper Yadkin, in and around the cities of Winston-Salem, Lexington, and Wilkesboro. Many others are in the western portion of the Lower Yadkin, as Charlotte's metropolitan area sprawls eastward into the basin, increasing the populations of Concord, Kannapolis, and other towns. Other parts of the basin are rural, with forestland and agricultural land comprising much of the area. As North Carolina changes, so do the impacts on the Yadkin-Pee Dee River ecosystem.

Currently, the overall Yadkin-Pee Dee basin is not a highly urbanized watershed. Forest covers just over half of the land in the basin. Agriculture (combining cultivated and pasture land) covers 30%. Urban land covers only 11%, but the amount of urban land is increasing dramatically (38% from 1982 to 1992). Agricultural land has been decreasing in recent decades, as developments and industries are taking over the farmland due to urban sprawl. The largest urban area in the watershed is Winston-Salem, with a population of over 170,000. The fastest growing cities in the basin are those on the eastern edge of Charlotte's sprawl. Between 1980 and 2000, through both annexation and population increase, Huntersville (Mecklenburg Co.) grew 1830%, Matthews (Mecklenburg Co.) grew 1245%, and Weddington (Union Co.) grew 690% (NC Division of Water Quality, 1998). Growth of the population in the Yadkin-Pee Dee basin brings more homes, roads, businesses, and industries. As the population continues to grow, urban water quality impacts such as wastewater, stormwater, construction erosion, and industrial dischargers, will increase. Rural water quality impacts, such as leaking septic systems and agricultural runoff, will decrease. Social changes may also impact water quality. Increased affluence and sprawl has spurred development of riparian areas for residences. Increased recreational use of the river may increase pressures on reservoir management. Finally, a population increase will lead to greater problems of water quantity, already a concern for the region.

SEDIMENT

Sediment is the greatest threat to water quality in the Yadkin-Pee Dee River. Sediment damages the ecosystem, as it covers the streambed (suffocating fish eggs), clogs gills, and reduces visibility for predators. A sediment-loaded stream will widen, and flows with high sediment loads have greater potential to scour the streambanks. As land is eroded and washes into a stream as sediment, it often brings along nutrients, toxins, and bacteria. Finally, sediment greatly increases water treatment requirements and related costs for any downstream communities using the stream for drinking water supply (NC Division of Water Quality, 1998).

Some sediment is natural in streams, but human activities have greatly increased the rate at which sediment enters the water. Humans create impervious surfaces (roads and roofs). Water drains quickly from these surfaces. As the water leaves the impervious surface at higher velocity, it has an increased ability to erode. (When the water enters the stream or river faster, it exacerbates flooding, which can damage property and further increase downstream erosion.) Activities that remove vegetation and expose bare ground also increase erosion. Some specific activities increasing sediment in streams are construction (including road construction), urban runoff, golf courses, agriculture, and livestock operations. Impacts from most of these activities can be reduced through affordable techniques called Best Management Practices (BMPs).

In the 19th and early 20th centuries, erosion from agriculture was at its highest rate in North Carolina. Since then, the amount of land devoted to agriculture has decreased, and soil conservation practices have become much more common. By 1970, sediment in rivers in the Southeastern US had fallen to approximately one third of the 1910 levels (NC Division of Water Quality, 1998). The amount of sediment contributed by agriculture in the Yadkin basin, although still very large, continues to decrease. However, sediment loads from construction and the more rapid and powerful runoff from impervious surfaces continues to increase.

There is some good news about the sediment problem. Solutions are known, such as riparian buffers, and rigorous construction best management practices, and they are attainable. Furthermore, sediment is not a long-lasting contaminant. If we can reduce the amount of new sediment entering the Yadkin Pee Dee system, the river will improve as storms wash the existing sediments downstream. (Note that dams impair this natural flushing of sediment, as well as nutrients and toxins. See **Dams and Reservoirs in the Yadkin** below.)

NUTRIENTS

Excess nutrients in the river lead to algal blooms, fish kills and excessive plant growth in still waters. The term "nutrients" generally refers to two major requirements for plant growth, phosphorus and nitrogen. Phosphorus is the nutrient of greatest concern in the Yadkin-Pee Dee River. Of course, some level of nutrients occurs naturally in streams and rivers. However, as with sediment problems, human activities increase nutrient levels. Sediment and nutrient pollution often enter streams and rivers together, from both non-point and point sources.

Non-point sources include agricultural runoff and urban runoff (or stormwater) bearing manure, fertilizer, sediment, and chemical agents. Leaking sewer pipes and septic systems are considered non-point sources. Atmospheric deposition (from air emissions of pollutants) is another significant non-point source of nutrients. Point sources of nutrient pollution are mainly wastewater treatment plants that discharge treated sewage. Even after treatment, most wastewater effluent remains high in nitrogen and phosphorus.

Large-scale hog farms (a type of Concentrated Animal Feed Operation, or CAFO) are a particular concern in North Carolina, because they release nitrogen under normal operations and because they use lagoons to store liquefied animal waste. The lagoons can and do fail, releasing tremendous nutrient loads into the river.

High nutrient levels begin a sequence of ecological changes in a river system. Nutrients feed aquatic plants. In most cases, algae are the primary beneficiaries. Algae, small simple plants, can grow very rapidly in high nutrient conditions, producing algal blooms. As the algae grow, the water takes on a greenish hue. In very high nutrient conditions, the algae can form a mat, like a crust, on the water surface. The algae will eventually exhaust the nutrient source, and die. When the algae die, bacteria eat them, consuming oxygen as they decompose the algae. The action of the bacteria can reduce the available oxygen levels in the water. Just as we breathe air to get oxygen, fish breathe water to get their oxygen. When the amount of oxygen available in the water (the dissolved oxygen) is depleted, fish leave or die. These algal blooms occur only in slow-moving waters, such as reservoirs and coastal rivers. Eastern North Carolina has experienced numerous fish kills from this process.

Reservoirs and estuaries have their own particular nutrient problems in addition to oxygen depletion. As water slows in reservoirs and lakes, nutrients may settle out. This causes nutrients to concentrate in the slower water, and nutrient problems to be worst there. Naturally, cold-water lakes would be low in nutrients, or oligotrophic. Adding excess nutrients pushes reservoirs from an oligotrophic to a eutrophic state. This changes the ecosystem, and often discourages recreation uses at reservoirs that seek to serve that purpose. (See **Dams and Reservoirs in the Yadkin**.)

Bacteria

Closely related to nutrient problems are bacterial and parasite problems. Pollution can include pathogens that can impact human health. The chief organisms of concern in the Yadkin-Pee Dee River are fecal coliform bacteria. Although some fecal coliform bacteria can themselves be a health concern, the main interest in this organism is that its presence indicates the potential presence of other disease-causing organisms. These organisms are associated with mammalian feces, so sources include wastewater treatment plants, leaking sewer or septic systems, and livestock operations. Fecal coliform problems have occurred throughout the Yadkin basin.

Toxic Pollutants

Throughout the Yadkin, there are many facilities that pollute the water and air. Industrial facilities and wastewater treatment plants discharge effluent into the river and its tributaries. Facilities may discharge oxygen-demanding wastes, nutrients, sediment, color, and toxins. (Facilities may also release air pollution that deposits directly into the river, or deposits where it will be washed into the river.) Every facility that discharges pollutants into the nation's waters must have an NPDES (National Pollutant Discharge Elimination System) permit. Facilities are also required to self-monitor and submit to the state reports on the composition of their discharges. Some urban areas are also required to have an NPDES permit for their stormwater runoff. (The number of NC municipalities required to get permits for their stormwater is increasing, as the EPA implements Phase Two of the stormwater requirements involving small municipal separate storm sewer systems.)

Textile plants, tobacco product plants, rendering plants, petroleum and plastic manufacturers, and furniture factories are common industrial facilities in the Yadkin basin. There are a total 345 facilities that have permits allowing them to release toxic chemicals to the air, water and land. 326 facilities (many duplicated from the toxic release category) are allowed to discharge contaminated water into the Yadkin.

In addition to industrial facilities, wastewater treatment plants are also dischargers. Although these facilities are mainly discharging nutrient-rich effluent, they also may discharge heavy metals and other toxins. Some industrial facilities channel their effluent into public wastewater treatment plants, also known as publicly owned treatment works, or POTWs. This allows the corporation to avoid some liability issues, and can impair the effectiveness of the wastewater treatment plant. These facilities rely on bacterial action to decompose wastes, and toxic substances may reduce the functioning of the bacteria. In North Carolina, regulators tolerate an even greater level of non-compliance from wastewater treatment plants than from industrial sources. Wastewater treatment plants and industrial facilities are rarely penalized at a level that compensates for damage done or the benefits of non-compliance, and may therefore function as chronic, almost predictable polluters for years.

It is important to note that the largest percentage of toxic releases, as reported by industry to the Environmental Protection Agency's (EPA) Toxic Releases Inventory, are releases to air. These releases are either emissions from smokestacks, called stack emissions, or emissions from evaporation, spills, and leaks, called fugitive emissions. Some substances, whether released as stack emissions or fugitive emissions, fall back to earth. Indeed, many industries have built tall smokestacks to dilute the pollution they emit rather than reducing the amount of pollution they release to the air. Some of these pollutants fall directly into streams and rivers, and others are washed in during rainfall. Thus, air emissions may have quite significant impacts on water quality. One of the most significant of such pollutants is mercury. When emitted into the air, mercury is deposited directly into surface waters or on land where it often reaches streams and rivers in storm water runoff. Frequently, mercury contamination forces the state to declare fish consumption advisories, which may direct pregnant women not to eat fish from a particular river, and others to limit their fish consumption.

Oxygen Demand

One particular type of effluent pollution is oxygen-demanding wastes, generally organic or carbon-containing material, such as from rendering plants or food processing plants. Bacteria in the water break down the wastes, but this natural process may deplete the oxygen levels in the water. Oxygen-demanding wastes can therefore lead to fish kills, if oxygen levels drop below what the fish require.

Water Quantity

As the population of North Carolina, and of the Yadkin basin, continues to grow, demands for water will increase. In 1997, 75 local governments withdrew water from the Yadkin basin to serve as tap water. This results in an average daily use of 151 million gallons of Yadkin water. The population of those towns and cities is expected to grow 16% per decade for the foreseeable future. Also, per capita water use is increasing. These factors lead to a projected 74% increase in Yadkin water use by 2020, to 263 million gallons per day (MGD) (NC Division of Water Quality, 1998). (Compare this to the total flow of the Pee Dee River near Rockingham, averaging 5036 MGD.) This increased demand will threaten domestic well supplies, and may decrease in-stream flows needed by wildlife, irrigators, and recreationists. The increased use of the Yadkin's water has the potential to increase all the water quality threats described above.

As this report was being prepared, North Carolina was under extreme drought conditions. The drought has been most severe in the Piedmont area. In some spots along the Yadkin-Pee Dee River, water levels are the lowest ever recorded. In North Carolina, reservoir levels have dropped, reducing recreation values, lowering water quality, and threatening to dip below some drinking water intake pipes. In South Carolina, residents and industries fear that the Yadkin-Pee Dee River will dwindle to the point that industries and towns will be waterless, and that salty water will move upstream, damaging estuarine ecosystems and contaminating groundwater.

An Update, A Look at Needs of the Basin and Its People

This report is an extension to and an update to two earlier publications. "A Citizen's Report on the Mid-Yadkin River Basin," was prepared in 1991 by Clean Water Fund of NC (the former name of Clean Water for North Carolina) to inform and motivate citizen action for the river. Ann Long of the Clean Water Fund-NC compiled "A Citizen's Report on the Mid-Yadkin River Basin." This report was a collaborative effort of many groups located in the Mid-Yadkin: Davie Environmental Awareness League (DEAL), Earth Stewardship Committee from St. Paul's Episcopal Church in Winston Salem, Foothills Group Sierra Club and Forsyth Residents for Environmental Education (FREE). This report focused on stream monitoring and evaluating known discharges into streams.

The other, "*A River Runs Through Us*," is a book format compilation of *Salisbury Post* articles written by reporter Mark Wineka during July of 1997. The articles range in focus from how the wastewater is treated to how people use the river, from recreational purposes to agricultural, to a history of the people who live on its banks.

The current report, while a follow-up to both of these, is structured differently. It is divided according to the three sub-basins of the Yadkin River, the Upper Yadkin, the South Yadkin, and the Lower Yadkin. Water quality issues are examined for each sub-basin. A comprehensive search was done for each sub-basin to find the discharging facilities located in each county that have an impact on the river. This data was mainly taken from the EPA's "Surf Your Watershed" web site (www.epa.gov/surf). Major polluters from each basin are listed and mapped.

A RIVER IN JEOPARDY

UPPER YADKIN

This is the most densely populated portion of the watershed, containing Winston-Salem, Statesville, Salisbury, Lexington, and the western suburbs of High Point. In 1990, the population was around 630,000.

A study of sediment in the Yadkin was conducted in the late 1970's. Unfortunately, this was the last year such comprehensive calculations were made. In 1978, the Upper Yadkin lost an average of 4.2 tons of soil per acre per year. This is slightly less than the losses from the South Yadkin, and much more than the losses from the Lower Yadkin. A more recent study focused on the upper half of the Upper Yadkin estimated that this area lost 5.3 tons/acre/year in the 1980's and 3.7 tons/acre/year in the early 1990's (NC Division of Water Quality, 1998). Over 70% of the sediment that enters the Yadkin will remain in one of the six large impoundments on the mainstem. High Rock Lake, being the most upstream, is likely to retain the largest share of sediment. This means that the sediment impact actually decreases downstream. In the 1970's analysis, there was almost 10 times as much sediment in the Yadkin above mainstem reservoirs than in the Pee Dee below them. Partially as a result of sediment, High Rock Lake, the most upstream of the mainstem reservoirs, is the most eutrophied.

The 1970's sediment analysis relied on numerous measuring stations. Of particular interest is the station on Dutchmans Creek near Uwharrie, NC. This creek drains mostly forested land of the Uwharrie National Forest, and so presumably represents background, unaltered conditions. In the 1970's, many of the other stations were recording sediment rates 10 or 15 times as much as Dutchmans Creek. However, the sediment loads of the mainstream of the Pee Dee, below the six impoundments, was only about 20% higher than Dutchmans Creek, further indication that the reservoirs trap most of the sediment.

The Clean Water Act requires the state to list all streams that are considered impaired. (See **Impaired Streams** below.) Within the Upper Yadkin, several streams are considered impaired, especially those around Winston-Salem. Sources of impairment include sediment from agriculture, urban runoff, construction; turbidity (cloudiness resulting from sediment and nutrients); municipal wastes; and bacteria.

Nutrient problems are most significant in slow waters, where oxygen levels are lower. In North Carolina, the only parts of the Yadkin-Pee Dee that are still or slow moving are the waters in reservoirs. In the Upper Yadkin, High Rock Lake, the largest reservoir on the mainstem, has high nutrient levels. (See the **Dams and Reservoirs in the Yadkin** section below.) Another smaller reservoir, Lake Corriher, near the town of Landis, also has high nutrient levels, and is considered threatened.

The Upper Yadkin has significant fecal coliform problems. The mainstem at Roaring River, the Ararat River, Salem Creek, and Muddy Creek all had average fecal coliform counts greater than the water quality standard of 200 colonies per 100 ml between 1992 and 1996. Salem Creek averaged over 1000 colonies per ml.

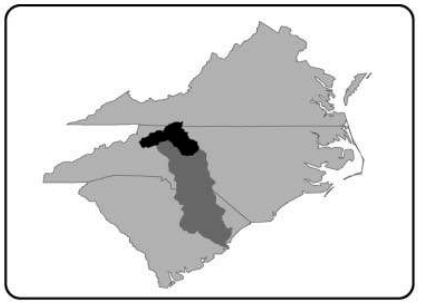
Along with the highest population of the three sub-basins, the Upper Yadkin has the most significant industrial polluters. One company, ABTCO, releases more than twice as much pollution as any other facility in the Upper Yadkin. ABTCO, a reconstituted wood company, released over one million pounds of pollutants in 2000. Two R.J. Reynolds cigarette-making facilities in Forsyth County released large amounts of hydrochloric acid and ammonia. American Drew, a furniture manufacturer, has four facilities in Wilkes County that were considered together. Rexam Beverage, formerly American National Can, released mostly glycol ethers as it produced cans. Weyerhauser, another reconstituted wood factory, released large amounts of acetaldehyde and formaldehyde into Surry County's air. Douglas Battery, a Winston-Salem facility, released less than the others mentioned, but their releases were highly toxic, including over 1700 pounds of lead.

Table 1. Emissions data for the most significant industrial polluters in the Upper Yadkin, 2000 data. Units are pounds per year.

Facility	FA	SA	Water	POTW	Land	TR	TW
Rexam Beverage	74,773	436,407		28		511,180	562,717
Douglas Battery	297	844	599	8		1740	9,355,466
R.J. Reynolds Tobacco Co., Tobaccoville		368,337		3755		368,337	378,613
R.J. Reynolds Tobacco Co., W-S	1057	440,877		70,569		441,935	1,158,193
American Drew (multiple facilities)		815,444				43,098	815,444
Weyerhauser	4568	520,757			2446	527,771	563,120
ABTCO	510	1,029,000	255		25	1,029,775	1,115,430

FA- fugitive air, SA – stack air, Water – discharges to water, POTW – transfer to publicly-owned treatment works, Land – discharges to land (landfills), TR – total releases, TW – total wastes (some of which may be reused on site)

Upper Yadkin Sub Basin



Source: USGS, EPA
Cartography By: The Project for Appalachian Community and Environment

Several wastewater treatment plants within the Upper Yadkin are chronic polluters. As mentioned previously, regulators are extremely slow to correct permit violations by these facilities. Effluent violations indicate the number of times the facility has exceeded its permitted limits, while enforcement actions indicate the number of times the facility received any consequences. Note that this does not usually result in any fine being paid by the facility. Small, prefabricated treatment plants, or "package plants," are often used as a quick, relatively cheap way to treat wastewater at new, outlying developments, because they save developers the expense of long hookups to larger plants. Unfortunately, as in the case of the Sequoia Plant on Reynolds Creek (photo below) near Winston-Salem, contractors often fail to monitor and maintain the facilities, resulting in untreated sewage releases. The Division of Water Quality had recommended looking for an alternative to the Sequoia plant in its 1998 Yadkin Basin Planning Report, but no action was taken until a child was found playing in raw sewage and her family sued to close the facility. Table 2 shows some of the major facilities that discharge wastewater into the Upper Yadkin River.

Table 2. Major NPDES facilities in the Upper Yadkin sub-basin.

County	Facility	Volume (MG/D)	Toxic Exceedances 1999-2001	Toxin(s) Released
Yadkin	Yadkinville WWTP	1	3	cadmium
Forsyth	Winston-Salem Elledge WWTP	30	1	cyanide
Forsyth	Winston-Salem Lower Muddy Creek	15	0	
Surry	Chatham Manufacturing, Inc.	4	0	
Surry	Hamilton Beach, Proctor Silex	0.085	0	
Surry	Mount Airy WWTP	4	7	cyanide, lead, mercury
Surry	Pilot Mountain WWTP	1.5	1	cadmium
Wilkes	Abitibi-Price Co.	1	0	
Wilkes	North Wilkesboro WWTP	1	0	
Wilkes	Wilkesboro WWTP	4.9	1	cyanide
Guilford	High Point Westside WWTP	6.2	3	cyanide

Volume is the permitted maximum, in million gallons per day. Exceedances are the number of times the facility exceeded its permitted limits for one or more toxins.

South Yadkin

The South Yadkin River watershed contains the town of Statesville. Outside of that urban area, much of the drainage is rural, either forested or agricultural. In 1990, the population was around 95,000.

The 1970's sediment analysis found that the South Yadkin lost 5.1 tons of sediment per acre per year in 1978, making this sub-basin the most impaired at that time. Because there are no major impoundments on the South Yadkin, much of the sediment that enters the stream is transported to High Rock Lake, at the mouth of the South Yadkin. Fourth Creek and Brushy Fork are both impaired due to sediment.

The South Yadkin River has severe bacterial pollution. Samples taken at four stations in the sub-basin from 1992 to 1996 all averaged higher than the water quality standard of 200 colonies per ml. Over a series of 17 samples, Fourth Creek near Elmwood averaged over 1200 colonies per ml! (Data from NC Division of Water Quality, 1998.)

As the South Yadkin is a smaller and more rural sub-basin, it does not have as many toxic polluters as the Upper or Lower Yadkin. The larger polluters are listed in Table 3. ASMO, in Rowan County, released over 80,000 pounds of glycol ethers. International Paper, in Statesville, released over 33,000 pounds of formaldehyde. Freightliner, in a Rowan County facility that makes auto bodies, released a variety of pollutants including toluene and xylene.

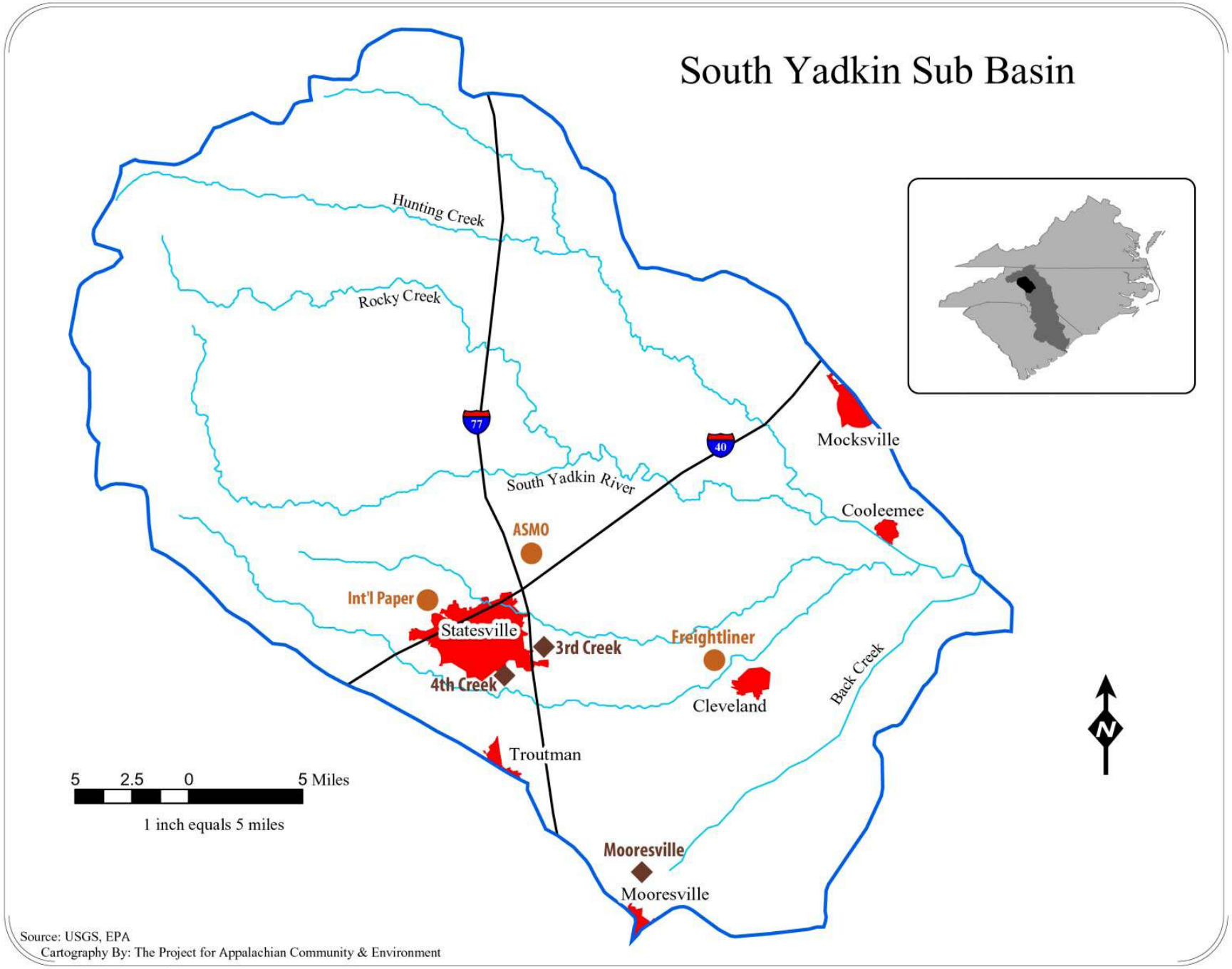

South Yadkin Sub Basin
Hunting Creek
Rocky Creek
77
40
South Yadkin River
Mocksville
Cooleemee
ASMO
Int'l Paper
Statesville
3rd Creek
4th Creek
Freightliner
Cleveland
Back Creek
Troutman
Mooresville
Mooresville
5 2.5 0 5 Miles
1 inch equals 5 miles
N
Source: USGS, EPA
Cartography By: The Project for Appalachian Community & Environment

Table 3. Emissions data for the most significant industrial polluters in the South Yadkin, 2000 data. Units are pounds per year.

Facility	FA	SA	Water	POTW	Land	TR	TW
ASMO North Carolina Inc.	460	77,712				78,172	80,858
Freightliner Corporation	14,217	184,779		3		198,996	663,031
International Paper Container		33,300				33,300	33,139

FA- fugitive air, SA – stack air, Water – discharges to water, POTW – transfer to publicly-owned treatment works, Land – discharges to land (landfills), TR – total releases, TW – total wastes (some of which may be reused on site)

Several wastewater treatment plants within the South Yadkin have histories of non-compliance. However, as they are smaller facilities serving smaller towns, their emissions probably represent less of a threat to the Yadkin than the emissions of larger wastewater treatment facilities upstream, such as High Point's West Side facility and Winston-Salem's Elledge facility. Table 4 lists the most significant facilities discharging wastewater to the South Yadkin.

Table 4. Major NPDES facilities in the South Yadkin sub-basin.

County	Facility	Volume (MG/D)	Toxic Exceedances 1999-2001	Toxin(s) Released
Rowan	Fieldcrest Mills, NC Finishing	4.25	0	
Davie	Cooleemee WWTP	1.5	0	
Iredell	Mooresville WWTP	5.2	0	
Iredell	Statesville Fourth Creek WWTP	4	1	chromium
Iredell	Statesville Third Creek WWTP	4	0	

Volume is the permitted maximum, in million gallons per day. Exceedances are the number of times the facility exceeded its permitted limits for one or more toxins.

Lower Yadkin

In the Lower Yadkin, sprawl from Charlotte has created the most densely populated urban and suburban areas, in Mecklenburg, Union, and Cabarrus Counties. This area includes the towns of Concord, Kannapolis, Mint Hill, and Monroe. In 1990, the population of the sub-basin was around 500,000 people.

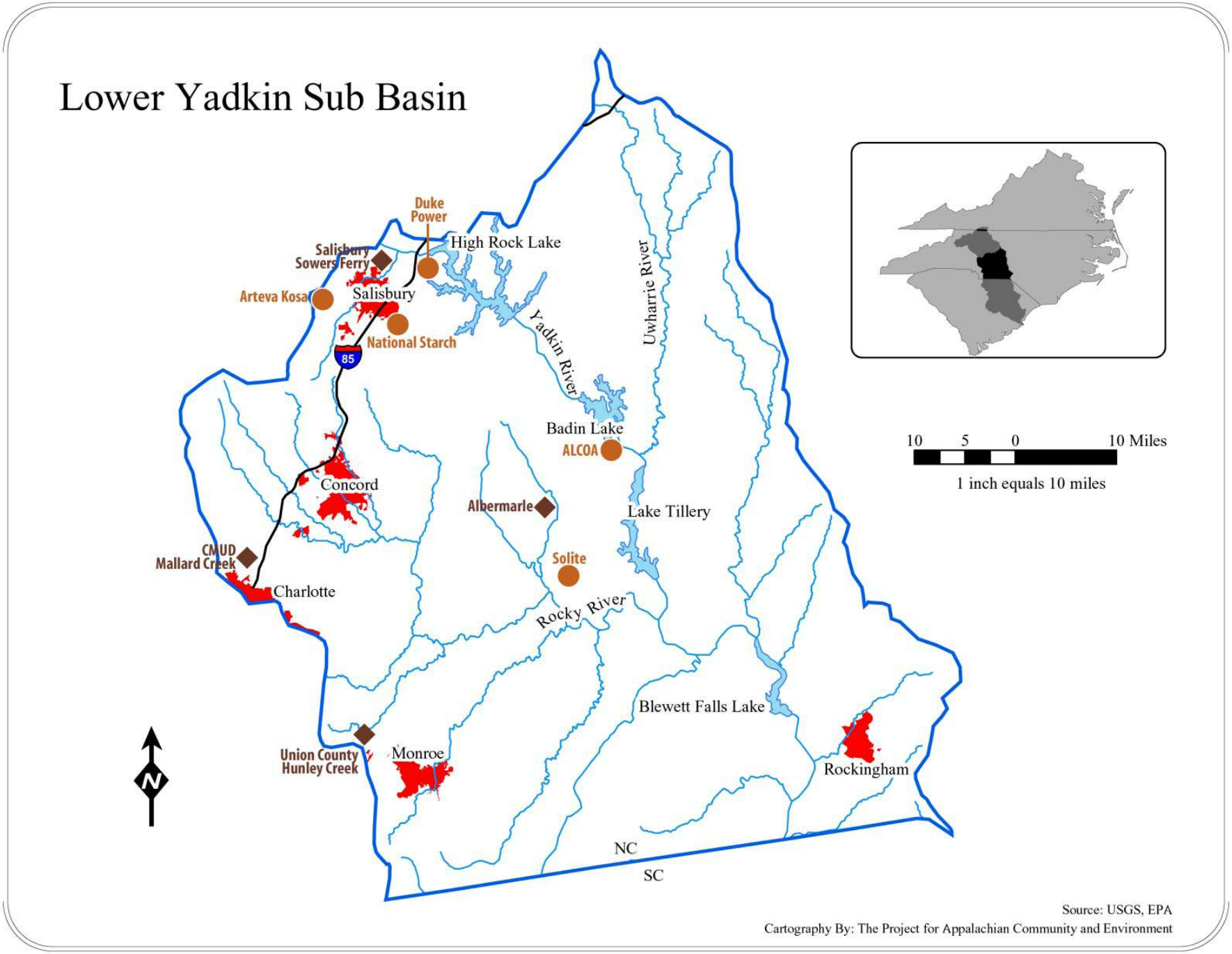
The 1970's sediment analysis indicated that the Lower Yadkin sub-basin lost 2.7 tons of sediment per acre per year, much less than either the Upper Yadkin or the South Yadkin. This is probably due to the lower population of the Lower Yadkin, and the higher proportion of forested land (aided by the presence of the Uwharrie National Forest).

In the Lower Yadkin, Lake Lee and Lake Monroe, both in Union County, have high nutrient levels.

Toxic polluters in the Lower Yadkin sub-basin are mostly found near the towns of Salisbury, Concord, and Kannapolis. Ball Metal, which produces metal cans, released almost 100,000 pounds of glycol ethers in 2000. Alcoa is a major facility that owns and operates the Badin Dam, using the electricity it generates to produce aluminum. Its pollutants are quite different from those of any other facility in the basin, including almost 200,000 pounds of carbonyl sulfide in 2000. The company announced the closure of its Badin facility in the summer of 2002. National Starch and Chemical Company of Salisbury produces surfactants, and in the process they release 18 different pollutants, including 19,000 pounds of ammonia released in 2000.

The Buck Steam Station is the only coal-fired power plant in the Yadkin basin. However, there are others just outside the basin, and air-borne pollutants from these facilities undoubtedly drift into the Yadkin basin. The Buck Steam Station released 10 different pollutants, including 1.8 million pounds of hydrochloric acid and 130,000 pounds of sulfuric acid in 2000. The facility also released 97 pounds of mercury, an especially toxic element. In addition to the pollutants that are considered "released" into the atmosphere, the facility places large amounts of several pollutants into a surface impoundment, including 160,000 pounds of barium, 35,000 pounds of manganese, and 34,000 pounds of vanadium compounds in 2000.

Arteva Kosa, also located near Salisbury, is a plastics facility. In 2000, it produced an incredible 17,000,000 pounds of toxic waste. While most of these substances are reused, some of them are released, including over 46,000 pounds of ethylene glycol and over 20,000 pounds of polycyclic aromatic compounds. Solite, formerly known as Carolina Solite, is located in rural Stanly County. This facility, which has a long history of permit violations, burns a variety of toxic wastes to power its operations. Note that the 2000 data were not available on-line for this corporation, with regulators unable to explain the omission. This illustrates


Lower Yadkin Sub Basin
Duke Power
High Rock Lake
Salisbury Sowers Ferry
Arteva Kosa
Salisbury
National Starch
85
Yadkin River
Uwharrie River
Badin Lake
ALCOA
Concord
Albermarle
Lake Tillery
CMUD Mallard Creek
Charlotte
Solite
Rocky River
Blewett Falls Lake
Union County Hunley Creek
Monroe
Rockingham
NC
SC
N
10 5 0 10 Miles
1 inch equals 10 miles
Source: USGS, EPA
Cartography By: The Project for Appalachian Community and Environment

some of the challenges in obtaining information about corporate polluters.

Table 5. Emissions data for the most significant industrial polluters in the Lower Yadkin, 2000 data

Units are pounds per year.

Facility	FA	SA	Water	POTW	TR	TW
Ball Metal	47,001	139,032			186,033	256,206
Alcoa	61,432	208,532	87		270,051	3,153,055
National Starch and Chemical Co.	6541	37,198		32,729	43,739	3,921,279
Duke Power, Buck Steam Station	45	2,052,846	3609		2,363,542	2,368,510
Solite (*1999 data)	1551	74,514			76,065	5,684,838
Arteva Specialties DBA Kosa	125,839	16,895	12,471		155,455	17,594,465

FA- fugitive air, SA – stack air, Water – discharges to water, POTW – transfer to publicly-owned treatment works, TR – total releases, TW – total wastes (some of which may be reused on site)

Several streams in the Lower Yadkin are considered impaired. Notably, portions of the Pee Dee River are considered impaired due to a low pH and low oxygen levels. Portions of the Rocky River, a major tributary, are impaired due to turbidity and bacteria. Portions of 19 other streams in the Lower Yadkin sub-basin are impaired! These include streams in the western part of the sub-basin, generally impaired from urban runoff, agriculture, and construction. Animal holding areas, presumably a Concentrated Animal Feeding Operation or CAFO impairs one stream, Clarke Creek. Clarke Creek flows into the Rocky River. (See **Impaired Streams** below.)

Table 6 shows the most significant facilities discharging wastewater to the Lower Yadkin. Note that the Aluminum Company of America (ALCOA) has discontinued operations, so volume of discharge will be greatly reduced in 2002.

Table 6. Major NPDES facilities in the Lower Yadkin sub-basin.

County	Facility	Volume (MG/D)	Toxic Exceedances 1999-2001	Toxin(s) Released
Rowan	Duke Power, Buck Steam Station	400+	0	
Rowan	Fieldcrest Cannon	0.05	1	mercury
Rowan	Hoechst Celanese	1.574	0	
Rowan	Salisbury, Town Creek WWTP	5	0	
Rowan	Salisbury Grant Creek WWTP	7.5	2	mercury
Davidson	Lexington WWTP	5.5	0	
Davidson	Thomasville WWTP	4	21	cadmium, cyanide
Stanly	Albermarle WWTP	16	0	
Stanly	Aluminum Company of America	5.12	0	
Richmond	Hamlet WWTP	1	2	cyanide

Volume is the permitted maximum, in million gallons per day. Exceedances are the number of times the facility exceeded its permitted limits for one or more toxins.

Impaired Streams

The Clean Water Act requires North Carolina to produce a list of all its impaired streams, set priorities for cleanup, and submit the list to Congress every two years. This list is called the 303(d) list, after the pertinent section of the act. All streams on the list are supposed to be cleaned up, but the state is allowed to defer some cleanups. For some streams, the state is required to develop a restoration plan. This is a Total Maximum Daily Load (TMDL) plan. This basically asks the state to consider the cumulative effects of all permits and management practices on the stream, and to improve them until the stream is no longer impaired. NC's list of impaired streams in the Yadkin-Pee Dee basin includes these categories:

- TMDL in place (Category 4a)
- Other pollution control mechanisms (such as stormwater controls or improvement to a single NPDES permit) are expected to attain water quality standards (Category 4b)
- TMDL is not considered the appropriate mechanism, (Category 4c)
- TMDL is needed (Category 5)
- Biologically impaired, more data is needed to determine whether a TMDL is appropriate (Category 6)

The draft 2002 impaired streams list includes 403 stream miles and 301 acres of lakes in the Yadkin-Pee Dee basin. See Table 7 for particular impaired streams. The table does not include 30 stream segments totaling over 349 miles that are considered biologically impaired (Category 6). Generally, these are impaired streams for which the cause of impairment is unknown, or streams that were historically considered impaired by sediment. Potential sources of impairment are non-point sources, mainly agriculture, urban runoff, and construction. Further study is needed on these streams, and that study will place these streams in Category 4c or 5.

A TMDL has been developed for one stream segment in the Yadkin-Pee Dee basin, 9.5 miles of Fourth Creek impaired for fecal coliform. Note that the same segment is listed as impaired for turbidity, but a mechanism other than TMDL will address that.

Impaired streams are listed as high priority or low priority, based on impacts to human health and endangered species. The state anticipates submitting TMDLs for Grants Creek, Rich Fork, Hamby Fork, McKee Creek, Clear Creek, Rocky River, Goose Creek, Salem Creek, and Hitchcock Creek for fecal coliform and Faulkner Creek for sediment within two years.

Note that the list below is restricted by the Division of Water Quality's desire to reduce the number of stream segments for which it will be required to dedicate resources for developing restoration plans (TMDLs). Also, some residents would argue that the Division has resisted including some pollutants such as color in surface water quality standards. For example, bright red color in Third Creek, as a result of a Statesville dye company transferring its waste to the municipal wastewater treatment facility, is interfering with habitat and human access to the creek, according to residents testifying during public hearings the summer of 2002. These are uses that the Clean Water Act requires be protected for all North Carolina waters.

Table 7. Impaired streams in the Yadkin-Pee Dee basin, except biologically impaired. Draft 2002 303(d) list.

Stream	Sub-basin	Miles/Acres	Cause of Impairment	Approach	Priority
Faulkner Creek	Upper	6	Sediment	TMDL needed	Low
Hamby Creek	Upper	12.5	Fecal coliform	TMDL needed	Low
Rich Fork	Upper	20.7	Fecal coliform	TMDL needed	Low
Salem Creek	Upper	11.7	Fecal coliform	TMDL needed	Low
Salem Creek	Upper	11.7	Turbidity	Other methods	Low
Fourth Creek	South	9.5	Turbidity	Other methods	Low
Fourth Creek	South	9.5	Fecal coliform	TMDL approved	
Brown Creek	Lower	22	Low dissolved oxygen pH	TMDL needed	Low
Clear Creek	Lower	1.6	Fecal coliform	TMDL needed	Low
Goose Creek	Lower	17	Fecal coliform	TMDL needed	High
Grants Creek	Lower	17.9	Fecal coliform	TMDL needed	Low
Grants Creek	Lower	17.9	Turbidity	Other methods	Low
Hitchcock Creek	Lower	6.1	pH Fecal coliform	TMDL needed	Low
McKee Creek	Lower	6.5	Fecal coliform Sediment	TMDL needed	Low
Pee Dee River	Lower	5.7	pH	TMDL needed	High
Pee Dee River	Lower	?	Low Dissolved Oxygen	TMDL not appropriate	High
Rocky River	Lower	9.2	Fecal coliform	TMDL needed	Low
Rocky River	Lower	9.2	Turbidity	Other methods	Low
Ledbetter Lake	Lower	100 acres	Fish advisory –mercury	TMDL needed	High
Rockingham City Lake	Lower	27 acres	Aquatic weeds	TMDL needed	High

Dams and Reservoirs in the Yadkin

Dams in North Carolina have traditionally been built to supply power. Originally, that power was mechanical, using waterwheels to power grain mills. In the Twentieth Century, the hydropower was transformed into electricity for industrial and residential uses. More recently, dams were valued for flood control and recreational opportunities. Dams have had both positive and negative impacts on the Yadkin-Pee Dee basin. Although dams provide hydropower, flood control, and recreational opportunities in their reservoirs, these benefits come at a high price. Dams block the migration of fish and other species. Within the Yadkin-Pee Dee river, shad, sturgeon, and eels are blocked from upstream migration to their traditional habitats. While dams control floods downstream, they also prevent the periodic deposition of organic material along the banks that make river bottomlands so agriculturally productive. Finally, dams create reservoirs that have particular problems with nutrients and sediment.

As mentioned above, sediment and nutrient pollution are major problems in most North Carolina rivers, and in the Yadkin-Pee Dee specifically. As the river bearing these pollutants enters an impoundment, the water slows down. Some of the pollutants settle out of the water. Thus, reservoirs gradually accumulate sediment and nutrients. While nutrients are beneficial to still-water ecosystems in small amounts, large amounts can overwhelm the ecosystem. In the reservoirs, nutrients feed algae, tiny plant life that grows in the water. The algae may grow rapidly, until the nutrients are exhausted. The algae then die, and are decomposed by bacteria. This decomposing activity produces unpleasant odors, and limits recreational uses. Downstream users will pay much more to treat their drinking water. More critically, the decomposition reduces the level of oxygen in the water, possibly killing all fish life in the reservoir. Natural cold-water lakes tend to have low nutrient levels, and thus low algal growth. Lakes in this state are called oligotrophic. Lakes with medium nutrient levels are called mesotrophic, and lakes with high nutrient levels are called eutrophic. Natural processes often cause gradual increases in nutrient levels. Human activity can dramatically increase the rate and extent of this eutrophication. Eutrophic lakes are generally considered impaired, and unable to provide uses such as recreation, drinking water, and habitat. In slower waters, nutrients encourage the growth of larger aquatic plants, such as milfoil and hydrilla. These plants can further inhibit recreational use, and can hinder commercial fishing, because they slow boats and prevent net fishing.

There are seven major mainstem reservoirs on the Yadkin. From upstream to downstream, they are the Kerr Scott Reservoir, High Rock Lake, Tuckertown, Badin Lake, Falls Lake, Tillery, and Blewett Falls.

Shoreline developments are a particular concern along the river. Most of this development is taking place along the reservoirs, where deep, flat water allows pleasure boating. Development is occurring rapidly, especially in the areas around Winston-Salem, High Point, and Salisbury. Poor construction practices allow sediment to wash into the river. After construction, increased impervious surfaces near the water (roofs, driveways, and roads) speed the overland flow of water, increasing its ability to erode more sediment. Lawn fertilizers and septic tanks add nutrients to the reservoirs.

Much of the land around these reservoirs is already developed. However, large tracts of land remain undeveloped for now, and offer a great opportunity for preservation that will protect water quality on the Yadkin Pee Dee. Power companies worked closely with the government to plan and construct these dams. An early step in dam construction was acquisition of large parcels of land. The government aided the power companies in land acquisition, seeing reservoir construction as a public need. Now, however, the power companies or their spin-off companies are rapidly developing land along reservoirs and rivers throughout the state. These development companies should remember the favorable conditions under which they acquired the land, and should take actions with these lands that continue to reflect the greatest societal good. Unfortunately, the power companies do not have a good track record of protecting water quality or riparian environments. The coming years offer an excellent opportunity for the public to become more involved in the fate of these undeveloped parcels. In 2003, the dams along the Yadkin Pee Dee will begin a 5-year process of renewing their licenses with the Federal Energy Regulatory Commission. The licenses that are agreed upon in 2008 will contain requirements for shoreline management, including controls on development.

Upper Yadkin

The 1450-acre W. Kerr Scott Reservoir is much further upstream than the other six major impoundments. It is located in Wilkes County, near Wilkesboro. The most recent sampling, done in 1994, indicated that this reservoir was oligotrophic, and fully supporting its designated uses.

Near Clemmons is the Idols dam. This is a privately owned hydropower generating facility. It is operated as a run-of-the-river facility, meaning that some of the river's flow is diverted to a dam while some of the flow continues unchecked.

High Rock Lake, in Rowan and Davidson Counties, is the first of a series of six impoundments that form the Yadkin Chain Lakes. These impoundments provide water supply, hydropower, and recreational opportunities for nearby residents, but also offer a special set of problems to the health of the river. High Rocks Lake is by far the largest impoundment in the watershed, at 12,200 acres. The Division of Water Quality considers this lake threatened. There are 195 permitted dischargers upstream of High Rock, including the cities of Winston-Salem, High Point, and Salisbury. Development and agricultural operations upstream also deliver sediment and nutrients into the lake. Visibility in the lake is often only a few inches, and phosphorus levels are high. The lake is eutrophic, meaning that algal growth is too high.

Development along the lakeshore is a major concern. There are 3,200 homes along the shore, and 400 new lots were platted between 1989 and 1999. During the five year drought, which has worsened in 2002, High Rock Lake levels have dropped dramatically, creating considerable controversy about the flow regime along the river for industry and power production versus residential, recreational and water supply uses.

South Yadkin

There is only one large dam on the South Yadkin, the Cooleemee, near the town of the same name. This small run-of-the-river dam is located between Davie and Rowan Counties. Local residents have complained that the dam diverts up to 95% of the river, resulting in an almost dry stretch of riverbed.

Lower Yadkin

The Yadkin Chain Lakes continue in the Lower Yadkin. Tuckertown Reservoir, a 2550-acre impoundment, is almost as eutrophic as High Rock Lake. It is located mostly in Rowan County, just downstream from High Rock Lake. Tuckertown is a run-of-the-river dam. Below Tuckertown, Badin Lake is the second-largest reservoir on the river, at 5350 acres. It is mostly located between Stanly and Montgomery Counties. Badin Lake is considered mesotrophic, borderline eutrophic. Nutrient enrichment is a particular concern here, from construction activities and a golf course. At the downstream end of the lake is an Alcoa facility, which is a major electricity consumer and a major polluter.

A couple of miles below the Narrows Dam that forms Badin Lake, Falls Lake is another small (203 acres) run-of-the-river impoundment. Because water moves through the reservoir relatively quickly, the lake does not have eutrophication problems.

Below Falls Lake, the Uwharrie joins the Yadkin, and the river becomes the Pee Dee.

Lake Tillery, at 5264 acres, is about the size of Badin Lake. It lies between Stanly and Montgomery Counties near the town of Norwood. Lake Tillery is further from population areas and does not have the same levels of development pressure as reservoirs upstream. Below Lake Tillery, the Pee Dee has a rare stretch of natural flow before reaching the lowest of the downstream reservoirs, Blewett Falls Lake.

Several river miles below Lake Tillery, Blewett Falls Dam forms the lowest of the Yadkin Chain Lakes. This 2570-acre reservoir lies between Anson and Richmond Counties, near the city of Rockingham.

Tributary Dams

In addition to these large dams, there are many smaller dams on tributaries to the Yadkin-Pee Dee. These dams were built for flood control, hydropower, water supply, recreation, and to power old mills. Many are no longer functioning for their intended purpose, and some are abandoned. In some of these cases, the current owners of the dam may be unaware that they even own a dam. These smaller dams are barriers to migration of fish and other aquatic species, and alter natural flow patterns. These dams could fail, releasing a large pulse of water and choking sediment. What is worse, sediments behind dams are often contaminated with toxins from old upstream discharges.

These dams have created reservoirs such as Winston Lake, Salem Lake, Lake Thom-A-Lex, Lake Monroe, Lake Lee, and Rockingham City Lake. Long Lake (Albemarle city lake) was the most eutrophied lake that DWQ sampled in the Yadkin-Pee Dee watershed. It has been drained as the city tries to improve its water quality. The East Prong of the Little Yadkin, which drains the southwestern corner of Stokes County, has been targeted for 22 small dams. These dams are meant to control sediment. At least 14 have been built.

RELICENSING

Dams are licensed by the Federal Energy Regulatory Commission. The licenses are typically good for 25 or 50 years. At the end of the life of a license, a relicensing period offers a great opportunity for the public to comment and potentially influence aspects of the dam such as flow regimens, fish transport, protection of land adjacent to the reservoir, nutrient solutions, and even dam removal. Such opportunities are coming up. The Yadkin Chain Lake dams are up for relicensing in 2008. (Kerr Scott is not due until 2035.) The relicensing process takes five years, so public hearings and comment periods for the Yadkin Chain Lakes will begin in 2003.

RECOMMENDATIONS

Clean Water for North Carolina believes that it is in the interest of all North Carolinians, including future generations, to protect and restore the health of the Yadkin-Pee Dee, to protect public health, the environment, and our economic future. To that end, we call for:

- Substantial improvement in non-point source pollution control, particularly sediment. While sedimentation impacts due to farming have gradually diminished due to better practices and decreased farming in the basin, the Yadkin still runs brick red after any significant rainfall, and downriver habitats, water quality and reservoirs have been highly impacted. It will require economic incentives for farmers and developers, strict enforcement of sedimentation and erosion regulations for all sectors, and serious regional transportation and development planning to prevent further rapid degradation of the Yadkin's waters and quality of life in the basin. (Many sources of funding are available, including the funding in the 2002 Farm Bill. One potential source is a CREP, a conservation reserve enhancement program.)

- Continuous reductions for toxic releases in all air, water and land application/landfill permits in the Yadkin-Pee Dee basin. Elimination of all variances to water quality standards by 2008.

- Elimination of concentrated animal feeding operations (CAFOs) within the basin. As an interim step, CAFOs should be required to close any waste lagoons within 1000 feet of rivers and streams.

- More rigorous enforcement of all regulations and permit requirements, and implementation of Special Orders by Consent by the regional offices of the Department of Environment and Natural Resources that have jurisdiction in the watershed (Fayetteville, Mooresville, and Winston-Salem offices).

- Strong initiatives in stormwater management and treatment, beginning with urban and rapidly developing areas of the basin.

- No new dam construction with the basin. Small and abandoned dams should be evaluated for possible removal. Funding for removal should be sought through mitigation requirements on developers.

- Dam relicensing should be followed closely by river advocates. New management plans should include strict shoreline protections and curbs on development. Shoreline areas should be identified for permanent protection. Flows should approach natural conditions. Fish passage should be enhanced through the retro-fitting of fish ladders or through a hauling system to take fish around dams.

- Establishment of a Yadkin-Pee Dee watershed watchdog group that would provide monitoring of river conditions, public environmental education, and advocacy for the river.

- Cooperation within the basin to implement and maintain significant water conservation measures. Ordinances should be developed to begin water conservation measures automatically in times of drought, to provide a pricing structure that rewards conservation, and to require large water users to conduct water audits.

Some Toxins Released in the Yadkin Basin

For more information on these chemicals or others, check out the concise, "plain English" New Jersey Chemical Fact Sheets, available at http://www.state.nj.us/health/eoh/rtkweb/rtkhsfs.htm , Scorecard, a program of Environmental Defense, at www.scorecard.org/chemical-profiles/ or, for more technical detail, the website of the Agency for Toxic Substances and Disease Registry, http://atsdr1.atsdr.cdc.gov/toxfaq.html.

Acetaldehyde—Used as an intermediate in the synthesis of other chemicals, or produced as a byproduct of processes such as pulping wood for paper. An eye, skin, and respiratory tract irritant, acetaldehyde may also cause growth retardation, slight anemia, and increased kidney weight.

Ammonia—An irritant to the eyes and throat, in higher concentrations may cause burns to the throat, skin and eyes, and could possible lead to death, blindness and lung disease.

Barium—Breathing barium may irritate the nose, throat, and lungs. Very high levels of exposure can cause vomiting, muscle weakness, and death. Some barium occurs naturally, but generally in very low amounts.

Carbonyl sulfide**—Used to manufacture other chemicals and rayon; is a respiratory and skin irritant; high exposures can cause buildup of lung fluid (edema), vomiting, muscle cramps, irregular heartbeat, brain damage, convulsions, and even death.**

Ethylene Glycol—Used for many industrial purposes, ethylene glycol may cause central Nervous system depression, including such symptoms as vomiting, drowsiness, coma, respiratory failure, and convulsions, cardiopulmonary effects, and eventually renal damage.

Formaldehyde—An eye, throat, and nose irritant, it may also cause coughing, wheezing, chest pains and bronchitis. It can also cause ulcers in the mouth, esophagus and stomach.

Glycol Ethers—Health and environmental effects are unknown.

Hydrochloric Acid—Corrosive to the eyes, skin, and mucous membranes, hydrochloric acid may cause coughing, hoarseness, inflammation and ulceration of the respiratory tract, chest pain, and pulmonary edema in humans when exposed to it in short periods. If ingested, it may cause corrosion of the mucous membranes, esophagus, and stomach. Dermal contact may produce severe burns, ulceration, and scarring. Chronic exposure to hydrochloric acid may cause gastritis, chronic bronchitis, dermatitis, and photosensitization. Prolonged exposure to low concentrations may also cause dental discoloration and tooth erosion.

Lead—A dangerous and pervasive poison that damages virtually every system in the body, especially neurological damage to young children.

Manganese—A toxin that may affect the gastrointestinal tract, liver, the reproductive tract, respiratory tract, and might be a neurotoxicant.

Mercury**—Used in diverse instruments, electrical equipment and coatings; a skin and eye irritant; at high exposures, can cause difficulty breathing, skin rashes, tremors, brain or kidney damage, clouding of eyes.**

Polycyclic aromatics**—A class of compounds found in creosote and asphalt, combustion products, known to include compounds capable of causing mutations and cancer.**

Sulfuric Acid—A known carcinogen, sulfuric acid also causes respiratory problems and may have adverse effects on the structure and function of the muscles, bones and joints of humans.

Toluene—A central nervous system toxin, causing dysfunction and narcosis with acute and chronic exposure. Brain damage, dizziness, and tingling in the extremities are also observed after exposure.

Vanadium**—A skin and eye irritant; high exposures can cause vomiting, tremors, abdominal pain, difficulty breathing, kidney damage and anemia.**

Xylene—Used as a safer replacement for benzene as a solvent, xylene is a throat and nose irritant, has many gastrointestinal effects, may cause neurological damage. Signs of exposure include headaches, dizziness, fatigue and tremors.

GLOSSARY

303(d) List – a list of all the impaired waters in the state, required by the Clean Water Act, updated every two years

Fecal Matter – animal or human waste.

Fugitive Air Release - non-point air emissions, cannot locate the emissions point

Major facility – one that has a flow rate at or above one million gallons per day. There are some minor facilities that are classified as major based on an EPA toxicity worksheet score.

Minor facilities - do not have to have any of their data entered into PCS except for some facility data.

POTW (Publicly – Owned Treatment Works) — Public wastewater treatment facility, your municipal water treatment plant.

Stack Air Release - point source air emissions.

Total Release – toxins released directly into the environment from the facility.

Total Waste – all toxins that the facility produces, includes waste transferred to other sites or reused.

Turbidity – the cloudiness, presence of suspended solids in the water body.

Watershed — The land area that drains into a stream.

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