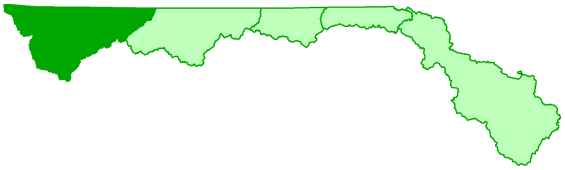
CHAPTER 1



UPPER DAN RIVER SUBBASIN

HUC 03010103

Includes: Dan River, Snow Creek, Big Creek, Town Fork Creek, Mayo River, Rock House Creek, Smith Creek, & Wolf Island Creek

SUBBASIN WATER QUALITY OVERVIEW

The Upper Dan River Subbasin is the western most subbasin and runs along the North Carolina/Virginia state line. The subbasin contains two Impaired streams: five segments of the Dan River are Impaired for either fecal coliform bacteria, turbidity or both; and the Smith River is Impaired for biological integrity, fecal coliform bacteria and copper.

During this assessment cycle (2004-2009), the subbasin experienced a moderate drought in 2005 and 2006 as well as a prolonged drought between 2007 and 2008. Monitoring the biological community during this cycle showed only a small percent declined. There were no major ambient monitoring violations; however, a long term pattern of a slight increase in pH was seen.

This subbasin is part of a bi-state coordinated effort between Virginia and North Carolina to focus studies and restoration implementation on the greater Dan River drainage area. More information about these efforts can be found in the Recommendations, Action Plans & Other Information at the Subbasin Scale section.

SUBBASIN AT A GLANCE

COUNTIES:

Surry, Stokes, Forsyth, Rockingham, & Caswell

MUNICIPALITIES:

Eden, Stoneville, Wentworth, Mayodan, Reidsville, Stokesdale, Danbury, Walnut Cove, Rural Hall, & Walkertown

ECOREGIONS:

Sauratown Mountains, Northern Inner Piedmont, & Triassic Basin

PERMITTED FACILITIES:

NPDES Dischargers:	126
Major	5
Minor	28
General	93
NPDES Non-Dischargers:	3
Stormwater:	49
General	49
Individual	0
Animal Operations:	8

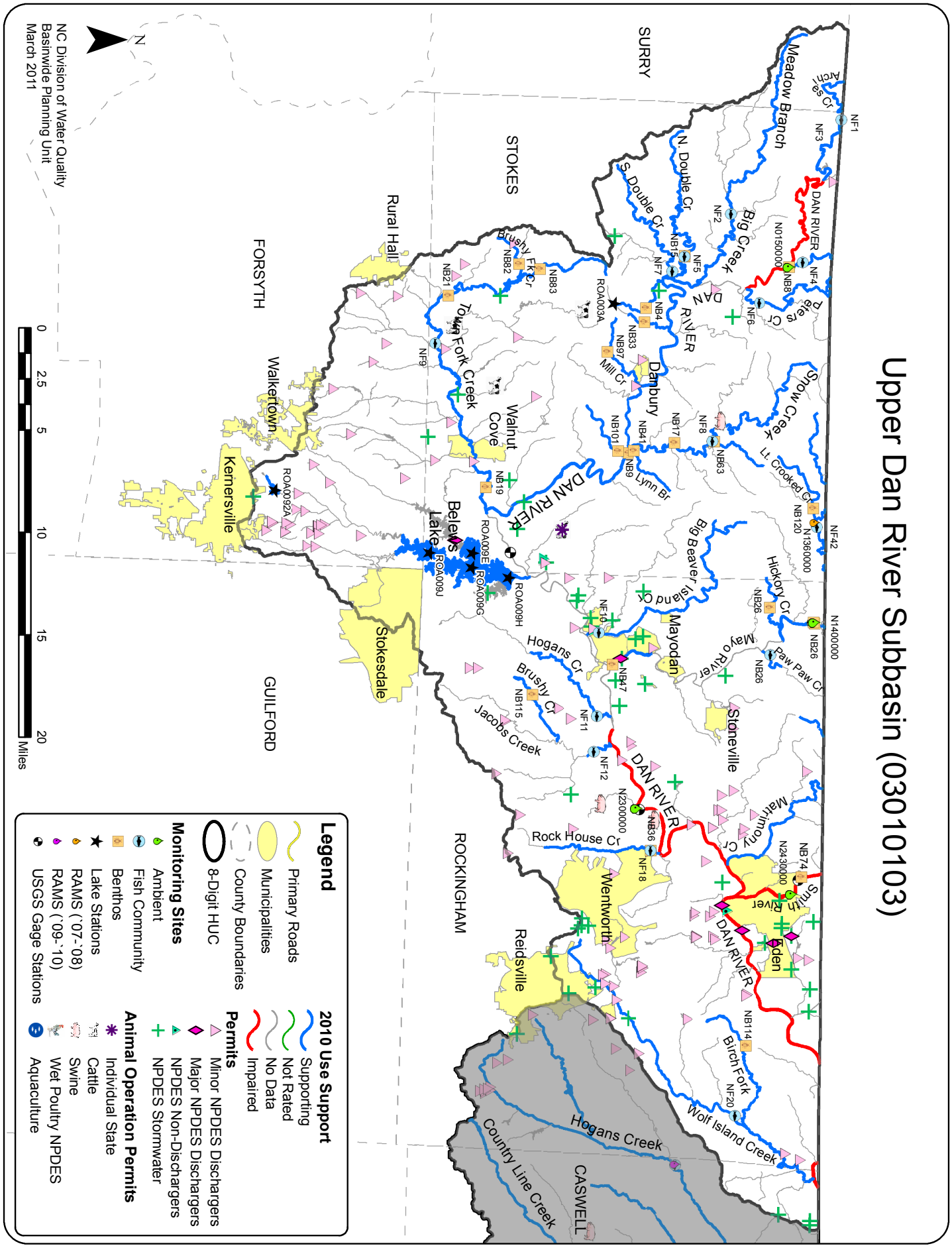
POPULATION:

2010 Census	124,907

2006 LAND COVER:

Open Water	1.2%
Developed	8.3%
Forest	62.8%
Agriculture	19.0%
Wetlands	0.6%
Barren Land	0.1%
Shrub/Grassland	8.0%

FIGURE 1-1: UPPER DAN RIVER SUBBASIN (03010103)



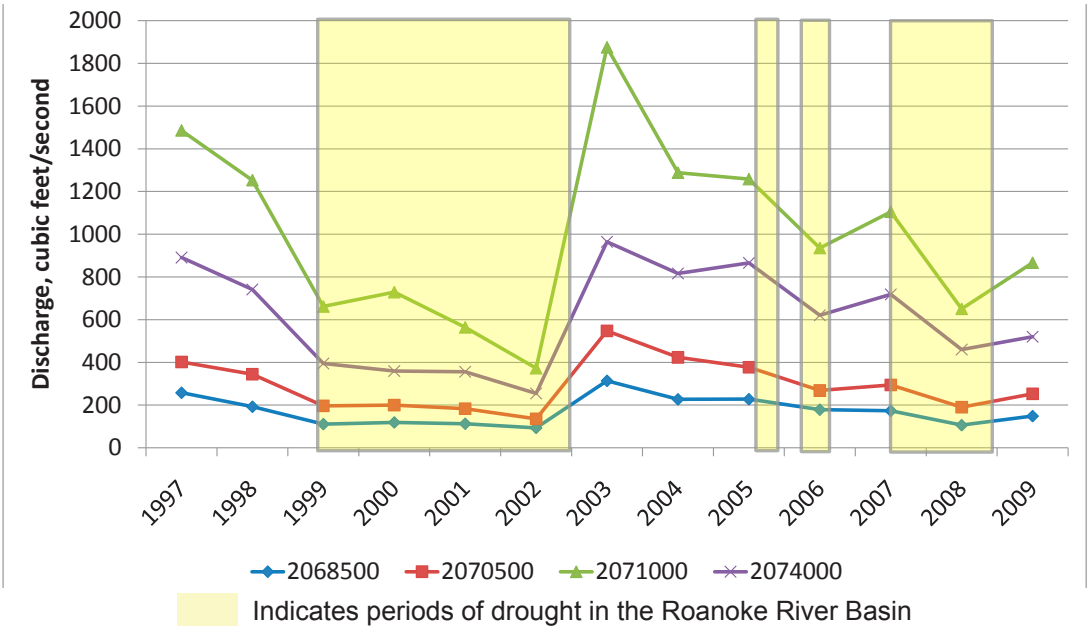
Water Quality Data Summary for this Subbasin

Monitoring stream flow, aquatic biology and chemical/physical parameters is a large part of the basinwide planning process. More detailed information about DWQ monitoring and the effects each parameter has on water quality is discussed in Chapters 2 and 3 of the Supplemental Guide to North Carolina's Basinwide Planning document.

Stream Flow

The basin experienced prolonged droughts from 1998-2002 and again from 2007-2008, with moderate droughts in 2005 and 2006 (Figure 1-2). More detail about flows in the Roanoke River Basin can be found in the 2010 Roanoke River Basinwide Assessment Report produced by DWQ-Environmental Science Section.

Figure 1-2: Yearly Flow Rates (cfs) of the USGS Gage Stations in the Upper Dan River Subbasin Between 1997 & 2009



From Left to Right:

- 2068500: Dan River (Francisco)
- 2070500: Mayo River
- 2071000: Dan River (Wentworth)
- 2074000: Smith River

Biological Data

Biological samples were collected during the spring and summer months of 2009 by the DWQ-Environmental Sciences Section as part of the five year basinwide sampling cycle, in addition to special studies. Overall, 30 biological sampling sites were monitored within the Upper Dan River Subbasin. The ratings for each station can be seen in Appendix 1-B.

Benthic Macroinvertebrate Sampling

Each benthic station monitored during the current cycle is shown in Figure 1-3 and color coded based on the current rating. Each of the sites are discussed in more detail in the watershed section below. Figure 1-5 is a comparison of benthic site ratings sampled during the last two basinwide cycles to indicate if there are any overall shifts in ratings. Benthic ratings from this cycle are similar to those received during the previous cycle indicating a relatively stable community.

Benthic Sampling Summary

Total Stations Monitored	15
Total Samples Taken	17
Number of New Stations	9

FIGURE 1-3: BENTHIC STATIONS COLOR CODED BY CURRENT RATING IN THE UPPER DAN RIVER SUBBASIN

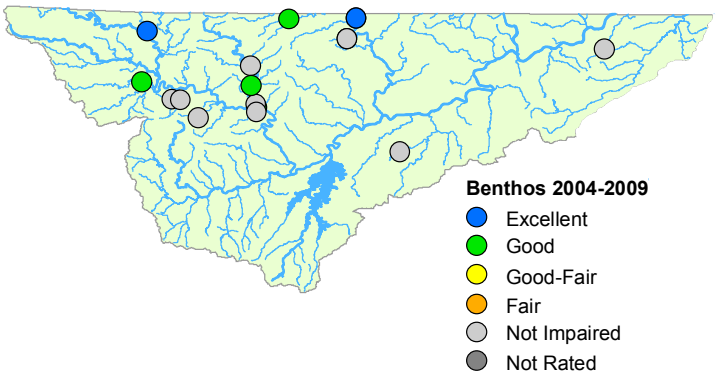


FIGURE 1-4: CURRENT BENTHIC SITE RATINGS

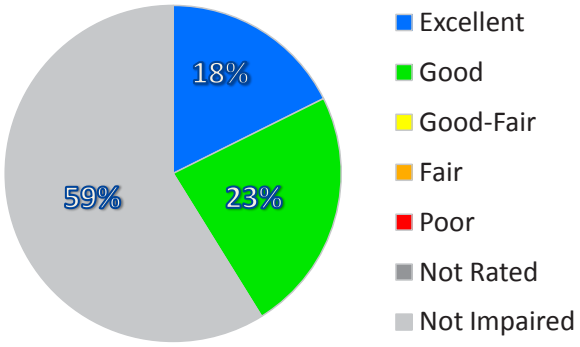
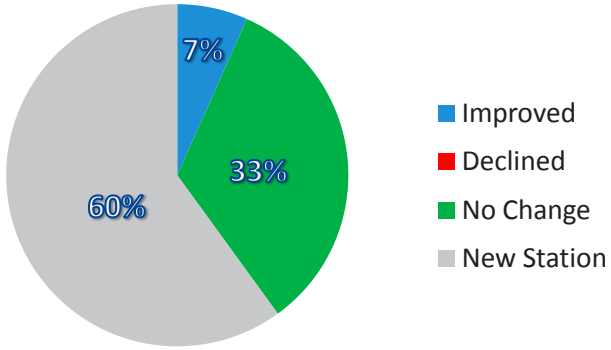


FIGURE 1-5: CHANGE IN BENTHIC SITE RATINGS



Fish Community Sampling

Each fish community station monitored during the current cycle is shown in Figure 1-6 and color coded based on the current rating. Each of the sites are discussed in more detail in the watershed section below. Figure 1-7 shows the percentages of each rating given during this sampling cycle within this subbasin. Figure 1-8 is a comparison of fish community site ratings sampled during the last two cycles to determine if there are any overall watershed shifts in ratings. Overall, the community is relatively stable.

FISH COM. SAMPLING SUMMARY

Total Stations Monitored	15
Total Samples Taken	15
Number of New Stations	1

FIGURE 1-6: FISH COMMUNITY STATIONS COLOR CODED BY CURRENT RATING IN THE UPPER DAN RIVER SUBBASIN

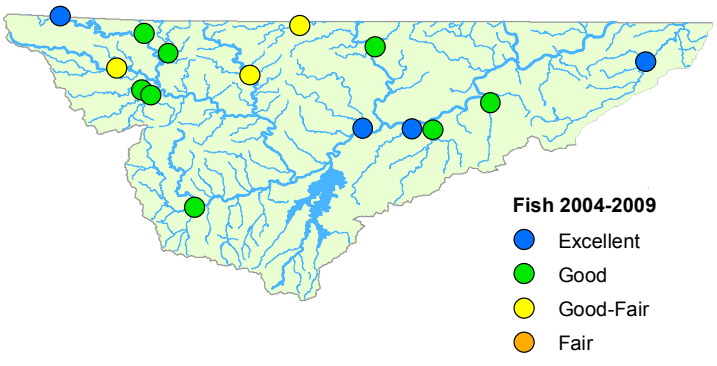


Figure 1-7: Current Fish Community Site Ratings

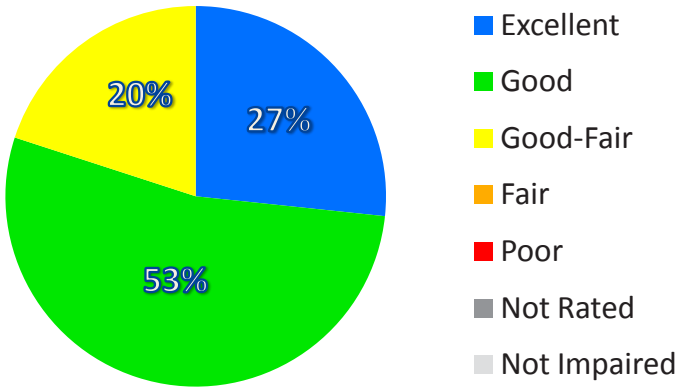
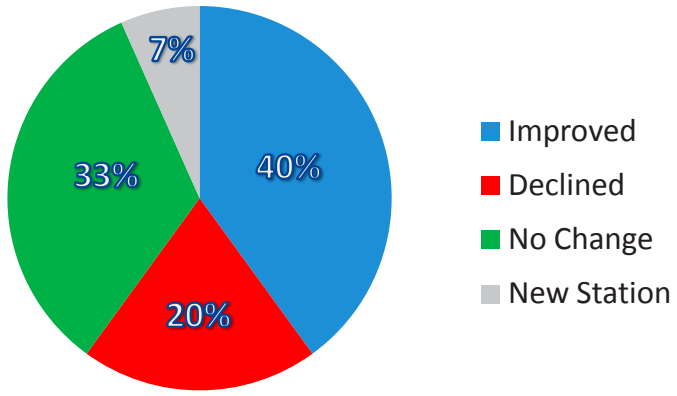


Figure 1-8: Change in Fish Community Site Ratings



For more information about biological data in this subbasin, see the 2010 Roanoke River Basinwide Assessment Report. Detailed data sheets for each sampling site can be found in Appendix 1-B.

Ambient Data

The ambient data are used to develop use support ratings every two years, which are then reported to the EPA via the Integrated Report (IR). The IR is a collection of all monitored waterbodies in North Carolina and their water quality ratings. The most current IR is the 2010 version and is based on data collected between 2004 and 2008. The ambient data reported in this basin plan were collected between 2005 and 2009 and will be used for the 2012 IR. If a waterbody receives an Impaired rating, it is then placed on the 303(d) Impaired Waters List. The Roanoke River Basin portion of the 2010 IR can be found in Appendix 1-A and the full 2010 IR can be found on the Modeling & TMDL Unit's website.

Four Ambient Monitoring System (AMS) stations are located in the Upper Dan River subbasin (see Figure 1-1 for the station locations). During the current sampling cycle (January 2005 and December 2009), samples were collected for all parameters on a monthly basis except metals which were sampled quarterly until May 2007 when metals sampling was suspended. For more information about the ambient monitoring, parameters, how data are used for use support assessment and other information, see Chapter 2 of the Supplemental Guide to North Carolina's Basinwide Planning.

Long Term Ambient Monitoring

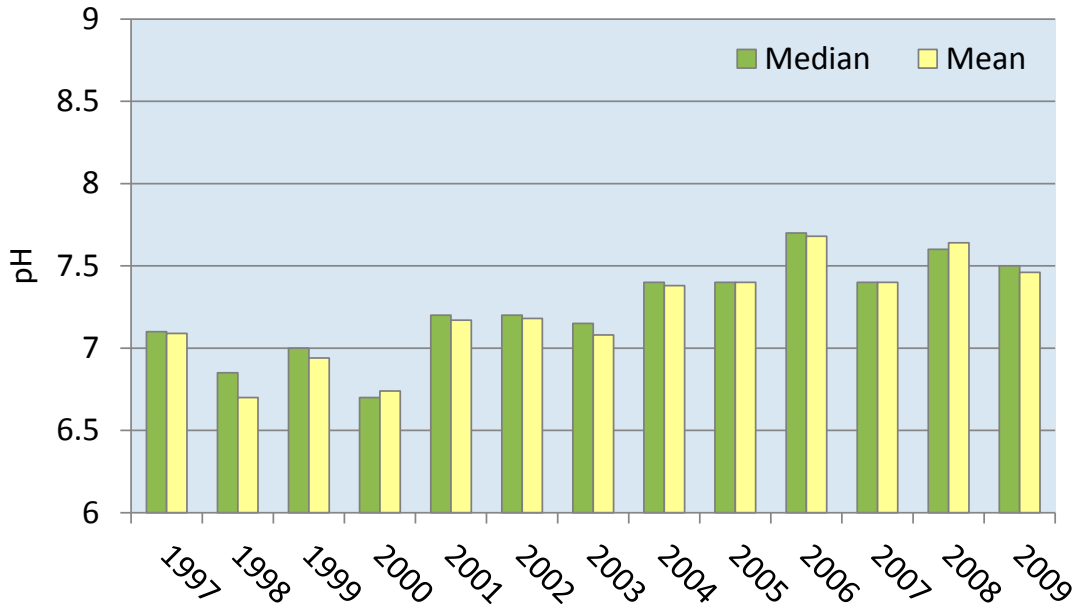
The following discussion of ambient monitoring parameters of concern include graphs showing the median and mean concentration values for each ambient station in this subbasin by specific parameter over a 13 year period (1997-2009). The geometric mean is a type of mean or average, which indicates the central tendency or typical value of a set of numbers. The graphs are not intended to provide statistically significant trend information, but rather an idea of how changes in land use or climate conditions can affect parameter readings over the long term. The difference between median and mean results indicate the presence of outliers in the data set. Box and whisker plots of individual ambient stations were completed by parameter for data between 2005 and 2009 by DWQ's Environmental Sciences Section (ESS) and can be found in the Roanoke River Basin Ambient Monitoring System Report.

pH

Figure 1-9 shows the mean and median pH levels for all samples taken over the course of 13 years in the Upper Dan River Subbasin. The pH pattern seen during this time period is a steady increase until 2006 when it dips back down. This pattern is seen in other parts of the northwestern corner of the state. Possible causes of the increasing levels in this subbasin could be atmospheric deposition, groundwater influences or precipitation influences. However, the exact reason is unknown at this time.

Proper riparian buffers throughout the subbasin could reduce the impact of stormwater runoff, which can include nutrients from farm or lawn fertilizers, as well as impacts from acid rain. Trees within riparian buffers are also beneficial for shading streams and reducing water temperatures. It is recommended to continue monitoring pH levels within the subbasin and investigate possible causes.

FIGURE 1-9: SUMMARIZED PH VALUES FOR ALL DATA COLLECTED AT AMBIENT SAMPLING STATIONS IN HUC 03010103



* NC pH Standard: Between 6.0 and 9.0 su

Turbidity

All four AMS stations within the Upper Dan River subbasin exceeded the state's turbidity standard in 6 to 23 percent of samples, as seen in Figure 1-10 indicated by yellow and red dots. Possible sources of the elevated turbidity levels are discussed in the 10-digit watershed section. Figure 1-11 shows the mean and median turbidity levels for all samples taken over the course of 13 years in the Upper Dan River subbasin. The yearly averages are well below the state standard of 50 NTUs with the exception of the 2009 mean. The western most station is located in a designated Trout Water which has a standard of 10 NTU.

While some erosion is a natural phenomenon, human land use practices may accelerate the process to unhealthy levels for aquatic life. Construction sites, mining operations, agricultural operations, logging operations and excessive stormwater flow off impervious surfaces are all potential sources. Turbidity exceedances demonstrate the importance of using best management practices to minimize the impacts of agriculture and development upon water quality, and **protecting and conserving stream buffers and natural areas**.

Figure 1-10: Percentage of Samples Exceeding the Turbidity Standard (2005-2009)

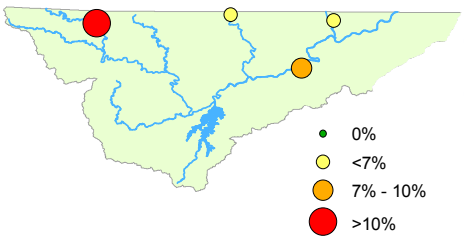
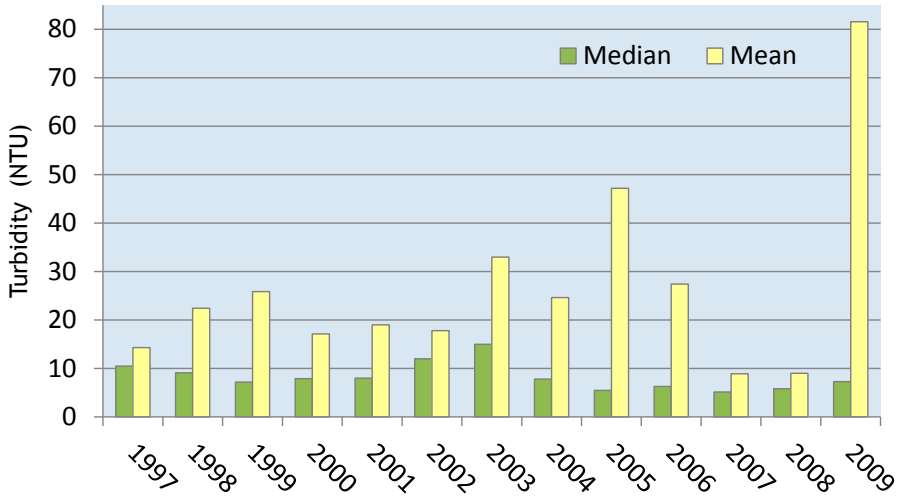


Figure 1-11: Summarized Turbidity Values for All Data Collected at Ambient Sampling Stations in HUC 03010103



* NC Turbidity Standard: Class C Waters = 50 NUT; Class Tr Waters = 10 NTU

Dissolved Oxygen (DO)

As seen in Figure 1-12, none of the four sites recorded DO standard exceedance during this monitoring cycle. Figure 1-13 shows the mean and median of DO levels for all samples taken over the course of 13 years in the Upper Dan River subbasin. These averages are well within the normal DO range.

Figure 1-12: Percentage of Samples Exceeding the DO Standard (2005-2009)

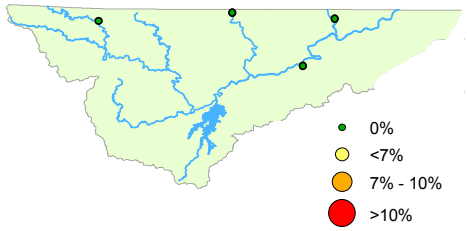
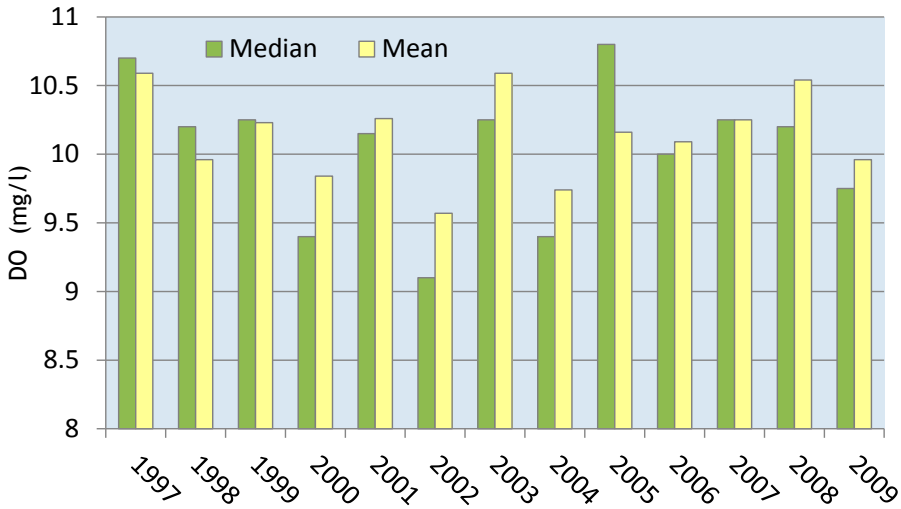


Figure 1-13: Summarized DO Values for All Data Collected at Ambient Sampling Stations in HUC 0301010

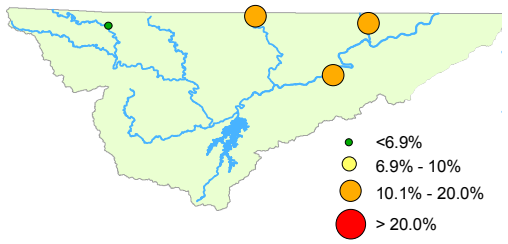


* NC DO Standard: Not < 5 mg/l daily avg. or not < 4 mg/l instantaneous

Fecal Coliform Bacteria

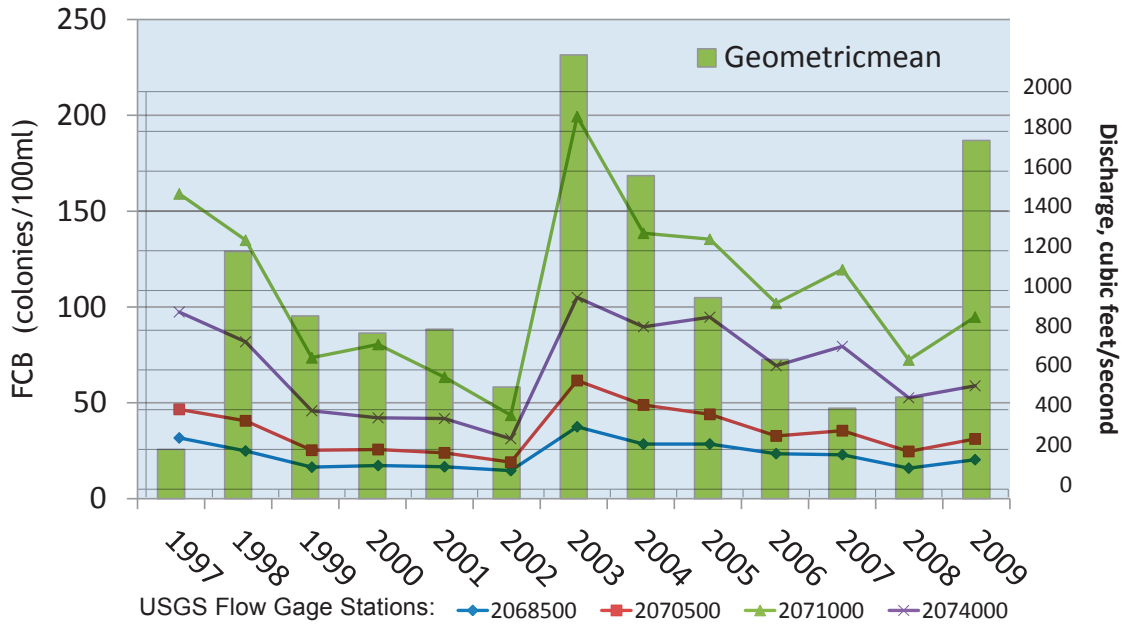
Fecal coliform bacteria (FCB) occurs in water as a result of nonpoint sources such as animal waste from wildlife, farm animals and/or pets, as well as from sanitary sewer overflows (SSOs). The FCB standard for freshwater streams is not to exceed the geometric mean of 200 colonies/100 ml, or 400 colonies/100 ml in 20% of the samples where five samples have been taken in a span of 30 days (5-in-30). Only results from a 5-in-30 study are used to indicate whether the stream is Impaired or Supporting. Waters with a use classification of B (primary recreational waters) receive priority for 5-in-30 studies. Other waters are studied as resources permit.

Figure 1-14: Percentage of Samples with Elevated FCB Levels (2005-2009)



As seen in Figure 1-14, three of the four sites had between 10% and 20% of samples over 400 colonies/100 ml. Possible sources of elevated levels of FCB are discussed in the subwatershed sections. Figure 1-15 shows the yearly geometric mean (calculated average) for all samples taken over the course of 13 years in the Upper Dan River subbasin. The highest yearly geometric mean was recorded in 2003 (232 colonies/100 ml). The figure also includes the yearly average stream flow, as seen in Figure 1-2, to show how flow can be closely linked to FCB levels.

Figure 1-15: Summarized Fecal Coliform Bacteria Values for All Data Collected at Ambient Sampling Stations in HUC 03010103 with Overlaying Flow



* NC FCB Standard (5-in-30 data only): Geomean not > 200/100 ml or 400/100 ml in 20% of samples

Additional information about possible causes of parameters discussed above for particular stations, see the stream write ups below. For more information regarding any of the parameters listed above, see Section 3.3 of the Supplemental Guide to North Carolina's Basinwide Planning. For additional information about ambient monitoring data collected in this river basin, see the Roanoke River Basin Ambient Monitoring System Report.

Understanding the Data

Biological & Ambient Ratings Converted to Use Support Categories

Biological (benthic and fish community) samples are given a bioclassification/rating based on the data collected at the site by DWQs Environmental Sciences Section (ESS). These bioclassifications include Excellent, Good, Good-Fair, Not Impaired, Not Rated, Fair and Poor. For specific methodology defining how these rating are given see Benthic Standard Operating Procedures (SOP) or the Fish Community SOP. Once a rating is given, it is then translated into a Use Support Category (see Figure 1-16).

Figure 1-16: Use Support Categories for Biological Ratings

Biological Ratings	Aquatic Life Use Support
Excellent	Supporting (Categories 1-2)
Good	
Good-Fair	
Not Impaired	
Not Rated	Not Rated (Category 3)
Fair	Impaired (Categories 4-5)
Poor	

Ambient monitoring data are analyzed based on the percent of samples exceeding the state standard for individual parameters for each site within a five year period. In general, if a standard is exceeded in greater than 10.0% of samples taken for a particular parameter, that stream segment is Impaired for that parameter. The fecal coliform bacteria parameter is exception to the rule. See the Fecal Coliform Bacteria section in the Ambient Data portion above.

Figure 1-17: Category Number to Use Support Rating

Category #	Use Support Rating
1	Supporting
2	
3	Not Rated
4	Impaired
5	

Each biological parameter (benthic and fish community) and each ambient parameter is assigned a Use Support Category based on its rating or percent exceedance. A detailed description of each category can be found on the first page of Appendix 1-A. Each monitored stream segment is given an overall category number which reflects the highest individual parameter category. Figure 1-17 shows how the category number is translated into the use support rating.

Example

Stream A had a benthic sample that rated Good-Fair and 12% of turbidity samples taken at the ambient station were exceeding the standard. The benthic sample would be given an individual category number of 1 (Figure 1-16) and the turbidity parameter would be given a category number of 5 since >10% of samples exceeded the standard. Therefore, stream A's overall category number would be a 5, indicating the stream has a use support rating of Impaired.

RECOMMENDATIONS, ACTION PLANS & OTHER INFORMATION AT THE SUBBASIN SCALE

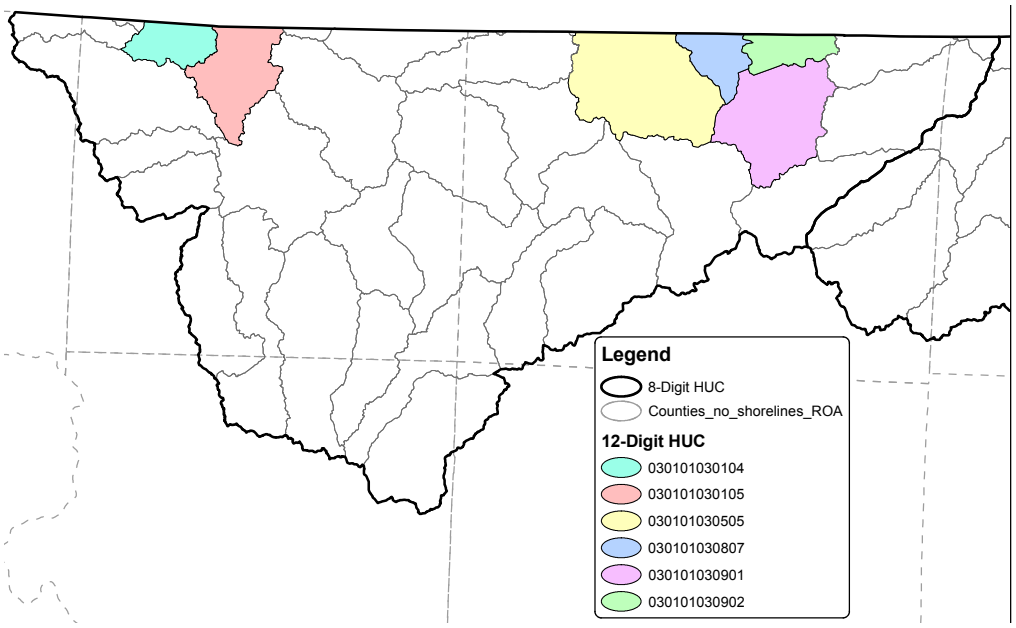
WATERSHED RESTORATION IMPROVEMENT TEAM (WRIT)

The Upper Dan River Subbasin has been prioritized as an area in which to focus resources by the NC Watershed Restoration Improvement Team (WRIT), which has only a selected few areas across the state. The WRIT is comprised of representatives from different DENR divisions and programs (although now due to 2011 legislative organizational mandates there are programs from the NC Department of Agriculture and Consumer Services as well) who are working to better coordinate watershed efforts across the state. WRIT has specifically selected the following 12-digit HUCs within this subbasin as part of those few watersheds across the state to focus efforts:

- Elk Creek (030101030104);
- Peters Creek (030101030105);
- Matrimoney Creek (030101030505);
- Smith River (030101030807);
- Town Creek (030101030901); and
- Cascade Creek (030101030902).

More specific details on these subwatersheds can be found in the 10-Digit Watershed section below.

FIGURE 1-18: UPPER DAN RIVER WRIT SUBWATERSHEDS



NORTH CAROLINA & VIRGINIA COORDINATED EFFORTS

The states of Virginia and North Carolina have been communicating periodically over the last few years in an effort to coordinate watershed efforts between the two states. The entire Dan River drainage area which crosses the state lines several times, has been selected as a larger area in which to coordinate efforts between the states.

Rodney Wright with the Stokes, Rockingham, and Caswell County Soil & Water Conservation Districts is serving as the watershed coordinator for the Upper Dan River Subbasin. He is working with locals and others to identify and implement management measures in the subbasin. This effort will mainly focus on those areas that drain to Impaired waters. Some specific projects implemented by this effort will be discussed in the 10-digit HUC's Local Initiatives sections. The coordinator and local districts will be making a concerted effort to work with their counterparts in VA in those subwatersheds that border VA to better coordinate activities.

Piedmont Triad Regional Council (PTRC) received a Clean Water Management Trust Fund Grant to develop an Eden Area Watershed Plan intended to address the impairments on both the Dan and Smith rivers in this area. For more information on this effort, please refer to the PTRC's website. PTRC also received a 205(j)/604(b)-funded GIS project to prioritize 12-digit HUC watersheds in both NC & VA for conservation and restoration as they had previously done for the Yadkin-Pee Dee River Basin.

DWQ Priority Summary

Table 1-1 is a list of waters in the Upper Dan River Subbasin that DWQ has prioritized for restoration/protection. The order of priority is not based solely on the severity of the steam's impairment or impacts but rather by the need for particular actions to be taken. A stream that is currently supporting its designated uses may be prioritized higher within this table than a stream that is currently impaired. This is based on a more holistic evaluation of the drainage area which includes monitoring results, current and needed restoration/protection efforts, land use and other activities that could potentially impact water quality in the area. Some supporting streams may have a more urgent need for protections than an impaired stream with restoration needs already being implemented.

The table also lists potential stressors and sources that may be impacting a stream including in-field observations, monitoring data, historical evidence and permit or other violations. Additional study may be needed to determine exact source(s) of the impact. The last column includes a list of recommended actions.

Table 1-1: Notable Waters in the Upper Dan River Subbasin (Not Ranked)

Stream Name	AU#	Class.	Potential Stressor(s)	Potential Source(s)	Qualitative Status	Actions Needed
Dan River	22-(1)a	C;Tr	--	--	Supporting	P: additional (biological diversity)
Dan River	22-(1)b	C;Tr	Turbidity	--	Impaired	P (endangered species)
Dan River	22-(8)	WS-V	--	--	Supporting	P (rare species)
North Double Cr	22-10	C	Nutrients (in the past)	--	Supporting	M
South Double Cr	22-11	B	--	--	Supporting	M
Archies Cr	22-2	C;Tr	--	--	Supporting	P (qualifies for HQW)
Snow Cr	22-20	C	Nutrient enrichment	--	Supporting	RBR
Town Fork Cr	22-25a & b	C	--	--	Supporting	M
Big Beaver Island Cr	22-29	C	--	--	Improving	P (Fed Endangered)
Jacobs Cr	22-32-(3)	WS-IV	Turbidity	--	Supporting	SEC BMPs
Rock House Cr	22-34-(2)	WS-IV	Turbidity	--	Supporting	P (rare species)
Smith River	22-40-(1), (2.5) & (3)	WS-IV; CA;C	Turbidity, FCB, Copper	--	Impaired	SS
Elk Cr	22-5	C;Tr	Habitat Degradation (Riparian Buffers)	--	Supporting	RBR
Peter Cr	22-6	C;Tr	--	--	Supporting	M, P (state threatened species)
Big Cr	22-9	C;Tr	Nutrients, DO Saturation	--	Supporting	SS

Class.: Classification (e.g., C, B, WS-I, WS-II, WS-III, WS-IV, WS-V, Tr, HQW, ORW, SW, UWL)

Stressor: Chemical parameters or physical conditions that at certain levels prevent waterbodies from meeting the standards for their designated use (e.g., low/high DO, nutrients, toxicity, habitat degradation, etc.). Fecal Coliform Bacteria (FCB),

Source: The cause of the stressor. (Volume & Velocity: when a stream receives stormwater runoff at a much higher volume and velocity than it would naturally receive due to ditching, impervious surfaces, etc.)

Status: Impaired, Impacted, Supporting, Improving (For current Use Support Assessment see the Integrated Report.)

Actions Needed: Agriculture BMPs (**Ag**), Best Management Practices (**BMPs**), Daylight Stream (**DS**), Education (**E**), Forestry BMPs (**F**), Local Ordinance (**LO**), Monitoring (**M**), Nutrient Mgnt Controls (**NMC**), Protection (**P**), Restoration (**R**), Riparian Buffer Restoration (**RBR**), Stormwater Controls (**SC**), Sediment and Erosion Control BMPs (**SEC BMPs**), Species Protection Plan (**SPP**), Stressor Study (**SS**), .

STATUS & RECOMMENDATIONS FOR MONITORED WATERS

UNDERSTANDING THIS SECTION

In this Section, more detailed information about stream health, special studies, aquatic life stressors and sources and other additional information is provided by each 10-digit Hydrological Unit Code (HUC). Waterbodies discussed in this Chapter include all monitored streams, whether monitored by DWQ or local agencies with approved methods. Use Support information on all monitored streams within this watershed can be seen on the map in Figure 1-1, and a Use Support list of all monitored waters in this basin can be found in the Use Support Chapter.

Use Support & Monitoring Box:

Each waterbody discussed in the Status & Recommendations for Monitored Waters within this Watershed section has a corresponding Use Support and Monitoring Box (Table 1-2). The top row indicates the 2010 Use Support and the length of that stream or stream segment. The next two rows indicate the overall Integrated Report category which further defines the Use Support for both the 2008 and the 2010 reports. These first three rows are consistent for all boxes in this Plan. The rows following are based on what type of monitoring stations are found on that stream or stream segment and may include benthic, fish community and/or ambient monitoring data. If one of these three types of monitoring sites is not shown, then that stream is not sampled for that type of data. The first column indicates the type of sampling in bold (e.g., **Benthos**) with the site ID below in parenthesis (e.g., CB79). The latest monitoring result/rating of that site is listed in the next column followed by the year that sample was taken. If there is more than one benthic site, for example, on that stream, the second site ID and site rating will be listed below the first. The last row in the sample box in Table 1-2 is the AMS data. The data window for all AMS sites listed in the boxes in this Plan is between 2004-2008. Only parameters exceeding the given standard are listed in the second column with the percent of exceedance listed beside each parameter.

TABLE 1-2: EXAMPLE OF A USE SUPPORT AND MONITORING BOX

USE SUPPORT: **IMPAIRED** (14 MI)	
2008 IR Cat.	4a
2010 IR Cat.	4
Benthos (CB79) (CB80)	 Fair (2002) Fair (2002)
Fish Com (CF33)	 Good-Fair (2002)
AMS (C1750000)	Turbidity - 12% FCB - 48%

Please note any fecal coliform bacteria (FCB) listing in the last row (as seen in Table 1-2) only indicates elevated levels and a study of five samples in 30 days (5-in-30) must be conducted before a stream becomes Impaired for FCB.

DAN RIVER CURRENT WATER QUALITY STATUS

The Dan River drainage area stretches across two subbasins (03010103 & 03010104); however, the full length of the NC portion of the river is discussed here including a summary of all Dan River Impairments and TMDLs. A bi-state restoration effort for the Dan River drainage area is discussed in the section above.

Dan River [AU#: 22-(1)a]

This portion of the Dan River is the first segment to across the state line into NC. The river crosses the state line four additional times before exiting NC west of the Town of Milton flowing northward to Kerr Lake. The segment is approximately five miles from the state line to it's confluence with the Little Dan River [AU#: 22-4] and is designated as Trout Waters. The majority of the drainage area is forestry, agriculture, residential and some industrial areas.

USE SUPPORT: **SUPPORTING** (5.1 MI)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF3)	 Good (2004)

All waters upstream of the Big Creek and Dan River confluence hold the secondary use classification of Trout Waters. Near the most upstream portion of this segment, just after the Dan River crosses into NC, there is a designated 363 acre Significant Natural Heritage Area. The river is known for its high level of fish species

diversity and the presence of several endemic species that are endangered, threatened, or significantly rare. This segment of the Dan River was placed under the Supporting use support category on the 2010 Integrated Report based on the 2004 fish sample.

Water Quality Status

This segment was last monitored in 2004. At that time, the fish population comprised of all pollution intolerant species. There was a concern for the absence of sunfish and piscivores as a result of the segment being Hatchery Supported Trout Waters; however, it is likely due to the habitat and fast running nature of the river. The NC Wildlife Resources manages efforts to stock 6,800 brook, rainbow and brown trout from May to July each year. Overall, the fish community in this segment was healthy as of 2004.

Dan River [AU#: 22-(1)b]

The second segment of the Dan River is approximately 11.6 miles from it's confluence with the Little Dan River [AU#: 22-4] to Peters Creek [AU#: 22-6] and is designated as Trout Waters. The majority of land cover in the drainage area is agriculture, forest and some residential. This segment of the Dan River has been on the Impaired Waters List since 2008 for exceeding the turbidity standard.

Use Support: Impaired (11.6 mi)	
2008 IR Cat.	5
2010 IR Cat.	5
Benthos (NB8)	Excellent (2009)
AMS (N0150000)	Turbidity - 22%

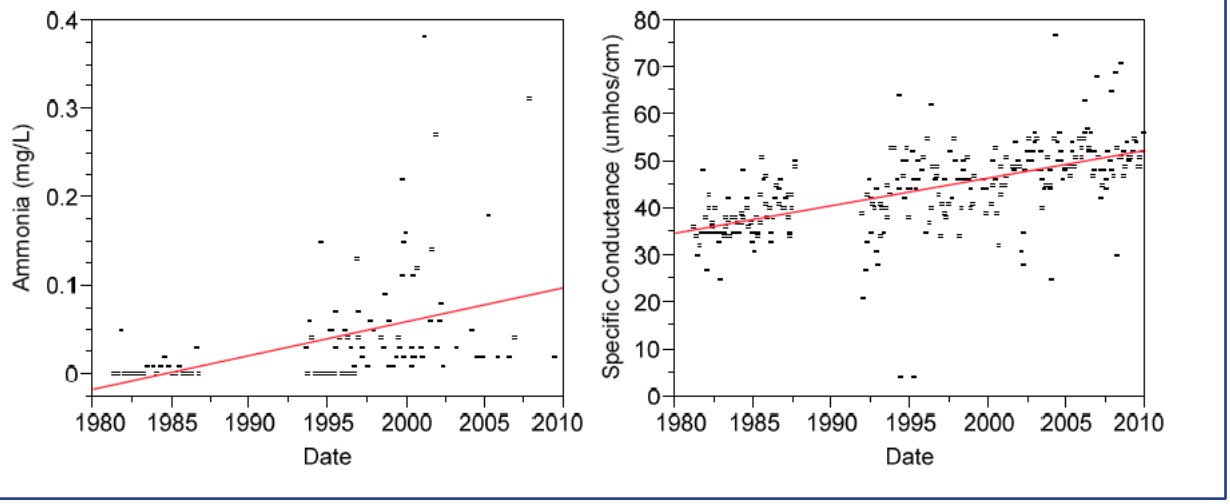
Water Quality Status

This segment of the Dan River has been monitored by DWQ since 1984 at the benthic station NB8. Ratings between 1984 and 2009 have either been Good or Excellent. In 2009, the site received an Excellent rating, reflecting the stable pollution intolerant macroinvertebrate community which has been observed in the past.

An ambient station is also located on this segment which has shown turbidity standard exceedances since the 2001 plan. The segment was first listed as Impaired for turbidity in 2008 and was not included on previous lists due to difference in use support methodology. Streams classified as Trout Waters, as this segment is, have a lower turbidity standard of 10 NTUs verses 50 NUTs for Class C waters. Even though the number of samples exceeding the standard didn't change much between the previous monitoring cycle and the present cycle, the value of the exceeding samples increased.

A nutrient and sediment trend analysis was completed during this cycle. The analysis showed nutrients peaking in February and August and decreasing to a minimum in October. Turbidity and total suspended solid levels peaked in late spring and early summer months. Long term trends were evaluated during this cycle for data collected between 1980 and 2009. Ammonia and specific conductance increased +0.004 mg/l per year and +0.60 umhos/cm per year, respectively (Figure 1-19). See the **Roanoke River Ambient Monitoring Report** for more details.

Figure 1-19: Long Term Trends at N0150000 (1980-2010)



Recommendations

Examine the possibility of additional monitoring stations, stream walking or other investigation to try to identify causes and sources of turbidity problems in Dan River. The upper part of this segment is located in Elk Creek subwatershed which is one of the subwatersheds targeted for greater focus and resources by WRIT; therefore, additional resources may be available for investigation. DWQ should coordinate with VA when working on this river segment.

Dan River [AU#: 22-(8)]

This segment of the Dan River is approximately 26 miles from Big Creek [AU#: 22-9] to Town Fork Creek [AU#: 22-25b]. However, only about 11.6 miles of the segment are within this watershed. The land cover for majority of the drainage area is forest and agriculture. There are two mining operations towards the downstream portion of the segment.

USE SUPPORT: **SUPPORTING** (25.9 MI)	
2008 IR Cat.	2
2010 IR Cat.	2
Benthos (NB9)	Good (2009)

Water Quality Status

The benthic station is just downstream from the Little Dan River watershed (0301010301) boundary and gives a representation of the water quality in that watershed. The land running parallel to the river in this upstream area is mostly forested. Samples have been taken at this benthic site since 1994 when it received a Good-Fair rating. That rating increased to a Good in 1999 and has remained at that rating ever since with a slightly increasing overall score. A few rare species (*Trycorythodes robacki* and *Ceraclea mentiea*)were collected in the 2009 sample.

Recommendations

This segment and the rare species found within it would benefit from additional protections on a state and local level.

Dan River [AU#: 22-(31.5)a & (31.5)b]

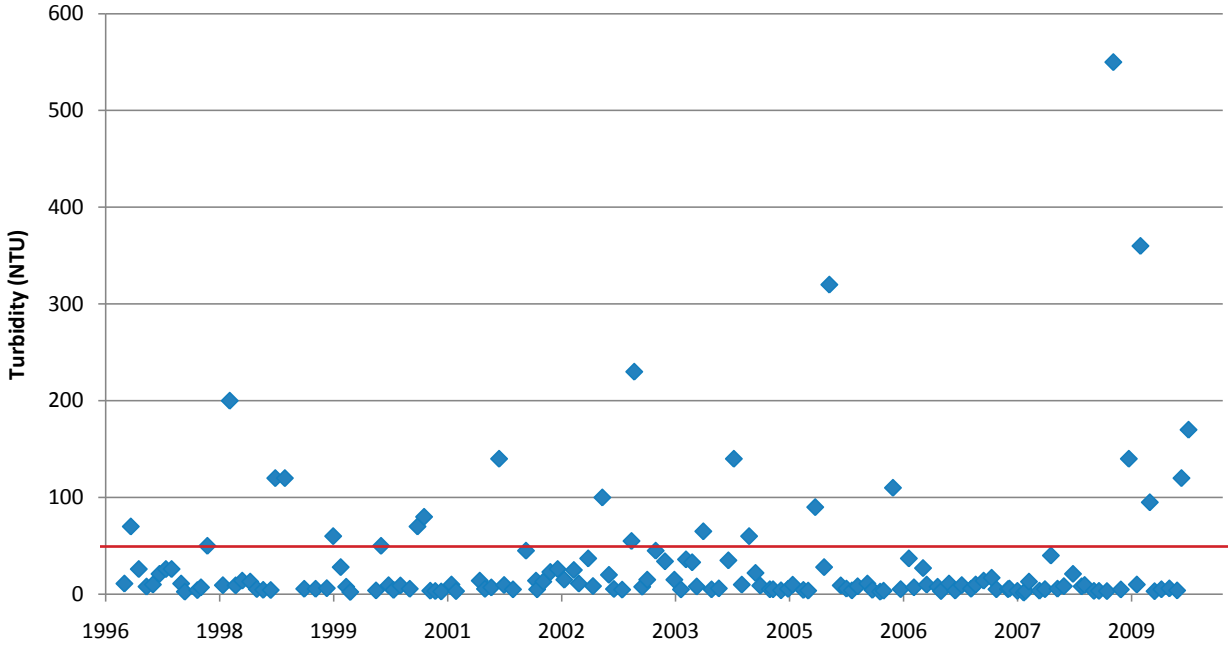
These two segments of the Dan River are approximately 14 miles combined from just over half a mile downstream of Jacobs Creek [AU#: 22-32-(3)] to Mill Branch [AU#: 22-39.5]. Land cover along these segments is mostly agriculture and residential with urban area around the Town of Eden. This segment has been on the Impaired Waters List since 2002 for turbidity standard violations.

USE SUPPORT: **IMPAIRED** (14.2 MI)	
2008 IR Cat.	5
2010 IR Cat.	4
AMS (N2300000)	Turbidity (14.8%)

Water Quality Status

There is one monitoring (AMS) station between these two segments. Almost 15% of turbidity samples exceeded the state standard at this station. Instream mining operations have been noted as a source in past plans. DWQ developed a **TMDL for turbidity** for this section of the Dan River in 2005. The TMDL recommended a 59% reduction in total suspended solids between both point and nonpoint sources. As seen in Figure 1-20, majority of sampling results have been reduced to below 35 NTUs since the TMDL was released in 2005 indicating progress.

Figure 1-20: Long Term Turbidity Sampling at N2300000 (1997-2009)



Dan River [AU#: 22-(39)a & b]

Use Support: Impaired (23.4 mi)	
2008 IR Cat.	5
2010 IR Cat.	5
AMS (N3000000) (N3500000)	Turbidity (19%) Turbidity (23%)

These two segments of the Dan River run from Mill Branch [AU#: 22-39.5] about 12 miles northeast to the state line. The river flows through Virginia for roughly six miles, crosses back into NC for a mile and a half before it returns to Virginia. After crossing state line again into NC, it flows for about 10 miles before its final exit just before reaching the Town of Milton. These segments are lined with agriculture and some forested areas, with tributaries draining additional farmland and residential areas. There are also two major dischargers within two and a half miles from the Smith River confluence (City of Eden WWTP and Duke Energy Dan River Steam Station). These segments have been on the Impaired Waters List for FCB and Turbidity since 2008.

Water Quality Status

There are two AMS monitoring stations along these two segments. Both station's samples exceeded the turbidity state standard. The average turbidity levels for both stations have decreased; however, the amount of samples exceeding the standard have increased at both stations. Both segments are on the Impaired Waters List for FCB standard violations as well. A **TMDL for FCB** for the Smith and Dan Rivers was developed in 2009 to address that impairment.

BMP Implementation

NC Division of Soil & Water Conservation was awarded an NC Section 319 NPS Program grant in 2008 to implement BMPs throughout the Dan River Watershed. BMPs that will be installed during the course of this project include: conservation cover, conservation crop rotation, cover crop, critical area planting, diversions, livestock exclusion fencing, field borders, grassed waterways, heavy use area protection, troughs, water wells, and watering facilities. This grant will conclude in March 2012. The DSWC received an additional 319 grant in 2011 to continue implementing these BMPs throughout the watershed. Quarterly reports providing updated on these projects are on the **NPS 319 Program** webpage.

Dan River Impairment Summary

There are a total of 49.8 miles of the Dan River Impaired for turbidity standard violations as well as 38.2 miles Impaired for fecal coliform bacteria standard violations.

Table 1-3: Dan River Impairments by Segment

AU#	Distance Impaired (mi)	Turbidity Impairment (% exceeded*)	New Turbidity Impairment	Fecal Impairment	New Fecal Impairment
22-(1)b	11.6	24%	No	No	--
22-(31.5)a	4.8	10%	No	Yes	Yes
22-(31.5)b	9.4	10%	No	Yes	No
22-(38.5)	0.6	12%	No	Yes	No
22-(39)a	13.8	12%	Yes	Yes	Yes
22-(39)b	9.6	16%	Yes	Yes	No

* Percents based off of 2010 Impaired Waters List (2004-2008)

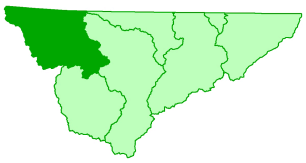
The 11.6 miles in the upper Dan River are in trout waters where the turbidity standard is 10 NTUs. This segment had elevated turbidity again during this assessment period. These same waters received an Excellent and a Good benthic bioclassification during the last three basin cycles.

The remaining 38.2 miles of the Dan River are impaired for both turbidity and fecal coliform bacteria. Of these, 14.2 miles were impaired for turbidity on the 2002 Impaired Waters List (22-(31.5)a & 22-(31.5)b). A TMDL for this 14.2 miles segment was approved by the USEPA in January 2005, which recommends a 59 percent reduction in Total Suspended Solids distributed over both point and nonpoint sources in order to achieve acceptable water quality levels in this area. A turbidity TMDL will have to be developed for the remaining 24 miles. An addendum to the approved Virginia bacteria TMDL was approved in July 2009 to include the segments of the Dan River in North Carolina which are Impaired for fecal coliform bacteria. The **FCB TMDL** for both NC point sources and NC and VA nonpoint sources is 2.88E+12 counts/day.

In the past, the Dan River was often called the “Muddy Dan” by locals. The river almost always ran brown due to sediment in the river. There were several instream sand mining operations as well as a lot of agricultural activity along the river. No permitted sand mining operations remain along this segment of the Dan River and many of the tobacco fields in this area have been converted to other agricultural practices such as cattle farming. Many of these fields have also been converted to permanent grasslands or to natural vegetation with help from the NC agriculture cost share program. While more environmentally friendly agricultural practices have started to occur in this area, more timber harvesting is occurring in both North Carolina and Virginia. Since the Dan River flows back and forth across the state line, timber harvesting practices in one state ultimately affects the water quality in the other. Development of single family homes have increased in this area as well. Sediment and erosion controls are often not required on these smaller size lots. The use of ATV’s was also noted as an activity in this area that is likely contributing to the sediment load in the small tributaries that flow into the Dan River. With a continued push to improve agricultural and forestry BMPs in the area as well as better sediment and erosion control ordinances along the Dan River, improvements should be achievable.

See the WRIT section above for more detail on focused state and bi-state study and restoration efforts for the Dan River drainage area.

Little Dan River-Dan River (0301010301)



Includes: Dan River [AU#: 22-(1)a, b, c, & (8)]**, Archies Creek** [AU#: 22-2], **Elk Creek** [AU#: 22-5], **Peter Creek** [AU#: 22-6]**, Big Creek** [AU#: 22-9]**, North Double Creek** [AU#: 22-10]**, South Double Creek** [AU#: 22-11]**, Cascade Creek** [AU#: 22-12-(2)a & b]**, Indian Creek** [AU#: 22-13-(2)]**, & Mill Creek** [AU#: 22-18]

This watershed contains a mix land use of agriculture, forested and some residential areas. There are five minor NPDES permitted facilities located within the watershed. Only one segment within this watershed (Dan River [AU#: 22-(1)b]) is on the 2010 Impaired Waters List.

Archies Creek [AU#: 22-2]

Approximately seven miles of Archies Creek is within NC and flows into the Dan River after crossing back into Virginia. The majority of the drainage area is agricultural and forested land. The stream holds a secondary classification of Trout Waters.

Use Support: Supporting (7.3 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF1)	Excellent (2009)

Water Quality Status

A fish community site is located just before the stream flows back into Virginia where it meets the Dan River. This site was monitored for the first time in 2004 when it received an Excellent rating as it did again in 2009. The site had the highest number of pollution intolerant species and lowest percentage of pollution tolerant fish of any site in 2009. Even though this is not a NCWRC Hatchery Supported Trout stream, one large stocked Brook Trout was collected. This, along with other pollution sensitive fish collected and suitable habitat conditions, help toward qualifying this site as a regional reference site; however, the percentage of forested land does not meet the criteria.

Recommendations

There are a high number of pollution intolerant fish species. DWQ will coordinate with Virginia on any restoration or protection efforts in this river segment.

Elk Creek [AU#: 22-5]

Elk Creek is approximately three miles from the state line to the Dan River [AU#: 22-(1)b]. The majority of the land cover in this drainage area is forest and agriculture. This creek holds the secondary use classification of Trout Waters.

Use Support: Supporting (2.9 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF4)	Good (2009)

Water Quality Status

A fish community site, located at Puckett Road, has been monitored since 2004 when it received a Good-Fair rating. At that time, riparian buffers along the stream were minimal, providing little to no shade for the stream and sometimes completely absent. The buffer zones had been periodically burned and noted as contributing to nonpoint source nutrients and sediment within the stream.

The 2009 sample improved to a Good rating. Biologists contributed the higher rating to an increased diversity in certain fish species and greater abundance of others. Streambanks have been re-vegetated since 2004; however, riparian zones were still narrow and offered little shading. This segment was noted to become easily silted and, at the time of sampling was slightly turbid.

Recommendations

Elk Creek would benefit from additional riparian buffer restoration. This should include widening buffer zones and planting of trees and large bushes to provide needed shade for better habitat for trout and other temperature sensitive species. Wider buffer zones will also increase filtration of nonpoint source runoff.

Monitoring turbidity levels in Elk Creek could help determine if the stream is contributing to turbidity exceedances measured just downstream of the Elk Creek/Dan River confluence. The Elk Creek subwatershed has been targeted for study and restoration/protection by WRIT; therefore, additional resources may be available for this investigation. DWQ will coordinate with Virginia on restoration or protection efforts in this river segment.

Peter Creek [AU#: 22-6]

Peter Creek is approximately nine miles from the state line to the Dan River [AU#: 22-(1)b]. The majority of the land cover in this drainage area is forest and agriculture. This creek holds the secondary use classification of Trout Waters.

USE SUPPORT: SUPPORTING (9.1 MI)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF6)	Good (2009)

Water Quality Status

A fish community station, located on Hart Road, has been sampled since 2004 when it received an Excellent rating. That sample indicated exceptionally high water quality and qualified the site as a new fish community regional reference site. The 2004 sample also included the only collection of the State Threatened Bigeye Jumprock (*Scartomyzon ariommus*) within the basin.

The 2009 sample had similar results to the 2004 sample; however, it declined in rating to a Good. This sample did not include the Bigeye Jumprock or the Smallmouth Bass; both of which were in the 2004 sample. The fish community was still very diverse and included other pollution intolerant species. The pH level during the sample collection was lower than the state standard of 6.0 su and specific conductivity was slightly elevated. Habitat along the segment remained in good condition with good canopy cover, riffles and deep snag pools.

Recommendations

DWQ will continue to monitor this segment during the next sampling cycle. Due to the loss of the State Threatened species and the presence of the Roanoke Hogsucker, Blacktip Jumprock, and Riverweed Darter (Significantly Rare/Special Concern species), this stream would benefit from additional protections. DWQ will coordinate with Virginia on any restoration or protection efforts in this river segment.

Big Creek [AU#: 22-9]

Big Creek is approximately 20 miles from source to the Dan River [AU#: 22-(8)b]. Next to the Dan River, Big Creek has the largest drainage area of this watershed. The majority of the land cover draining to the creek is a mixture of forest, residential and agriculture including row crops and fish farms.

USE SUPPORT: SUPPORTING (19.9 MI)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF2)	Good-Fair (2009)

Water Quality Status

The 2009 fish community sample taken at Frye Road, decreased in rating from the first sample taken at this site in 2004. The site had decent habitat with the exception of moderate to severe streambank erosion in some places. Biologists noted signs of nonpoint source nutrient enrichment within the sample as well as indications of early morning periphyton production. The decline in number of pollution intolerant species was the reason for the decline in rating.

The sampling site is roughly two miles downstream of three fish farms which could be contributing to the periphyton production.

North Double Creek [AU#: 22-10]

North Double Creek is approximately 14 miles from source to the Dan River [AU#: 22-(8)]. The majority of the land cover draining to the creek is a mixture of forest, residential and agriculture.

USE SUPPORT: SUPPORTING (14.0 MI)	
2008 IR Cat.	2
2010 IR Cat.	2
Benthic (NB15)	Good (2009)
Fish Com (NF5)	Good (2009)

Water Quality Status

A benthic and a fish community monitoring stations are located about two and a half miles upstream of North Double Creek's confluence with the Dan River. The benthic site has been monitored since 1994 when it was rated Fair. Each

year the site has increased by one rating level with exception of 2009 when it remained at a Good rating. The 2009 sample included various pollution sensitive taxa and a few rarely collected taxa. Even though there were fewer pollution intolerant taxa as compared to the 2004 sample, it still suggests minimal upstream pollution inputs.

The fish community site has been sampled twice since 2004 when it was rated Good-Fair and is a regional reference site. The 2009 sample increased in rating to a Good. The presence of Bluehead Chub, which can be an indicator of excess nutrients in the stream, was reduced from 43% to 32% of fish collected. It is still the dominant species; however, the increase in other pollution sensitive species and a more balanced trophic structure is a possible indication of nutrient reductions.

Recommendations

DWQ will continue to monitor both biological sites to record possible future improvement.

South Double Creek [AU#: 22-11]

South Double Creek is approximately ten miles from source to the Dan River [AU#: 22-(8)]. The majority of the land cover draining to the creek is a mixture of forest, residential and agriculture.

Use Support: Supporting (9.9 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF7)	Good (2009)

Water Quality Status

A fish community site, located a little less than a mile from its confluence with the Dan River, was sampled in 2004 (Good) and 2009. The habitat score for the 2009 sample was relatively low (65 out of 100) mostly due to poor bottom substrate and riffle habitat. There were signs of re-vegetation along one bank. The water column was slightly turbid and pH was just below the state standard of 6.0. Despite the non-ideal habitat, there was a slightly larger percentage of pollution intolerant species. There were no other changes from the sample collected in 2004, indicating a somewhat stable community.

Recommendations

DWQ will continue to monitor this station.

Cascade Creek (Hanging Rock Lake) [AU#: 22-12-(2)a & b]

Cascade Creek is approximately four miles from source to the Dan River [AU#: 22-(8)]. A little less than a mile downstream from the source of Cascade Creek is a 12 acre lake named Hanging Rock Lake. Land cover in this drainage area is dominated by forest with some agriculture. From source to the lake, the creek holds secondary use classifications of B or recreational waters and ORW. Cascade Creek is located in Hanging Rock State Park.

Use Support: Supporting (4.3 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Benthic (NB4)	Not Impaired (2005)
Lake Station (ROA003A)	No Exceedance (2009)

Water Quality Status

A benthic sample was taken in 2005 as part of a special study to develop biocriteria for small streams in North Carolina. The sample was given a Not Impaired rating since the studies proposed criteria has yet to be approved. Habitat was rated high (92 out of 100) and the benthic community showed no signs of being impacted.

Five lake samples were taken on Hanging Rock Lake between May and September in 2009. The lake was first monitored in 1985 by DWQ. DO, temperature, pH, turbidity, and percent DO saturation levels were all normal for the lake. Nutrient levels reflected low biological productivity and was found to be oligotrophic as it has been since first sampled.

Indian Creek [AU#: 22-13-(2)]

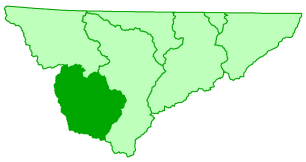
Indian Creek is approximately three miles from source to the Dan River [AU#: 22-(8)]. Almost the entire drainage area is forested. The first seven tenths of a mile of the stream holds a secondary use classification of ORW.

Use Support: Supporting (2.7 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Benthic (NB33)	Not Impaired (2005)

Water Quality Status

A benthic sample was taken in 2005 as part of a special study to develop biocriteria for small streams in North Carolina. The sample was given a Not Impaired rating since the studies proposed criteria has yet to be approved. Habitat was rated high (92 out of 100) and the benthic community showed no signs of being impacted.

Town Fork Creek (0301010302)



Includes: Town Fork Creek [AU#: 22-25a & b]**, Brushy Fork Creek** [AU#: 22-25-1]**, & Neatman Creek** [AU#: 22-25-6]

This watershed contains a mix land use of agriculture, forest and some residential and urban areas. There are 16 minor NPDES permitted facilities and three permitted cattle animal operations located within the watershed. There are no streams on the 2010 Impaired Waters List in this watershed.

Town Fork Creek [AU#: 22-25a & b]

Use Support: Supporting (26 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Benthos	
(NB83)	Good (2004)
(NB21)	Good-Fair (2004)
(NB19)	Good (2004)
Fish Com	
(NF9)	Good (2009)

Town Fork Creek is approximately 18 miles from source to the Dan River [AU#: 22-(25.5)]. All streams in this watershed drain to Town Fork Creek; therefore, land cover for this drainage area is the same as that of the watershed.

Water Quality Status

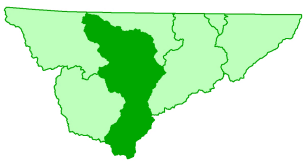
Town Fork Creek was listed on the Impaired Waters list between 2002 and 2006 due to a Poor benthic rating in 1995. Since that time, the water quality in this creek has gradually improved. A TMDL stressor study was conducted in 2004 and found that previous samples taken at NB83 and NB21 were too close to an impoundment to give a good representation of the upper Town Fork Creek watershed. There were also a significant number of agricultural BMPs implemented during the previous cycle, totaling in $46,504 in Agricultural Cost Share Program funding.

During the current cycle, one sample was taken at the fish community site. Despite the presences of periphyton and high dissolved oxygen saturation (128%), the NCIBI score slightly increased from the 2004 sample. The slight increase was due to the larger percentage of insectivores. The specific conductivity levels were somewhat elevated and the water column was slightly turbid. The overall habitat score was relatively good, at 79 out of 100.

Recommendations

Benthic station NB19 should be monitored during the upcoming sampling cycle if resources allow. This site provides the most holistic view of the watershed.

Belews Lake-Dan River (0301010303)



Includes: Dan River [AU#: 22-(8), (25.5), (27.5) & (28.5)]**, Snow Creek** [AU#: 22-20]**, Fulk Creek** [AU#: 22-24], **Belews Creek (Kernersville Lake)** [AU#: 22 27-(1.5)], **Belews Lake** [AU#: 22-27-10, 22-27-(6), (7), (7.5), 22-27-8-(2), 22-27-9-(3) & (4)], **Lynn Branch** [AU#: 22-20-9], **Raccoon Creek** [AU#: 22-20-4], **Wood Benton Branch** [AU#: 22-21], **& Big Beaver Island Creek** [AU#: 22-29]

This watershed contains a mix land use of agriculture, forest, residential and some urban areas. There are 28 minor and one major NPDES permitted facilities and three permitted animal operations located within the watershed. There are no streams on the 2010 Impaired Waters List in this watershed.

Snow Creek [AU#: 22-20]

Use Support: Supporting (18.9 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Benthos (NB17)	Good (2009)
Fish Com (NF8)	Good-Fair (2009)

Snow Creek is approximately 19 miles from source to the Dan River [AU#: 22-(8)]. The headwaters of Snow Creek and its tributaries has land cover which is dominated by agriculture. Further downstream, the land cover transitions to a blend of agriculture, forest and residential areas.

Water Quality Status

A benthic sample site is located just under four miles from Snow Creek's confluence with the Dan River. This site has been given a Good rating since 2000 and the benthic community has remained stable since that time. A few additional pollution sensitive species were collected in the 2009 sample that were not previously recorded indicating a possible increase in water quality.

The fish community site is about three and a half miles upstream from the benthic site. This site was first sampled in 2004 when it received a Good rating. The 2009 sample resulted in a decrease in rating to a Good-Fair. This was due to the increased number of omnivores which are an indication of nonpoint source nutrient enrichment. This site is closer to the headwaters which is mostly agricultural land, including one swine operation. Many of the tributaries in this drainage area have riparian buffers along either side of the streambanks. However, there are others that completely lack any buffer area.

Recommendations

Riparian buffer restoration would enhance water quality for this creek and its tributaries.

Raccoon Creek [AU#: 22-20-4]

Use Support: Supporting (3.4 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Benthos (NB63)	Not Impaired (2005)

Raccoon Creek is approximately three miles from source to Snow Creek [AU#: 22-20]. The land cover in this drainage area is a mixture of agriculture, forest and some residential.

Water Quality Status

A benthic sample was taken in 2005 as part of a special study to develop biocriteria for small streams in North Carolina. The sample was given a Not Impaired rating since the studies proposed criteria has yet to be approved. Habitat was rated somewhat high (84 out of 100) and the benthic community showed no signs of being impacted.

Lynn Branch [AU#: 22-20-9]

Use Support: Supporting (3.1 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Benthos (NB41)	Not Impaired (2005)

Lynn Branch is approximately three miles from source to Snow Creek [AU#: 22-20]. The majority of the drainage area is forested with some agriculture.

Water Quality Status

A benthic sample was taken in 2005 as part of a special study to develop biocriteria for small streams in North Carolina. The sample was given a Not Impaired rating since the studies proposed criteria has yet to be approved. Habitat was good (74 out of 100) and the benthic community showed no signs of being impacted.

Wood Benton Branch [AU#: 22-21]

Use Support: Supporting (3.7 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Benthos (NB101)	Not Impaired (2005)

Wood Benton Branch is approximately four miles from source to the Dan River [AU#: 22-(8)]. The majority of the drainage area is forested with areas of agriculture in the headwaters.

Water Quality Status

A benthic sample was taken in 2005 as part of a special study to develop biocriteria for small streams in North Carolina. The sample was given a Not Impaired rating since the studies proposed criteria has yet to be approved. Habitat was good (77 out of 100) and the benthic community showed no signs of being impacted.

Belews Creek (Kernersville Lake) [AU#: 22-27-(1.5)]

USE SUPPORT: SUPPORTING (46.1 ACRES)	
2008 IR Cat.	2
2010 IR Cat.	3n
Lake Station (ROA0092A)	Chlorophyll a (20%)*

* This data will be reflected on the 2012 Impaired Waters list.

Kernersville Lake is approximately 46 acres and drains to Belews Creek [AU#: 22-27-(2)]. The majority of the drainage area is residential and forest land. The lake also receives runoff from the Town of Kernersville. The lake is an emergency drinking reservoir for the town and holds the use classification of WS-IV; B.

Water Quality Status

The lake was sampled at one location five times in 2007 and five times in 2009. Results of both years were similar with the exception of DO levels that dropped down to 4.6 mg/l in September 2007. DO levels in 2009 returned to normal levels. Nutrient levels were elevated during both years and blue-green alga associated with nutrient-rich water was present in the lake during sampling. Twenty percent of chlorophyll *a* samples were above the state standard; therefore, the lake is expected to go on the 2012 Impaired Waters List.

An Algal Growth Potential Test was completed in 2009 and it was determined the lake is nitrogen limited. The test also showed that the lake has elevated biological productivity (eutrophic). The lake has been designated eutrophic since it was first sampled by DWQ in 1985.

Belews Lake [AU#: 22-27-(7), (7.5) & 22-27-9-(4)]

USE SUPPORT: SUPPORTING (2,982.4 MI)	
2008 IR Cat.	2
2010 IR Cat.	2
Lake Station (ROA009J) (ROA009E) (ROA009G) (ROA009H)	(2009) Temp (3 of 5) Temp (2 of 5)

Belews Lake's approximately 2,982 acres has four main arms which drain the southern portion of this watershed and flows into the Dan River [AU#: 22-(25.5)]. The majority of the drainage area is agriculture, residential, urban and some forested areas. The Duke Energy Belews Creek Steam Station is located along the west side of the lake.

Water Quality Status

The lake is split into seven different AU segments. There are four lake monitoring stations which are located in three of the seven segments. The segment AU#'s are listed above. Monitoring results from the five samples taken in 2009 indicated very little change from previous monitoring years. One exception was the elevated water temperatures that were found at ROA009J and ROA009E which is likely due to the thermal discharge from the coal-fired power plant.

Nutrients monitored resulted in normal to below detection levels. This lake has been designated as oligotrophic or very low biological productivity and has been since first sampled by DWQ in 1981. For more information see the **Roanoke River Basin Lake and Reservoir Assessment**.

Big Beaver Island Creek [AU#: 22-29]

USE SUPPORT: SUPPORTING (15.2 MI)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF10)	Excellent (2009)

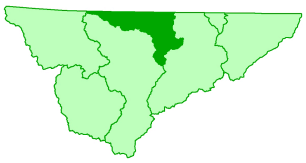
Big Beaver Island Creek is approximately 15 miles from source to the Dan River [AU#: 22-(28.5)]. The land cover in this area transitions from agriculture in the headwaters to forested land to more urban (residential and industrial) towards the creeks confluence with the Dan River.

Water Quality Status

A fish community sample was collected about a half mile upstream from its confluence with the Dan River. The habitat at this site was less than optimal with severe bank erosion in some places and a large debris dam at the end of the sampling reach. However, most of the bank vegetation and canopy were high quality.

The site was also sampled in 2004. At that time it received a rating of Good. The 2009 sample increased to an Excellent. This is due to the number of fish collected tripled from the previous sample. This can sometimes be a sign of nutrient enrichment if the species are mostly omnivores. That was not the case here. The sample showed a very diverse community which included the Federally Endangered Roanoke Logperch.

Mayo River (0301010304)



Includes: Mayo River [AU#: 22-30-(1), (5.5), (9.5) & (10)], **Crooked Creek** [AU#: 22-30-2-2], **Little Crooked Creek** [AU#: 22-30-2-2-2], **Hickory Creek** [AU#: 22-30-5] **& Pawpaw Creek** [AU#: 22-30-6-(2)]

This watershed contains a mix land use of agriculture, forest, residential and some urban areas. There are two minor and one major NPDES permitted facilities located within the watershed. There are no stream on the 2010 Impaired Waters List in this watershed.

Mayo River [AU#: 22-30-(1)]

There are three segments of the Mayo River within this watershed; however, only the first segment has been monitored during the past few cycles. This segment of the Mayo River is approximately four miles from the state line to half a mile down stream of the Hickory Creek [AU#: 22-30-5] confluence. Land cover along this segment is mostly forest and agriculture.

Use Support: Supporting (3.5 mi)	
2008 IR Cat.	5
2010 IR Cat.	2
Benthos (NB28)	Excellent (2009)
AMS (N140000)	Turbidity (10.2%)*

* This data will be reflected on the 2012 Impaired Waters list.

Water Quality Status

A benthic sampling station is located about a half mile downstream of the Virginia/North Carolina state line. The site has been sampled five times since 1989 and received a Good rating during every event except in 2009 when it received an Excellent rating. The increase in rating is due to the increase in EPT taxa richness or the diversity of pollution intolerant macroinvertebrates. This may be contributed to a reduction in nonpoint source runoff as a result of the prolonged drought.

An ambient monitoring station is located at the same place as the benthic station. Turbidity exceedances increased from 8.6% of samples exceeding the standard during the previous cycle to 10.2% exceeding during this cycle. This exceedance will cause this segment of the Mayo River to be listed on the Impaired Waters List for 2012. Copper and manganese levels were also elevated; however, only nine samples were collected. Fecal coliform bacteria exceedances were down by 10% from the previous cycle.

Recommendations

These sites will continue to be monitored by DWQ.

Crooked Creek [AU#: 22-30-2-2]

Crooked Creek begins in NC and flows in and out of the state twice before crossing back into Virginia to drain into the South Mayo River. The NC portion of the creek is approximately nine miles. Land cover in this drainage area starts with mostly agriculture in the headwaters and transitions to mostly forested area downstream.

Use Support: Supporting (8.5 mi)	
2008 IR Cat.	--
2010 IR Cat.	2
Fish Com (NF42)	Good-Fair (2007)
RAMS `07-`08 (N1360000)	No Exceedances

Hickory Creek [AU#: 22-30-5]

Hickory Creek is approximately four miles from source to the Mayo River [AU#: 22-30-(1)]. The majority of the drainage area is forest.

Use Support: Supporting (4.0 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Benthos (NB26)	Not Impaired (2006)

Water Quality Status

A benthic sample was taken in 2006 as part of a special study to develop biocriteria for small streams in North Carolina. The sample was given a Not Impaired rating since the studies proposed criteria has yet to be approved. Habitat was rated somewhat high (84 out of 100) and the benthic community showed no signs of being impacted.

Pawpaw Creek [AU#: 22-30-6-(2)]

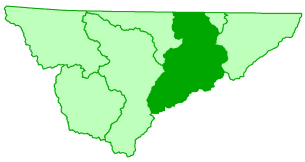
USE SUPPORT: SUPPORTING (1.8 MI)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF14)	Good (2009)

Pawpaw Creek is approximately 4.8 miles in total from the state line to the Mayo River [AU#: 22-30-(5.5)] and is split into two segments. Land cover in this drainage area is a mixture of agriculture and forest.

Water Quality Status

A fish community site has been monitored about a half mile upstream of Pawpaw Creek's confluence with the Mayo River since 1990. The last sample was taken in 2004 and resulted in a Good-Fair rating. The 2009 sample reflected some improvement in water quality with an increased rating of Good. There was a greater number of fish collected which were more diverse.

MATRIMONY CREEK-DAN RIVER (0301010305)



Includes: Dan River [AU#: 22-(28.5), (31.5)a, (31.5)b & (39)a], **Hogans Creek** [AU#: 22-31 & 22-31-1], **Brushy Creek** [AU#: 22-32-1], **Jacobs Creek** [AU#: 22-32-(0.5) & (3)], **Rock House Creek** [AU#: 22-34-(1) & (2)] **& Matrimony Creek** [AU#: 22-38]

This watershed contains a mix land use of agriculture, forest, residential and some urban areas. There are 35 minor NPDES permitted facilities and two permitted swine animal operations located within the watershed. There is one stream (Dan River) within this watershed that is on the 2010 Impaired Waters List.

Hogans Creek [AU#: 22-31]

USE SUPPORT: SUPPORTING (12.7 MI)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF11)	Excellent (2009)

Hogans Creek is approximately 13 miles total from source to the Dan River [AU#: 22-(28.5)]. Land cover in this drainage area is a mixture of agriculture, forest and residential areas. The majority of forested area is found along the streams edge and agricultural land is in the tributary headwaters.

Water Quality Status

About a mile upstream from the confluence with the Dan River, Hogans Creek has been monitored for the pass two sampling cycles. In 2004, the site rated Good and was designated as a regional reference site. The rating increased to an Excellent in 2009 due to a greater and more diverse community collected in the sample. During both sampling years, this site had the highest habitat score of any other fish site within the basin.

Local Initiatives

In 1997, the Caswell County Soil and Water Conservation District and the Wetlands Restoration Program conducted a stream restoration project on an unnamed tributary of Hogans Creek. Approximately 900 feet of stream was restored and expanded to 1,800 feet. DWQ conducted pre and post stream project data collections in 1996 and 1998. Since then, beavers have populated the restored area.

Jacobs Creek [AU#: 22-32-(3)]

USE SUPPORT: SUPPORTING (1.8 MI)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF12)	Good (2009)

Jacobs Creek is approximately 13 miles total from source to the Dan River [AU#: 22-(31.5)a] and is split into two segments. The drainage area of this segment consists of a mixed land cover of forest and agriculture.

Water Quality Status

A fish community monitoring station is located about a mile and a half upstream from the confluence with the Dan River. This site was sampled during the last two sampling cycles. The site scored a Good rating during both sampling events. However, the habitat score was the lowest (55 out of 100) in 2009 than any other site of the 2004 and 2009 fish community samples in this basin. One bank had been re-vegetated since 2004, but the stream still suffers from substantial nonpoint source erosion and sedimentation.

Rock House Creek [AU#: 22-34-(2)]

Use Support: Supporting (6.5 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Benthos (NB36)	Good-Fair (2001)
Fish Com (NF18)	Good (2009)

Rock House Creek is approximately eight miles total from source to the Dan River [AU#: 22-(31.5)b] and is split into two segments. Land cover in this drainage area is a mixture of forest, agriculture and urban area in the Town of Wentworth.

Water Quality Status

A little over a half mile upstream of the confluence with the Dan River is a fish community station that has been monitored during the last two sampling cycles. This location is also downstream of where the tributaries draining the Town of Wentworth enter Rock House Creek. The site scored a Good rating during both sampling events. In 2009, the site had high quality banks and riparian zones; however, the stream still exhibits substantial nonpoint source erosion impacts. The number and diversity of the fish collected had slightly increased from the 2004 sample. The significantly rare Roanoke Hogsucker was also collected during this cycle.

Recommendations

DWQ will monitor the benthic site (NB36) during the upcoming sampling cycle to determine any changes in water quality, if resources allow.

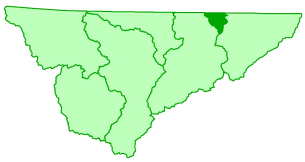
Matrimony Creek [AU#: 22-38]

Use Support: Supporting (11.2 mi)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF17)	Good (2004)

Matrimony Creek begins in NC, crosses into Virginia for roughly three to four miles before returning to NC. The NC portion of the creek is approximately 11 miles and drains into the Dan River [AU#: 22-(31.5)b]. Land cover in this drainage area is a mixture of agriculture, some forest and residential/urban area near the Town of Eden.

The 12-Digit subwatershed of Matrimony Creek (030101030505) is part of the WRIT study area within the Dan River drainage area. For more information see the Recommendations, Action Plans & Other Information at the Subbasin Scale section above.

Lower Smith River (0301010308)



Includes: Smith River [AU#: 22-40-(1), (2.5) & (3)]

This watershed contains a mix land use of urban, residential areas with some forested areas. There are no permitted facilities within the watershed. There is one stream (Smith River) within this watershed that is on the 2010 Impaired Waters List.

Smith River [AU#: 22-40-(1), (2.5) & (3)]

Use Support: Impaired (5.1 mi)	
2008 IR Cat.	5
2010 IR Cat.	5
Benthos (NB74)	Fair (1999)
AMS (N2430000)	Turbidity (10.0%) Copper (15.4%)

Smith River is approximately five miles from the state line to Dan River [AU#: 22-(39)a]. Land cover for the Smith River drainage area is mostly urban with some forested area near the state line. Smith Creek has been on the Impaired Waters List since 2002.

The 12-Digit subwatershed of Fall Creek-Smith Creek (030101030807) is part of the WRIT study area within the Dan River drainage area. For more information see the Recommendations, Action Plans & Other Information at the Subbasin Scale section above.

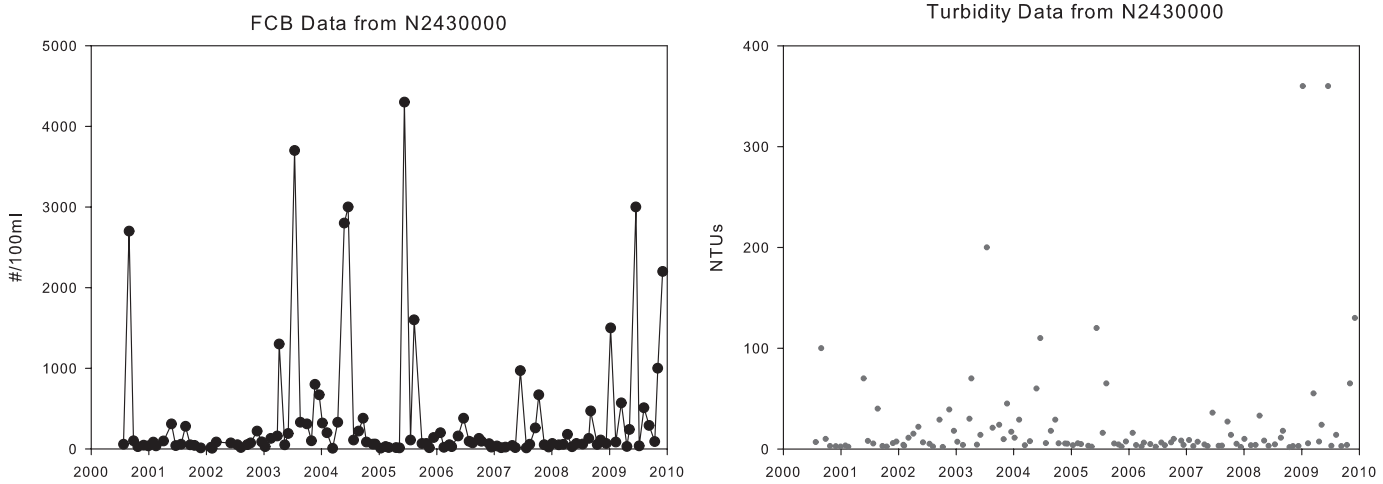
Water Quality Status

Smith River was first placed on the Impaired Waters List in 2002 due to a Fair benthic sample collected in 1999. Roughly two miles downstream of the state line is an ambient monitoring site. Samples collected between 2005 and 2009 showed elevated turbidity, fecal coliform bacteria and copper levels. The geometric mean of FCB between 2005 and 2009 decreased from data collected between 2000 and 2004; however, the

percent of samples over 400 colonies/100 ml increased (see Figure 1-21). Average turbidity levels as well as percent of samples exceeding the standard decreased. FCB and copper were added to the list of parameters exceeding state standards on the 2010 Impaired Waters List.

In 2009 a **Fecal Coliform Bacteria TMDL** was approved by EPA for the Smith and Dan Rivers. This is discussed in more detail in the **Dan River discussion**.

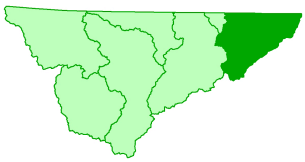
FIGURE 1-21: LONG TERM FCB & TURBIDITY SAMPLING AT N2430000 (2000-2010)



Recommendations

DWQ will monitor the benthic station on the Smith River to evaluate if there has been any biological improvements since 1999.

CASCADE CREEK-DAN RIVER (0301010309)



Includes: Dan River [AU#: 22-(39)a], **Wolf Island Creek** [AU#: 22-48] **& Birch Fork** [AU#: 22-48-4]

This watershed contains a mix land use of agriculture, forest, residential and some urban areas. There are 37 minor and four major NPDES permitted facilities located within the watershed. There is one stream (Dan River) within this watershed that is on the 2010 Impaired Waters List.

The 12-Digit subwatersheds Town Creek (030101030901) and Cascade Creek (030101030902) are part of the WRIT study area within the Dan River drainage area. For more information see the **Recommendations, Action Plans & Other Information at the Subbasin Scale** section above.

Wolf Island Creek [AU#: 22-48]

Wolf Island Creek is approximately 22 miles from source to the Dan River [AU#: 22-(39)a]. Land cover in this drainage area is mostly agriculture with some forest and residential area. The upper headwaters also drains a portion of the Town of Reidsville.

USE SUPPORT: SUPPORTING (21.8 MI)	
2008 IR Cat.	2
2010 IR Cat.	2
Fish Com (NF20)	Excellent (2009)

Water Quality Status

About a mile upstream from the streams confluence with Birch Fork Creek is a fish community site. This site had the most diverse community of any other fish community site in the basin. There is substantial nonpoint source erosion with channel and riparian bank instability which is responsible for the low habitat score. The diversity and large increase in the number of fish collected increased the site rating from a Good (2004) to an Excellent.

References

References marked with (*) indicates a DWQ special study report. These reports are not currently available online. Contact the DWQ Environmental Science Section at (919) 743-8400 to receive a hardcopy.

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Appendix 1-A

Use Support Ratings for All Monitored Waters in the Upper Dan River Subbasin

Draft 2010 IR Category	Integrated Reporting Categories for individual Assessment Unit/Use Support Category/ Parameter Assessments. A single AU can have multiple assessments depending on data available and classified uses.
1	All designated uses are monitored and supporting
1b	Designated use was impaired, other management strategy in place and no standards violations for the parameter of interest (POI)
1nc	DWQ have made field determination that parameter in exceedance is due to natural conditions
1r	Assessed as supporting watershed is in restoration effort status
1t	No criteria exceeded but approved TMDL for parameter of interest
2	Some designated uses are monitored and supporting none are impaired Overall only
2b	Designated use was impaired other management strategy in place and no standards violations Overall only
2r	Assessed as supporting watershed is in restoration effort status overall only
2t	No criteria exceeded but approved TMDL for POI Overall only
3a	Instream/monitoring data are inconclusive (DI)
3b	No Data available for assessment
3c	No data or information to make assessment
3n1	Chlorophyll a exceeds TL value and SAC is met-draft
3n2	Chlorophyll a exceeds EL value and SAC is not met first priority for further monitoring-draft
3n3	Chlorophyll a exceeds threshold value and SAC is not met first second priority for further monitoring-draft
3n4	Chlorophyll a not available determine need to collect-draft
3t	No Data available for assessment –AU is in a watershed with an approved TMDL
4b	Designated use impaired other management strategy expected to address impairment
4c	Designated use impaired by something other than pollutant
4cr	Recreation use impaired no instream monitoring data or screening criteria exceeded
4cs	Shellfish harvesting impaired no instream monitoring data- no longer used
4ct	Designated use impaired but water is subject to approved TMDL or under TMDL development
4s	Impaired Aquatic Life with approved TMDL for Aquatic Life POI or category 5 listing
4t	Designated use impaired approved TMDL
5	Designated use impaired because of biological or ambient water quality standards violations and needing a TMDL
5r	Assessed as impaired watershed is in restoration effort status

NC 2010 Integrated Report

All 13,123 Waters in NC are in Category 5-303(d) List for Mercury due to statewide fish consumption advice for several fish species

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year

Roanoke River Basin — **Little Dan River-Dan River Watershed** — **0301010301**

Roanoke River Basin — Dan River Headwaters Subbasin — 03010103

Roanoke River Basin — **Little Dan River-Dan River Watershed** — **0301010301**

22-2	**Archies Creek**	North Carolina portion	**7.3**	**FW Miles**	C;Tr
1	**Ecological/biological Integrity FishCom**	Excellent Bioclassification	Aquatic Life	2004	
22-9	**Big Creek**	From source to Dan River	**19.9**	**FW Miles**	C;Tr
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	
22-12-(2)b	**Cascade Creek**	From dam at swimming lake to Dan River	**4.3**	**FW Miles**	B
1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2005	
22-12-(2)a	**Cascade Creek (Hanging Rock Lake)**	From backwaters to dam at swimming lake	**12.2**	**FW Acres**	B
1	**Water Quality Standards Aquatic Life**	No Criteria Exceeded	Aquatic Life	2008	
22-(1)a	**DAN RIVER (North Carolina portion)**	From North Carolina-Virginia State Line to Little Dan River	**5.1**	**FW Miles**	C;Tr
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	
22-(1)b	**DAN RIVER (North Carolina portion)**	From Little Dan River to Peters Creek	**11.6**	**FW Miles**	C;Tr
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2004	
1	**Fecal Coliform (recreation)**	No Criteria Exceeded	Recreation	2008	
3a	**High Water Temperature**	Potential Standards Violation	Aquatic Life	2008	
5	**Turbidity**	Standard Violation	Aquatic Life	2008	2008
22-5	**Elk Creek**	From North Carolina-Virginia State Line to Dan River	**2.9**	**FW Miles**	C;Tr
1	**Ecological/biological Integrity FishCom**	Good-Fair Bioclassification	Aquatic Life	2004	
22-13-(2)	**Indian Creek**	From Window Falls to Dan River	**2.7**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2005	
22-18	**Mill Creek**	From source to Dan River	**4.7**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2005	
22-10	**North Double Creek**	From source to Dan River	**14.0**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Good Bioclassification	Aquatic Life	2004	
1	**Ecological/biological Integrity FishCom**	Good-Fair Bioclassification	Aquatic Life	2004	
22-6	**Peters Creek**	From North Carolina-Virginia State Line to Dan River	**9.1**	**FW Miles**	C;Tr
1	**Ecological/biological Integrity FishCom**	Excellent Bioclassification	Aquatic Life	2004	

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AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year

Roanoke River Basin — **Little Dan River-Dan River Watershed** — **0301010301**

22-11	**South Double Creek**	From source to Dan River	**9.9**	**FW Miles**	B
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	

Roanoke River Basin — **Town Fork Creek Watershed** — **0301010302**

22-25-1	**Brushy Fork Creek**	From source to Town Fork Creek	**3.0**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Good Bioclassification	Aquatic Life	2004	
22-25a	**Town Fork Creek**	From source to Timmons Cr.	**8.0**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Good Bioclassification	Aquatic Life	2004	
22-25b	**Town Fork Creek**	From Timmons Cr. to Dan River	**18.0**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Good Bioclassification	Aquatic Life	2004	
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	

Roanoke River Basin — **Belews Lake-Dan River Watershed** — **0301010303**

22-27-(7)	**Belews Creek (including Belews Lake below elevation 725) (1)**	From Southern Railroad Bridge to to a point 1.8 mile downstream of Forsyth-Stokes County Line	**789.7**	**FW Acres**	C
1	**Water Quality Standards Aquatic Life**	No Criteria Exceeded	Aquatic Life	2008	
22-27-(7.5)	**Belews Creek (including Belews Lake below elevation 725) (1)**	From a point 1.8 mile downstream of the Forsyth-Stokes County Line to Dan River, excluding the Arm of Belews Lake described below which are classified "WS-IV&B"	**1,283.8**	**FW Acres**	WS-IV
1	**Water Quality Standards Aquatic Life**	No Criteria Exceeded	Aquatic Life	2008	
1	**Water Quality Standards Water Supply**	No Criteria Exceeded	Water Supply	2008	
22-27-(1.5)	**Belews Creek (Kernersville Lake)**	From a point 0.5 mile upstream of backwaters of Kernersville Lake to Town of Kernersville Water Supply Dam	**46.1**	**FW Acres**	WS-IV;CA
3n	**Chlorophyll a**	Potential Standards Violation	Aquatic Life	2008	
1	**Water Quality Standards Water Supply**	No Criteria Exceeded	Water Supply	2008	
22-29	**Big Beaver Island Creek**	From source to Dan River	**15.2**	**FW Miles**	C
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	
22-(8)	**DAN RIVER**	From Big Creek to to a point 0.2 mile downstream of Town Fork Creek	**25.9**	**FW Miles**	WS-V
1	**Ecological/biological Integrity Benthos**	Good Bioclassification	Aquatic Life	2004	

NC 2010 Integrated Report

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AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year

Roanoke River Basin — Belews Lake-Dan River Watershed — 0301010303

22-20-9	Lynn Branch (Lynn Creek)	From source to Snow Creek	3.1 FW Miles	C	
1	Ecological/biological Integrity Benthos	Not Impaired Bioclassification	Aquatic Life	2005	
22-20-4	Raccoon Creek	From source to Snow Creek	3.4 FW Miles	C	
1	Ecological/biological Integrity Benthos	Not Impaired Bioclassification	Aquatic Life	2005	
22-20	Snow Creek	From source to Dan River	18.9 FW Miles	C	
1	Ecological/biological Integrity Benthos	Good Bioclassification	Aquatic Life	2004	
1	Ecological/biological Integrity FishCom	Good Bioclassification	Aquatic Life	2004	
22-27-9-(4)	West Belews Creek (West Belews Creek Arm of of Belews Lake below elevation 725)	From a point 0.4 mile downstream of Powerplant to Belews Creek	582.4 FW Acres	WS-IV	
1	Water Quality Standards Aquatic Life	No Criteria Exceeded	Aquatic Life	2008	
1	Water Quality Standards Water Supply	No Criteria Exceeded	Water Supply	2008	
22-21	Wood Benton Branch	From source to Dan River	3.7 FW Miles	C	
1	Ecological/biological Integrity Benthos	Not Impaired Bioclassification	Aquatic Life	2005	

Roanoke River Basin — Mayo River Watershed — 0301010304

22-30-2-2	Crooked Creek (North Carolina portion)	From source to last crossing of North Carolina-Virginia State Line	8.5 FW Miles	C	
1	Ecological/biological Integrity FishCom	Good-Fair Bioclassification	Aquatic Life	2007	
1	Water Quality Standards Aquatic Life	No Criteria Exceeded	Aquatic Life	2008	
22-30-5	Hickory Creek	From source to Mayo River	4.0 FW Miles	C	
1	Ecological/biological Integrity Benthos	Not Impaired Bioclassification	Aquatic Life	2006	
22-30-2-2-2	Little Crooked Creek	From source to Crooked Creek	4.7 FW Miles	C	
1	Ecological/biological Integrity Benthos	Good Bioclassification	Aquatic Life	2008	
22-30-(1)	Mayo River	From North Carolina-Virginia State Line to a point 0.6 mile downstream of Hickory Creek	3.5 FW Miles	WS-V	
1	Ecological/biological Integrity Benthos	Good Bioclassification	Aquatic Life	2004	
1	Fecal Coliform (recreation)	No Criteria Exceeded	Recreation	2008	
1	Water Quality Standards Aquatic Life	No Criteria Exceeded	Aquatic Life	2008	
1	Water Quality Standards Water Supply	No Criteria Exceeded	Water Supply	2008	

NC 2010 Integrated Report

All 13,123 Waters in NC are in Category 5-303(d) List for Mercury due to statewide fish consumption advice for several fish species

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year

Roanoke River Basin — **Mayo River Watershed** — **0301010304**

22-30-6-(2)	**Pawpaw Creek**	From a point 1.3 mile upstream of Rockingham County SR 1360 to Mayo R.	**1.8 FW Miles**		WS-IV
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	

Roanoke River Basin — **Matrimony Creek-Dan River Watershed** — **0301010305**

22-32-1	**Brushy Creek (West Prong Jacobs Creek)**	From source to Jacobs Creek	**4.3 FW Miles**		C
1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2007	
22-(31.5)a	**DAN RIVER**	From a point 0.7 mile upstream of Jacobs Creek to subbasin 03-02-02/03 boundary	**4.8 FW Miles**		WS-IV
4t	**Fecal Coliform (recreation)**	No Criteria Exceeded	Recreation	2008	2008
4t	**Turbidity**	Data Inconclusive	Aquatic Life	2008	2002
1	**Water Quality Standards Aquatic Life**	No Criteria Exceeded	Aquatic Life	2008	
1	**Water Quality Standards Water Supply**	No Criteria Exceeded	Water Supply	2008	
22-(31.5)b	**DAN RIVER**	From 03-02-02 boundary to a point 0.8 mile downstream of Matrimony Creek	**9.4 FW Miles**		WS-IV
4t	**Fecal Coliform (recreation)**	Standard Violation	Recreation	2008	2008
4t	**Turbidity**	Data Inconclusive	Aquatic Life	2008	2002
1	**Water Quality Standards Aquatic Life**	No Criteria Exceeded	Aquatic Life	2008	
1	**Water Quality Standards Water Supply**	No Criteria Exceeded	Water Supply	2008	
22-(38.5)	**DAN RIVER**	From a point 0.8 mile downstream of Matrimony Creek to Mill Branch (Town of Eden water supply intake)	**0.6 FW Miles**		WS-IV;CA
4t	**Fecal Coliform (recreation)**	Standard Violation	Recreation	2008	2008
5	**Turbidity**	Standard Violation	Aquatic Life	2008	2008
22-31	**Hogans Creek**	From source to Dan River	**12.7 FW Miles**		C
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	
22-32-(3)	**Jacobs Creek**	From N.C. Hwy. 704 to Dan River	**1.8 FW Miles**		WS-IV
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	
22-38	**Matrimony Creek (North Carolina portion)**	From source to Dan River	**11.2 FW Miles**		WS-IV
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	

NC 2010 Integrated Report

All 13,123 Waters in NC are in Category 5-303(d) List for Mercury due to statewide fish consumption advice for several fish species

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year

Roanoke River Basin — Matrimony Creek-Dan River Watershed — 0301010305

◉ 22-30-(10)	Mayo River	From dam at Mayodan Water Supply Intake to Dan River	2.4	FW Miles	C

1	Ecological/biological Integrity Benthos	Good-Fair Bioclassification	Aquatic Life	1999	

◉ 22-34-(2)	Rock House Creek	From Rockingham Countly SR 2381 to Dan River	6.5	FW Miles	WS-IV

1	Ecological/biological Integrity Benthos	Good-Fair Bioclassification	Aquatic Life	2001	
1	Ecological/biological Integrity FishCom	Good Bioclassification	Aquatic Life	2004	

Roanoke River Basin — Lower Smith River Watershed — 0301010308

◉ 22-40-(1)	Smith River	From North Carolina-Virginia State Line to a point 0.8 mile downstream of Rockingham County SR 1714 (Aiken Road)	2.8	FW Miles	WS-IV

5	Copper	Standard Violation	Aquatic Life	2008	2008
4s	Ecological/biological Integrity Benthos	Fair Bioclassification	Aquatic Life	1999	2008
4t	Fecal Coliform (recreation)	Standard Violation	Recreation	2008	2008
1	Water Quality Standards Water Supply	No Criteria Exceeded	Water Supply	2008	

◉ 22-40-(2.5)	Smith River	From a point 0.8 mile downstream of Rockingham County SR 1714 (Aiken Road) to Fieldcrest Mills Water Supply Intake	0.5	FW Miles	WS-IV;CA

5	Copper	Standard Violation	Aquatic Life	2008	2008
4s	Ecological/biological Integrity Benthos	Fair Bioclassification	Aquatic Life	1999	2008
4t	Fecal Coliform (recreation)	Standard Violation	Recreation	2008	2008
1	Water Quality Standards Water Supply	No Criteria Exceeded	Water Supply	2008	

Roanoke River Basin — Cascade Creek-Dan River Watershed — 0301010309

◉ 22-48-4	Birch Fork	From source to Wolf Island Creek	8.4	FW Miles	C

1	Ecological/biological Integrity Benthos	Not Impaired Bioclassification	Aquatic Life	2007	

◉ 22-(39)a	DAN RIVER (North Carolina portion)	From Mill Branch to NC/VA crossing downstream of Wolf Island Creek	13.8	FW Miles	C

4t	Fecal Coliform (recreation)	Standard Violation	Recreation	2008	2008
5	Turbidity	Standard Violation	Aquatic Life	2008	2008

◉ 22-40-(3)	Smith River	From Fieldcrest Mills Water Supply Intake to Dan River	1.8	FW Miles	C

5	Copper	Standard Violation	Aquatic Life	2008	2008
4s	Ecological/biological Integrity Benthos	Fair Bioclassification	Aquatic Life	1999	2008
4t	Fecal Coliform (recreation)	Standard Violation	Recreation	2008	2008

NC 2010 Integrated Report

All 13,123 Waters in NC are in Category 5-303(d) List for Mercury due to statewide fish consumption advice for several fish species

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year

Roanoke River Basin — **Cascade Creek-Dan River Watershed** — **0301010309**

⊙	**22-48**	**Wolf Island Creek**	From source to Dan River	**21.8 FW Miles**	C

1	**Ecological/biological Integrity FishCom**	Excellent Bioclassification	Aquatic Life	2004

Appendix 1-B

Biological Sampling Site Data Sheets (Benthic Macroinvertebrate & Fish Community) for the Upper Dan River Subbasin

Biological Samples Taken During this Assessment Cycle

Station ID	Waterbody	County	Site Location	Sample Results
Benthic Sample Sites				
NB101	WOOD BENTON BR	STOKES	SR 1707	05 - Not Impaired
NB114	BIRCH FK	ROCKINGHAM	SR 1912	07 - Not Impaired
NB115	BRUSHY CR	ROCKINGHAM	SR 2321	07 - Not Impaired
NB120	L CROOKED CR	Stokes	SR 1622	08 - Good
NB15	N DOUBLE CR	STOKES	SR 1504	09 - Good
NB17	SNOW CR	STOKES	SR 1673	09 - Good
NB26	HICKORY CR	ROCKINGHAM	SR 1354	06 - Not Impaired 05 - Not Impaired
NB28	MAYO R	ROCKINGHAM	SR 1358	09 - Excellent 09 - Excellent
NB33	INDIAN CR	STOKES	SR 1001	05 - Not Impaired
NB4	CASCADE CR	STOKES	SR 2012	05 - Not Impaired
NB41	LYNN BR	STOKES	SR 1696	05 - Not Impaired
NB63	RACOON CR	STOKES	STEELE RD	05 - Not Impaired
NB8	DAN R	STOKES	NC 704	09 - Excellent
NB9	DAN R	STOKES	SR 1695	09 - Good
NB97	UT MILL CR	STOKES	SR 2018	05 - Not Impaired
Fish Community Sample Sites				
NF1	Archies Cr	Stokes	SR 1415	09 - Excellent
NF10	Big Beaver Island Cr	Rockingham	US 311	09 - Excellent
NF11	Hogans Cr	Rockingham	NC 704	09 - Excellent
NF12	Jacobs Cr	Rockingham	NC 704	09 - Good
NF14	Pawpaw Cr	Rockingham	SR 1360	09 - Good
NF18	Rock House Cr	Rockingham	SR 2127	09 - Good
NF2	Big Cr	Stokes	SR 1471	09 - Good-Fair
NF20	Wolf Island Cr	Rockingham	SR 1767	09 - Excellent
NF4	Elk Cr	Stokes	SR 1433	09 - Good
NF42	Crooked Cr	Stokes	off SR 1626	07 - Good-Fair
NF5	N Double Cr	Stokes	SR 1504	09 - Good
NF6	Peters Cr	Stokes	SR 1497	09 - Good
NF7	S Double Cr	Stokes	SR 1483	09 - Good
NF8	Snow Cr	Stokes	SR 1652	09 - Good-Fair
NF9	Town Fork Cr	Stokes	SR 1955	09 - Good

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
DAN R	**NC 704**	**NB8**	**08/10/09**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.514722	-80.303056	22-(1)b	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr	169.0	886	19	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10 (road/boat access)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	26.0
Dissolved Oxygen (mg/L)	10.8
Specific Conductance (µS/cm)	49
pH (s.u.)	8.2
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	8
Pool Variety (10)	10
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	92

Site Photograph

Substrate Mix of boulder, cobble, gravel, sand, and silt.

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/09	10747	106	52	4.16	3.38	Excellent
07/07/04	9403	91	45	3.89	3.42	Excellent
08/23/99	7981	85	41	4.17	3.26	Good
08/23/94	6686	57	28	3.85	3.51	Good
07/12/90	5379	94	48	4.46	3.65	Excellent

Taxonomic Analysis

Several intolerant macroinvertebrate taxa were collected at this sampling location such as the mayflies *Epeorus vitreus* , *Seratella serratoides* , and *Ephoron leukon* ; the long-lived stoneflies *Acroneuria abnormis* , *Paragnetina ichusa/media* , and P*teranarcys spp* .; and the caddisflies *Brachycentrus appalachia* , *B. lateralis* , *B. numerosus, and Goera spp* . Rarely collected taxa found at this site included *Brachycercus spp.* and *Brachycentrus lateralis.* Aquatic beetle fauna were extremely rich (13) at this sampling location.

Data Analysis

This portion of the Dan River continues to reflect Excellent water quality based on macroinvertebrate communities. The NCBI and EPTBI has remained low at the site since sampling began in 1984 and the highest total taxa richness (106) and EPT taxa richness (52) on record at this sample site was collected during the 2009 season. EPT abundance was also high at 216. This portion of the Dan River in North Carolina is relatively undisturbed by metropolitan areas found furthur downstream. A pollution intolerant macroinvertebrate community continues to reside at this sampling location. If requested, this site qualifies for reclassification as an Outstanding Resource Water or High Quality Water due to continued Excellent bioclassifications.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
DAN R	SR 1695	NB9	08/11/09	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.401944	-80.138333	22-(8)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-V	335.0	700	40	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	10	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (℃)	27.8
Dissolved Oxygen (mg/L)	10.5
Specific Conductance (µS/cm)	53
pH (s.u.)	7.2

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	7
Bank Erosion (7)	6
Bank Vegetation (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	78

Site Photograph

Substrate Mostly bedrock, boulder, and cobble with less gravel and sand.

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/11/09	10749	100	42	4.62	3.82	Good
07/07/04	9404	87	43	4.89	4.07	Good
08/23/99	7984	72	37	4.56	3.93	Good
08/23/94	6688	45	20	4.74	3.83	Good-Fair

Taxonomic Analysis

Several intolerant EPT taxa were collected including the mayflies *Epeorus vitreus*, *Ephoron leukon*, and *Serratella serratoides*; the stoneflies *Acroneuria abnormis* and *Paragnetina fumosa*; and the caddisflies *Brachycentrus lateralis* and *Polycentropus spp.* The intolerant beetles *Optioservus trivittatus*, *Promoresia elegans*, and *Psephenus herricki* were also common. Rare EPT taxa collected at this sampling station inluded *Trycorythodes robacki* and *Ceraclea mentiea* listed as "vulnerable to extirpation" by Morse *et al.* (1997) and Significantly Rare by the North Carolina Natural Heritage Program (2006) respectively.

Data Analysis

This site continues to exhibit Good water quality based on macroinvertebrate fauna. The NCBI and EPTBI has remained relatively similar since sampling began in 1994. Total taxa richness and EPT taxa richness steadily increased beginning in 1999 elevating the bioclassification from Good-Fair to Good; where it has remained. Consistent good water quality at the site is likely attributed to the mostly forested upstream land use with minimal anthropogenic activities.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
N DOUBLE CR	SR 1504	NB15	08/10/09	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.440000	-80.311020	22-10	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	12.0	785	8	0.1

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	10	20	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (℃)	22.3
Dissolved Oxygen (mg/L)	10.3
Specific Conductance (µS/cm)	58
pH (s.u.)	6.4

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	14
Pool Variety (10)	10
Riffle Habitat (16)	7
Bank Erosion (7)	5
Bank Vegetation (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	83

Site Photograph

Substrate Mostly gravel and sand with some cobble substrate.

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/09	10746	---	31	---	4.27	Good
06/28/04	9396	---	31	---	3.42	Good
08/23/99	7982	---	25	---	3.95	Good-Fair
08/23/94	6687	---	17	---	5.05	Fair

Taxonomic Analysis

Various pollution sensitive EPT taxa were collected at this monitoring station in 2009 including the stoneflies *Acroneuria abnormis*, *Leuctra spp*, and *Tallaperla spp*. *Tallaperla* has never been collected at this station. The intolerant mayflies *Leucrocuta spp*, *Heptagenia marginalis*, and *Stenacron pallidum* were common. Pollution-sensitive caddisflies such as *Chimarra spp*. and *Polycentropus spp*. were abundant and common respectively. The rarely collected mayfly *Seratella serrata* was also collected in 2009.

Data Analysis

This stream retained its bioclassification of Good in 2009 suggesting minimal upstream pollution input. EPT richness remained the same as in 2004, however, EPTBI was elevated. This higher EPTBI may be due to the emergence of some intolerant taxa found in 2004 such as *Pycnopsyche spp*. Empty *Pycnopsyche spp.* cases were found at the site suggesting the insects had already emerged preventing collection. Despite the presence of small infrequent riffles, this station continues to exhibit good water quality most likely due to minimal anthropogenic input and a mostly forested catchment.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
SNOW CR	**SR 1673**	**NB17**	**08/10/09**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.434444	-80.147778	22-20	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	34.0	650	11	0.1

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	10	0	30

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (℃)	27.2
Dissolved Oxygen (mg/L)	9.5
Specific Conductance (µS/cm)	80
pH (s.u.)	6.8

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	8
Pool Variety (10)	8
Riffle Habitat (16)	5
Bank Erosion (7)	3
Bank Vegetation (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	68

Site Photograph

Substrate Mostly sand with minimal cobble and gravel.

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/09	10748	---	29	---	4.48	Good
07/07/04	9405	---	31	---	4.33	Good
09/13/00	8308	---	29	---	4.08	Good
08/23/99	7983	---	18	---	4.29	Fair
08/23/94	6689	---	22	---	4.04	Good-Fair

Taxonomic Analysis

Both mayfly and caddisfly taxa new to this location were collected in 2009 including the caddislfies *Brachycercus spp* and *Glossosoma spp.* These macroinvertebrates are considered sensitive to pollution and usually are not present in degraded water quality conditions. Additionally, the moderately caddisfly intolerant *Polycentropus spp* was common at this site consistent with samples collected since 2000. *Leuctra spp* was the only stonefly collected at this location.

Data Analysis

The bioclassification at this site has remained Good since 2000. It was reassessed following the Fair rating it received in 1999 pending its addition to the 303(d) list. The EPTBI in 2009 is slightly elevated compared to past samples, however, EPT taxa richness has remained consistent between 29 and 31 beginning in 2000. Overall, water quality has improved at the site since 1999 when presumably this location suffered from low flows and/or temporary bridge construction impacts. No NPDES dischargers are currently active upstream from this macroinvertebrate monitoring station.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
MAYO R	SR 1358	NB28	08/11/09	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Rockingham	2	03010103	36.535520	-79.990620	22-30-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-V	261.0	720	40	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100	0	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (℃)	26.6
Dissolved Oxygen (mg/L)	10.2
Specific Conductance (µS/cm)	53
pH (s.u.)	7.3

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	89

Site Photograph

Substrate Mostly bedrock and rubble with some boulders, gravel, and sand.

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/11/09	10807	91	48	4.03	3.37	Excellent
07/08/04	9406	78	33	4.74	4.13	Good
08/23/99	7985	70	32	4.27	3.45	Good
08/22/94	6685	64	38	3.58	3.20	Good
08/08/89	5035	79	42	4.79	4.00	Good

Taxonomic Analysis

In 2009, a diverse macroinvertebrate community was observed at this sampling location. EPT richness (48) was the highest yet recorded during Basinwide sampling at this site. Many intolerant EPT taxa were collected including but not limited to the mayflies *Drunella allegheniensis*, *Epeorus vitreus*, and *Serratella serratoides*; the stoneflies *Leuctra spp*, *Paragnetina fumosa*, and *Pteranarcys spp, and* the caddisflies *Brachycentrus lateralis*, *B. nigrosoma*, *B. numerosus*, *Ceraclea mentiea*, *Micrasema wataga*, and *M. bennetti*. Rarely collected EPT taxa included *Heterocloeon petersi*, *Rhithrogena spp*., *Brachycentrus lateralis* and *Ceraclea mentiea*. Intolerant beetles present included *Promeresia elegans*, *Psephenus herricki*, *Optioservus ovalis*, and *O. trivittatus*.

Data Analysis

The Mayo River Basinwide sampling location received a bioclassification of Excellent in 2009 suggesting an improvement in water quality from past benthic samples. This may reflect a reduction in non point pollution inputs as a result of the prolonged drought. The NCBI and EPTBI has remained stable throughout basinwide sampling at this location, however, total taxa richness and EPT taxa richness increased significantly in 2009 compared to past samples. A history of Good ratings (1989-2004) and recent Excellent rating (2009) suggests improved water quality and very little anthropogenic activity upstream. Further sampling should occur in the near future to determine if macroinvertebrate fauna continue to reflect improved water quality at this location. The presence of so many intolerant and rare taxa in this stretch of river suggests further investigation(s) are needed to assess its potential for reclassification.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
ARCHIES CR	SR 1415	05/11/09	NF1	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.55	-80.43277778	22-2	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	9.3	1180	7	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	70	5	25	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	15.3
Dissolved Oxygen (mg/L)	9.2
Specific Conductance (µS/cm)	49
pH (s.u.)	6.0

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	**93**

Site Photograph

Substrate Bedrock, cobble, boulder, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/11/09	2009-28	22	54	Excellent
04/19/04	2004-09	21	54	Excellent

Most Abundant Species 2009 Redlip Shiner (23%), Bluehead Chub (21%)

Exotic Species 2009 Brown Trout, Smallmouth Bass

Species Change Since Last Cycle **Gains** -- Brown Trout (n=1). **Losses** -- none.

Data Analysis

Watershed -- drains southern Patrick County, VA and a very small portion of the extreme northwest corner of Stokes and northeastern Surry counties; no municipalities in the watershed; tributary to the Dan River; site is ~ 0.7 miles upstream of the creek's confluence with the river. **Habitats** -- very high quality instream and riparian habitats, site would have qualified as a regional reference site except the watershed landuse did not appear to be as greatly forested (~ 50 %) as required to meet the criteria (≥ 70 %). **Water Quality** -- specific conductance has always been low (37 and 49 µS/cm). **2009** -- greatest number of intolerant species (n=4) and lowest percentage of tolerant fish (3%) of any site in 2009; not a NCWRC Hatchery Supported Trout waters, but one stocked Brook Trout, 200 mm TL was collected. **2004 & 2009** -- 22 species known from the site, including 5 species of darters and the endemic Cutlip Minnow [Special Concern], Roanoke Hogsucker [Significantly Rare], Blacktip Jumprock, and Riverweed Darter [Special Concern]; dominant species are the Bluehead Chub and Redlip Shiner. Based on this site's most recent Excellent rating, the site qualifies at minimum for High Quality Waters (HQW) designation.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
ELK CR	**SR 1433**	**05/11/09**	**NF4**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.52388889	-80.3075	22-5	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	8.5	890	7	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	75	25	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	15.3
Dissolved Oxygen (mg/L)	9.2
Specific Conductance (µS/cm)	48
pH (s.u.)	6.3
Water Clarity	Slightly turbid, easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	16
Erosion (7)	6
Bank Vegetation (7)	3
Light Penetration (10)	4
Left Riparian Score (5)	1
Right Riparian Score (5)	2
Total Habitat Score (100)	**75**

Site Photograph

Substrate Bedrock, boulder, cobble, gravel, silt, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/11/09	2009-29	18	52	Good
04/20/04	2004-13	21	44	Good-Fair

Most Abundant Species 2009 Bluehead Chub (34%)

Exotic Species 2009 Smallmouth Bass

Species Change Since Last Cycle

Gains -- White Sucker, Northern Hogsucker. **Losses** -- Mountain Redbelly Dace, Cutlip Minnow, Creek Chub, Golden Redhorse, Brown Trout. All species gained or lost were represented by 1 fish/species, except for Golden Redhorse and White Sucker (n=5 and 8, respectively).

Data Analysis

Watershed -- drains primarily southern Patrick County, VA and a very small portion of northwestern Stokes County; no municipalities in the watershed; tributary to the Dan River, site is ~ 0.8 miles above the creek's confluence with the river. **Habitats** -- high gradient stream with plunge pools and riffles; narrow riparian zones offering minimal shading to the stream, banks have re-vegetated since 2004. **Water Quality** -- specific conductance has always been low (41 and 48 µS/cm). **2009** -- a slight increase in the diversity of suckers and a greater abundance of piscivores (i.e., Smallmouth Bass) were largely responsible for the improved NCIBI score and rating; other metrics were unchanged. **2004 & 2009** -- 23 species known from the site, including 5 species of darters, 4 species of suckers, the endemic Cutlip Minnow [Special Concern], Roanoke Hogsucker [Significantly Rare], and Riverweed Darter [Special Concern], but only one species of sunfish; dominant species is the Bluehead Chub.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
PETERS CR	**SR 1497**	**05/12/09**	**NF6**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.49388889	-80.27138889	22-6	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	28.6	830	11	0.4	Yes

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	75	0	25	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	12.5
Dissolved Oxygen (mg/L)	11.2
Specific Conductance (µS/cm)	57
pH (s.u.)	5.4

Water Clarity: Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	11
Erosion (7)	4
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**83**

Site Photograph

Substrate: Cobble, boulder, gravel, sand, silt.

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/12/09	2009-30	27	50	Good
04/21/04	2004-14	24	54	Excellent

Most Abundant Species 2009: Bluehead Chub (24%)

Exotic Species 2009: Bluegill

Species Change Since Last Cycle

Gains -- Central Stoneroller, Bull Chub, Golden Shiner, Northern Hogsucker, Golden Redhorse, V-lip Redhorse. **Losses** -- Bigeye Jumprock, Smallmouth Bass, Chainback Darter. All species gained or lost were represented by 1or 2 fish/species, except for V-Lip Redhorse, Golden Redhorse, and Central Stoneroller (n=6, 7, and 19, respectively).

Data Analysis

Watershed -- drains a portion of the southern part of Patrick County, VA and north-central Stokes County; no municipalities in the watershed; tributary to the Dan River, site is ~ 1.9 miles above the creek's confluence with the river. **Habitats** -- a regional reference site; riffles, deep snag pools; good canopy over the stream. **Water Quality** -- pH less than the water quality standard of 6.0 s.u. **2009** -- 6 species of suckers collected, the most of any site in 2009 (Wolf Island Creek also had 6 species); the loss of the intolerant Bigeye Jumprock [State Threatened], and the intolerant Smallmouth Bass were responsible for the decline in the NCIBI score and rating; other metrics were unchanged. **2004 & 2009** -- very diverse community, 30 species known from the site, including 7 species of suckers, 6 species of darters and the endemic Roanoke Hogsucker [Significantly Rare], Bigeye Jumprock, Blacktip Jumprock, and Riverweed Darter [Special Concern]; the loss of the Bigeye Jumprock and Smallmouth Bass and the decline from Excellent to Good warrants additional monitoring in 2014.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BIG CR	SR 1471	05/13/09	NF2	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.4725	-80.34888889	22-9	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	32.7	890	8	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	75	5	20	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	13.7
Dissolved Oxygen (mg/L)	13.0
Specific Conductance (µS/cm)	52
pH (s.u.)	6.0

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	5
Pool Variety (10)	10
Riffle Habitat (16)	7
Erosion (7)	4
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**73**

Site Photograph

Substrate Sand, gravel, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/13/09	2009-33	19	42	Good-Fair
04/20/04	2004-10	17	48	Good

Most Abundant Species 2009 Bluehead Chub (47%)

Exotic Species 2009 Bluegill

Species Change Since Last Cycle

Gains -- Central Stoneroller, White Shiner, Mountain Redbelly Dace, Blacktip Jumprock, Flat Bullhead. **Losses** -- Green Sunfish, Riverweed Darter, Roanoke Darter. All species gained or lost were represented by 1-9 fish/species.

Data Analysis

Watershed -- drains eastern Surry and northwestern Stokes counties; no municipalities in the watershed; tributary to the Dan River. **Habitats** -- gravel riffles, runs, pools, woody debris, bank erosion is moderate to severe in places. **Water Quality** -- dissolved oxygen saturation at 125% indicating high early morning periphyton production. **2009** -- more than twice as many fish collected in 2009 than in 2004 (888 *vs*. 413), primarily Bluehead Chub and Crescent Shiner; highest percentage of omnivores+ herbivores of any site (49%, indicative of non-point source nutrient enrichment; the loss of two intolerant darters, Roanoke Darter and Riverweed Darter, and one species of sunfish were responsible for the decline in the NCIBI score and rating. **2004 & 2009** -- 22 species known from the site, including 4 species of darters and the endemic Roanoke Hogsucker [Significantly Rare], Blacktip Jumprock, and Riverweed Darter [Special Concern]; dominant species is the Bluehead Chub.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
N DOUBLE CR	SR 1504	05/12/09	NF5	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.43972222	-80.31111111	22-10	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	12.4	790	8	0.4	Yes

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	75	15	10	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	15.0
Dissolved Oxygen (mg/L)	10.2
Specific Conductance (µS/cm)	52
pH (s.u.)	6.1

Water Clarity: Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	8
Riffle Habitat (16)	12
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**73**

Site Photograph

Substrate: Sand, gravel, some cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/12/09	2009-32	20	50	Good
04/20/04	2004-11	18	42	Good-Fair

Most Abundant Species 2009: Bluehead Chub (32%), Crescent Shiner (25%)

Exotic Species 2009: Bluegill

Species Change Since Last Cycle: **Gains** -- Satinfin Shiner, Golden Redhorse, Bluegill, Roanoke Darter. **Losses** -- Flat Bullhead, Largemouth Bass. All species gained or lost were represented by 1-5 fish/species.

Data Analysis

Watershed -- drains west-central Stokes County; no municipalities in the watershed; tributary to the Dan River, site is ~ 2.7 miles upstream of the creek's confluence with the river. **Habitats** -- a regional reference site; primarily gravel/sand runs; one riffle at the upper end, some snags, undercuts; high quality riparian zone on the right. **2009** -- the number of fish collected in 2009 was ~ 1.5 times more than in 2004 (811 vs. 539), primarily Crescent Shiner which increased almost 10-fold; the slight increase in the diversity of suckers and darters and a more balanced trophic structure (i.e., less dominance by the omnivorous Bluehead Chub) were responsible for the increased NCIBI score and rating; no lingering drought impacts. **2004 & 2009** -- 22 species known from the site, including 4 species of darters and the endemic Roanoke Hogsucker [Significantly Rare]; dominant species is the Bluehead Chub.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
S DOUBLE CR	SR 1483	05/12/09	NF7	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.43138889	-80.29805556	22-11	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
B	16.4	750	7	0.5	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	70	10	20	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	12.9
Dissolved Oxygen (mg/L)	10.5
Specific Conductance (µS/cm)	47
pH (s.u.)	5.9
Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	5
Erosion (7)	6
Bank Vegetation (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	**65**

Site Photograph

Substrate Sand, gravel, bedrock outcrops

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/12/09	2009-31	21	48	Good
04/20/04	2004-12	22	46	Good

Most Abundant Species 2009 Bluehead Chub (27%), Redbreast Sunfish (20%)

Exotic Species 2009 Bluegill

Species Change Since Last Cycle

Gains -- Central Stoneroller, Blacktip Jumprock, Bluegill. **Losses** -- Mountain Redbelly Dace, Flat Bullhead, Green Sunfish, Chainback Darter. All species gained or lost were represented by 1-5 fish/species.

Data Analysis

Watershed -- drains west-central Stokes County; no municipalities in the watershed; tributary to the Dan River, site is ~ 0.8 miles upstream of the creek's confluence with the river. **Habitats** -- borders the Sauratown Mountains Level IV ecoregion; gravel riffles and runs, silty pools with bedrock outcrops; re-vegetated left bank. **Water Quality** -- lowest specific conductance of any site in 2009, has always been low (46 µS/cm in 2004). **2009** -- slightly more total fish and a lower percentage of tolerant fish were largely responsible for the very slight increase in NCIBI score and rating, no other changes in the other metric scores; no lingering impacts from droughts. **2004 & 2009** -- 25 species known from the site, including 5 species of darters and the endemic Roanoke Hogsucker [Significantly Rare] and Blacktip Jumprock; dominant species is the Bluehead Chub.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
SNOW CR	SR 1652	05/13/09	NF8	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.46166667	-80.14972222	22-20	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	22.7	750	9	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	90	10	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	13.9
Dissolved Oxygen (mg/L)	12.2
Specific Conductance (µS/cm)	66
pH (s.u.)	6.2

Water Clarity: Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	4
Pool Variety (10)	6
Riffle Habitat (16)	10
Erosion (7)	4
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**72**

Site Photograph

Substrate: Sand, gravel, cobble, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/13/09	2009-34	19	44	Good-Fair
04/21/04	2004-15	16	46	Good

Most Abundant Species 2009: Bluehead Chub (38%)

Exotic Species 2009: Bluegill

Species Change Since Last Cycle

Gains -- Central Stoneroller (n=9), Northern Hogsucker (n=4), Blacktip Jumprock (n=1), Bluegill (n=14).
Losses -- Flat Bullhead (n=6).

Data Analysis

Watershed -- drains northeastern and north-central Stokes County; no municipalities in the watershed; tributary to the Dan River. **Habitats** -- shallow riffles, runs, side snags, bedrock outcrop pool at the end of the reach. **2009** -- 3 times more fish collected in 2009 than in 2004 (746 *vs* . 249), primarily Bluehead Chub, Redlip Shiner, and Crescent Shiner (69% of all the fish collected); a slight increase in sucker diversity was offset by the abundance of omnivores, primarily Bluehead Chub, indicative of nonpoint source nutrient enrichment, which slightly decreased the NCIBI score and rating; no lingering effects from the drought. **2004 & 2009** -- only 20 species known from the site, including the endemic Roanoke Hogsucker [Significantly Rare] and Blacktip Jumprock; interestingly Snow Creek was the only site in the basin from which the Johnny Darter or the Tessellated Darter was not collected in 2004 or 2009, its absence is unexplained; dominant species is the Bluehead Chub.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
TOWN FORK CR	SR 1955	05/13/09	NF9	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
STOKES	1	03010103	36.26416667	-80.2325	22-25b	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	28	680	10	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	25	15	60	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	16.7
Dissolved Oxygen (mg/L)	12.4
Specific Conductance (µS/cm)	95
pH (s.u.)	6.9
Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	8
Pool Variety (10)	7
Riffle Habitat (16)	15
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	**79**

Site Photograph

Substrate Bedrock shelves, gravel, cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/13/09	2009-35	21	52	Good
04/21/04	2004-16	21	48	Good

Most Abundant Species 2009 Fantail Darter (34%)

Exotic Species 2009 Bluegill, Green Sunfish

Species Change Since Last Cycle **Gains** -- Mountain Redbelly Dace (n=5). **Losses** -- V-lip Redhorse (n=5).

Data Analysis

Watershed -- drains south-central Stokes and northern Forsyth counties, north and east of the City of Winston-Salem metropolitan area; three NPDES aci ities ithi the cree s atershed (00 5 00577 0 a d 00 7 com i ed $_{w}$ = 0.107 MGD); tributary to the Dan River. **Habitats** -- shallow gravel riffles, runs, bedrock riffles with *Podostemum,* side snag pools. **Water Quality** -- dissolved oxygen saturation at 128% due to afternoon photosynthetic activity by the periphyton. **2009** -- 2.2 times more fish collected in 2009 than in 2004, primarily an increase in the number of Fantail Darter (from 16% to 34%) and a decrease in the dominance of the Bluehead Chub (from 38% to 21%); these changes (decreasing the percentage of omnivores+herbivores and increasing the percentage of insectivores) slightly increased the NCIBI score but not the rating. **2004 & 2009** -- 22 species known from the site, including 5 species of sucker, 3 species of darters, and the endemic Roanoke Hogsucker [Significantly Rare]; dominant species is the Fantail Darter and Bluehead Chub.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BIG BEAVER ISLAND CR	US 311	05/14/09	NF10	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ROCKINGHAM	2	03010103	36.3825	-79.98083333	22-29	Triassic Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	23.8	570	6	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	25	50	25	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.5
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	64
pH (s.u.)	6.3

Water Clarity: Clear, easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	6
Pool Variety (10)	8
Riffle Habitat (16)	10
Erosion (7)	1
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	**67**

Site Photograph

Substrate: Gravel, cobble, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/14/09	2009-38	26	56	Excellent
04/22/04	2004-18	22	52	Good

Most Abundant Species 2009: Bluehead Chub (27%)

Exotic Species 2009: Bluegill

Species Change Since Last Cycle

Gains -- Creek Chub, Golden Redhorse, V-lip Redhorse, Blacktip Jumprock, Redfin Pickerel, Largemouth Bass, Roanoke Logperch. **Losses** -- Golden Shiner, Northern Hogsucker, Glassy Darter, Chainback Darter. All species gained or lost were represented by 1 or 2 fish/species, except for Glassy Darter, Northern Hogsucker, Golden Redhorse, and Redfin Pickerel (n=4, 7, 9, and 28, respectively).

Data Analysis

Watershed -- drains north-central Stokes and northwest Rockingham counties, including the western area of the towns of Madison and Mayodan; tributary to the a i er site is ~ 0. mi es a o e the cree s co ue ce ith the ri er. **Habitats** -- severe bank erosion in places, but bank vegetation and canopy are of high quality; riffles, runs, side undercuts and snags, large coarse woody debris, large debris dam at end of reach. **2009** -- ~ 3.5 times more fish collected in 2009 than in 2004 (866 vs. 247), primarily Bluehead Chub, Redlip Shiner, Fantail Darter, and Crescent Shiner (71% of all the fish collected); the collection of 28 piscivorous Redfin Pickerel resulted in a more balanced trophic structure, increasing the NCIBI score and rating; one specimen of the Federally Endangered Roanoke Logperch was collected. **2004 & 2009** -- very diverse community with 30 species known from the site, including 6 species of darters, 6 species of suckers, and the endemic Roanoke Hogsucker [Significantly Rare], Blacktip Jumprock, and Roanoke Logperch; dominant species is the Bluehead Chub.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
PAWPAW CR	**SR 1360**	**05/14/09**	**NF14**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ROCKINGHAM	2	03010103	36.50444444	-79.96277778	22-30-6-(2)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	8.1	750	7	0.3	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	65	2	33	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	14.4
Dissolved Oxygen (mg/L)	9.2
Specific Conductance (µS/cm)	57
pH (s.u.)	6.1

Water Clarity: Clear, easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	10
Pool Variety (10)	4
Riffle Habitat (16)	15
Erosion (7)	5
Bank Vegetation (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	**75**

Site Photograph

Substrate: Cobble, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/14/09	2009-36	21	52	Good
04/22/04	2004-17	18	44	Good-Fair
08/03/90	90-08	23	48	Good

Most Abundant Species 2009: Bluehead Chub (22%)

Exotic Species 2009: Green Sunfish, Bluegill

Species Change Since Last Cycle: **Gains** -- White Sucker (n=4), Golden Redhorse (n=18), Pumpkinseed (n=10), Warmouth (n=2). **Losses** -- White Shiner (n=8).

Data Analysis

Watershed drai s orth ester oc i ham ou t o mu ici a ities i the atershed tri utar to the a o i er site is ~ 0. mi es a o e the cree s confluence with the river. **Habitats** -- good gradient with riffles and runs, shallow pools, narrow riparian zones. **2009** -- almost twice as many fish collected in 2009 than in 2004 (979 *vs*. 527), primarily Redlip Shiner, Crescent Shiner, Central Stoneroller, and Fantail Darter (45% of all the fish collected); greater diversities of sunfish and suckers and a very slight improvement in the trophic structure were responsible for the increased NCIBI score and rating. **1990 - 2009** -- 27 species known from the site, including 4 species of darters and the endemic Roanoke Hogsucker [Significantly Rare] and Bigeye Jumprock [State Threatened]; the dominant species is the Bluehead Chub; the intolerant Bigeye Jumprock and Roanoke Darter have not been collected since 1990; the loss of two intolerant species, one of which is an endemic species of sucker, and the absence another species of sucker since 1990 from this site warrants repeat assessment in 2014.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HOGANS CR	NC 704	05/14/09	NF11	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ROCKINGHAM	2	03010103	36.3816593	-79.9076818	22-31	Triassic Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	23	600	8	0.4	Yes

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	95	0	0	5 (road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

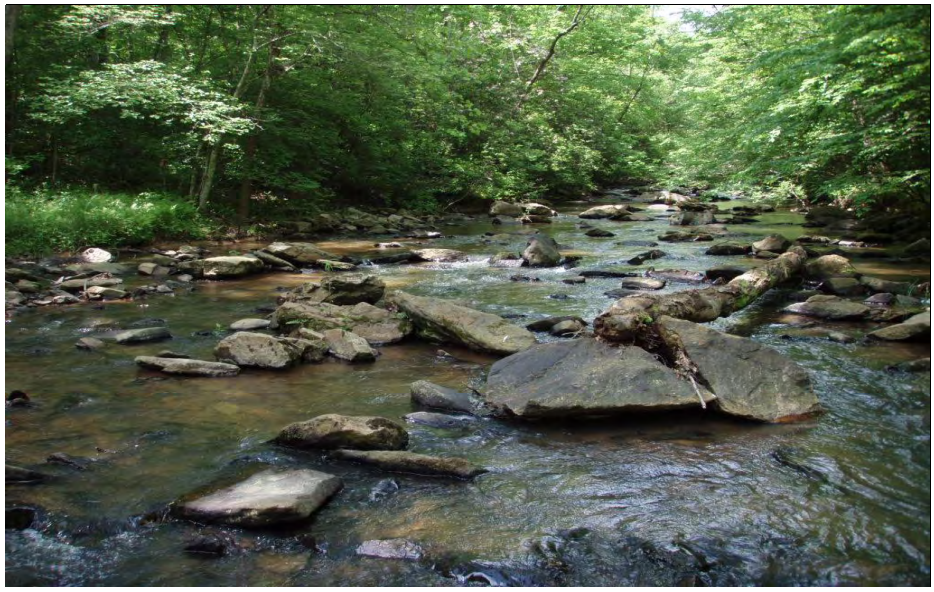
Temperature (°C)	16.0
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	62
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**95**

Site Photograph



Substrate Cobble, boulder, gravel, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/14/09	2009-37	24	54	Excellent
04/22/04	2004-19	17	48	Good

Most Abundant Species 2009 Redlip Shiner (31%)

Exotic Species 2009 Green Sunfish, Bluegill

Species Change Since Last Cycle

Gains -- White Shiner, Satinfin Shiner, Golden Redhorse, V-lip Redhorse, Green Sunfish, Pumpkinseed, Bluegill, Largemouth Bass, Riverweed Darter, Glassy Darter. **Losses** -- Rosyside Dace, Golden Shiner, Blacktip Jumprock. Species gained or lost were represented by 1-10 fish/species.

Data Analysis

Watershed drai s south est oc i ham ou t o mu ici a ities i the atershed tri utar to the a i er site is ~ . mi es a o e the cree s co ue ce ith the ri er our sma aci ities or mo i e home ar s ithi the cree s atershed (tota $_w$=0.251 MGD). **Habitat --** a regional reference site; borders the Northern Outer Piedmont Level IV ecoregion, atypical Triassic Basin habitats; highest score of any site in the basin in 2004 and 2009; high gradient boulder and cobble riffles, runs, deep, long pools. **2009** -- 2.3 times more fish collected in 2009 than in 2004, primarily Redlip Shiner; with a greater diversity of sunfish and more species with multiple age classes in 2009 than in 2004 the NCIBI score and rating increased; other metric scores were unchanged; no lingering drought impacts. **2004 & 2009** -- 27 species known from the site, including 6 species of suckers, 5 species of darters, and the endemic Roanoke Hogsucker [Significantly Rare], Blacktip Jumprock, and Riverweed Darter [Special Concern]; dominant species is the Redlip Shiner; extremely low flows during the 2002 drought may have impacted the community in 2004; as a regional reference site and with an Excellent rating, if requested the site qualifies as High Quality Waters. Based on this site's most recent Excellent rating, the site qualifies at minimum for High Quality Waters (HQW) designation.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
JACOBS CR	NC 704	05/20/09	NF12	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ROCKINGHAM	2	03010103	36.37944444	-79.87638889	22-32-(3)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	36.2	565	8	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	75	0	25	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	11.6
Dissolved Oxygen (mg/L)	9.5
Specific Conductance (µS/cm)	76
pH (s.u.)	6.1

Water Clarity: Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	3
Erosion (7)	2
Bank Vegetation (7)	4
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**55**

Site Photograph

Substrate: Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/20/09	2009-39	22	50	Good
04/22/04	2004-20	19	50	Good

Most Abundant Species 2009: Redlip Shiner (26%)

Exotic Species 2009: Bluegill

Species Change Since Last Cycle

Gains -- Rosyside Dace, Mountain Redbelly Dace, Creek Chub, Golden Redhorse, Flat Bullhead, Bluegill, Chainback Darter. **Losses** -- Margined Madtom, Snail Bullhead, Green Sunfish, Largemouth Bass. All species gained or lost were represented by 1-4 fish/species, except for Bluegill, Creek Chub, and Golden Redhorse, (n=6, 8, 12, respectively).

Data Analysis

Watershed -- drains southwestern Rockingham County; no municipalities in the watershed; tributary to the Dan River, site is ~ 1.6 miles above the creek's co ue ce ith the ri er t o sma aci ities ithi the cree s atershed 00 5 a d 00 700 tota $_w$ = 0.01 MGD). **Habitats** -- gravely and sandy runs, side snags and deadfall pools, scour pools, boulders and bluff along the right bank; left bank has re-vegetated since 2004; site still suffers from very substantial nonpoint source erosion and sedimentation; habitat score was the lowest of any site in 2004 and 2009. **2009** -- 2.6 times more fish collected in 2009 than in 2004 (459 vs. 176), primarily Redlip Shiner; piscivores absent; no other changes in the metric scores. **2004 & 2009** -- 26 species known from the site, including 5 species of suckers, 5 species of darters, and the endemic Roanoke Hogsucker [Significantly Rare]; dominant species are the Redlip Shiner and Bluehead Chub.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
ROCK HOUSE CR	SR 2127	05/20/09	NF18	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ROCKINGHAM	3	03010103	36.42055556	-79.79055556	22-34-(2)	Triassic Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	23	510	9	0.3	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	75	5	20	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	13.1
Dissolved Oxygen (mg/L)	9.6
Specific Conductance (µS/cm)	84
pH (s.u.)	6.7

Water Clarity	Clear, easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	6
Riffle Habitat (16)	7
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**68**

Site Photograph

Substrate Sand, gravel, some cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/20/09	2009-40	24	52	Good
04/23/04	2004-22	17	48	Good

Most Abundant Species 2009 Bluehead Chub (23%), Fantail Darter 18%)

Exotic Species 2009 Bluegill, Redear Sunfish

Species Change Since Last Cycle

Gains -- Central Stoneroller (n=21), Rosyside Dace (n=4), Swallowtail Shiner (n=10), Creek Chub (n=10), V-lip Redhorse (n=15), Redear Sunfish (n=1), Largemouth Bass (n=2), Chainback Darter (n=1). **Losses** -- Green Sunfish (n=34).

Data Analysis

Watershed -- drains central Rockingham County; no municipalities in the watershed; tributary to the Dan River, site is ~ 0.6 miles above the creek's confluence with the river. **Habitats** -- sand and gravel bars, very shallow sandy runs, side pools, high quality banks and riparian zones, but stream still exhibits some substantial nonpoint source erosion impacts. **2009** -- 2.7 times more fish collected in 2009 than in 2004 (1149 vs. 417), primarily Fantail Darter and Bluehead Chub; most fish collected from any site in 2009; less dominance by the omnivorous Bluehead Chub resulted in a more balanced trophic structure and a slight increase in the NCIBI score; no lingering drought effects. **2004 & 2009** -- 25 species known from the site, including 5 species of darters and the endemic Roanoke Hogsucker [Significantly Rare]; dominant species is the Bluehead Chub.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
WOLF ISLAND CR	**SR 1767**	**05/20/09**	**NF20**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ROCKINGHAM	3	03010103	36.48138889	-79.55861111	22-48	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	43.2	510	10	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	75	25	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	16.5
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	103
pH (s.u.)	6.5
Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	7
Erosion (7)	1
Bank Vegetation (7)	6
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**63**

Site Photograph

Substrate Sand, gravel, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/20/09	2009-41	28	56	Excellent
04/23/04	2004-23	21	50	Good

Most Abundant Species 2009 Bluehead Chub (25%), Crescent Shiner (18%)

Exotic Species 2009 Bluegill, Redear Sunfish

Species Change Since Last Cycle

Gains -- Rosyside Dace, Mountain Redbelly Dace, Blacktip Jumprock, Pumpkinseed, Redear Sunfish, Largemouth Bass, Black Crappie, Glassy Darter, Chainback Darter, Roanoke Darter. **Losses** -- Notchlip Redhorse, Green Sunfish, Smallmouth Bass. All species gained or lost were represented by 1-4 fish/species.

Data Analysis

Watershed -- drains the northeast corner of Rockingham County; headwaters begin northwest of the Town of Reidsville; tributary to the Dan River; one small NPDES facility in the headwaters (NC0078271, Q_w = 0.0084). **Habitats** -- large deadfalls and coarse woody debris, stick riffles, snag pools, wide riparian zones with mature trees; stream still exhibits substantial nonpoint source erosion with channel and riparian bank instabilities. **2009** -- ~4 times more fish collected in 2009 than in 2004 (719 *vs*. 177), primarily Bluehead Chub, Redlip Shiner, Crescent Shiner, and Bluegill; most diverse community of any site, including 6 species of suckers; increased abundance and species richness of darters and sunfish were largely responsible for the increase in NCIBI score and rating, no lingering drought effects. **2004 & 2009** -- very diverse community with 31 species known from the site, including 6 species of sucker, 5 species of darters, and the endemic Roanoke Hogsucker [Significantly Rare] and Blacktip Jumprock; dominant species is the Bluehead Chub.

Appendix 1-C

Ambient Monitoring Systems
Station Data Sheets
for the Upper Dan River Subbasin

Station ID	Waterbody	AU#	Location
N0150000	Dan River	22-(1)	AT NC 704 NEAR FRANCISCO
N1400000	Mayo River	22-30-(1)	AT SR 1358 NEAR PRICE
N2300000	Dan RIver	22-(31.5)	AT SR 2150 NEAR WENTWORTH
N2430000	Smith River	22-40-(1)	AT SR 1714 NEAR EDEN
N3000000	Dan River	22-(39)	AT SR 1761 NEAR MAYFIELD

Ambient Monitoring System Station Summaries
NCDENR, Division of Water Quality
Basinwide Assessment Report

Location: DAN RIV AT NC 704 NR FRANCISCO
Station #: N0150000 **Hydrologic Unit Code:** 03010103
Latitude: 36.51459 **Longitude:** -80.30282 **Stream class:** C Tr
Agency: NCAMBNT **NC stream index:** 22-(1)

Time period: 01/10/2005 to 01/04/2010

	# results	# ND	EL	Results not meeting EL #	%	%Conf	Percentiles Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	57	0	<6	0	0		6.1	8.3	8.8	10.4	12.1	13.2	17.5
pH (SU)	58	0	<6	0	0		6.2	7	7.3	7.6	7.8	8.2	8.6
	58	0	>9	0	0		6.2	7	7.3	7.6	7.8	8.2	8.6
Spec. conductance (umhos/cm at 25°C)	56	0	N/A				30	47	49	51	55	59	71
Water Temperature (°C)	58	0	>32	0	0		1.2	4.5	8.8	14.5	21.9	24.1	27.5
Other													
TSS (mg/L)	20	9	N/A				2.5	2.5	3.2	6.2	7	12.9	15
Turbidity (NTU)	58	1	>10	13	22.4	99.9	1	1.5	2	3.8	8	25.5	450
Nutrients (mg/L)													
NH3 as N	58	52	N/A				0.02	0.02	0.02	0.02	0.02	0.02	0.31
NO2 + NO3 as N	58	1	N/A				0.02	0.16	0.27	0.36	0.41	0.5	0.55
TKN as N	58	33	N/A				0.2	0.2	0.2	0.2	0.23	0.45	3.4
Total Phosphorus	58	17	N/A				0.02	0.02	0.02	0.02	0.03	0.08	1
Metals (ug/L)													
Aluminum, total (Al)	10	0	N/A				62	63	80	115	315	702	730
Arsenic, total (As)	10	10	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	10	10	>0.4	0	0		1	1	1.8	2	2	2	2
Chromium, total (Cr)	10	10	>50	0	0		10	10	21	25	25	25	25
Copper, total (Cu)	10	9	>7	0	0		2	2	2	2	2	4	5
Iron, total (Fe)	10	0	>1000	0	0		150	151	168	245	500	959	990
Lead, total (Pb)	10	10	>25	0	0		10	10	10	10	10	10	10
Mercury, total (Hg)	8	8	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	10	10	>88	0	0		10	10	10	10	10	10	10
Zinc, total (Zn)	10	10	>50	0	0		10	10	10	10	10	10	10

Fecal Coliform Screening(#/100mL)

# results:	Geomean:	# > 400:	% > 400:	%Conf:
58	41.5	4	6.9	

Key:
result: number of observations
ND: number of observations reported to be below detection level (non-detect)
EL: Evaluation Level; applicable numeric or narrative water quality standard or action level
Results not meeting EL: number and percentages of observations not meeting evaluation level
%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)
Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

Location: MAYO RIV AT SR 1358 NR PRICE

Station #: N1400000 **Hydrologic Unit Code:** 03010103

Latitude: 36.53514 **Longitude:** -79.99117 **Stream class:** WS-V

Agency: NCAMBNT **NC stream index:** 22-30-(1)

Time period: 01/10/2005 to 12/03/2009

	# results	# ND	EL	Results not meeting EL #	%	%Conf	Percentiles Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	59	0	<4	0	0		6.5	7.8	8.8	10.5	12	13.1	17.2
	59	0	<5	0	0		6.5	7.8	8.8	10.5	12	13.1	17.2
pH (SU)	59	0	<6	0	0		6.7	7.2	7.4	7.6	7.9	8.1	8.3
	59	0	>9	0	0		6.7	7.2	7.4	7.6	7.9	8.1	8.3
Spec. conductance (umhos/cm at 25°C)	57	0	N/A				35	49	56	58	64	68	91
Water Temperature (°C)	59	0	>32	0	0		1.3	5.9	9.2	14.3	22.9	25.4	28.7
Other													
TSS (mg/L)	20	9	N/A				2.5	2.6	4.4	6.2	15.8	41.6	182
Turbidity (NTU)	59	0	>50	6	10.2	62.3	2	2.7	3.5	6.2	13	55	800
Metals (ug/L)													
Aluminum, total (Al)	9	0	N/A				120	120	140	180	1215	5400	5400
Arsenic, total (As)	9	9	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	9	9	>2	0	0		1	1	2	2	2	2	2
Chromium, total (Cr)	9	9	>50	0	0		10	10	25	25	25	25	25
Copper, total (Cu)	9	7	>7	1	11.1		2	2	2	2	2	17	17
Iron, total (Fe)	9	0	>1000	3	33.3		310	310	425	440	1750	12000	12000
Lead, total (Pb)	9	8	>25	0	0		10	10	10	10	10	15	15
Manganese, total (Mn)	9	0	>200	1	11.1		12	12	20	24	46	950	950
Mercury, total (Hg)	8	8	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	9	9	>25	0	0		10	10	10	10	10	10	10
Zinc, total (Zn)	9	7	>50	0	0		10	10	10	10	11	29	29

Fecal Coliform Screening(#/100mL)

# results:	Geomean:	# > 400:	% > 400:	%Conf:
58	100.3	9	15.5	

Key:
result: number of observations
ND: number of observations reported to be below detection level (non-detect)
EL: Evaluation Level; applicable numeric or narrative water quality standard or action level
Results not meeting EL: number and percentages of observations not meeting evaluation level
%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)
Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

Ambient Monitoring System Station Summaries
NCDENR, Division of Water Quality
Basinwide Assessment Report

Location: DAN RIV AT SR 2150 NR WENTWORTH
Station #: N2300000 **Hydrologic Unit Code:** 03010103
Latitude: 36.41055 **Longitude:** -79.82693 **Stream class:** WS-IV
Agency: NCAMBNT **NC stream index:** 22-(31.5)

Time period: 01/10/2005 to 12/03/2009

	# results	# ND	EL	Results not meeting EL #	%	%Conf	Percentiles Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	60	0	<4	0	0		6.3	7.2	7.8	9.6	11.4	13.3	14.7
	60	0	<5	0	0		6.3	7.2	7.8	9.6	11.4	13.3	14.7
pH (SU)	60	0	<6	0	0		6.6	7	7.2	7.4	7.5	7.7	8.2
	60	0	>9	0	0		6.6	7	7.2	7.4	7.5	7.7	8.2
Spec. conductance (umhos/cm at 25°C)	58	0	N/A				37	58	64	71	84	140	158
Water Temperature (°C)	60	0	>32	0	0		1.4	5.4	8.8	17	23.8	25.8	28.8
Other													
TSS (mg/L)	19	6	N/A				2.5	3	6.2	10	23	150	201
Turbidity (NTU)	61	0	>50	9	14.8	92	1.6	3.3	4	7.1	15.5	118	550
Nutrients (mg/L)													
NH3 as N	61	47	N/A				0.02	0.02	0.02	0.02	0.02	0.03	0.04
NO2 + NO3 as N	61	0	>10	0	0		0.02	0.05	0.12	0.18	0.24	0.3	0.34
TKN as N	61	26	N/A				0.2	0.2	0.2	0.23	0.31	0.89	2.2
Total Phosphorus	61	1	N/A				0.02	0.02	0.03	0.03	0.05	0.22	0.83
Metals (ug/L)													
Aluminum, total (Al)	9	0	N/A				110	110	175	320	700	6600	6600
Arsenic, total (As)	9	9	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	9	9	>2	0	0		1	1	2	2	2	2	2
Chromium, total (Cr)	9	9	>50	0	0		10	10	25	25	25	25	25
Copper, total (Cu)	9	8	>7	0	0		2	2	2	2	2	3	3
Iron, total (Fe)	9	0	>1000	2	22.2		390	390	535	700	1125	5000	5000
Lead, total (Pb)	9	9	>25	0	0		10	10	10	10	10	10	10
Manganese, total (Mn)	9	0	>200	0	0		21	21	27	32	54	90	90
Mercury, total (Hg)	8	8	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	9	9	>25	0	0		10	10	10	10	10	10	10
Zinc, total (Zn)	9	7	>50	0	0		10	10	10	10	12	25	25

Fecal Coliform Screening(#/100mL)

# results:	Geomean:	# > 400:	% > 400:	%Conf:
61	101.6	10	16.4	

Key:
result: number of observations
ND: number of observations reported to be below detection level (non-detect)
EL: Evaluation Level; applicable numeric or narrative water quality standard or action level
Results not meeting EL: number and percentages of observations not meeting evaluation level
%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)
Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

Ambient Monitoring System Station Summaries
NCDENR, Division of Water Quality
Basinwide Assessment Report

Location: SMITH RIV AT SR 1714 NR EDEN
Station #: N2430000 **Hydrologic Unit Code:** 03010103
Latitude: 36.52087 **Longitude:** -79.75281 **Stream class:** WS-IV
Agency: NCAMBNT **NC stream index:** 22-40-(1)

Time period: 01/10/2005 to 12/03/2009

	# results	# ND	EL	Results not meeting EL #	%	%Conf	Percentiles Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	60	0	<4	0	0		7.1	8	8.6	10.3	11.4	13.2	14.8
	60	0	<5	0	0		7.1	8	8.6	10.3	11.4	13.2	14.8
pH (SU)	60	0	<6	0	0		6.4	7.1	7.3	7.5	7.7	8	8.6
	60	0	>9	0	0		6.4	7.1	7.3	7.5	7.7	8	8.6
Spec. conductance (umhos/cm at 25°C)	58	0	N/A				35	59	74	82	90	96	107
Water Temperature (°C)	60	0	>32	0	0		1.6	6.1	8.8	16	20.7	23.6	26
Other													
TSS (mg/L)	19	4	N/A				2.8	3.2	6.2	8.2	33	152	470
Turbidity (NTU)	60	0	>50	7	11.7	75.2	1.8	2.4	3.2	5.5	14	64	360
Metals (ug/L)													
Aluminum, total (Al)	9	0	N/A				84	84	125	210	720	8200	8200
Arsenic, total (As)	9	9	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	9	9	>2	0	0		1	1	2	2	2	2	2
Chromium, total (Cr)	9	9	>50	0	0		10	10	25	25	25	25	25
Copper, total (Cu)	9	6	>7	1	11.1		2	2	2	2	5	14	14
Iron, total (Fe)	9	0	>1000	2	22.2		360	360	410	490	1010	7600	7600
Lead, total (Pb)	9	9	>25	0	0		10	10	10	10	10	10	10
Manganese, total (Mn)	9	0	>200	1	11.1		26	26	30	36	56	240	240
Mercury, total (Hg)	8	8	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	9	9	>25	0	0		10	10	10	10	10	10	10
Zinc, total (Zn)	9	5	>50	0	0		10	10	10	10	16	28	28

Fecal Coliform Screening(#/100mL)

# results:	Geomean:	# > 400:	% > 400:	%Conf:
60	92.9	11	18.3	

Key:
result: number of observations
ND: number of observations reported to be below detection level (non-detect)
EL: Evaluation Level; applicable numeric or narrative water quality standard or action level
Results not meeting EL: number and percentages of observations not meeting evaluation level
%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)
Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

Ambient Monitoring System Station Summaries
NCDENR, Division of Water Quality
Basinwide Assessment Report

Location: DAN RIV AT SR 1761 NR MAYFIELD
Station #: N3000000 **Hydrologic Unit Code:** 03010103
Latitude: 36.54142 **Longitude:** -79.60525 **Stream class:** C
Agency: NCAMBNT **NC stream index:** 22-(39)

Time period: 01/10/2005 to 12/03/2009

	# results	# ND	EL	Results not meeting EL #	%	%Conf	Percentiles Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	59	0	<4	0	0		6	7.1	7.7	9.6	11.4	12.9	14
	59	0	<5	0	0		6	7.1	7.7	9.6	11.4	12.9	14
pH (SU)	59	0	<6	0	0		6.2	7.1	7.3	7.5	7.7	7.9	8.1
	59	0	>9	0	0		6.2	7.1	7.3	7.5	7.7	7.9	8.1
Spec. conductance (umhos/cm at 25°C)	58	0	N/A				45	71	91	114	141	187	225
Water Temperature (°C)	59	0	>32	0	0		5.4	7.4	10.2	17.6	23.8	27.9	30
Other													
TSS (mg/L)	20	2	N/A				4	4.1	8	10.2	27.2	62.4	322
Turbidity (NTU)	59	0	>50	11	18.6	98.7	2	3.1	4.7	7.4	25	160	260
Metals (ug/L)													
Aluminum, total (Al)	10	0	N/A				140	142	220	430	1035	2040	2100
Arsenic, total (As)	10	10	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	10	10	>2	0	0		1	1	1.8	2	2	2	2
Chromium, total (Cr)	10	10	>50	0	0		10	10	21	25	25	25	25
Copper, total (Cu)	10	5	>7	0	0		2	2	2	2	4	5	6
Iron, total (Fe)	10	0	>1000	4	40	99.8	470	472	565	880	1875	3000	3100
Lead, total (Pb)	10	10	>25	0	0		10	10	10	10	10	10	10
Mercury, total (Hg)	8	8	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	10	10	>88	0	0		10	10	10	10	10	10	10
Zinc, total (Zn)	10	7	>50	0	0		10	10	10	10	12	13	13

Fecal Coliform Screening(#/100mL)

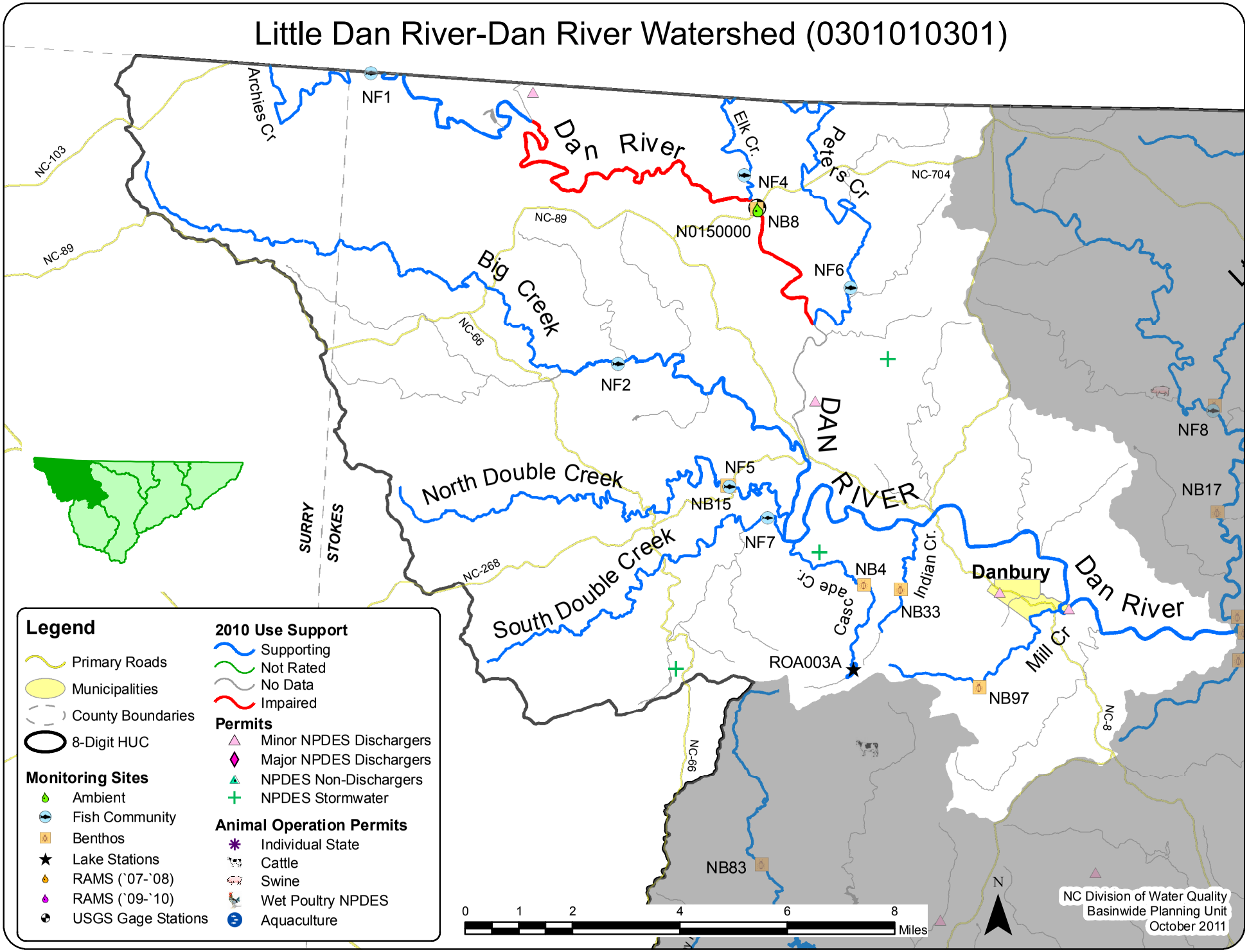
# results:	Geomean:	# > 400:	% > 400:	%Conf:
59	86.6	11	18.6	

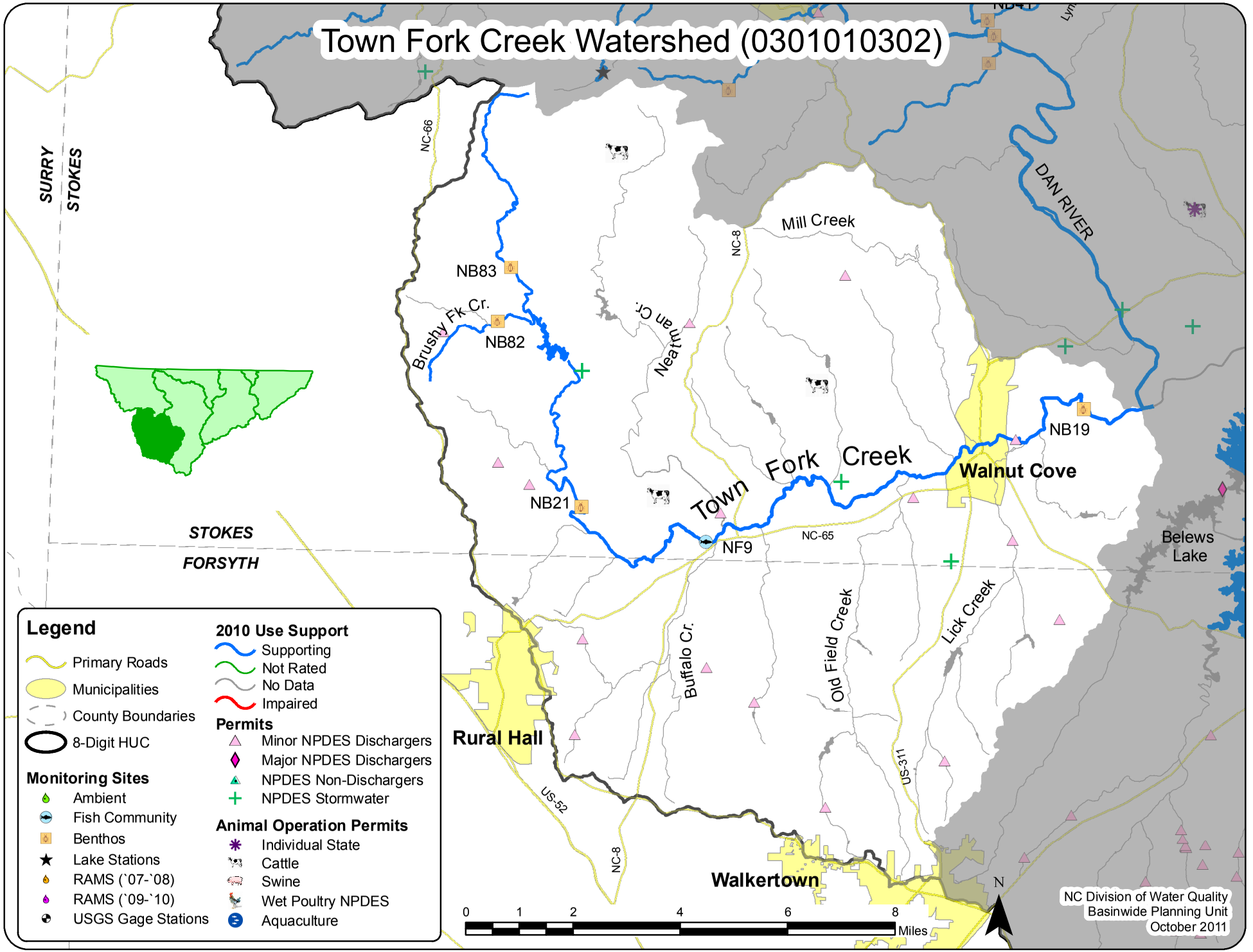
Key:
result: number of observations
ND: number of observations reported to be below detection level (non-detect)
EL: Evaluation Level; applicable numeric or narrative water quality standard or action level
Results not meeting EL: number and percentages of observations not meeting evaluation level
%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)
Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

Appendix 1-D

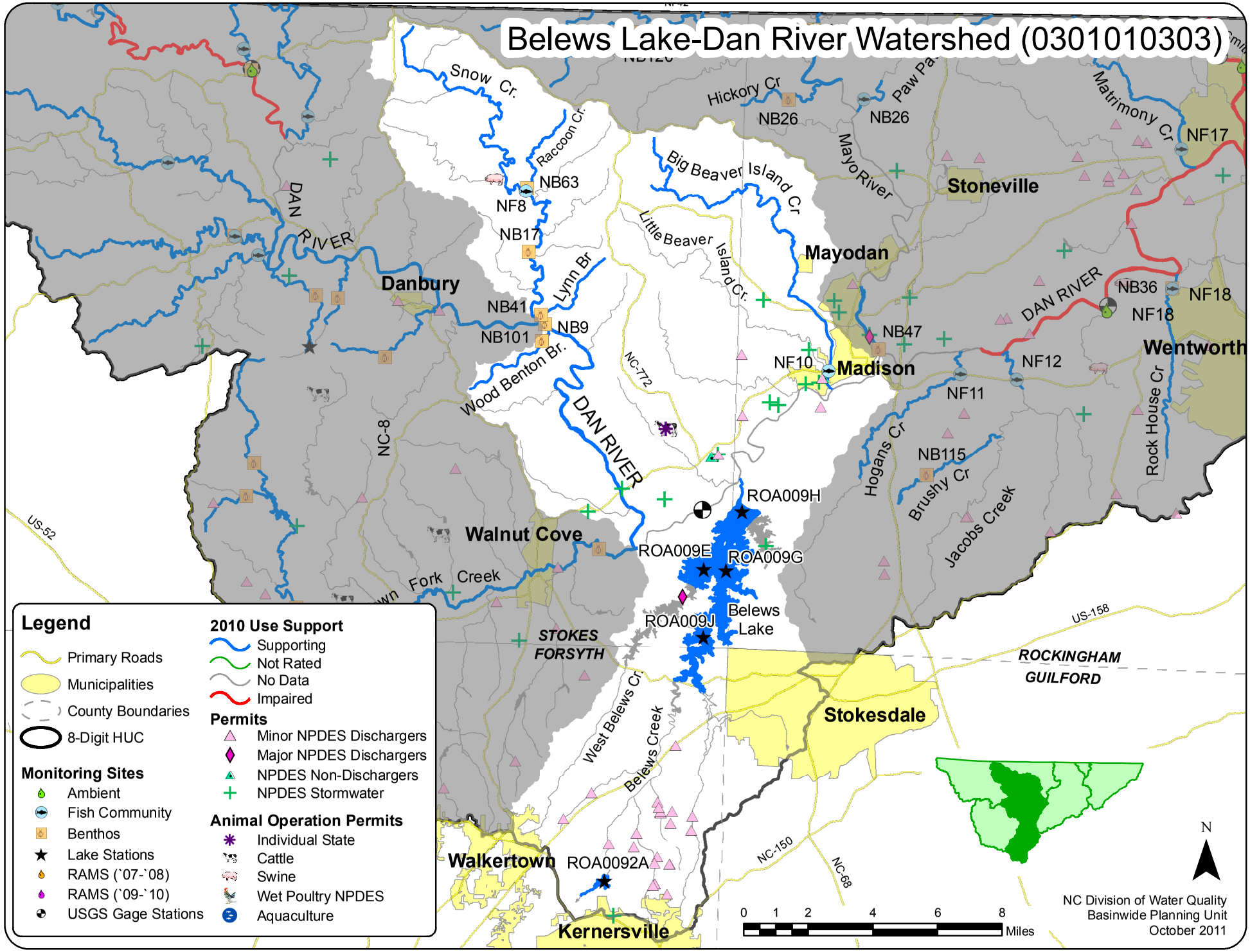
10-Digit Watershed Maps for the Upper Dan River Subbasin

Little Dan River-Dan River Watershed (0301010301)

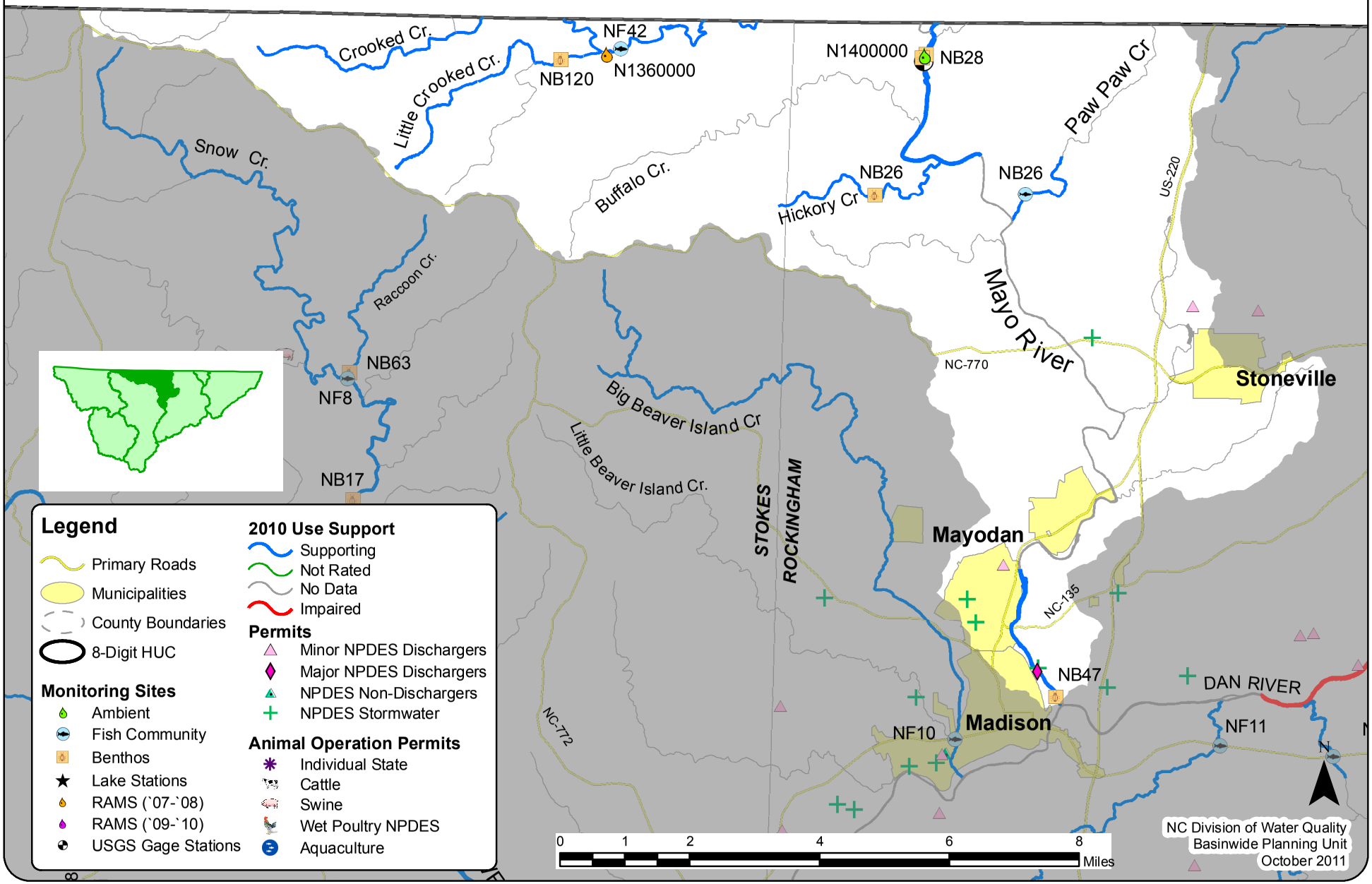



Town Fork Creek Watershed (0301010302)
SURRY
STOKES
STOKES
FORSYTH
NC-66
NB83
Brushy Fk Cr.
NB82
Neatman Cr.
NC-8
Mill Creek
DAN RIVER
NB19
Walnut Cove
Town Fork Creek
NB21
NF9
NC-65
Belews Lake
Buffalo Cr.
Old Field Creek
Lick Creek
US-311
Rural Hall
US-52
NC-8
Walkertown
N
0 1 2 4 6 8
Miles
NC Division of Water Quality
Basinwide Planning Unit
October 2011
Legend
Primary Roads
Municipalities
County Boundaries
8-Digit HUC
Monitoring Sites
Ambient
Fish Community
Benthos
Lake Stations
RAMS (`07-`08)
RAMS (`09-`10)
USGS Gage Stations
2010 Use Support
Supporting
Not Rated
No Data
Impaired
Permits
Minor NPDES Dischargers
Major NPDES Dischargers
NPDES Non-Dischargers
NPDES Stormwater
Animal Operation Permits
Individual State
Cattle
Swine
Wet Poultry NPDES
Aquaculture

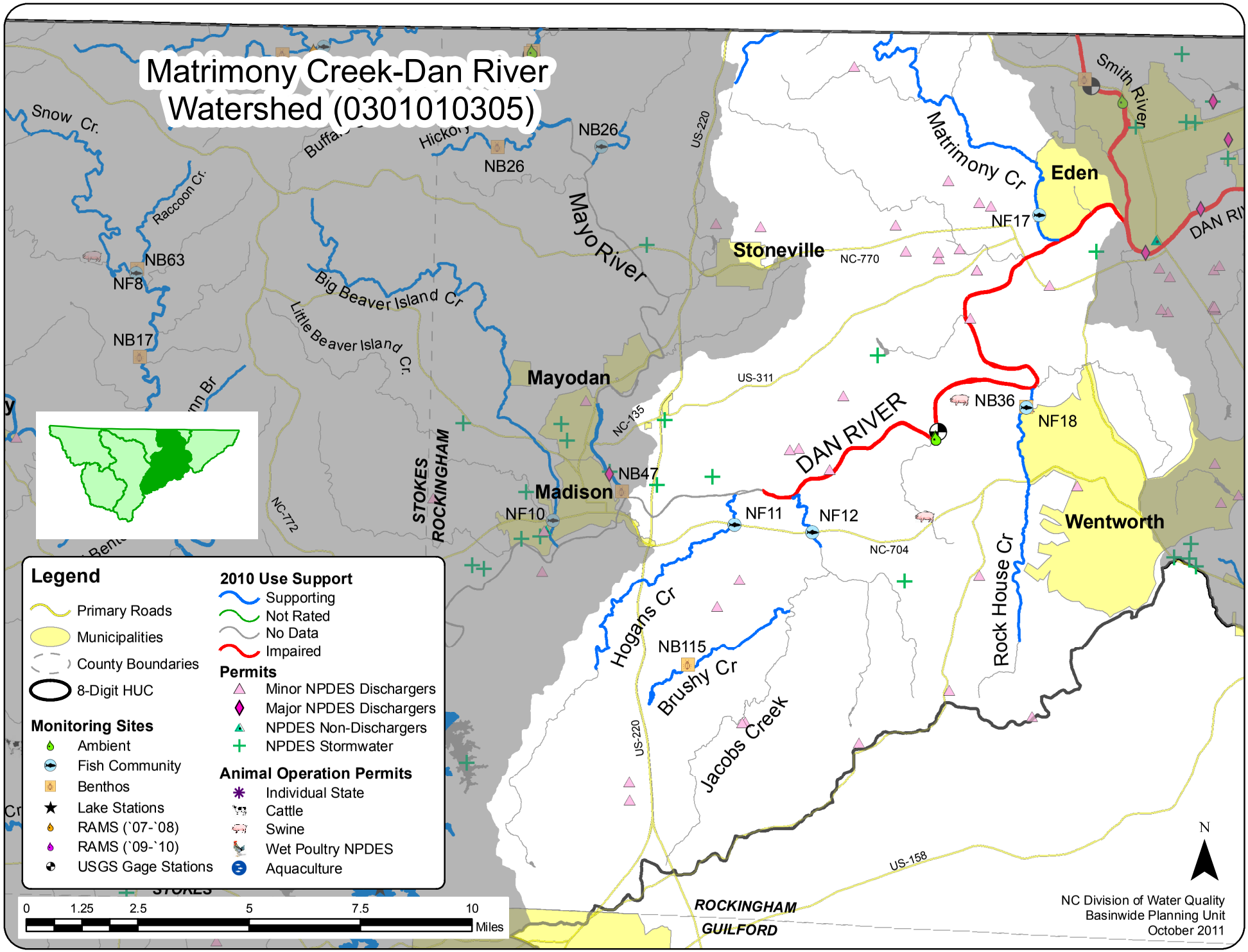
1-D.4


Belews Lake-Dan River Watershed (0301010303)
Snow Cr.
Raccoon Cr.
Hickory Cr
NB26
NB26
Paw Pa
Matrimony Cr
NF17
Big Beaver Island Cr
Mayo River
Stoneville
NB63
NF8
NB17
Little Beaver Island Cr.
Mayodan
DAN RIVER
Lynn Br
Danbury
NB41
NB9
NB101
Wood Benton Br.
NC-772
NF10
Madison
NB47
DAN RIVER
NB36
NF18
NF18
Wentworth
NF12
NF11
Rock House Cr
Hogans Cr
NB115
Brushy Cr
Jacobs Creek
NC-8
DAN RIVER
ROA009H
US-52
Walnut Cove
ROA009E
ROA009G
Fork Creek
ROA009J
Belews Lake
US-158
STOKES
FORSYTH
ROCKINGHAM
GUILFORD
Stokesdale
West Belews Cr
Belews Creek
Walkertown
ROA0092A
NC-150
NC-68
Kernersville
Legend
Primary Roads
Municipalities
County Boundaries
8-Digit HUC
Monitoring Sites
Ambient
Fish Community
Benthos
Lake Stations
RAMS (`07-`08)
RAMS (`09-`10)
USGS Gage Stations
2010 Use Support
Supporting
Not Rated
No Data
Impaired
Permits
Minor NPDES Dischargers
Major NPDES Dischargers
NPDES Non-Dischargers
NPDES Stormwater
Animal Operation Permits
Individual State
Cattle
Swine
Wet Poultry NPDES
Aquaculture
N
0 1 2 4 6 8
Miles
NC Division of Water Quality
Basinwide Planning Unit
October 2011

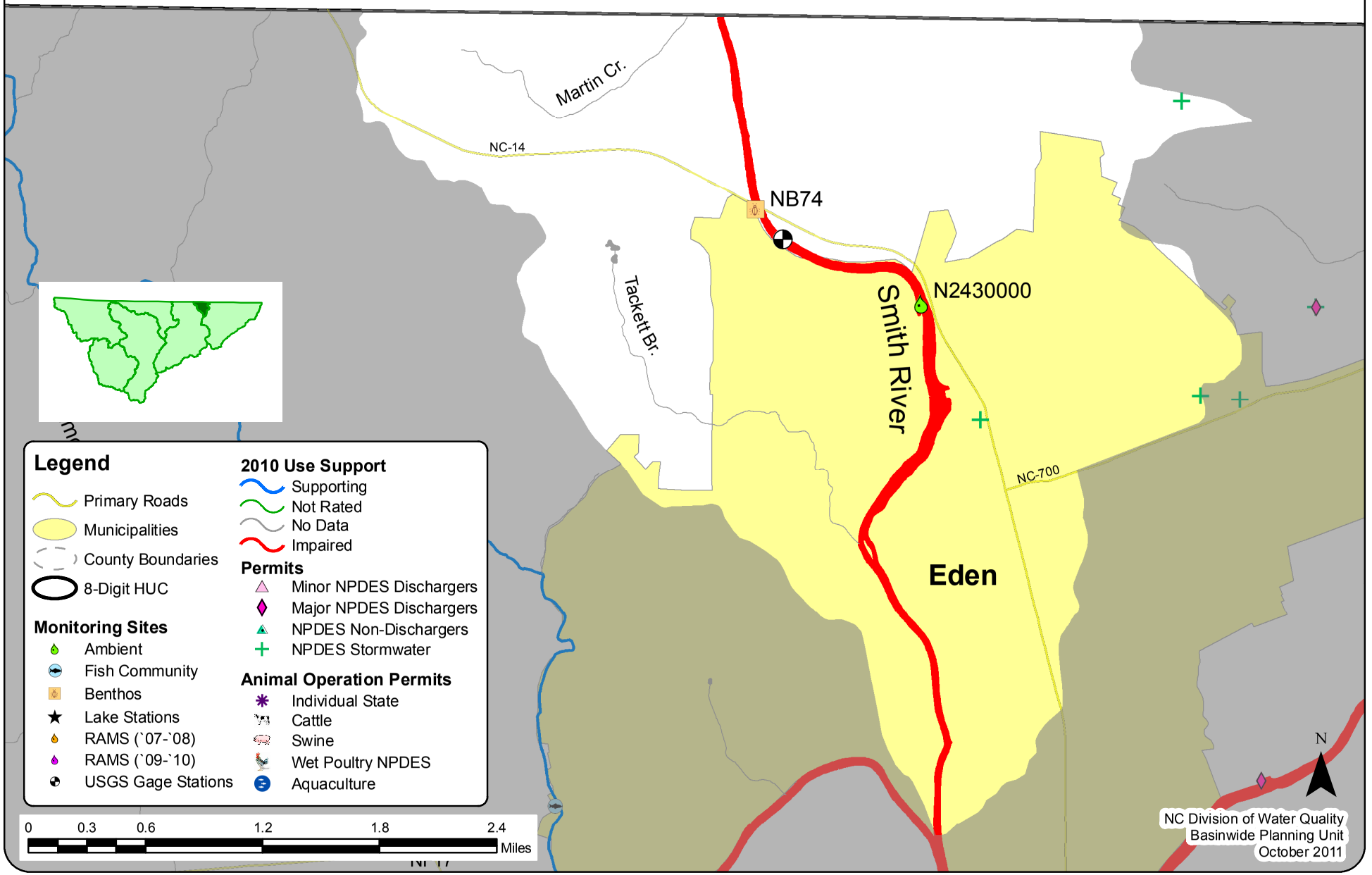
Mayo River Watershed (0301010304)



1-D.6


Matrimony Creek-Dan River Watershed (0301010305)
Snow Cr.
Raccoon Cr.
NB63
NF8
NB17
Big Beaver Island Cr
Little Beaver Island Cr.
NB26
NB26
Mayo River
US-220
Matrimony Cr
Smith River
Eden
NF17
Stoneville
NC-770
DAN RIVER
NB36
NF18
US-311
Mayodan
NC-135
NB47
Madison
NF10
STOKES
ROCKINGHAM
NC-772
NF11
NF12
NC-704
Wentworth
Rock House Cr
Hogans Cr
NB115
Brushy Cr
Jacobs Creek
US-220
US-158
ROCKINGHAM
GUILFORD
Legend
Primary Roads
Municipalities
County Boundaries
8-Digit HUC
Monitoring Sites
Ambient
Fish Community
Benthos
Lake Stations
RAMS (`07-`08)
RAMS (`09-`10)
USGS Gage Stations
2010 Use Support
Supporting
Not Rated
No Data
Impaired
Permits
Minor NPDES Dischargers
Major NPDES Dischargers
NPDES Non-Dischargers
NPDES Stormwater
Animal Operation Permits
Individual State
Cattle
Swine
Wet Poultry NPDES
Aquaculture
0 1.25 2.5 5 7.5 10
Miles
N
NC Division of Water Quality
Basinwide Planning Unit
October 2011

Lower Smith River Watershed (0301010308)



1-D.8

Cascade Creek-Dan River Watershed (0301010309)