Chapter 32
Water Resources, Minimum Streamflows and Interbasin Transfers

32.1 River Basin Hydrologic Units

Under the federal system, the Cape Fear River basin is made up of hydrologic areas referred to as cataloging units (USGS 8-digit hydrologic units). The Cape Fear River basin is made up of seven whole cataloging units. Cataloging units are further divided into smaller watershed units (14-digit hydrologic units or local watersheds) that are used for smaller scale planning. There are 2,819 local watershed units in the basin. Table 33 compares the three systems. A map identifying the hydrologic units and subbasins can be found in Appendix I.

Table 33 Hydrologic Subdivisions in the Cape Fear River Basin

Watershed Name and Major Tributaries	DWQ Subbasin 6-Digit Codes	USGS 8-Digit Hydrologic Units
Onslow Bay	03-06-24	03030001
Masonboro and Middle Sounds		
Topsail and Stump Sounds		
Haw River and Jordan Reservoir	03-06-01, 02, 03, 04, 05, 06	03030002
Upper Haw River	01	
Reedy Fork, Stony Creek and Haw River (middle)	02	
Big and Little Alamance Creeks	03	
Haw River (lower)	04	
New Hope Creek and Jordan Reservoir	05	
Morgan Creek and University Lake	06	
Deep River	03-06-08, 09, 10, 11, 12	03030003
Deep River (upper) and Muddy Creek	08	
Deep River (middle) and Richland Creek	09	
Deep River (middle), Cabin Creek and McLendons Creek	10	
Deep River (lower)	11	
Rocky River	12	
Upper Cape Fear River	03-06-07, 13, 13, 15	03030004
Cape Fear River (upper)	07	
Upper Little River	13	
Little River	14	
Rockfish Creek and Cape Fear River	15	
Lower Cape Fear River	03-06-15, 16, 17	03030005
Cape Fear River	16	
Town Creek, Brunswick River and Cape Fear River (extreme lower)	17	
Black River	03-06-18, 19, 20	03030006
South River	18	
Great Coharie Creek, Six Runs Creek and Upper Black River	19	
Black River	20	
Northeast Cape Fear River	03-06-21, 22, 23	03030007
Upper Northeast Cape Fear River	21	
Middle Northeast Cape Fear River, Goshen Swamp and Rockfish Creek	22	
Lower Northeast Cape Fear River	23	

32.2 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, recommends conditions relating to release of flows to satisfy minimum instream flow requirements. The Division of Land Resources issues the permits.

The Federal Energy Regulatory Commission (FERC) licenses all dams associated with hydropower that meet the conditions of the Federal Poser Act. FERC-related dams are exempt from DLR authority, and flow requirements are included in the federal license. Flow requirements were also requested by agencies in the Certification of Convenience and Necessity (CPCN) that is required for public utilities and issued by the NC Utility Commission.

32.2.1 Deep River Hydroelectric Projects

Coltrane Dam is unlicensed and will be inundated by the Randleman Reservoir project.

Worthville Dam has no minimum release requirement according to their FERC license. This dam operates in a run-of-river (non-peaking) mode and has no bypass reach. The dam is located near Ramseur.

Cox Lake Dam is required by FERC to provide a minimum flow of 42 cfs. The dam is located near Asheboro and has a 506-foot bypass reach.

Cedar Falls Dam is required by FERC to provide a minimum flow of 32 cfs. The dam is located near Asheboro and has a 2,112-foot bypass reach. The license has been transferred to Piedmont Triad Regional Water Authority. The possible removal of the dam is being studied.

Franklinville/Randolph Mills Dam was deemed non-jurisdictional by FERC and is unlicensed. This dam operates in a run-of-river (non-peaking) mode and has no bypass reach. There is a 46cfs minimum flow requirement in its CPCN. The by-pass reach is 480 feet. The dam is located near Franklinville.

Ramseur Dam is required by FERC to provide a minimum flow of 45 cfs. The dam is located near Ramseur and has a 1,430-foot bypass reach.

Coleridge Dam is required by FERC to provide a minimum flow of 35 cfs. The dam is located near Coleridge and has a 500-foot bypass reach.

High Falls Dam is required by FERC to provide a minimum flow of 108 cfs. The dam is located near Robbins and has a 2,844-foot bypass reach.

Carbonton Dam has no minimum release requirement according to their FERC license. This dam operates in a run-of-river (non-peaking) mode and has no bypass reach. The dam is located upstream of Sanford.

Lockville Dam is required by FERC to provide a minimum flow of 70 cfs. The dam is located near Sanford and has a 2,300-foot bypass reach. The upper 700 feet is subject to project operations and lower 1,600 feet is the backwater of the Buckhorn Dam

32.2.2 Haw River Hydroelectric Projects

Altamahaw Dam is unlicensed and has no minimum release requirements. The dam is located near Altamahaw and has an 800-foot bypass reach.

Glencoe Mills Dam is required by FERC to provide a minimum flow of 57 cfs. The dam is located near Glencoe and has a 1,815-foot bypass reach.

Swepsonville Dam is unlicensed and not operational. The dam is being considered for removal.

Saxapahaw Dam is required by FERC to operate in run-of-river non-peaking mode. The CPCN states that 10 cfs or one-quarter of the reservoir inflow, whichever is less, is required in the west channel below the dam. The dam is located near Saxapahaw and has a 5,200-foot bypass reach.

Bynum Dam is required by FERC to provide a minimum flow of 80 cfs. The dam is located near Bynum and has a 3,000-foot bypass reach.

32.2.3 Rockfish Creek Hydroelectric Projects

Raeford Dam has no minimum release requirement according to their FERC license. This dam operates in a run-of-river (non-peaking) mode and has no bypass reach. The dam is located near Raeford.

32.2.4 Rocky River Hydroelectric Projects

Rocky River Dam has no minimum release requirement according to their FERC license. This dam operates in a run-of-river (non-peaking) mode and has no bypass reach. The dam is located upstream of Sanford.

32.2.5 Lake Mackintosh (Big Alamance Creek) Burlington Water Supply

The Town of Burlington's water supply, Lake Mackintosh, has a tiered release with a maximum flow release of 9 cfs at full pool. The recommendation was based on a wetted perimeter study done by Division of Water Resources (DWR).

32.2.6 Back Creek (Graham-Mebane Reservoir) Graham-Mebane Water Supply

DWR requested, following the review of the environmental assessment for the expansion of the Graham-Mebane water treatment plant from 6 to 12 MGD, a tiered release with a maximum low flow release of 5 cfs at full pool from Graham-Mebane Lake. The flow recommendation was based on a wetted perimeter study by DWR.

32.2.7 Bones Creek (Lake Rimm)

Lake Rim is used by the NC Wildlife Resources Commission as a fish hatchery storage pond. DWR requested a minimum flow as a stipulation for dam repair. The Division assisted the Commission in determining a tiered release of 18 cfs from the impoundment in all months except July, when the release is 10.5 cfs. The releases are based on a hydrologic desktop investigation. A calibrated gage is required to monitor releases.

32.2.8 Bransom Creek (Forest Lake Dam)

A stipulation for repairs to Forest Lake Dam in Fayetteville was a minimum flow requirement of 3.4 cfs. The recommendation is based on a NC Wildlife Resources Commission habitat evaluation and a hydrologic desktop investigation.

32.2.9 Little Cross Creek (below Glenville Lake)

DWR participated in an aquatic habitat assessment of Little Cross Creek below Glenville Lake (Fayetteville's reserve water source) with the NC Wildlife Resources Commission and DWQ. A minimum flow of 3.6 cfs, based on a hydrologic desktop investigation, was established.

32.2.10 Deep River (Randleman Dam)

The proposed Randleman Reservoir will serve the cities of Greensboro and High Point. The reservoir will have a tiered minimum release ranging from a high of 30 cfs at full pool, 20 cfs when below 60 percent full pool, and 10 cfs when below 30 percent full pool. The minimum flow recommendations are based on a wetted perimeter study. The project will divert up to 30.5 MGD (47.1 cfs) that will reduce the average annual flow. The natural low flows in the lower Deep River will be increased by the minimum release. There will be some interbasin transfer. Randleman Reservoir will impact hydropower generation in the Deep River. The Coltrane Mill project will be inundated by the impoundment. DWR estimates that hydropower generation will be reduced by 5 to 15 percent depending on the amount of withdrawal from the reservoir, proximity of the generation facility to Randleman, and the minimum flow requirement at each project.

32.2.11 Mill Creek (Reservoir Park Dam Southern Pines)

Reservoir Park Dam in Southern Pines has a minimum flow requirement of 0.5 cfs based upon consultation with the NC Wildlife Resources Commission and a hydrologic desktop investigation.

32.2.12 Nick's Creek (Town of Carthage Water Supply)

Based on an instream flow study, the Town of Carthage was granted permission for an increase of its run-of-river withdrawal from 0.5 MGD to 1 MGD with no flow requirement. Carthage received temporary permits to reconstitute the breached dam upstream of the water supply intake. A flow requirement is under consideration.

32.2.13 Reedy Fork Creek (Lake Townsend)

Lake Townsend in Greensboro has a minimum flow requirement of 7.1 cfs at full pool as a stipulation for expansion of the water treatment plant from 20 to 30 MGD. The recommended flow is based upon a wetted perimeter study done by DWR.

32.2.14 Rocky River (Rocky River Reservoir)

The Town of Siler City has a tiered release at their water withdrawal structure based on an instream flow study performed by DWR. The minimum release from December through May is 3.5 cfs when the town's reservoir is at 40 percent capacity or greater. The town has installed gages to monitor the release. The Siler City is proposing to build a new dam 105 downstream of the existing lower dam that would increase storage from 24.1 to 162.5 acres. Instream flow requirements are being developed based on requirements in the 401 permit.

32.2.15 Haw River (Greensboro Emergency Intake)

Greensboro has an emergency intake on the Haw River that can only be used during drought conditions. Based on previous studies a minimum instream flow of 22 cfs is recommended below the intake at all times during pumping.

32.2.16 Little Rockfish Creek (Hope Mills Dam)

The Hope Mills dam was destroyed during high flow events in 2003. Based on existing studies DWR recommends a minimum instream flow of 38 cfs after dam reconstruction.

32.2.17 Juniper Branch (Forest Creek Golf Club)

The Forest Creek Golf Club irrigation impoundment provides a 0.15 cfs minimum instream flow.

32.3 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 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. 143-215.22I). 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. Table 60 summarizes interbasin transfers within the Cape Fear River basin.

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.
- 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. For more information, visit the website at http://www.ncwater.org/ or call DWR at (919) 733-4064. Water users in North Carolina are required to register their water withdrawals and transfers with the Division of Water Resources if the amount is 100,000 gallons per day or more, according to NCGS §143-215.22H. In addition, transfers of two million gallons per day or more require certification from the Environmental Management Commission, according to NCGS §143-215.22I.

The river basin boundaries that apply to these requirements are designated on a map entitled *Major River Basins and Sub-Basins in North Carolina* that was filed in the Office of the Secretary of State on April 16, 1991. Within the Cape Fear River basin, six subbasins are delineated: the Haw River, the Deep River, the Cape Fear River, the South River, Northeast Cape Fear River and the New River. (Note: The New River is not considered part of the Cape Fear River basin under the basinwide management approach which utilizes basin definitions adopted by the Department of Water and Air Resources in 1974. The New River will be addressed as part of the *White Oak River Basinwide Water Quality Plan* in 2001.)

Table 34 lists all potential transfers within the basin. Unless otherwise noted, the transfer amounts are 1992 average daily amounts in million gallons per day (MGD) based on Local Water Supply Plans and registered withdrawal/transfer information. Many of the transfers can not be quantified due to undocumented consumptive losses (examples: septic, lawn irrigation). Note: Under a provision of Senate Bill 1299 (ratified by the General Assembly on September 23, 1988), all local water systems are now required to report existing and anticipated interbasin transfers as part of the Local Water Supply Planning process. This information will be available for future updates of this management plan and will allow an assessment of cumulative impacts.

There are two permitted transfers in the Cape Fear River basin. The first permit is for Cary/Apex's 16 MGD transfer from the Haw River subbasin to the Neuse River basin. The EMC granted an increased transfer to 24 MGD effective July 2001. The certificate requires that any water used in the Neuse basin in excess of 16 MGD shall be returned to the Haw River subbasin or into the Cape Fear River by 2010. Water used for consumptive purposes in the Neuse basin is not subject to this condition. The second permit, for Piedmont Triad Water Authority's 30.5 MGD transfer from the Deep River subbasin to the Haw and Yadkin River subbasins, covers anticipated transfers for the operation of the proposed Randleman Dam.

Beginning in 1999, North Carolina General Statute 143-215.22H requires all persons who withdraw or transfer 100,000 gallons per day or more of surface or groundwater on any day to register with the Division of Water Resources (DWR). Table 34 lists the registered withdrawals in the Cape Fear River basin as of January 1, 1999.

Table 34 Interbasin Transfers in the Cape Fear River Basin

Source System	Receiving System	Source Subbasin	Receiving Subbasin	Estimated Transfer (MGD)[1,2,3]
Permitted Transfers				
Cary/Apex	Cary/Apex	Haw	Neuse	16.0[4]
Piedmont Triad WA	Piedmont Triad WA	Deep	Haw, Yadkin	30.5[5]
Other Transfers				
Graham	Orange-Alamance	Haw	Neuse	Emergency
Greensboro	Jamestown	Haw	Deep	0.09
Greensboro	Greensboro	Haw	Deep	Unknown
OWASA	Hillsborough	Haw	Neuse	Emergency
Reidsville	Reidsville	Haw	Roanoke	Unknown
High Point	Greensboro	Deep	Haw	Unknown
High Point	Thomasville	Deep	Yadkin	Emergency
High Point	High Point	Deep	Yadkin	3.5
Lower Cape Fear WSA	Brunswick County	Cape Fear	Shallotte	Unknown
Carthage	Carthage	Cape Fear	Deep	Unknown
Dunn	Benson	Cape Fear	Neuse	1.0
Dunn	Dunn	Cape Fear	South	Unknown
Dunn	Benson	Cape Fear	South	Unknown
Harnett	Fuquay-Varina	Cape Fear	Neuse	Unknown
Harnett	Angier	Cape Fear	South	Unknown
Harnett	Coats	Cape Fear	South	Unknown
Harnett	Dunn	Cape Fear	South	Emergency
Sanford	Chatham County East	Cape Fear	Deep	Unknown
Sanford	Sanford	Cape Fear	Deep	Unknown
Sanford	Lee County - Tramway	Cape Fear	Deep	Emergency
Wilmington	Wilmington	Cape Fear	New	Unknown
General Electric	General Electric	NE Cape Fear	Cape Fear	0.75
Southern Pines	Southern Pines	Lumber	Cape Fear	Unknown
Archer Daniel Midland	Archer Daniel Midland	Shallotte	Cape Fear	1.89
Durham	OWASA	Neuse	Haw	Emergency
Durham	Durham	Neuse	Haw	18.0[6]
Goldsboro	Wayne WD	Neuse	NE Cape Fear	Emergency
Hillsborough	Orange-Alamance WS	Neuse	Haw	Emergency
Orange-Alamance WS	Mebane	Neuse	Haw	Emergency
Orange-Alamance WS	Orange-Alamance WS	Neuse	Haw	Unknown
Raleigh	Holly Springs	Neuse	Cape Fear	0.8
Davidson	Archdale	Yadkin	Deep	Unknown
Davidson	Davidson	Yadkin	Deep	Unknown
Montgomery County	Montgomery County	Yadkin	Deep	1.0
North Wilkesboro	Broadway	Yadkin	Cape Fear	Unknown
Winston Salem	Kernersville	Yadkin	Haw	Unknown
Winston Salem	Winston Salem	Yadkin	Deep	Unknown
Winston Salem	Winston Salem	Yadkin	Haw	Unknown
Asheboro	Randleman	Uwharrie	Deep	Emergency
Asheboro	Asheboro	Uwharrie	Deep	4.7

[1] Transfer amounts are based on average daily water use reported in 1992 Local Water Supply Plans, and the 1993 Water Withdrawal and Transfer Registration Database.

[2] "Unknown" refers to undocumented consumptive use.

[3] "Emergency" refers to emergency connections.

[4] Transfer amount for Cary/Apex are based on its permitted transfer.

[5] Transfer amount for Piedmont Triad Regional Water Authority is based on its permitted transfer, but will not become effective until completion of Randleman Dam.
[6] The estimated transfer amount for Durham is based on information in their Jordan Lake allocation application.

32.4 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. 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 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 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.