

Chapter 18

Water Resources

18.1 River Basin Hydrologic Units

Under the federal system, the Roanoke River basin is made up of hydrologic areas referred to as cataloging units (USGS 8-digit hydrologic units). The Roanoke River basin is made up of five whole cataloging units: Dan River (NC portion), County Line Creek and Hyco Reservoir, Kerr Reservoir and Tributaries, Lake Gaston and Smith Creek and Cashie River and Roanoke River. Cataloging units are further divided into smaller watershed units (14-digit hydrologic units or local watersheds) that are used for smaller scale planning like that done by NCEEP. There are 123 local watershed units in the basin. Table 18 compares the three systems. A map identifying the hydrologic units and subbasins can be found in Appendix I.

Table 18 - Hydrologic Subdivisions in the Roanoke River Basin

Watershed Name and Major Tributaries	DWQ Subbasin 6-Digit Codes	USGS 8-Digit Hydrologic Units	USGS 14-Digit Hydrologic Units Local Watersheds*
<i>Dan River (NC Portion)</i> Town Fork Creek, Snow Creek, Wolf Island Creek, Big Beaver Island, Belews Lake, Mayo River, Smith River	03-02-01 03-02-02 03-02-03	03010103	170010, 170020, 170030, 180010, 170050, 170040, 180020, 190010, 180030, 190020, 180050, 180040, 210100, 210150, 210200, 220020, 220010, 220030, 220050, 220040, 230010, 230020, 250030, 230040,
<i>Country Line Creek and Hyco Reservoir</i> Hogans Creek, Country Line Creek, Hyco Creek, Marlowe Creek, Hyco River, Mayo Reservoir	03-02-03 03-02-04 03-02-05 03-02-06	03010104	021010, 021020, 021030, 021040, 021050, 021060, 021070, 021080, 032010, 032020, 032030, 040040, 061010, 061020, 061030, 061040, 061050, 061060, 061070, 061080, 061090, 062010, 062020, 063010, 065010
<i>Kerr Reservoir and Tributaries</i> Grassy Creek, Island Creek, Nutbush Creek	03-02-06	03010102	161010, 161020, 161030, 161040, 170010, 170020, 170030, 170040, 180010
<i>Lake Gaston and Smith Creek</i> Sixpound Creek, Deep Creek, Roanoke Rapids Lake	03-02-07 03-02-08	03010106	031010, 041010, 041020, 041030, 041040, 041050, 041060, 041070, 041080, 041090, 041100
<i>Cashie River and Roanoke River</i> Roquist Creek, Conoho Creek, Hardison Mill Creek, Quankey Creek, Conconnara Swamp, Connaritsa Swamp, Kehukee Swamp	03-02-08 03-02-09 03-02-10	03010107	080010, 080020, 080040, 080030, 070010, 070030, 070020, 080050, 090020, 070040, 110010, 090010, 090030, 160010, 160011, 160020, 100020, 110020, 100010, 160012, 160050, 160030, 130010, 160040, 160070, 110030, 120010, 160060, 120020, 160071, 160090, 130020, 160110, 160080, 120050, 160130, 120040, 160115, 160120, 160081, 120030, 170020, 130030, 120070, 130040, 150020, 170010, 120060, 140050, 150030, 140040, 150010, 140020, 140030, 140010

* Numbers from the 8-digit and 14-digit column make the full 14-digit HU.

18.2 Minimum Streamflow

One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. Conditions may be placed on dam operations specifying mandatory minimum releases in order to maintain adequate quantity and quality of water in the length of a stream affected by an impoundment. The Division of Water Resources, in conjunction with the Wildlife Resources Commission (WRC), recommends conditions relating to release of flows to satisfy minimum instream flow requirements. The Division of Land Resources (DLR) issues the permits. The Federal Energy Regulatory Commission (FERC) licenses all dams associated with hydropower.

Hydroelectric Dams

There are three operational dams in the Roanoke River basin, which are all located on the Roanoke River (subbasin 03-02-07, 03-02-08). Information on these three dams is presented below. In addition, there are two dam projects that are under development both of which are located on the Mayo River (subbasin 03-02-02).

J.H. Kerr Dam is owned and operated by the U.S Army Corp of Engineers and covers 48,900 acres at an elevation of 300 feet. John H. Kerr project is authorized for recreation, flood control, hydroelectric power generation, fish and wildlife, and water supply. John H. Kerr is not regulated for low flow augmentation since the Federal Energy Regulatory Commission (FERC) assigned that requirement to the two Virginia Power Company projects located downstream. Kerr Reservoir extends into Mecklenburg, Charlotte and Halifax counties in Virginia and Granville, Vance and Warren counties in North Carolina.

Gaston and Roanoke Rapids Dam is owned and operated by Dominion North Carolina Power. These projects are regulated by FERC and have minimum flow requirements per FERC license number P-2009. The life of the license is forty years and was issued on March 31, 2004 and re-issued as 'revised' on March 4, 2005. Several license requirements are listed in the articles below:

Article 407. Roanoke River Bypassed Reach Flows.

Notwithstanding, the minimum flow in the bypass shall not be less than 325 cfs.

Article 409. Roanoke Rapids Flow Operating Restrictions.

From December 1 through January 15, the licensee shall maintain a minimum flow of 2,000 cubic feet per second (cfs) if the U.S. Army Corps of Engineers' (Corps) weekly flow declaration for the Kerr dam is less than 6,000 cfs, or the daily mean of the weekly declaration (as defined in Settlement Agreement Article GP2), whichever is less. Notwithstanding, the licensee shall only release flows less than 2000 cfs pursuant to the provisions of article 405 of this license and settlement agreement article FL2, Section 4.2. If the Corps' weekly flow declaration for the Kerr dam is equal to, or greater than, 6,000 cfs, the licensee shall maintain a minimum flow of 2,500 cfs.

From January 16 through the end of February, the licensee shall maintain a minimum flow of 2,500 cfs if the Corps' weekly flow declaration for the Kerr dam is less than 6,000 cfs, or the daily mean of the weekly declaration (as defined in Settlement Agreement Article GP2),

whichever is less. Notwithstanding, the licensee shall only release flows less than 2000 cfs pursuant to the provisions of article 405 of this license and settlement agreement article FL2, Section 4.2. If the Corps' weekly flow declaration for the Kerr dam is equal to, or greater than, 6,000 cfs, the licensee shall maintain a minimum flow of 3,000 cfs.

From March 1 through March 31, the licensee shall be afforded up to five days with which to operate in a peaking mode, provided that peaking operations occur only subject to all of the following conditions: (1) for no more than three consecutive days; (2) for no more than three days in any 7-day period; (3) during no more than two weeks during the month of March; (4) for no more than two days from March 25 through March 31; and (5) provided further that the Corps' weekly declaration flow is greater than 3,500 cfs. During peaking operations, the licensee shall maintain a minimum flow of 3,500 cfs, and maintain an 8,500-cfs flow for 1 hour as flows are increased from the minimum flow to the generation flow and decreased from the generation flow to the minimum flow. At all other times, the licensee shall maintain a continuous flow equal to the daily mean of the Corps' weekly declaration flow for Kerr Dam (as defined in Settlement Agreement Article GP2).

From April 1 through June 15, the licensee shall maintain, at all times, a continuous minimum flow equal to the Corps' weekly declaration flow for the Kerr dam (as defined in Settlement Agreement Article GP2), and no change in weekly flow shall exceed 5,000 cfs per hour.

From June 16 through November 30, the licensee shall maintain the following minimum flows:

Time Period	Discharge (cfs)
June 16 – June 30	2,800
July 1 – September 15	2,000
September 16 – November 15	1,500
November 16 – November 30	2,000

Under drought conditions, as determined by the Corps', the licensee shall maintain, between January 1 and August 31, a minimum flow of 2,000 cfs; and between September 1 and November 30, a minimum flow of 1,500 cfs; and between December 1 and December 31, a minimum flow of 2,000 cfs.

For complete license, go to Federal Energy Regulatory Commission (FERC) e-Library, Advanced Search Page at: <http://elibrary.ferc.gov/idmws/search/fercadvsearch.asp> and enter "20050304-3070" in "Accession Number" field.

18.3 Interbasin Transfers

In addition to water withdrawals (discussed above), water users in North Carolina are also required to register surface water transfers with the Division of Water Resources (DWR) if the amount is 100,000 gallons per day or more. In addition, persons wishing to transfer two million gallons per day (MGD) or more, or increase an existing transfer by 25 percent or more, must first obtain a certificate from the Environmental Management Commission (G.S. 143-215.221). The river basin boundaries that apply to these requirements are designated on a map entitled *Major River Basins and Sub-Basins in North Carolina*, on file in the Office of the Secretary of State. These boundaries differ from the 17 major river basins delineated by DWQ.

In determining whether a certificate should be issued, the state must determine that the overall benefits of a transfer outweigh the potential impacts. Factors used to determine whether a certificate should be issued include:

- the necessity, reasonableness and beneficial effects of the transfer;
- the detrimental effects on the source and receiving basins, including effects on water supply needs, wastewater assimilation, water quality, fish and wildlife habitat, hydroelectric power generation, navigation and recreation;
- the cumulative effect of existing transfers or water uses in the source basin;
- reasonable alternatives to the proposed transfer; and
- any other facts and circumstances necessary to evaluate the transfer request.

A provision of the interbasin transfer law requires that an environmental assessment or environmental impact statement be prepared in accordance with the State Environmental Policy Act as supporting documentation for a transfer petition.

In the Roanoke River basin, the Kerr Lake Regional Water System (KLRWS) is a public water system serving portions of Vance, Granville, Franklin and Warren counties. The System serves three bulk customers—the City of Henderson, City of Oxford, and Warren County—which currently supply water to the Town of Kittrell, Town of Norlina, Town of Warrenton, Town of Middleburg, Franklin County and the City of Louisburg.

In June 2003, KLRWS submitted an Environmental Assessment (EA) to the North Carolina Department of Environment and Natural Resources (NCDENR) for the Kerr Lake Water System Expansion to increase their existing water treatment plant capacity from 10 MGD to 20 MGD. This EA was granted a Finding of No Significant Impact (FONSI) on June 19, 2003. The treatment plant has been approved for a higher filter rating, allowing the plant to operate under special circumstances at 15 MGD or potentially operate at 25 MGD after plant expansion.

A meeting was held at NCDENR's office in Raleigh, NC on February 24, 2004 to review and prepare the scoping document for the KLRWS Interbasin Transfer petition. The compilation of key environmental issues and relevant agency comments at this meeting revealed greater clarity as to the requirements for this petition. Since the magnitude of the impacts from this proposed project is uncertain at this time, an Environmental Assessment (EA) was chosen as the initial document format. If, however, the EA concludes that the environmental impacts will be significant and cannot be fully mitigated, an EIS will be prepared. A determination that an EIS is required may be made at any time during the EA review process.

For more information on interbasin transfers, visit the website at <http://www.ncwater.org> or call DWR at (919) 733-4064.

18.4 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 flow. 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 the land surface 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 that may not be as extreme as future droughts. 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 increases 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 decreased flow conditions create longer retention times and allow algae to take full advantage of the nutrients present resulting in algal blooms. During the daylight hours, algae greatly increase the amount 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.

18.5 Source Water Assessment of Public Water Supplies

18.5.1 Introduction

The Federal Safe Drinking Water Act (SDWA) Amendments of 1996 emphasize pollution prevention as an important strategy for the protection of ground and surface water resources. This new focus promotes the prevention of drinking water contamination as a cost-effective means to provide reliable, long-term and safe drinking water sources for public water supply (PWS) systems. In order to determine the susceptibility of public water supply sources to contamination, the amendments also required that all states establish a Source Water Assessment Program (SWAP). Specifically, Section 1453 of the SDWA Amendments require that states develop and implement a SWAP to:

- delineate source water assessment areas;

- inventory potential contaminants in these areas; and
- determine the susceptibility of each public water supply to contamination.

In North Carolina, the agency responsible for the SWAP is the Public Water Supply (PWS) Section of the DENR Division of Environmental Health (DEH). The PWS Section received approval from the EPA for their SWAP Plan in November 1999. The SWAP Plan, entitled *North Carolina's Source Water Assessment Program Plan*, fully describes the methods and procedures used to delineate and assess the susceptibility of more than 9,000 wells and approximately 207 surface water intakes. To review the SWAP Plan, visit the PWS website at <http://www.deh.enr.state.nc.us/pws/index.htm>.

18.5.2 Delineation of Source Water Assessment Areas

The SWAP Plan builds upon existing protection programs for ground and surface water resources. These include the state's Wellhead Protection Program and the Water Supply Watershed Protection Program.

Wellhead Protection (WHP) Program

North Carolinians withdraw more than 88 million gallons of groundwater per day from more than 9,000 water supply wells across the state. In 1986, Congress passed Amendments to the SDWA requiring states to develop wellhead protection programs that reduce the threat to the quality of groundwater used for drinking water by identifying and managing recharge areas to specific wells or wellfields.

Defining a wellhead protection area (WHPA) is one of the most critical components of wellhead protection. A WHPA is defined as "the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The SWAP uses the methods described in the state's approved WHP Program to delineate source water assessment areas for all public water supply wells. More information related to North Carolina's WHP Program can be found at <http://www.deh.enr.state.nc.us/pws/swap>.

Water Supply Watershed Protection (WSWP) Program

DWQ is responsible for managing the standards and classifications of all water supply watersheds. In 1992, the WSWP Rules were adopted by the EMC and require all local governments that have land use jurisdiction within water supply watersheds adopt and implement water supply watershed protection ordinances, maps and management plans. SWAP uses the established water supply watershed boundaries and methods established by the WSWP program as a basis to delineate source water assessment areas for all public water surface water intakes. Additional information regarding the WSWP Program can be found at <http://h2o.enr.state.nc.us/wswp/index.html>.

18.5.3 Susceptibility Determination – North Carolina's Overall Approach

The SWAP Plan contains a detailed description of the methods used to assess the susceptibility of each PWS intake in North Carolina. The following is a brief summary of the susceptibility determination approach.

Overall Susceptibility Rating

The overall susceptibility determination rates the potential for a drinking water source to become contaminated. The overall susceptibility rating for each PWS intake is based on two key components: a contaminant rating and an inherent vulnerability rating. For a PWS to be determined “susceptible”, a potential contaminant source must be present and the existing conditions of the PWS intake location must be such that a water supply could become contaminated. The determination of susceptibility for each PWS intake is based on combining the results of the inherent vulnerability rating and the contaminant rating for each intake. Once combined, a PWS is given a susceptibility rating of higher, moderate or lower (H, M or L).

Inherent Vulnerability Rating

Inherent vulnerability refers to the physical characteristics and existing conditions of the watershed or aquifer. The inherent vulnerability rating of groundwater intakes is determined based on an evaluation of aquifer characteristics, unsaturated zone characteristics and well integrity and construction characteristics. The inherent vulnerability rating of surface water intakes is determined based on an evaluation of the watershed classification (WSWP Rules), intake location, raw water quality data (e.g., turbidity and total coliform) and watershed characteristics (e.g., average annual precipitation, land slope, land use, land cover, groundwater contribution).

Contaminant Rating

The contaminant rating is based on an evaluation of the density of potential contaminant sources (PCSs), their relative risk potential to cause contamination, and their proximity to the water supply intake within the delineated assessment area.

Inventory of Potential Contaminant Sources (PCSs)

In order to inventory PCSs, the SWAP conducted a review of relevant, available sources of existing data at federal, state and local levels. The SWAP selected sixteen statewide databases that were attainable and contained usable geographic information related to PCSs.

18.5.4 Source Water Protection

The PWS Section believes that the information from the source water assessments will become the basis for future initiatives and priorities for public drinking water source water protection (SWP) activities. The PWS Section encourages all PWS system owners to implement efforts to manage identified sources of contamination and to reduce or eliminate the potential threat to drinking water supplies through locally implemented programs

To encourage and support local SWP, the state offers PWS system owners assistance with local SWP as well as materials such as:

- fact sheets outlining sources of funding and other resources for local SWP efforts;
- success stories describing local SWP efforts in North Carolina; and
- guidance about how to incorporate SWAP and SWP information in Consumer Confidence Reports (CCRs).

Information related to SWP can be found at <http://www.deh.enr.state.nc.us/pws/swap>.

18.5.5 Public Water Supply Susceptibility Determinations in the Roanoke River Basin

In April 2004, the PWS Section completed source water assessments for all drinking water sources and generated reports for the PWS systems using these sources. A second round of assessments were completed in April 2005. The results of the assessments can be viewed in two different ways, either through the interactive ArcIMS mapping tool or compiled in a written report for each PWS system. To access the ArcIMS mapping tool, simply click on the “NC SWAP Info” icon on the PWS web page (<http://www.deh.enr.state.nc.us/pws/swap>). To view a report, select the PWS System of interest by clicking on the “SWAP Reports” icon.

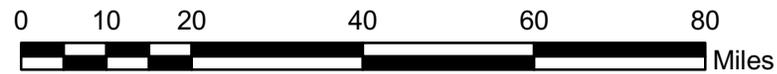
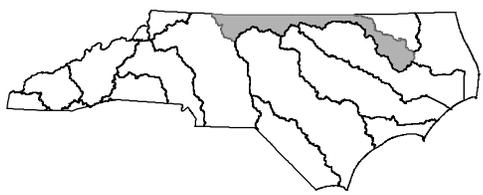
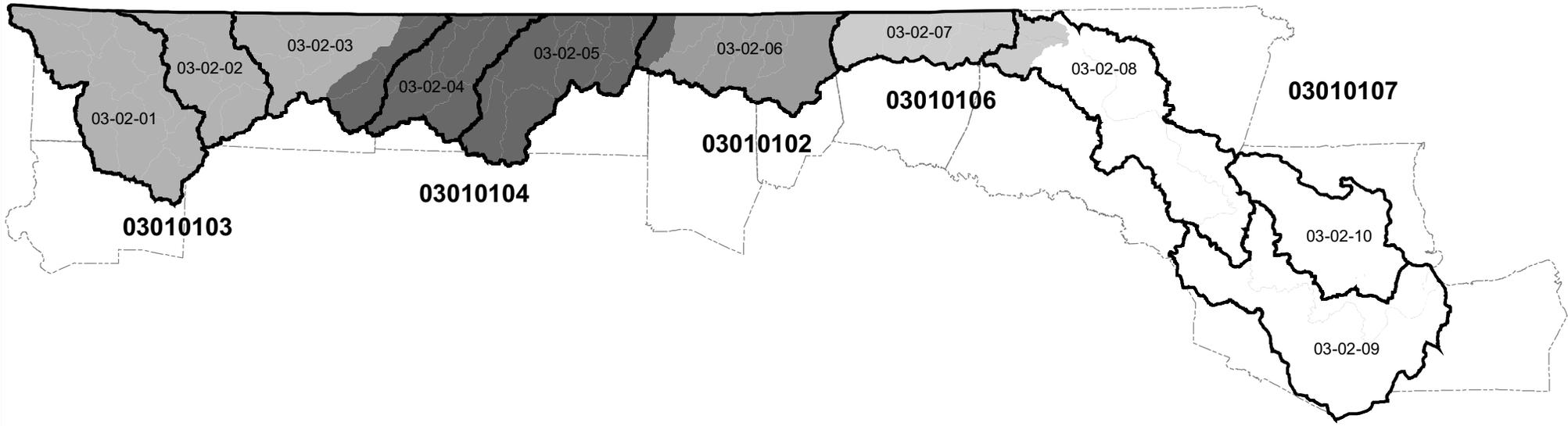
In the Roanoke River Basin, 456 public water supply sources were identified. Thirteen are surface water sources and 443 are groundwater sources. Of the 443 groundwater sources, 15 have a Higher susceptibility rating, 403 have a Moderate susceptibility rating and 25 have a Lower susceptibility rating. Table 19 identifies the thirteen surface water sources and the overall susceptibility rating. It is important to note that a susceptibility rating of Higher does not imply poor water quality. Susceptibility is an indication of a water supply's potential to become contaminated by the identified PCSs within the assessment area.

Table 19 - SWAP Results for Surface Water Sources in the Roanoke River Basin

PWS ID Number	Inherent Vulnerability Rating	Contaminant Rating	Overall Susceptibility Rating	Name of Surface Water Source	Public Water Supply Name
0217010	M	L	M	Fullers Creek	Town of Yanceyville
0217010	M	L	M	Farmer Lake	Town of Yanceyville
0273010	M	L	M	Lake Roxboro	City of Roxboro
0273409	M	L	M	Hyco Lake	Roxboro Steam Plant
0273427	M	L	M	Mayo Lake	CP&L-Mayo Elec Gen Plant
0273010	M	L	M	City Lake	City of Roxboro
0279010	H	H	H	Dan River	Town of Eden
0279025	H	L	M	Mayo River	Town of Mayodan
0279030	H	M	H	Dan River	Town of Madison
0291010	M	L	M	Kerr Lake	Henderson-Kerr Lake Regional Water
0442010	M	L	M	Roanoke Rapids Lake	Roanoke Rapids Sanitary District
0442010	H	L	M	Roanoke River	Roanoke Rapids Sanitary District
0442020	H	L	M	Roanoke River	Weldon Water System

H – higher; M – moderate; L – lower.

Figure 25 8-Digit Hydrologic Units in the Roanoke River Basin



Planning Section
Basinwide Planning Unit
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