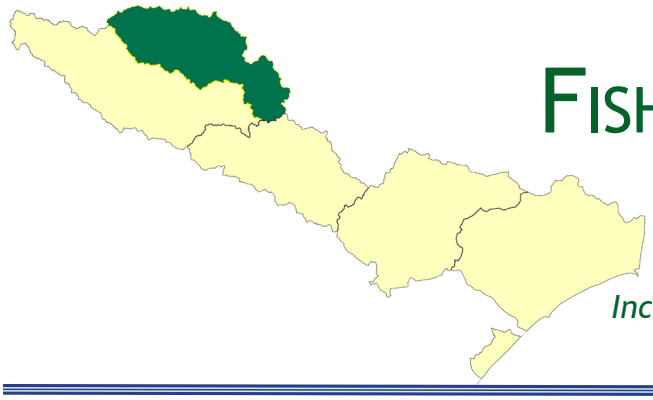


Fishing Creek Subbasin

Subbasin HUC 03020102

Includes the Fishing Creek and Tributaries

Water Quality Overview:

Overall, water quality in this rural subbasin is excellent. This subbasin is a priority for aquatic threatened and endangered species protection. It is recommended that biological samples be taken during normal flow conditions to evaluate potential ORW reclassifications. The main stressors to water quality include fecal coliform bacteria and incidences of low dissolved oxygen.

General Description

The Fishing Creek Subbasin, hydrologic unit code (HUC) 03020102, in the upper portion of the Tar-Pamlico River Basin was previously delineated as DWQ's Subbasin 03-03-04. The Fishing Creek Subbasin encompasses the ~894 square miles from its headwaters northeast of the City of Henderson to its confluence with the Tar River near the town of Tarboro (Figure 2-1).

This is a physiographically diverse area primarily in the Northern Outer Piedmont and Rolling Coastal Plain ecoregions with a smaller southeastern portion in the Southeastern Floodplains and Low Terraces ecoregion. These southeastern streams are characterized by naturally low dissolved oxygen, low current velocity, and low pH. However, only the Beech Swamp watershed has a supplemental classification of Swamp Waters.

The Fishing Creek Subbasin is recognized by NC Wildlife Resource Commission as a priority area for habitat protection because of threatened and endangered aquatic species found in the subbasin (e.g., tar spinymussel & drawf wedgemussel). There are no waters currently classified as High Quality Waters (HQW) or Outstanding Resource Waters (ORW) in this subbasin.

Watershed at a Glance

Counties:

Vance, Warren, Franklin, Nash, Halifax, Edgecombe

Municipalities:

Middleburg, Norlina, Warrenton, Littleton, Enfield, Scotland Neck, Hobgood, Speed

Permitted Facilities:

NPDES WWTP:.....9
- Major:.....2
- Minor.....7

NonDischarge:.....6

Stormwater:
- General.....5
- Individual.....2

Animal Operations:.....19

2000 Population: 36,744

Area: 894 sq mi.

Impervious Surface Estimate: 4 sq mi.

Primary Classifications:

Freshwater ~Miles.....575

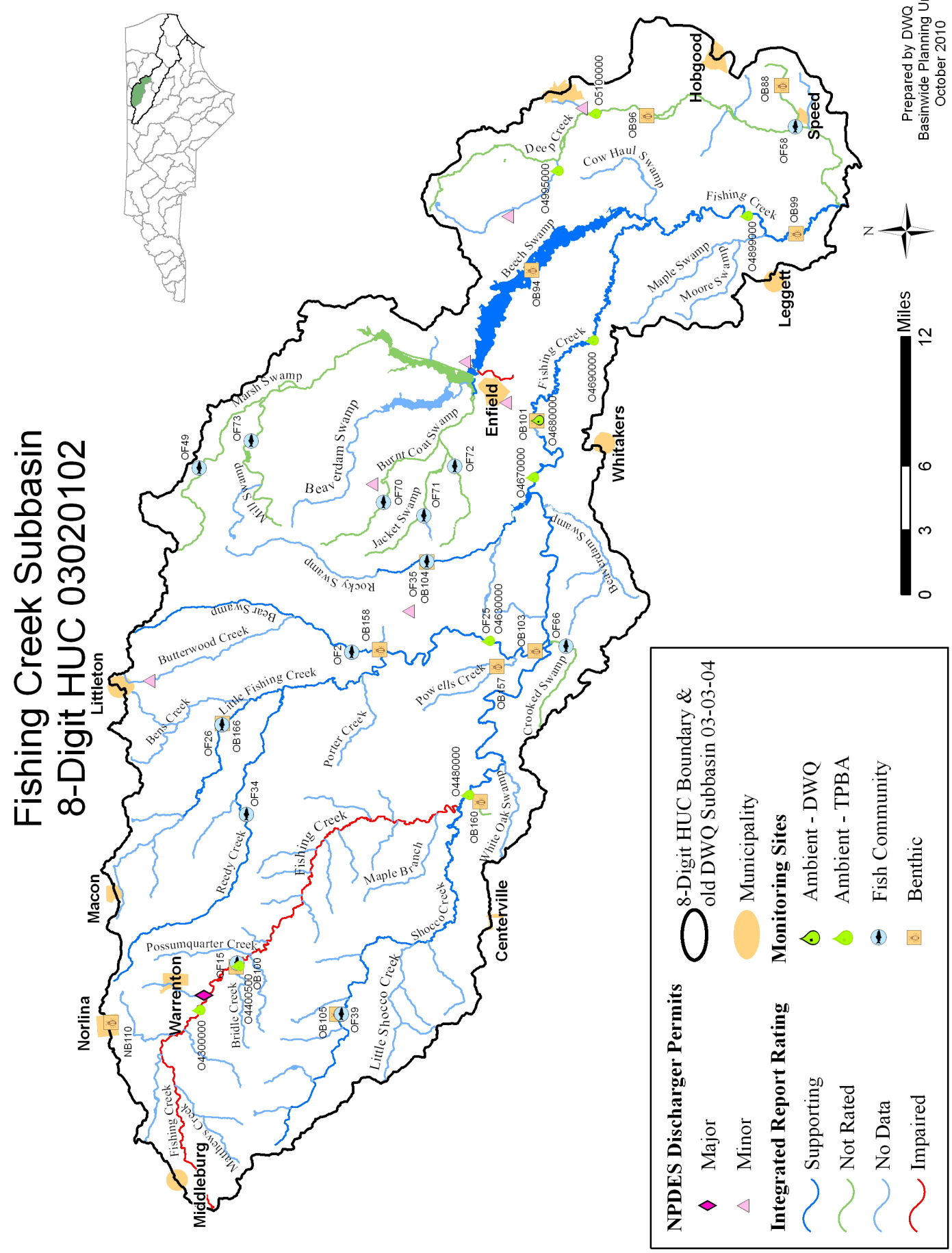
Supplemental Classification miles:

C;NSW.....354
C;Sw,NSW.....104
WS-IV;NSW.....99
WS-V;NSW.....17

Classification descriptions are found at: *http://portal.ncdenr.org/web/wq/ps/csu/classifications*

The small towns of Warrenton, Enfield, and Scotland Neck are the only urban areas and their wastewater treatment plants (WWTP) are the only major dischargers in this watershed. Warrenton WWTP discharges 2.0 million gallons/day (MGD) and Enfield WWTP discharges 1.0 MGD to Fishing Creek; the Scotland Neck facility discharges 0.675 MGD to Canal Creek, a small tributary to Deep Creek. Four other small facilities discharge a total of 0.302 MGD to small tributaries to Fishing Creek.

FIGURE 2-1. HUC 03020102 MAP



Several small parcels within the Shocco Creek subwatershed in Warren, Franklin, and Halifax counties are managed as part of the Shocco Creek Gameland by the NC Wildlife Resources Commission. Other gameland in the subbasin include the Embro Gameland encompassing small parcels in the Little Fishing Creek and Reedy Creek watersheds in Warren and Halifax counties. Medoc Mountain State Park is the only large publicly-owned parcel in this watershed. There are five North Carolina Natural Heritage Program Significant Natural Heritage Areas in this watershed: Fishing Creek Floodplain Forest, Lower Shocco Creek Bluff, Shocco Creek Centerville Bluffs, Medoc Mountain State Park, and Reedy Creek Hardwood Forest.

Current Status and Significant Issues

Use Support Assessment Summary

All surface waters in the state are assigned a classification reflecting the best-intended use of that water. Chemical, physical, and biological parameters are regularly assessed by DWQ to determine how well waterbodies are meeting their best-intended use. These data are used to develop use support ratings every two years as reported to EPA. The collected list of all monitored waterbodies and their water quality rating is called the Integrated Report (IR). Water not meeting surface water standards are rated as Impaired and reported on the 303(d) list. Water quality evaluation levels and how a waterbody earns a rating of Supporting or Impaired is explained in detail in the IR methodology. The 2010 IR is based on data collected between 2004 and 2008; the IR and methodology are available on the DWQ Modeling/TMDL website: http://portal.ncdenr.org/web/wq/ps/mtu/assessment. The most current use support ratings for this subbasin can be found in Appendix 2A.

In this subbasin, use support ratings were assigned for aquatic life, recreation, fish consumption, and water supply categories. Waters are Supporting, Not Rated, or No Data in the aquatic life and recreation categories on a monitored or evaluated basis. All waters are Impaired in the fish consumption category on an evaluated basis based on statewide fish consumption advice issued by the Department of Health and Human Services. All waters are Supporting in the Water Supply category. This evaluation is based on reports from Division of Environmental Health (DEH) regional water treatment plant consultants.

General Biological Health

Biological samples were collected during the spring and summer months of 2007 as part of the basinwide sampling five year cycle with the exception of a few special studies. Eight benthic macroinvertebrate sites and 13 fish community sites were sampled as part of the basinwide sampling cycle. Tables 2-1 and 2-2 provide a summary of site results and a description of the stream location to correspond to Figure 2-1. Site specific information is available in Appendix 2B and the entire Biological Assessment Report at: http://www.esb.enr.state.nc.us/documents/2008TARbasinwiderptfinal.pdf.

Benthos Community Sampling Summary

No changes in the bioclassifications were observed at three sites between 2002 and 2007. Two sites along Fishing Creek (OB101 & OB99) improved to Excellent from either Good-Fair or Good. Fishing Creek-OB100 in Warren County, which had not been sampled for benthic macroinvertebrates since 1997, declined from Good in 1997 to Good-Fair in 2007. The decline was attributed to drought, low flow conditions, and habitat alterations by beavers.

Table 2-1 Benthos Biological Sample Results

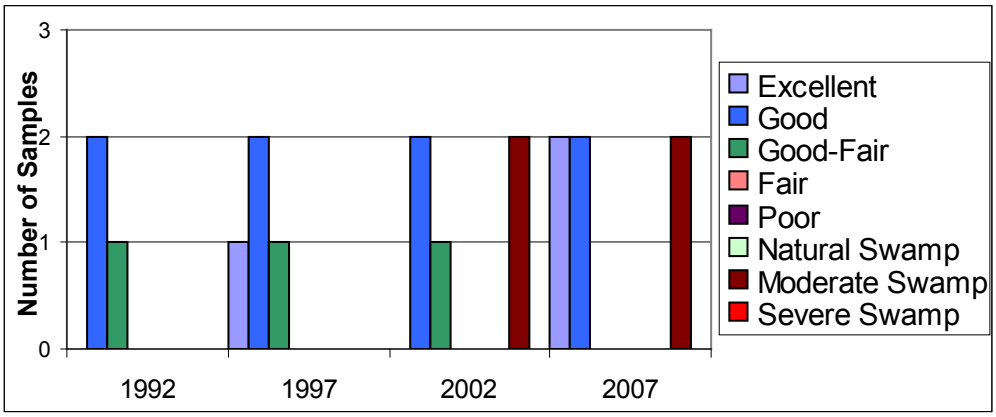
Site ID*	Waterbody	AU #	Description	Location	County	Date	BioClass
OB100	Fishing Cr	28-79-(1)	From source to Shocco Creek	SR 1600	Warren	7/3/07	Good-Fair
OB101	Fishing Cr	28-79-29	From Enfield Raw Water Supply Intake to a point 1.7 miles downstream of Beech Swamp	US 301	Edgecombe	6/28/07	Excellent
OB99	Fishing Cr	28-79-(30.5)	From a point 1.7 miles downstream of Beech Swamp to Tar River	SR 1500	Edgecombe	6/28/07	Excellent
OB105	Shocco Cr	28-79-22	From source to Fishing Creek	SR 1613	Warren	7/3/07	Not Rated
OB166	L Fishing Cr	28-79-25	From source to Fishing Creek	SR1509	Warren	3/9/09	Good-Fair
OB103	L Fishing Cr	28-79-25	From source to Fishing Creek	SR 1343	Halifax	6/29/07	Good
OB160	UT Fishing Cr	28-79-(21)ut2	From source to Fishing Creek	SR 1004	Nash	7/18/07	Not Rated
OB158 special study	UT Bear Swp	28-79-25-7ut34	Small stream criteria reference site on unnamed tributary to Bear Swp	Medoc Mt State Park	Halifax	6/9/05	Not Impaired
OB 157 special study	UT Powells Cr	28-79-25-8ut13	Small stream criteria reference site on unnamed tributary to Powells Cr	NC 481	Halifax	4/21/06	Not Impaired
OB104	Rocky Swp (Bellamy Lake)	28-79-28-(0.7)	From a point 1.0 mile downstream of N.C. Hwy. 561 to Fishing Creek	SR 1002	Halifax	6/28/07	Good
OB94	Beech Swp	28-79-30	From source to Fishing Creek	SR 1003	Halifax	2/5/07	Moderate
OB96	Deep Cr	28-79-32-(0.5)	From source to a point 1.3 miles upstream of N.C. Hwy. 97	SR 1100	Halifax	2/5/07	Moderate
OB88	Savage Mill Run	28-79-32-4	From source to Deep Creek	SR 1508	Edgecombe	10/16/00	Not Rated

Bioclassification of Excellent, Good, Natural, Good-Fair, Not Impaired or Moderate Stress = Supporting
Fair, Severe Stress or Poor = Impaired
* Corresponds to Station ID on Figure 2-1

Biological Trends

The bioclassification trends for all basinwide benthos sites in this subbasin can be seen in Figure 2 (results from special studies not included). Most of this subbasin is comprised of a mix of forest and agriculture, and there are very few large point source dischargers present. Bioclassifications generally improved from earlier samples. Notable examples of this could be seen at Fishing Creek (OB101) and Fishing Creek (OB99). Swamp bioclassifications remained unchanged in this subbasin.

Figure 2-2. Bioclassification Trends in HUC 03020102



Fish Community Sampling Summary

Thirteen fish community sites were sampled. Of those, seven sites were classified as Not Rated because metrics and criteria have yet to be developed for Coastal Plain streams. Three of the sites qualified as new fish community regional reference sites: Marsh, Mill, and Jacket Swamps. One of the sites, Crooked Swamp, borders the Northern Outer Piedmont and would rate as Excellent if Piedmont criteria were applied. Shocco Creek, whose fish community rated Excellent

in 2002, was not rated in 2007 due to hydrologic modifications by beavers.

Table 2-2. Fish Community Sample Results

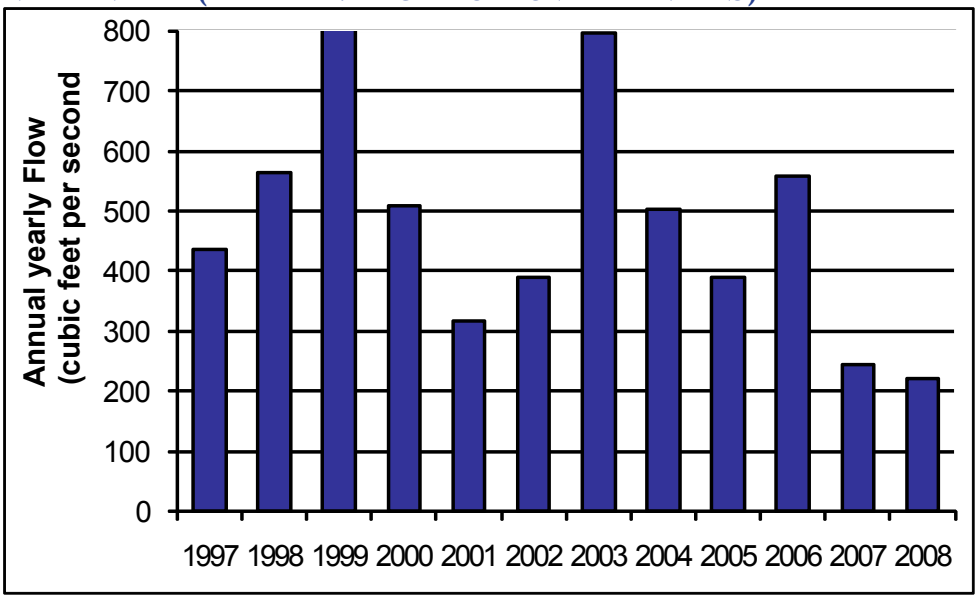
Site ID*	Waterbody	AU #	Description	Location	County	Date	BioClass
OF15	Fishing Cr	28-79-(1)	From source to Shocco Creek	SR 1600	Warren	05/07/07	Excellent
OF39	Shocco Cr	28-79-22	From source to Fishing Creek	SR 1613	Warren	04/11/07	Not Rated
OF66	Crooked Swp	28-79-24	From source to Fishing Creek	SR 1501	Nash	04/11/07	Not Rated
OF26	L Fishing Cr	28-79-25	From source to Fishing Creek	SR 1509	Warren	04/12/07	Excellent
OF34	Reedy Cr	28-79-25-5	From source to Little Fishing Cr	SR 1511	Warren	04/12/07	Good
OF2	Bear Swp	28-79-25-7	From source to Little Fishing Cr	NC 561	Halifax	05/07/07	Good
OF35	Rocky Swp	28-79-28-(0.7)	From a point 1.0 mile downstream of N.C. Hwy. 561 to Fishing Creek	SR 1002	Halifax	05/07/07	Good
OF49	Marsh Swp	28-79-30-1	From source to Beech Swamp	SR 1210	Halifax	05/08/07	Not Rated
OF73	Mill Swp	28-79-30-1-0.5	From source to Marsh Swamp	SR 1615	Halifax	04/13/07	Not Rated
OF70	Burnt Coat Swp	28-79-30-2	From source to Beech Swamp	SR 1216	Halifax	04/13/07	Not Rated
OF71	Jacket Swp	28-79-30-2-1	From source to Burnt Coat Swamp	SR 1216	Halifax	04/13/07	Not Rated
OF72	Breeches Swp	28-79-30-2-1-2	From source to Jacket Swamp	SR 1002	Halifax	04/13/07	Not Rated
OF58	Deep Cr	28-79-32-(1.5)	From a point 1.3 miles upstream of N.C. Hwy. 97 to Fishing Creek	SR 1506	Edgecombe	05/11/07	Not Rated

Not Rated = Fish community metrics and criteria have yet to be developed for Coastal Plain streams
Excellent, Good or Good-Fair = Supporting
Fair or Poor = Impaired
* Corresponds to Station ID on Figure 2-1

Stream Flow

Stream flow is monitored at US Geological Survey gaging stations. Flow, often abbreviated as "Q", is measured in terms of volume of water per unit of time, usually cubic feet per second (cfs). There are six gaging stations in this subbasin. Figure 2-3 provides an example of average stream flow over a 12 year period and gives an idea of which years received heavier precipitation. For more information about instream flow see DWR website: http://www.ncwater.org/About_DWR/Water_Projects_Section/Instream_Flow/welcome.html.

Figure 2-3 Stream Flow at USGS 02083000 Fishing Creek near Enfield (Yearly Average based on Daily Means)



Ambient Data

Subbasinwide, monthly chemical and physical samples are taken by DWQ (1 station) and by the Tar Pamlico Basin Association (9 stations) starting in 2007. A majority of the ambient stations are associated with waterbody locations where potential pollution could occur from known land use activities. There is also a significant portion of the subbasin where no water quality data are collected; therefore, we cannot evaluate the condition of the water quality in those areas. Parameters collected depend on the waterbody classification, but typically include conductivity, dissolved oxygen, pH, temperature, turbidity, nutrient measurements, metals, and fecal coliform. Each classification has an associated set of standards the parameters must meet in order to be considered supporting its designated uses. Stressors are either chemical parameters or physical conditions that at certain levels prevent waterbodies from meeting the standards for their designated use. Ten sample results are required within the five year data collection window in order to evaluate the water quality parameter and compare it to the water quality standards. Ambient stations are listed in Table 2-3, and their locations are found in Figure 2-1 and on watershed maps provided in Appendix 2D.

Table 2-3. Ambient Stations in HUC 03020102

Station ID	Agency	Active Since	Waterbody	AU#	Station Location	Stressors
O4300000	TPBA	3/1/07	Fishing Cr	28-79-(1)	SR 1001 Dr King Blvd near Warrenton	Low DO
O4400500	TPBA	3/1/07	Fishing Cr	28-79-(1)	SR 1600 Baltimore Rd near Warrenton	-
O4480000	TPBA	3/1/07	Fishing Cr	28-79-(21)	NC 561 near Wood	Low DO
O4630000	TPBA	3/1/07	Little Fishing Cr	28-79-25	NC 481 near White Oak	Low DO
O4670000	TPBA	3/1/07	Fishing Cr	28-79-(25.5)	SR 1222 Bellamy Mill Rd near Enfield	-
O4680000	NCAMBNT	11/25/80	Fishing Cr	28-79-(29)	US 301 near Enfield	-
O4690000	TPBA	3/1/07	Fishing Cr	28-79-(29)	SR 1109 Etheridge Farm Rd near Enfield	-
O4899000	TPBA	3/1/07	Fishing Cr	28-79-(30.5)	NC 97 near Lawrence	-
O4995000	TPBA	3/1/07	Deep Cr	28-79-32-(0.5)	SR 1104 near Scotland Neck	Low DO, Fecal Coliform Bacteria
O5100000	TPBA	3/1/07	Deep Cr	28-79-32-(0.5)	US 258 near Scotland Neck	Low DO, Fecal Coliform Bacteria
O4805000	RAMS	2007-2008	UT Beech Swamp	28-79-30ut1	SR 1003 at Enfield	zinc, water column mercury

TPBA= Tar Pamlico Basin Association, NCAMBNT= DWQ, RAMS= Random Ambient Monitoring System, sampled by DWQ
"-" indicates no stressors identified

The following discussion of ambient monitoring parameters includes graphs showing the median and mean concentration values for all ambient stations (n=10) in this subbasin for a specific parameter over each year. Because only one ambient station (O4680000) was monitored until March 2007 all the following summary graphs are for one station for 10 years and then the last two years includes an additional nine stations. Please note that these graphs are not intended to provide statistically significant trend information or loading numbers. The difference between median and mean results indicate the presence of outliers in the dataset. Box and whisker plots of individual ambient stations were completed by parameter for data between 2002-2007 and can be found in the Ambient Monitoring report: http://portal.ncdenr.org/c/document_library/get_file?uuid=994c08a8-a98d-4ff5-9425-656cadf8cfa4&groupId=38364. Summary sheets for ambient stations are found in Appendix 2C.

Turbidity

The turbidity standard for freshwater (Class C) streams is 50 NTUs. Currently, there are no streams impaired because of turbidity exceedances in this subbasin. Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), harm fish food sources, fill in pools (reducing cover from prey and high temperature refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul treatment systems, and fill reservoirs. (USEPA, 1999 and Waters, 1995). It is important to note that the turbidity standard does not capture incident duration or the amount of sedimentation, both of which can impact aquatic species.

Figure 2-4. Summarized Turbidity values for all data collected at Ambient Stations in HUC 03020102

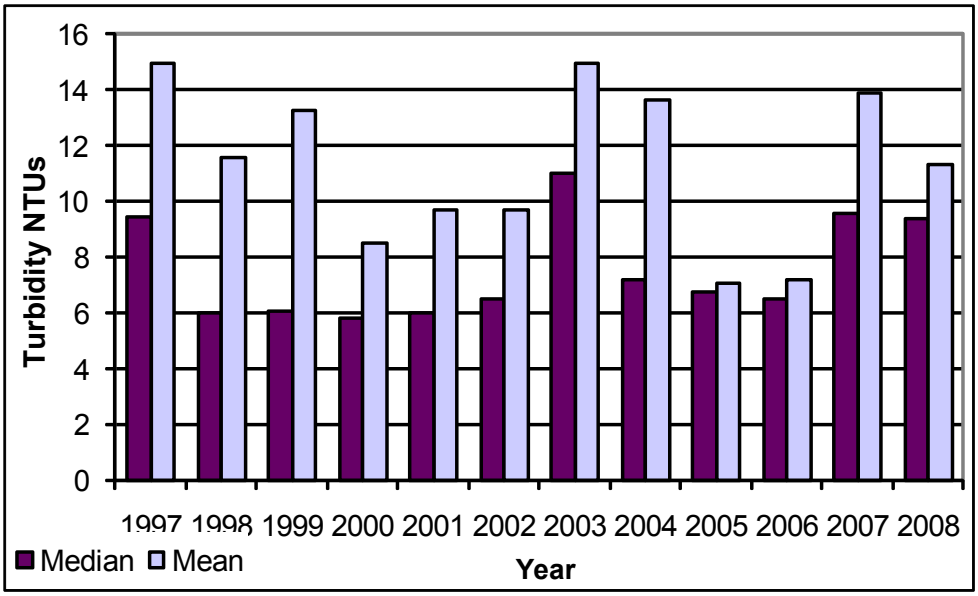


Figure 2-4 shows data over a 12 year period, representing 325 samples, of which only 3 samples had turbidity levels above 50 NTUs. Turbidity does not appear to be a problem in this subbasin.

Fecal Coliform Bacteria

The fecal coliform bacteria standard for freshwater streams is not to exceed the geomean of 200 colonies/100ml or 400 colonies/100ml 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 to be used to indicate whether the stream is Impaired or Supporting. Waters with a classification of B (primary recreation water) will receive priority for 5-in-30 studies. Other waterbodies will be studied as resources permit. Data through 2007 indicate several streams where bacteria colony numbers exceeded 400 colonies/100ml. These streams currently impacted by fecal coliform bacteria include:

Fishing Creek, C;NSW, (from Little Fishing Creek to 1.7 miles downstream of Beech Swamp) AU#s 28-79-(25.5) & 28-79-(29)
Deep Creek C;NSW, (from source to 1.3 miles upstream of Hwy. 97) AU# 28-79-32- (0.5)

The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other warm-blooded animals. At the time this occurred, the source water might have been contaminated by pathogens or disease producing bacteria or viruses that can also exist in fecal material. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste.

Figure 2-5. Summarized Fecal Coliform Bacteria numbers for all data collected at Ambient Stations in HUC 03020102

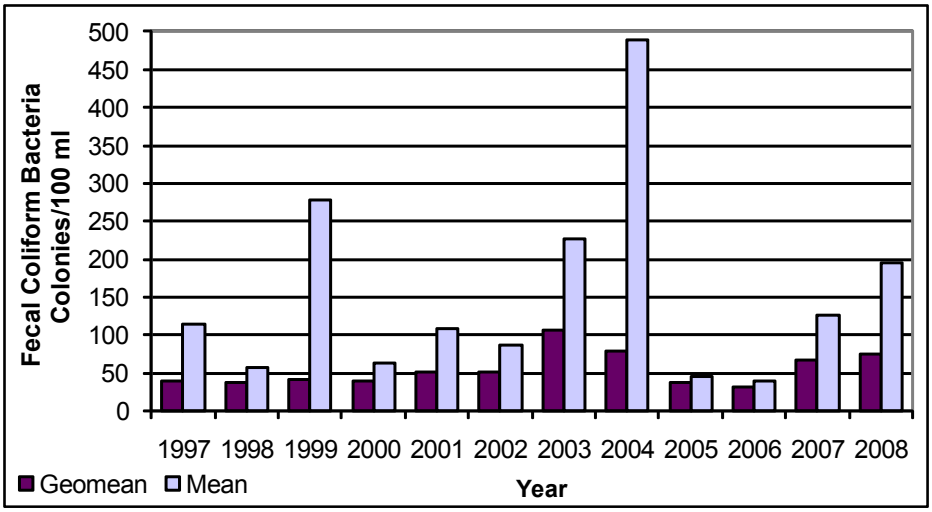


Figure 2-5 represents data over a 12 year period, representing 323 samples, of which 27 samples (8%) had fecal coliform bacteria levels above 400 colonies/100ml. A majority of these high fecal numbers occurred in 2007 & 2008 when sampling increased.

pH

The water quality standard for pH in surface freshwaters is 6.0 to 9.0 standard units. Swamp waters (supplemental Class Sw) may have a pH as low as 4.3 if it is the result of natural conditions. pH is a measure of hydrogen ion concentration that is used to express whether a solution is acidic or alkaline (basic). Values outside the 6.0-9.0 standard unit range can have chronic effects on the community structure of macroinvertebrates, fish and phytoplankton.

Figure 2-6. Summarized pH values for all data collected at Ambient Stations in huc 03020102

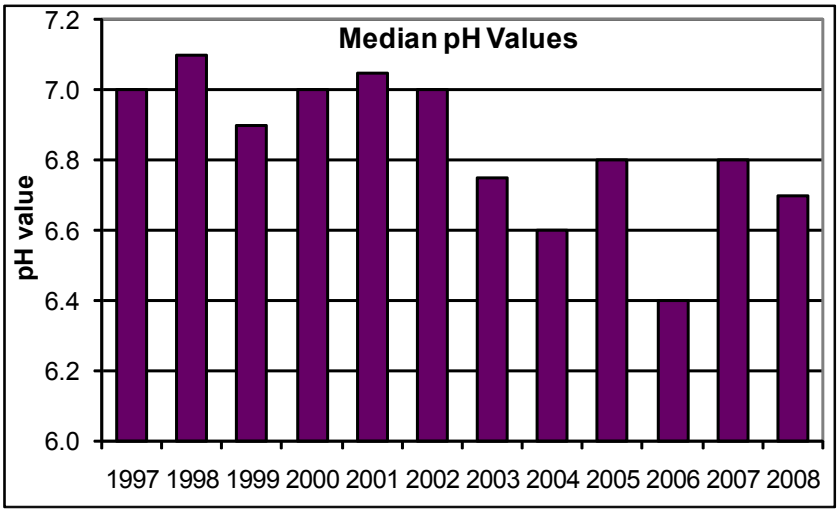


Figure 2-6 represent data over a 12 year period, representing 415 samples, of which 18 (4%) had pH levels below 6. A majority of these low pH readings occurred during 2008 and may be associated with drought conditions and the increase in monitoring by the TPBA sites.

Dissolved Oxygen

The dissolved oxygen (DO) water quality standard for Class C waters is not less than a daily average of 5.0 mg/L with a minimum instantaneous value of not less than 4 mg/L, the latter standard being the most commonly used. Swamp waters may have lower values if the low DO level is caused by natural conditions. Dissolved oxygen can be produced by wind or wave action that mix air into the water or through aquatic plant photosynthesis. During the day, DO levels are higher when photosynthesis occurs and they drop at night when respiration occurs by aquatic organisms. High levels are found mostly in cool, swift moving waters and low levels are found in warm, slow moving waters. In slow moving waters, such as reservoirs or estuaries, depth is also a factor. Wind action and plants can cause these waters to have a higher dissolved oxygen concentration near the surface, while biochemical reactions lower in the water column may result in concentration as low as zero at the bottom.

The drought conditions impacted DO levels throughout the basin There were many sites in the basin that had low dissolved oxygen measurements. However, most of these sites were Tar Pamlico Basin Association sites and had only been monitored since March 2007. Nearly the entire monitoring history for these sites was during the 2007-2008 drought, which, due to drops in flow, suppressed dissolved oxygen levels. Data from Fishing Creek (from Enfield Raw Water Supply Intake to a point 1.7 miles downstream of Beech Swamp) AU# 28-79-(29) indicates the creek is impacted because of low DO levels, this is a result of data collected prior to 2007 drought conditions.

Figure 2-7. Summarized Dissolved Oxygen Levels for all data collected at Ambient Stations in HUC 03020102

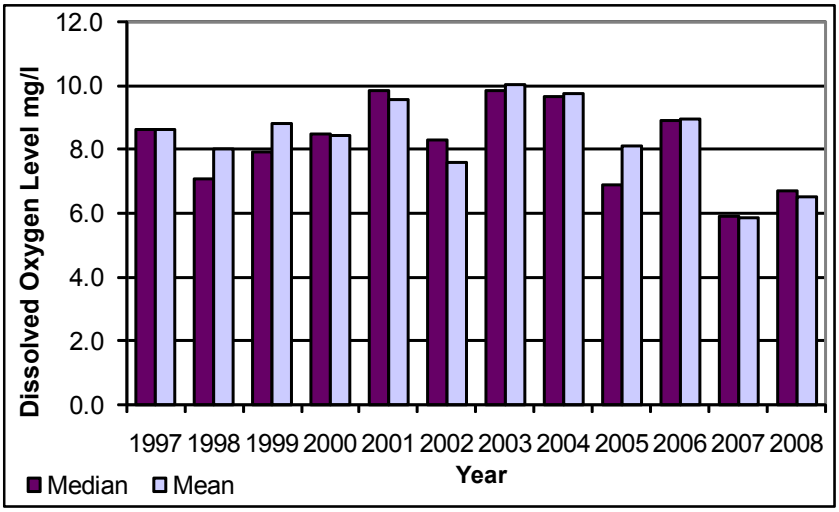


Figure 2-7 shows data over a 12 year period, representing 412 samples, documented 73 samples (18%) with DO levels below 4 mg/L. DO levels in this subbasin were heavily influenced by low flows during dry years, with 71 (97%) of the low DO samples occurring during the drought.

Nutrient Enrichment

Compounds of nitrogen and phosphorus are major components of living organisms and thus are essential to maintain life. These compounds are collectively referred to as “nutrients”. Nitrogen compounds include ammonia as nitrogen (NH_3), Total Kjeldahl Nitrogen (TKN), and nitrite+nitrate nitrogen (NO_2+NO_3). Total nitrogen (TN) is the sum of TKN and NO_2+NO_3. Phosphorus is measured as total phosphorus (TP) by DWQ. When nutrients are introduced to an aquatic ecosystem from municipal and industrial treatment processes or runoff from urban or agricultural land, the growth of algae and other plants may be accelerated. In addition to the possibility of causing algal blooms, ammonia-nitrogen may combine with high pH water to form ammonium hydroxide (NH_4OH), a form toxic to fish and other aquatic organisms.

Due to excessive levels of nutrients resulting in massive algal blooms and fish kills the entire Tar-Pamlico River Basin was designated as Nutrient Sensitive Water (NSW) in 1989. This designation resulted in the development and implementation of a nutrient management strategy to achieve a decrease in TN by 30% and no increase in TP loads compared to 1991 conditions. Even though implementation of the strategy has occurred by wastewater treatment plant dischargers, municipal stormwater programs, and agriculture, nutrient enrichment continues to be cumulatively impacting the Pamlico Estuary. A review of the NSW strategy, including implementation activities, progress towards meeting the loading goals and additional actions are discussed in Chapter 6.

Basin trend analyses were completed for nutrient concentration and daily loads to evaluate progress towards meeting TMDL reduction goals, as discussed in detail in the NSW Chapter 6. These analyses detected a statistically significant increase in TKN concentration and a decrease in NH_3 and NO_2+NO_3. There were no basinwide detected trends for TN or TP concentrations. TKN is defined as total organic nitrogen and NH_3. An increase in organic nitrogen is the likely source for the increase in TKN concentrations since NH_3 concentrations have decreased basinwide. Further analysis of these parameters were completed on a subbasin scale to determine whether

concentrations changed over an 11 year time period. Currently, NC does not have nutrient standards; however, NC normal nutrient levels in class C waters are typically:

TP = < 0.05 mg/L
TN= < 0.8 mg/L
TKN= <0.5 mg/L
NH_3= < 0.05 mg/L

In early 2001, the DWQ Laboratory Section reviewed it's internal Quality Assurance/Quality Control (QA/QC) programs and some of their analytical methods. This effort resulted in a marked increase in reporting levels for certain parameters. New analytical equipment and methods were subsequently acquired to establish new lower reporting levels and more scientifically supportable quality assurance. As a result, the reporting levels quickly dropped back down to at or near the previous reporting levels. Nutrients were especially affected by these changes, as shown below:

	Reporting Level by Date (mg/L)			
Parameter	Pre-2001	3/13/2001 to 3/29/2001	3/30/2001 to 7/24/2001	7/25/2001 to present
NH_3	0.01	0.05	0.2	0.01
TKN	0.1	1.0	0.6	0.2
NO_2+NO_3	0.01	0.5	0.15	0.01
TP	0.01	0.5	0.1	0.02
Note: Do not let increased reporting levels be interpreted as a sudden upward trend. The Laboratory Section cautions that the establishment of minimum reporting levels may have been inconsistent and undocumented prior to those established in July 2001.				

Also, from July 2001 to May 2003 insufficient staffing resulted in suspension of nutrient sampling at most stations, resulting in a smaller sample size for 2001 and 2002.

Pollution runoff into streams from nonpoint sources decreases during periods of limited precipitation, while point sources may contribute significant effluent to stream flow when surface runoff and baseflow is decreased. During rainier periods discharge effluent makes up less of the total stream volume and runoff from nonpoint sources increases. Although drought data are limited to three years (2001, 2007 & 2008) and likely influenced by the addition of nine Tar Pamlico Basin Association monitoring sites that started sampling in 2007 there is an increase in nutrient concentrations during these years (Figures 2-8 & 2-9). Additional data collection over the next several years with the increased sample size will help determine source influence on nutrient levels. It is unclear whether this subbasin is contributing to the basin increase in TKN as NH_3 and TKN show fluctuations over the years (Figures 2-10 & 2-11).

Figure 2-8. Summarized Total Phosphorus values for all data collected at Ambient Stations in HUC 03020102

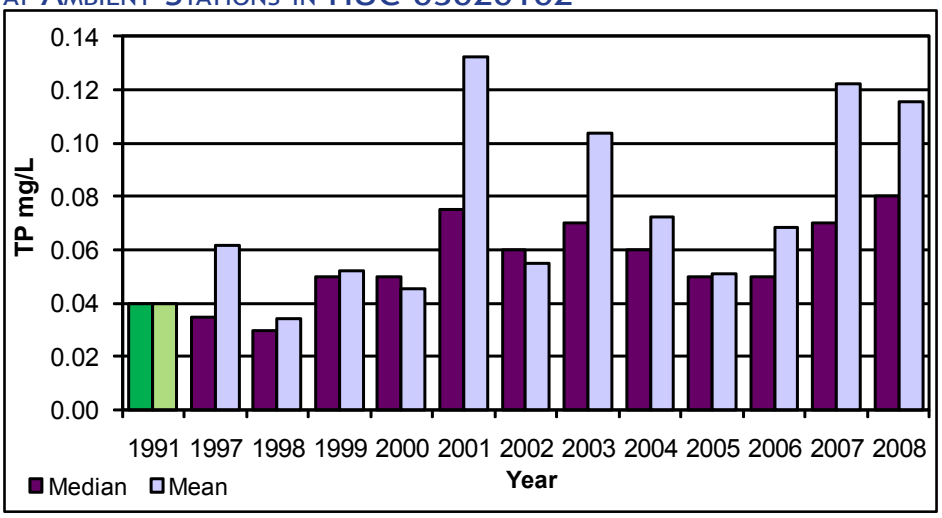
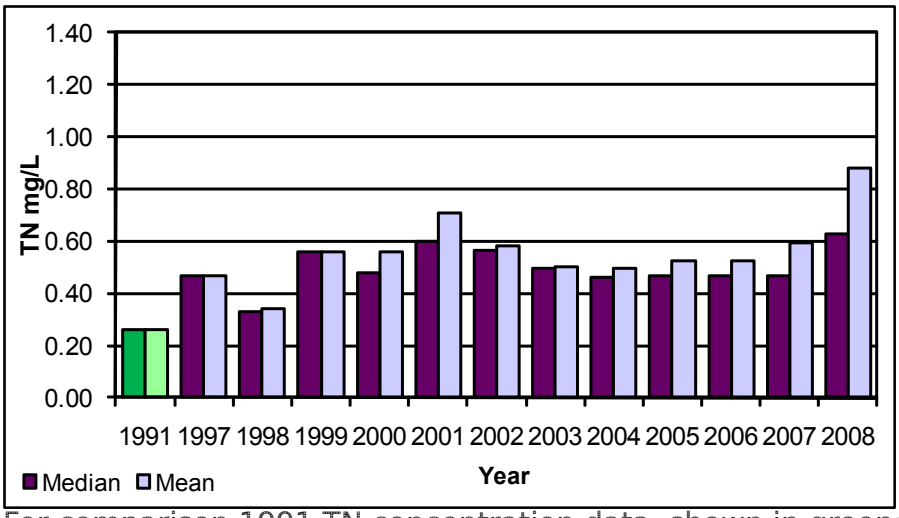


Figure 2-8 represents data from 312 samples which were taken over a 12 year period, of which 191 samples (61%) had TP levels above 0.05 mg/L. A majority of the high TP levels occurred at new TPBA monitoring sites during 2007-08. High TP levels were detected across all monitoring stations and were not focused in one area.

For comparison, 1991 TP concentration data, shown in green: Median= 0.04 Mean = 0.04

Figure 2-9. Summarized Total Nitrogen values for all data collected at Ambient Stations in HUC 03020102

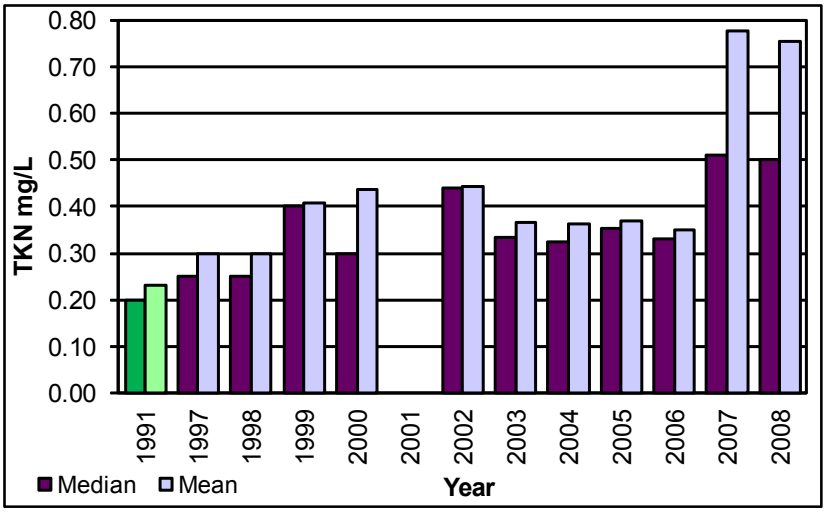


For comparison 1991 TN concentration data, shown in green:
Median= 0.26 Mean = 0.26

Figure 2-9 represents data from 311 samples which were taken over a 12 year period, of which 88 samples (28%) had TN levels above 0.8 mg/L.

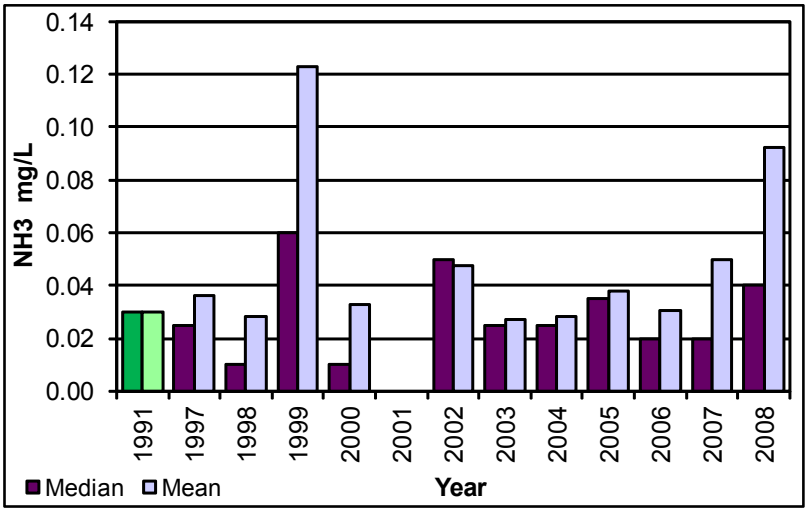
A majority of the high TN levels occurred at new TPBA monitoring sites during 2007-08. Several samples were from a site in the upper reach of Fishing Creek just below Warrenton's WWTP. The other stations with the majority of higher TN were located along Deep Creek.

Figure 2-10. Summarized TKN Concentrations in HUC 03020102



For comparison 1991 TKN concentration data, shown in green:
Median= 0.2 Mean = 0.23

Figure 2-11. Summarized Ammonia Concentrations in HUC 03020102



For comparison 1991 NH_3 concentration data, shown in green:
Median= 0.03 Mean = 0.03

The limited ammonia data in 2001 contained outliers that skewed the data and therefore were eliminated from the ammonia and TKN graphs but were included in the TN graph.

Restoration and Protection Opportunities

The following section provides more detail about specific streams where special studies have occurred or stressor sources information is available. Specific stream information regarding basinwide biological samples sites are available in Appendix 2B. Use support information on all monitored streams can be found in Appendix 2A. Detailed maps of each of the watersheds are found in Appendix 2D or by clicking on the following small maps. Interactive elements have been incorporated within all 10-digit watershed maps. To use the new features click on the Layers tab on the left side of the Adobe Reader window. Expand the folder tree by clicking on the (+) sign to the left of the map name. Each item in the subsequent folder tree is a layer on the map. These layers can be turned on or off by clicking the symbol to the left of the layer name. To return to your previous place within the text click the smaller map in the upper left corner of the 10-digit watershed map.

To assist in identifying potential water quality issues, we are requesting information be gathered by citizens, watershed groups and resource agencies through our Impaired and Impacted Stream/Watershed Survey found here: **http://portal.ncdenr.org/web/wq/ps/bpu/about/impactedstreamssurvey**.

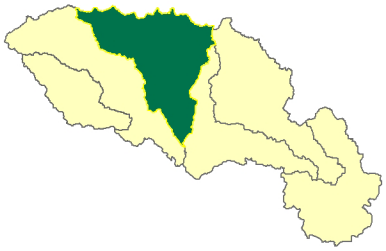
Aquatic Species Protection

Streams within the Fishing Creek Subbasin and associated riparian habitat support significantly rare fish, mussels, and plants in addition to the Tar spinymussel and dwarf wedgemussel. Fishing Creek, in particular, is a designated nationally significant aquatic natural heritage area. The federal species of concern and state endangered Atlantic pigtoe (*Fusconaia masoni*), yellow lance (*Elliptio lanceolata*),and yellow lampmussel (*Lampsilis cariosa*) are known to occur in the management area. Other mussels known from this area include the state-listed as threatened triangle floater (*Alasmidonta undulata*), creeper (*Strophitus undulatus*), Roanoke slabshell (*Elliptio roanokensis*) and eastern lampmussel (*Lampsilis radiata*), as well as the notched rainbow (*Villosa constricta*), a state species of concern. Two rare fish, the Carolina madtom (*Noturus furiosus*) and pinewoods shiner (*Lythrurus matutinus*), the rare North Carolina spiny crayfish (*Orconectes carolinensis*), the state species of special concern Neuse River waterdog (*Necturus lewisi*), the federal species of concern and State rare Roanoke bass (*Ambloplites cavifrons*) and the state threatened brook lamprey (*Lampetra aepyptera*) are also known to occur in this subbasin.

Shocco Creek Watershed (0302010201)

Shocco Creek (AU# 28-79-22, 26.7 miles) and Little Shocco Creek (AU# 28-79-22-6, 7.8 miles) are threatened and endangered aquatic species protection priority areas. In Shocco Creek, the 2007 fish community rating decreased to Good-Fair from its previous rating of Excellent as recorded in 1992. The 2007 benthic site was Not Rated but a decrease in the number of macroinvertebrates likely due to a beaver dam, was noted. The creek should be resampled during non-drought conditions.

Due to the presence of threatened and endangered species, this watershed is a priority for implementation of nonpoint source BMPs, including agricultural BMPs, stormwater control BMPs, buffer enhancement, and sediment and erosion control BMPs.



Little Fishing Creek Watershed (0302010202)

Little Fishing Creek (AU# 28-79-25, 31.4 miles) watershed is a threatened and endangered aquatic species protection priority area. A benthic sample was taken in Little Fishing Creek as part of a DWQ Level IV Ecoregional reference site internal study on 3/9/09 which rated Good-Fair. There is a small concentration of wastewater residual application fields in this watershed.

Littleton WWTP (NC0025691) discharges into Butterwood Creek in the Bear Swamp subwatershed (HUC 030201020204). Butterwood Creek is currently not monitored by DWQ. The NPDES permitted flow is 0.28 MGD and the median annual daily flow is currently 0.088 MGD. The WWTP is presently being well maintained and operated. Evaluation of the facility's discharge impact to endangered mussel species found in this segment of the river may be required.

Due to the presence of threatened and endangered species, this watershed is a priority for implementation of nonpoint source BMPs, including agricultural BMPs, stormwater control BMPs, buffer enhancement, and sediment and erosion control BMPs.

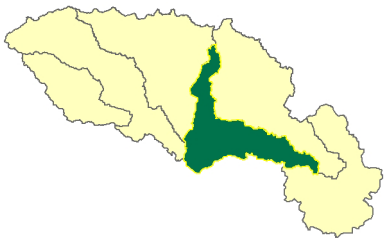
Upper Fishing Creek Watershed (0302010203)

Fishing Creek (AU# 28-79-(1), 36.7 miles) and Maple Branch (AU# 28-79-20.5, 6.5 miles) are threatened and endangered aquatic species protection priority areas. The benthic sample on Fishing Creek in the upper watershed rated Good-Fair in 2007, while the fish sample rated Excellent. The creek should be resampled during non-drought conditions.

The town of Warrenton's WWTP (NC0020834) discharges into Fishing Creek and is a member of the Tar Pam Basin Association. Evaluation of the facility's discharge impact to endangered mussel species found in this segment of the river may be required.
Due to the presence of threatened and endangered species, this watershed is a priority for implementation of nonpoint source BMPs, including agricultural BMPs, stormwater control BMPs, buffer enhancement, and sediment and erosion control BMPs.

Beech Swamp Watershed (0302010204)

There were five fish community samples taken in 2007 in this watershed. All of these samples indicated there were no apparent water quality issues. However, a Random Ambient Monitoring System (RAMS) station (O4805000) did detect zinc above the action level standard and water column mercury in an unnamed tributary to Beech Swamp. This UT to Beech Swamp (28-79-30ut1, 2.2 mi) is on the 2010 303(d) list for these metals exceedances.

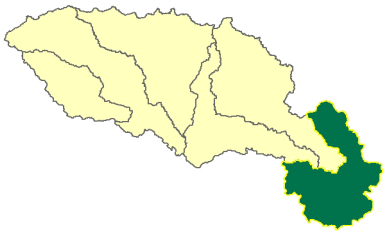


Middle Fishing Creek Watershed (0302010205)

Benthic samples in this watershed resulted in Good and Excellent bioclassifications and no apparent water quality issues. However, two ambient stations did have samples with high fecal coliform bacteria levels.

The town of Enfield WWTP (NC0025402) discharges into Fishing Creek, which has had recent permit exceedances for fecal coliform bacteria, ammonia, BOD, total suspended solids, pH and chlorine. This facility's compliance has improved but there is still a need to address inflow and infiltration to the wastewater collection system.

Rocky Swamp (HUC 030201020502), AU#s 28-79-28-(0.3) & 28-79-28-(0.7), located within this watershed is a threatened and endangered aquatic species protection priority area, making this watershed a priority for implementation of nonpoint source BMPs, including agricultural BMPs, stormwater control BMPs, buffer enhancement, and sediment and erosion control BMPs.



Lower Fishing Creek Watershed (0302010206)

A tributary to Deep Creek (HUC 030201020602), AU# 28-79-32-(0.5)ut18, is not Impaired but is considered impacted because of elevated fecal coliform bacteria levels. Low pH and low DO levels are considered to be a result of natural conditions in this subwatershed. Scotland Neck WWTP (NC0023337) discharges into Canal Creek which is a tributary to Deep Creek. Fecal coliform bacteria exceedances by the WWTP appear to stem from inflow and infiltration and their attempt to use an inadequate UV system. Installation of a permanent chlorine/dechlorination system is planned for when money becomes available, while continuing to use a temporary disinfection system. The town recently received grants to do extensive work on improving the collection system.

The benthic sample on the most downstream portion of Fishing Creek rated Excellent in 2007.

Additional Studies

Volunteer Water Information Network

The Volunteer Water Information Network (VWIN) is a partnership of groups and individuals dedicated to preserving water quality in North Carolina. In August 2005, the Pamlico-Tar River Foundation initiated a monitoring program in tributaries to the Tar River. The UNC-Asheville Environmental Quality Institute provided technical assistance through laboratory analyses of water samples, statistical analyses of water quality results, and written interpretation of the data. Volunteers collected water samples once a month from selected streams in Edgecombe, Nash, and Pitt counties. The results of this data collection are similar to DWQ's sampling results, but VWIN also collected data on streams that DWQ does not monitor. The VWIN report, available in Appendix 2E, provides statistical analyses and interpretation of data from samples gathered from Deep Creek, Fishing Creek, and White Oak Swamp.

Permit Programs

Wastewater Dischargers

The National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States, as authorized by the Clean Water Act. Non-compliance with permit limits on wastewater flow and constituents can lead to discharge of pollutants that degrades surface waters making them unsafe for drinking, fishing, swimming, and other activities. The NPDES Permitting and Compliance Programs of DWQ is responsible for administering the program for the state. These permits are reviewed and are potentially renewed every five years, a list of NPDES permits in this subbasin is in Table 2-4.

All NPDES permitted facilities use 7Q10s (the lowest stream flow for seven consecutive days that would be expected to occur once in ten years) as critical flow in determining permit limits for non-carcinogen toxicants. If a toxicant is a known carcinogen then the QA (the mean annual stream flow) is used in determining permit limits. In cases where an aesthetic standard is applicable to a pollutant then the permit limit is based on 30Q2 (the minimum average flow for 30 consecutive days that would be expected to occur once in 2 years). These critical flow values used to determine permit limits for all NPDES facilities may need to be reviewed as the permits come up for renewal. Currently, a 7Q10 is only evaluated in the initial application of the permit and upon expansion. Low flow conditions impact a stream's ability to assimilate both point and nonpoint source pollutants. Droughts, as well as the demand for water resources are very likely to increase; therefore, the reevaluation of stream flow will become more critical to water quality within the next decade or so. DWQ will work with Division of Water Resources and other agencies to discuss the need and resource availability to update 7Q10 values.

Table 2-4. NPDES Discharge Permits

Permit #	Owner Name	Facility Name	Owner Type	Permit Type	Class	Receiving Stream	Permit Flow MGD
NC0020834*	Town of Warrenton	Warrenton WWTP	Government - Municipal	Municipal Wastewater Discharge, Large	Major	Fishing Creek	2
NC0038580	Halifax County Schools	Eastman Middle School WWTP	Government - County	Discharging 100% Domestic < 1MGD	Minor	Little Fishing Creek	0.0048
NC0038610	Halifax County Schools	Pittman Elementary School WWTP	Government - County	Discharging 100% Domestic < 1MGD	Minor	Burnt Coat Swamp	0.0096
NC0038644	Halifax County Schools	Dawson Elementary School WWTP	Government - County	Discharging 100% Domestic < 1MGD	Minor	Deep Creek	0.0073
NC0084034*	Town of Enfield	Enfield WTP	Government - Municipal	Water Plants and Water Conditioning	Minor	Fishing Creek	0
NC0088587	Arcola Lumber Company, Inc.	Arcola Lumber Company	Industrial Process & Commercial	-	Minor	-	-
NC0023337*	Town of Scotland Neck	Scotland Neck WWTP	Government - Municipal	Municipal Wastewater Discharge, < 1MGD	Minor	Canal Creek	0.675
NC0025402*	Town of Enfield	Enfield WWTP	Government - Municipal	Municipal Wastewater Discharge, Large	Major	Fishing Creek	1
NC0025691	Town of Littleton	Littleton WWTP	Government - Municipal	Municipal Wastewater Discharge, < 1MGD	Minor	Butterwood Creek	0.28
* Indicates Tar-Pamlico Basin Association Permittee Member							

On-Site Wastewater Treatment Systems (Septic Systems)

Wastewater from many households is treated on-site through the use of permitted septic systems instead of being sent to a wastewater treatment facility. Poorly planned and/or maintained systems can fail and contribute to nonpoint source pollution. Wastewater from failing septic systems can contaminate groundwater and surface water. Failing septic systems are health hazards and are considered illegal discharges of wastewater if surface waters are impacted. Information about the proper installation and maintenance of septic tanks can be obtained by contacting the Department of Environmental Health and local county health departments. Local health departments are responsible for ensuring that new systems are sited and constructed properly and an adequate repair area is available. County, town and city planners need to understand the economic and human health ramifications caused by failing septic systems and plan for long-term septic system sustainability.

In 2007, North Carolina Agricultural Research Service completed a report concerning nitrogen contributions from on-site wastewater systems for each river basin. The results for this subbasin based on 1990 census data indicate a population of 22,777 people using 8,805 septic systems resulting in a nitrogen loading of 227,768 lbs/yr and nitrogen loading rate of 255 lbs/mi^2/yr. These numbers reflect the TN discharged to the soil from the septic system and does not account for nitrogen used because of soil processes and plant uptake. (Pradhan et al. 2007).

Wastewater Residuals (Biosolids)

Residuals, biosolids or treated sludge, are byproducts of the wastewater treatment process. After pathogen reduction, vector attraction reductions, and metal limits are met, these residuals are disposed in a manner to protect public health and the environment. Disposal sites include land fills, dedicated and non-dedicated residual disposal sites, agricultural land for crops not for human consumption, and distribution to the public for home use. When applied to the land, steps must be taken to assure that residuals are applied at or below agronomic rates based on the soil and crop types present at the disposal site. If these criteria cannot be met, permitted disposal must take place at a dedicated residual disposal site or landfill.

In this subbasin, four facilities that produce wastewater residuals (Class B) apply their treated sludge on an available 30 fields covering 998 acres (not all fields are used every year). A rough estimate of 69,860lbs/yr of nitrogen and 89,820 lbs/yr of phosphorus are applied to these fields. This estimate does not include Class A residuals which are not monitored by DWQ but do contain a potential source of nutrients. Of these permitted facilities, only one is located in the Tar-Pamlico River Basin, the other three permit holders are facilities outside the basin but apply their residuals within the basin. Additional research would be necessary to determine if organic nitrogen from biosolids are contributing to the basinwide increase in organic nitrogen. For more information about residuals please see DWQ's Aquifer Protection Section site: **http://portal.ncdenr.org/web/wq/aps/lau**.

Non-Discharge

Non-discharge systems have been the preferred alternative to discharge to surface waters for some NSW waterbodies and DWQ requires all new and expanding NPDES permit applicants to provide documentation that considers alternatives to surface waters. Non-discharge wastewater options include spray irrigation, rapid infiltration basins, and drip irrigation systems. Although these systems are operated without a direct discharge to surface waters, they still require a DWQ permit. The permit insures that treated wastewater is applied to the land at a rate that is protective of groundwater resources, and does not produce ponding or runoff into a waterbody. More information about land application and non-discharge requirements can be found on the DWQ Aquifer Protection Section – Land Application Unit website: **http://portal.ncdenr.org/web/wq/aps/lau**. Non-discharge permits in this subbasin are listed in Table 2-5.

Run-off and spills are not common at non-discharge facilities. In general, maintaining compliance

with permit conditions largely falls back to having a properly managed facility. Aging collection systems may lead to increased flows from inflow and infiltration or a facility may not be properly prepared to expand as flows increase and the upper limits of a plant's capacity are reached. Non-discharge facilities, just like any other, must properly plan for any elevated flows and take action to ensure that the facility is capable of managing the wastewater.

Groundwater moving into surface water is a mechanism to introduce nutrients into the surface water system in the absence of direct discharges and in NSW systems it is important to be able to better quantify these potential nutrient loads. Some facilities have a groundwater monitoring program to measure compliance with groundwater quality standards. However, it should be noted that a facility can be compliant with groundwater quality requirements while still contributing to the overall nutrient loading of a surface water system. A better understanding of the groundwater/surface water interaction process at non-discharge facilities may help to identify and quantify nutrient loading from these locations .

Table 2-5. Non-Discharge Permits

Facility Name	Permit Type	Permit #	Size
Perdue Farms Incorporated-Hatchery#9	Surface Irrigation	WQ0006058	Major
Enfield Sawmill	Wastewater Recycling	WQ0006962	Major
Highway 97 Truckwash	Surface Irrigation	WQ0014928	Minor
Warren County Transfer Station	Surface Irrigation	WQ0020926	Minor
Scotland Neck WWTP	Reuse	WQ0022697	Minor
International Paper Company-Ridgeway Chip Mil	Wastewater Recycling	WQ0023181	Minor

Wetland Or Surface Water Disturbance (401 Certification)

The "401" refers to Section 401 of the Clean Water Act. The North Carolina DWQ is the state agency responsible for issuing 401 water quality certifications (WQC). When the state issues a 401 certification, this certifies that a given project will not degrade waters of the state or violate state water quality standards. A 401 WQC is required for any federally permitted or licensed activity that may result in a discharge to waters of the U.S. Typically, if the United States Army Corps of Engineers determines that a 404 Permit or Section 10 Permit is required because a proposed project involves impacts to wetlands or surface waters, then a 401 WQC is also required. Locations of 401 WQCs are included on each watershed map. Examples of activities that may require permits include:

- Any disturbance to the stream bed or banks,
- Any disturbance to a wetland,
- The damming of a stream channel to create a pond or lake,
- Placement of any material within a stream, wetland or open water, including material that is necessary for construction, culvert installation, causeways, road fills, dams, dikes or artificial islands, property protection, reclamation devices, and fill for pipes or utility lines and
- Temporary impacts including dewatering of dredged material prior to final disposal and temporary fill for access roads, cofferdams, storage, and work areas.

Riparian Buffers

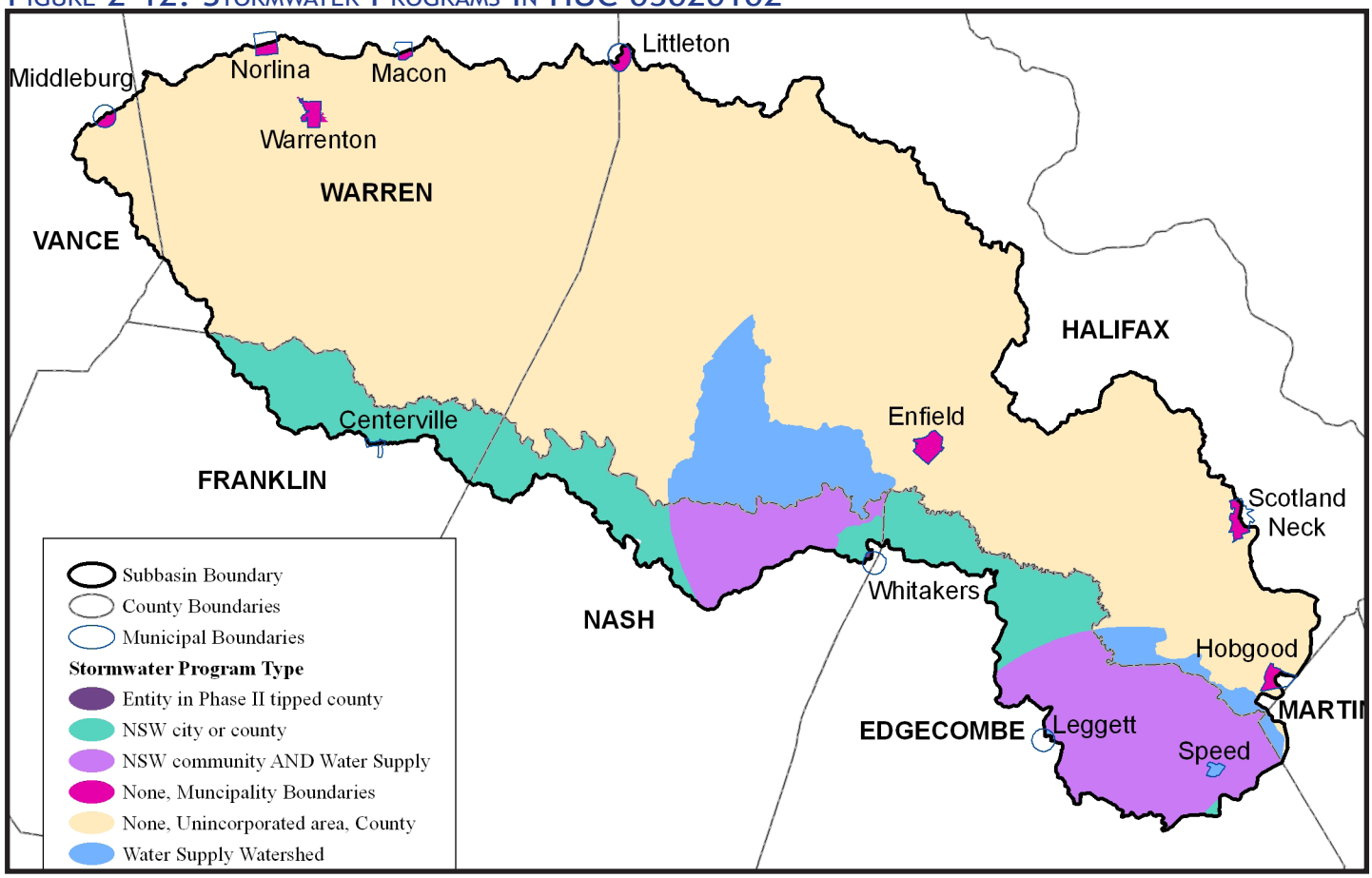
Riparian buffers in the basin are to be protected and maintained on both sides of intermittent and perennial streams, lakes, ponds, and estuarine waters. Tar-Pamlico River Basin Buffer Rules **(15A NCAC 2B.0259)** do not establish new buffers unless the existing use in the buffer area changes. The footprints of existing uses such as agriculture, buildings, commercial, and other facilities, maintained lawns, utility lines, and on-site wastewater systems are exempt. A total of 50 feet of riparian area is required on each side of waterbodies; within this 50 feet, the first 30 feet, is to remain undisturbed and the outer 20 feet must be vegetated. Activities that disturb this buffer require a buffer authorization from DWQ or may require a major variance approval from the Environmental Management Commission. More information about the buffer rules are available at: **http://portal.ncdenr.org/web/wq/swp/ws/401/riparianbuffers**.

Stormwater

There are many different stormwater programs administered by DWQ. One or more of these programs affects many communities in the Tar-Pamlico River Basin. The goal of the DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state through the use of stormwater runoff controls. Active stormwater control programs in the basin include Phase II NPDES and State post-construction, coastal stormwater, HQW/ORW stormwater, Tar-Pamlico River Basin NSW stormwater, and associated with the Water Supply Watershed Program requirements. The following Figure 2-12 shows that the different stormwater programs in this subbasin.

Franklin, Nash and Edgecombe counties are required to implement actions to prevent and treat stormwater runoff under the Tar-Pamlico NSW stormwater rules. These local programs include new development controls to reduce nitrogen runoff by 30 percent compared to pre-development levels and to keep phosphorus inputs from increasing over pre-development levels. The local programs must also identify and remove illicit discharges; educate developers, businesses, and homeowners; and make efforts toward treating runoff from existing developed areas. As of July 2009, there are five general stormwater and two individual stormwater permits.

FIGURE 2-12. STORMWATER PROGRAMS IN HUC 03020102



Interbasin Transfers

In 1993, the North Carolina Legislature adopted the Regulation of Surface Water Transfers Act (G.S. §143-215.22L) and subsequently modified it in 2007. This law regulates large surface water transfers between river basins by requiring a certificate from the Environmental Management Commission (EMC). A transfer certificate is required for a new transfer of 2 million gallons per day (MGD) or more and for an increase in an existing transfer by 25 percent or more (if the total including the increase is more than 2 MGD). Certificates are not required for facilities that existed or were under construction prior to July 1, 1993 up to the full capacity of that facility to transfer water, regardless of the transfer amount.

The Kerr Lake Regional Water System (KLRWS) is a regional provider of potable water service for portions of Vance, Granville, Franklin, and Warren counties. KLRWS has an existing grandfathered surface water transfer capacity of 10 MGD that allows the system to move water from the Roanoke River Basin (Kerr Lake) to Fishing Creek and Upper Tar subbasins. On February 18, 2009, KLRWS submitted a Notice of Intent to Request an Interbasin Transfer (IBT) Certificate to the Environmental Management Commission. The request is to increase the authorized transfer from 10 MGD to 24 MGD, based on water use projections to the year 2040. More information about this project is available from The Division of Water Resources: http://www.ncwater.org/Permits_and_Registration/Interbasin_Transfer/.

Agriculture

Agriculture is NC's leading industry and is especially strong in the Tar-Pamlico River Basin. Nonpoint source pollution from agriculture is an identified significant source of stream degradation in the Tar-Pamlico River Basin. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community and is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

The conversion of agricultural lands to developed lands with impervious surfaces is another potential nonpoint source of pollution. A report by the American Farmland Trust organization identifies this subbasin as having high quality farmland with large areas threatened by development. A map of these areas is available at: http://www.farmland.org/. Some farmers are protecting their land from developement through the Conservation Reserve Enhancement Program (CREP). CREP is a voluntary program utilizing federal and state resources to achieve long-term protection of environmentally sensitive cropland and marginal pastureland. These voluntary protection measures are accomplished through 10-, 15-, 30-year and permanent conservation easements. In this subbasin there are approximately 11,123 acres in easements, of which 55% are in 30-year or permanent easements.

North Carolina Agriculture Cost Share Program

Financial incentives are provided through North Carolina's Agriculture Cost Share Program, administered by DENR's Division of Soil and Water Conservation to protect water quality by installing BMPs on agricultural lands. In the Fishing Creek Subbasin, $1,892,623 was spent, between 2003-2008, on BMPs to reduce nonpoint source pollution from agriculture. Approximately 29,611 acres were affected by BMPs that prevented an estimated 289,170 tons of soil, 386,790 lbs of nitrogen and 152,523 lbs of phosphorous from running off into surface waters. Animal waste BMPs also accounted for better management of an estimated 62,350 lbs of nitrogen and 53,192 lbs of phosphorous.

DWQ's Animal Feeding Operations Unit

The Animal Feeding Operations Unit is responsible for the permitting and compliance activities of animal feeding operations across the state. Poultry farms with dry litter waste are not regulated or monitored by DWQ. Table 2-6 summarizes the number of registered livestock operations, total number of animals, number of facilities, and total steady state live weight (SSLW) in this subbasin. These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in the subbasin.

Table 2-6. Animal Operations in HUC 03020102

Type	# of Facilities	# of Animals	SSLWt
Cattle	2	1,105	962,000
Wet Poultry	1	64,000	256,000
Swine	15	58,569	16,871,872

*Steady State Live Weight (SSLW) is in pounds, after a conversion factor has been applied to the number of swine, cattle or poultry on a farm. Conversion factors come from the US Department of Agriculture, Natural Resource Conservation Service (NRCS) guidelines. Since the amount of waste produced varies by hog size, this is the best way to compare the sizes of the farms.

Animal waste is often stored in lagoons before it is applied to fields. Therefore there is concern that several animal operations in the basin will be abandoned without proper closeout of the lagoons. Numerous environmental hazards exist from these lagoons including: ammonia emissions, overflows into surface waters, and groundwater contamination.

A better understanding of groundwater quality in relation to animal feeding operation locations is needed. Often animal operations are located immediately adjacent to surface water bodies. Groundwater that is moving from beneath a facility into the surface water system may transport significant levels of nutrients. However, lack of groundwater quality data at animal operations hampers quantifying their impacts.

Restoration, Protection & Conservation Planning

Population

The 2000 census estimated population for this subbasin is 36,744, this is expected to decrease with the results of the 2010 census. Population estimates for each watershed within this subbasin are listed in Table 2-7.

Table 2-7. Watershed Population Estimates* for HUC 03020102

10-Digit HUC	2000 Population	2000 Population Density (per sq mi)	2010 Estimated Population	2020 Estimated Population	2030 Estimated Population
0302010201	3,325	40	3,586	3,871	4,152
0302010202	7,343	39	7,079	6,849	6,572
0302010203	9,758	56	9,787	9,844	9,846
0302010204	6,808	38	6,464	6,157	5,808
0302010205	4,267	35	4,202	4,154	4,080
0302010206	5,243	35	4,900	4,583	4,246
03020102	36,744	41	36,018	35,458	34,704

*NC Office of State Budget and Management http://www.osbm.state.nc.us/

Land Use

Table 2-8 lists the percentage of predominant land cover types within this subbasin (based on 2001 land cover data). A map showing these land types can be found in Appendix 2D.

Table 2-8. Land Cover Percentages in HUC 03020102

Land Cover Type	Percent
Developed Open Space	4.68
Developed Low Intensity	0.51
Developed Medium Intensity	0.07
Developed High Intensity	0.01
Total Developed	5.27
Bare Earth Transition	0.20
Deciduous Forest	23.38
Evergreen Forest	22.84
Mixed Forest	4.13
Total non-Wetland Forest	50.35
Scrub Shrub	1.86
Grassland Herbaceous	6.55
Pasture Hay	8.49
Cultivated Crops	17.31
Total Agriculture	25.80
Woody Wetlands	9.75
Emergent Herbaceous Wetland	0.23
Total Wetlands	9.97

Local Initiatives & Conservation Planning

Resources & Guides

NCDENR's One North Carolina Naturally initiative promotes and coordinates the long-term conservation of North Carolina's threatened land and water resources. Each DENR division specializes in management of a specific natural resource, while collaborative coordination and planning process results in cost-effective implementation and management of multiple resources. Natural resource planning and conservation provides the science and incentives to inform and support conservation actions of North Carolina's conservation agencies and organizations. The Conservation Planning Tool was developed to assist in building partnerships through the exchange of conservation information and opportunities, support stewardship of working farms and forests, inform conservation actions of

agencies and organizations, and guide compatible land use planning. A link to the interactive map view is found here: http://www.conservision-nc.net/.

Conservation planning is important on a local level to protect natural resources that provide recreational, aesthetic, and economic assets important to community growth and sustainability. The NC Wildlife Resource Commission developed a Green Growth Toolbox: http://www.ncwildlife.org/greengrowth/, to assist towns and cities to grow in nature-friendly ways. The tools provide assistance with using conservation data, green planning, green ordinances and green development and site design. Also, a guide to help local governments protect aquatic ecosystems while streamlining environmental review is available here: http://www.ncwildlife.org/planningforgrowth/swimming_with_the_current.pdf.

Land conservation accompanied with stream restoration projects can be very successful. Prevention and protection activities are known to be more cost effective than retrofits and restoration. DWQ strongly encourages conservation in this watershed. Local land trusts can help landowners explore conservation options and identify potential funding sources. For more information about land trusts in North Carolina see the Conservation Trust for North Carolina at: http://www.ctnc.org/site/PageServer. With the assistance of the Tar-River Land Conservancy and several state and federal agencies ~27,584 acres are protected within this subbasin, much of which are riparian buffers.

Local Initiatives

DWQ has regulatory authority over permitted activities to enforce the Clean Water Act and corresponding state regulations to protect water quality. However, local governments can also regulate and promote activities that protect water quality. Several local governments provided information on local activities, ordinances, and concerns about protecting their natural resources and water quality. The following information reflects projects and practices on a local level that protect water quality:

Warrenton & Warren County

Warrenton currently does not have any stricter stormwater controls than the state minimums, but is considering a local ordinance to address both stormwater and erosion and sedimentation control below one acre. The town felt additional training is needed on a local level for drafting local ordinances as well as having access to relevant templates and example ordinances.

Warren County emphasizes the importance of the NC Agriculture Cost Share program as a method to encourage conservation practices that improve and protect water quality and wildlife habitat.

Franklin County

The County's adopted Unified Development Ordinance states: "The purpose of Flexible Development is to preserve agricultural and forestry lands, natural and cultural features, and rural community character that might be lost through conventional development approaches. To accomplish this goal, greater flexibility and creativity in the design of such developments is encouraged and allowed."

Franklin County has adopted stormwater ordinances and enforces the Tar-Pamlico NSW regulations, but does not enforce erosion and sedimentation control plans. In 2008, the County contracted with NC State Watershed Education for Communities and Officials program (WECO) to initiate a stakeholder process to ascertain ways to better improve water quality within the County. The main recommendation from the stakeholder process was for the County to initiate its own erosion and sedimentation control program in accordance with current state regulations. However, due to current economic trends, funding for the implementation of a County erosion and sedimentation program has been delayed.

Franklin County does not conduct water quality sampling. The County has identified certain

streams as candidates for stream restoration and is working with the Franklin County Conservation District as well as the Tar River Land Conservancy to identify areas for restoration and protection. Additionally, a watershed plan was recently completed for Cypress Creek which identified multiple sites for restoration and or protection.

Erosion and Sedimentation Control

The Sedimentation Control Commission was created to administer the Sedimentation Control Program pursuant to the **N.C. Sedimentation Pollution Control Act of 1973**. It is charged with adopting rules, setting standards, and providing guidance for implementation of the Act. The Division of Land Resources (DLR) is the primary agency responsible for managing land disturbing activities that have the potential to violate the Sedimentation Pollution Control Act. For those land disturbing activities, an Erosion and Sedimentation Control Plan must be approved by DLR prior to land disturbing activities. Due to the large number of land disturbing activities and the limited number of DLR staff available to do inspections, cities and counties have been encouraged to adopt a local erosion and sediment control ordinance in compliance with State requirements. The Sedimentation Control Commission can then delegate the local government authority to administer the erosion and sedimentation control program within its jurisdiction. The local programs' staff then performs plan reviews and enforces compliance with plans within their jurisdictions. Within this subbasin, Franklin County is considering developing a local program.

Construction Grants and Loans

The NC Construction Grants and Loans (CG&L) Section of DWQ provides grants and loans to local government agencies for the construction, upgrades, and expansion of wastewater collection and treatment systems. As a financial resource, the Section administers five major programs that assist local governments. Of these, two are federally funded programs administered by the state, the Clean Water State Revolving Fund (SRF) Program and the State and Tribal Assistance Grants (STAG). The STAG is direct congressional appropriation for a specific "special needs" projects within NC. The High Unit Cost Grant Program, the State Emergency Loan (SEL) Program and the State Revolving Loan (SRL) Program are state funded programs, with the later two being below market revolving loan money. The Section also received an additional Capitalization Grant authorized by the American Recovery and Reinvestment Act of 2009 in the amount of $70,729,100. These funds are administered according to existing SRF procedures. All projects must be eligible under Title VI of the Clean Water Act. For more information please see the CG&L webpage at: **http://portal.ncdenr.org/web/wq/cgls**. Projects currently underway in this subbasin are listed in Table 2-9.

Table 2-9. CG&L Projects

Location	Project Description	Date	~Amount
Scotland Neck	Rehab and Spray Irrigation	pending	$3,000,000
Scotland Neck	Nutrient Removal	pending	$3,000,000
Scotland Neck	Phase III - WWTP modifications	2/12/2004	$400,000
Scotland Neck	Canal Creek Sewer Rehabilitation	pending	$1,534,250

Clean Water Management Trust Fund

Created in 1996, the Clean Water Management Trust Fund (CWMTF) makes grants to local governments, state agencies, and conservation non-profits to help finance projects that specifically address water pollution problems. The fund has made several investments in this Subbasin. Table 2-10 includes a list of recent projects and their cost.

Table 2-10. CWMTF Projects

Application ID	Proposed Project Description	Amount Funded	County
2004D-012 Tar River Land Conservancy - Donated Minigrant, Vaughan Tract	Minigrant to pay for transactional costs for a donated permanent conservation easement on 85 acres along Bear Swamp Creek.	$20,750	Halifax
2005A-503 Enfield, Town of - WW/ WWTP and Collection Rehabilitation, Fishing Creek	Reduce fecal coliform & nutrient contamination of Fishing Ck through infiltration/inflow work (replace or rehabilitate 11,600 LF of collection line), connection of 40 unsewered residences (75% failing), & installing reuse line at WWTP for plant washdown.	$1,010,000	Halifax
2006A-027 NC Div Parks & Recreation - Acq./ IP Timber Tracts, Little Fishing Creek	Protect through fee simple purchase 1,507 acres, including 588 riparian acres, along Little Fishing Creek. Tract expands Medoc Mtn State Park & aids in protection of rare aquatic species & a Nationally Significant Aquatic Habitat.	$744,000	Halifax
2006A-809 Littleton, Town of- Stormwater Minigrant/ Bens Creek Stormwater Plan	Fund a stormwater minigrant to develop a stormwater management plan for the Town. Map stormwater system, evaluate potential BMPs and prepare preliminary engineering report to summarize findings.	$21,000	Halifax
2007-544 Warrenton, Town of - WW/ Pump Station Rehabilitation, Fishing Creek	Install wetwell and replace portion of sewer line to mitigate overflows and reduce pollutant loading in Possumquarter Cr. Perform Sewer System Evaluation.	$271,000	Warren
2007-545 Warrenton, Town of - WW/ WWTP Upgrade, Fishing Creek	Design and permit improvements at WWTP to repair and replace existing worn out equipment to provide more reliable treatment of wastewater and protection of water quality in Fishing Cr	$50,000	Warren
2007-818 Scotland Neck, Town of - Plan/WWW/ I&I Assessment Study, Canal Creek	Perform Phase 2 Inflow/Infiltration Study to reduce Inflow & Infiltration, reduce hydraulic loading at WWTP and improve water quality in Canal Cr, and Deep Cr	$40,000	Halifax
2008-514 Enfield, Town of - WW/ Sewer Rehabilitation & Septic Tanks, Fishing Creek	Design, permit and rehabilitate portion of sewer system; design and permit elimination of failing septic systems. Project would reduce hydraulic load at WWTP and improve effluent quality discharged to Fishing Cr, a National Significant Aquatic Habitat	$1,393,000	Halifax
2008-533 Scotland Neck, Town of - WW/ Sewer Rehabilitation, Canal Creek	Rehabilitate portion of sewer system to reduce I/I to reduce hydraulic loading at WWTP; rehab chlorination/ dechloration contact chamber to improve effluent discharged to Canal Cr.	$1,591,000	Halifax

This list does not include regional or statewide projects that were in multiple river basins, or projects that were funded and subsequently withdrawn.

Recommendations

- More research is needed to understand the amount nutrients entering the river and its tributaries through baseflow and how this contribution can be managed. The NSW strategy targets point and some nonpoint source nutrient contributions to surface waters; however, some nonpoint sources are not specifically addressed in the strategy. Nutrients from non-discharge spray field systems, wastewater residual applications, septic systems, animal feeding operations, dry litter poultry farms, and tiled agriculture may all be contributing to nutrient loads in surface waters via groundwater. DWQ's Aquifer Protection Planning Unit is currently compiling a few select watershed-scale estimates of total nutrient loads from permitted land application facilities which will help determine the potential nutrient loading magnitude.

- Identify sources of organic nitrogen that could be contributing to the increase in basinwide TKN concentrations. Basinwide, the ammonia component of TKN shows a decrease in concentration since 1991. Specifically in this subbasin ammonia concentrations have remained fairly constant. TKN concentrations have also remained fairly constant with spikes occurring during drought years 2007 and 2008. This subbasin contributions to the basinwide increase in organic nitrogen are most likely to occur during drought years suggesting nonpoint source contributions.

- Total phosphorus concentrations have increased over a 12 year time period, this may be related to an increase in development, soil erosion and general increase in population. The Tar-Pamlico NSW strategy requires no increase in phosphorus loads from the 1991 conditions. To achieve this reduction, older laws should be examined to identify where new technology alternatives may be able to assist in meeting nutrient goals (e.g., G.S 143-214.4 prohibits certain cleaning agents from containing phosphorus, household dishwashing machine detergent is exempt.) Several states have recently **banned phosphorous** in dishwasher detergent and lawn fertilizers.

- Explore development of a more comprehensive basinwide stormwater management to prevent uncontrolled development in areas currently exempt from stormwater regulations and to protect watersheds with threatened and endangered species.

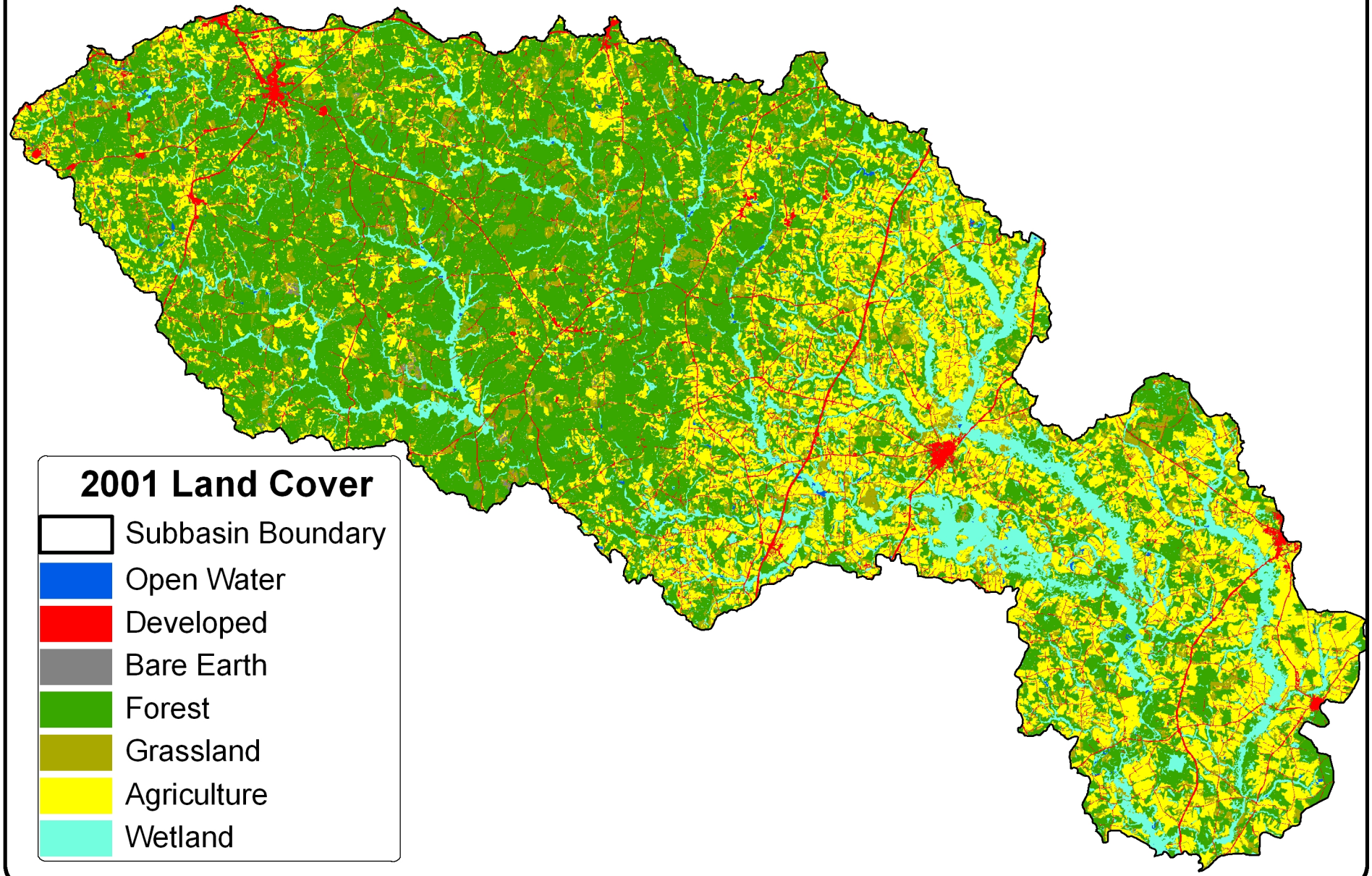
- Continue to work with advising agencies on developing a site-specific management plan, a statewide mussel protection plan or ORW/HQW protection for the threatened and endangerd mussel species in this subbasin.

References

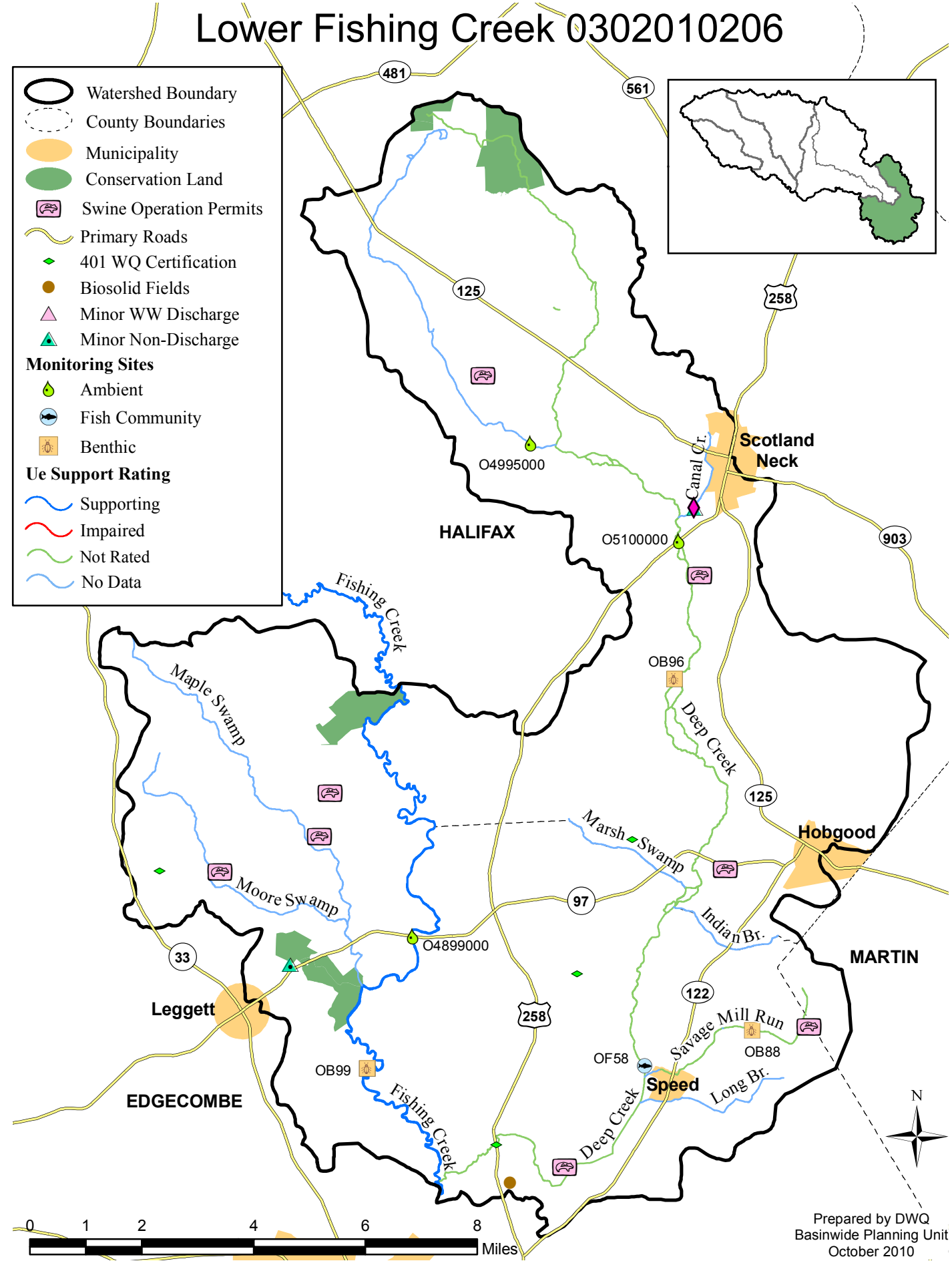
American Farmland Trust. Farming on the Edge: North Carolina State Map. http://www.farmland.org/resources/fote/states/map_northcarolina.asp.

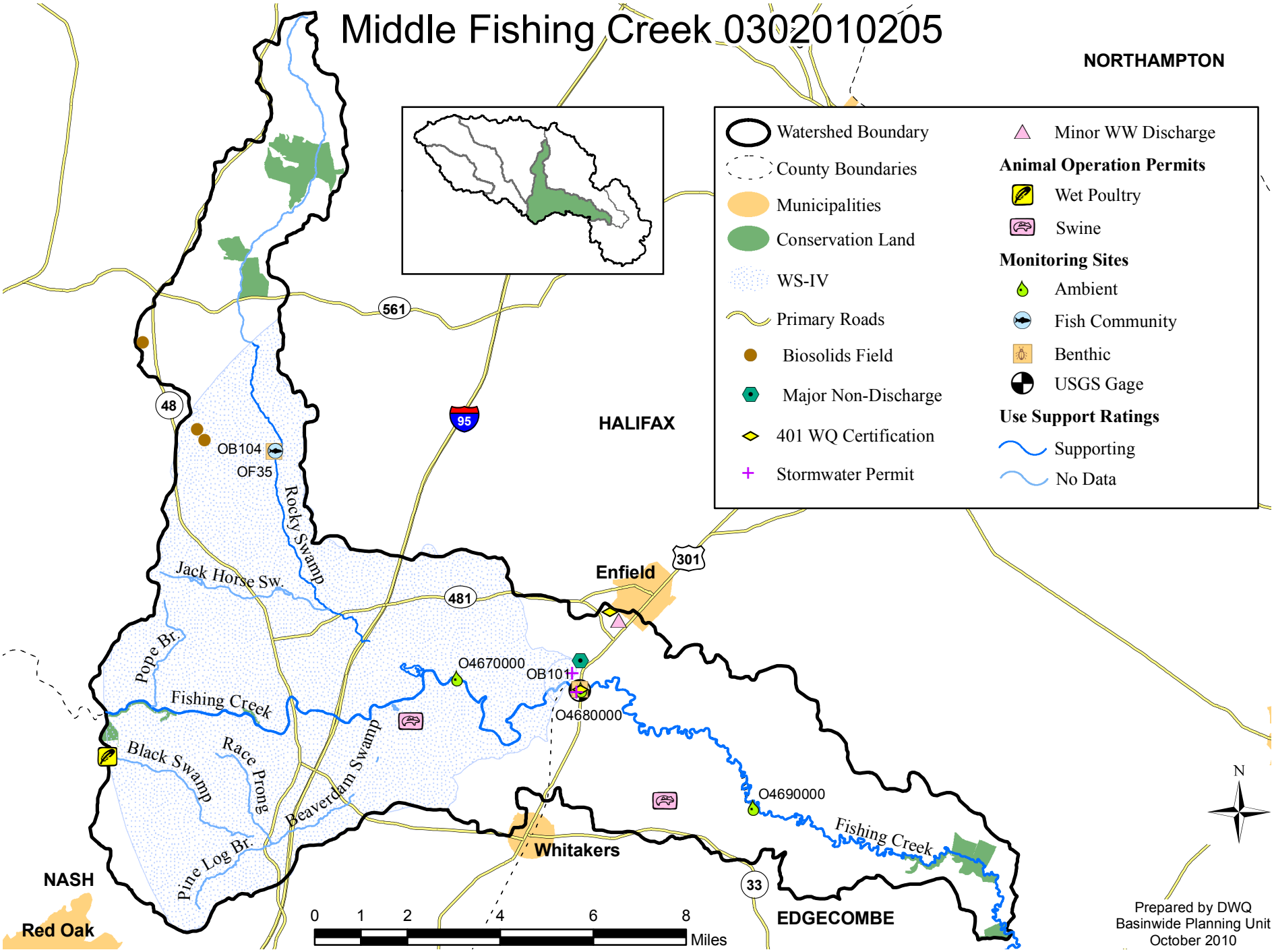
Pradhan, S.S., Hoover, M.T., Austin, R.E. and H. A. Devine. 2007. Potential Nitrogen Contributions from On-site Wastewater Treatment Systems to North Carolina's River Basins and Sub-basins Technical Bulletin 324. North Carolina Agricultural Research Service North Carolina State University Raleigh, NC.

Fishing Creek Subbasin
HUC 03020102

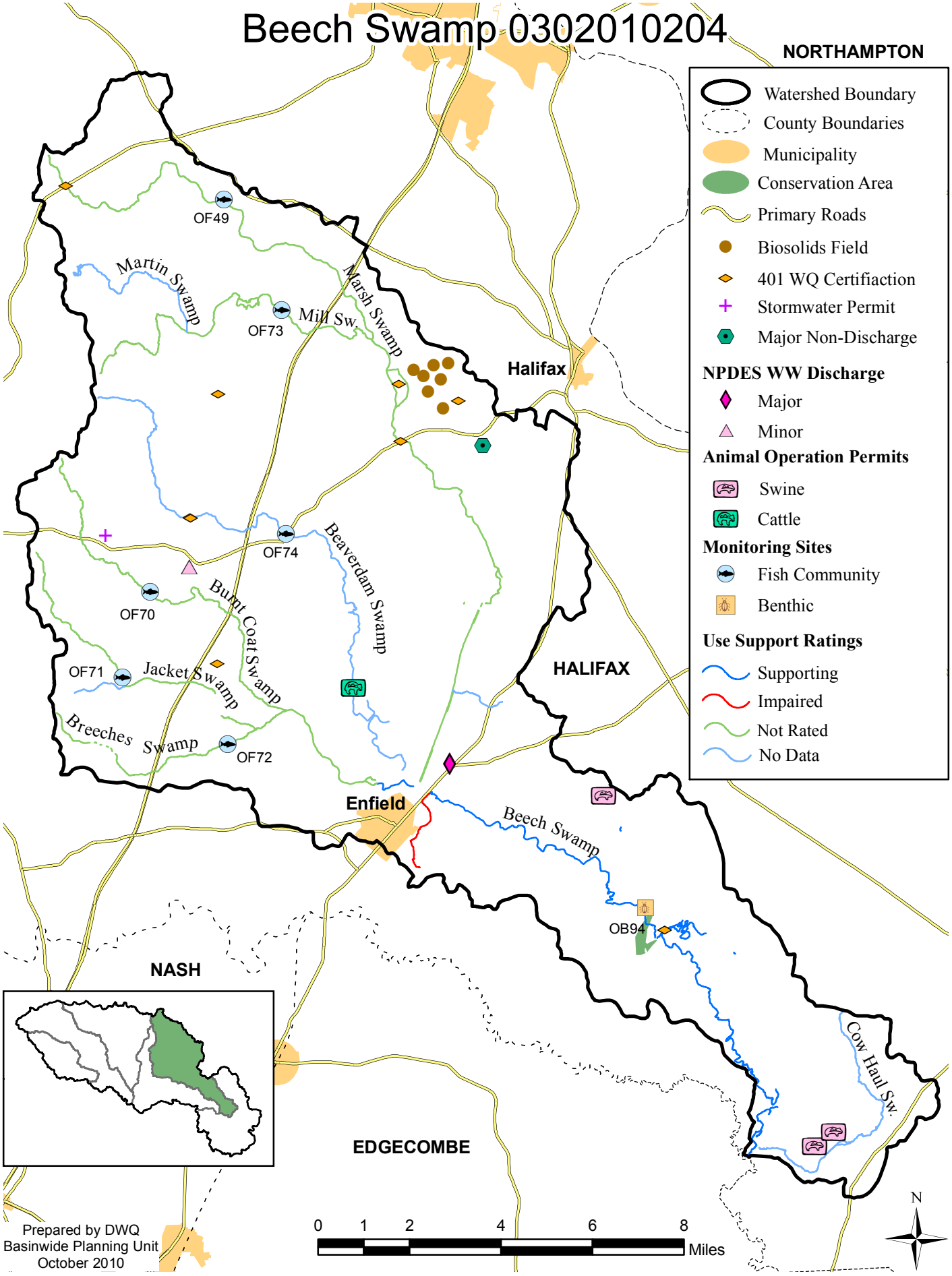


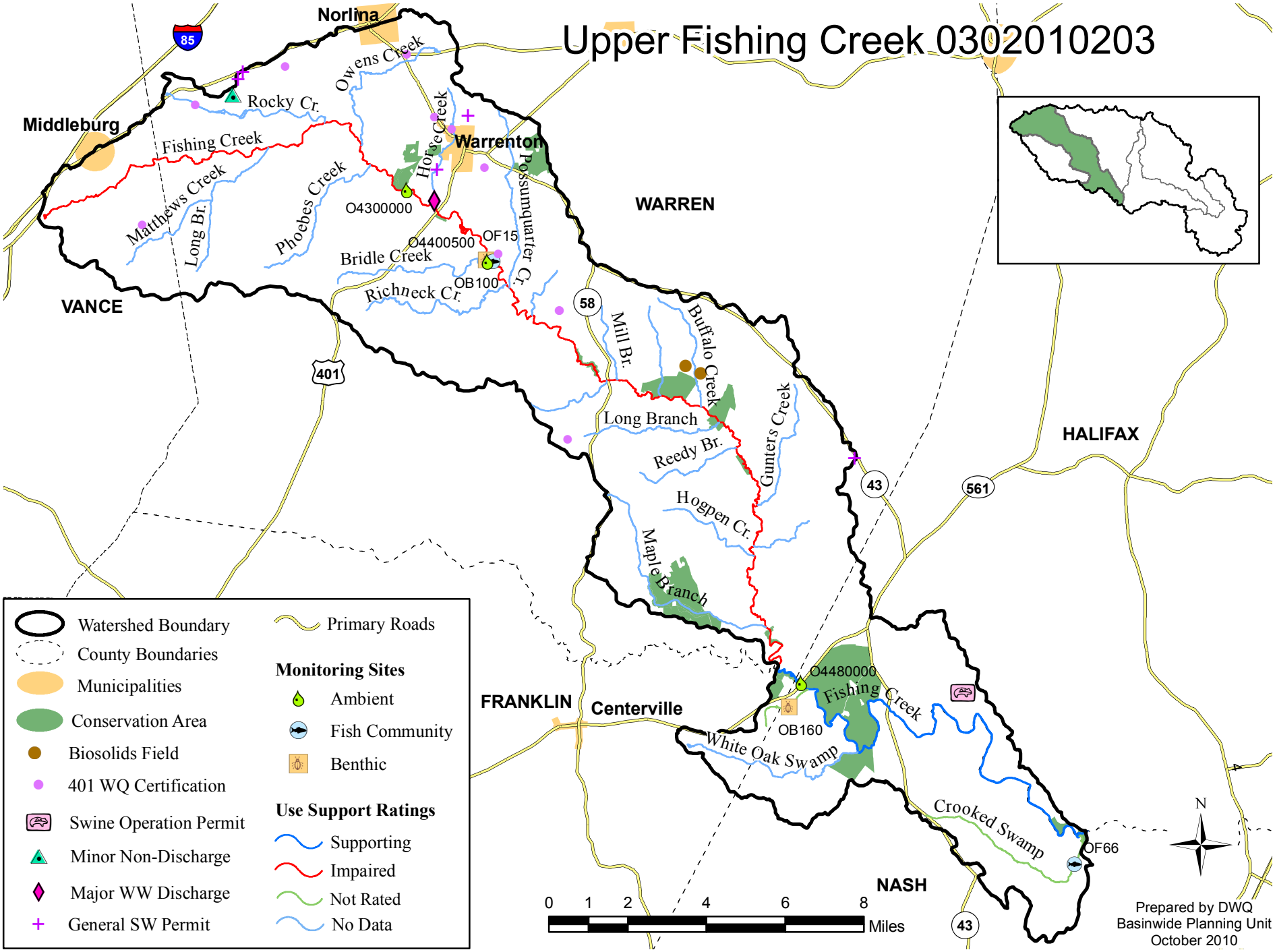
Lower Fishing Creek 0302010206



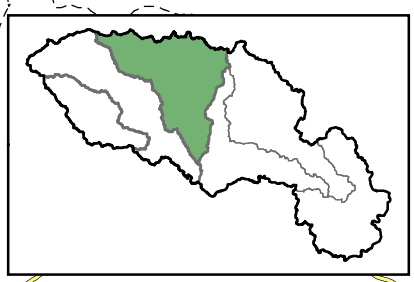

Middle Fishing Creek 0302010205
NORTHAMPTON
HALIFAX
NASH
EDGECOMBE
Red Oak
Enfield
Whitakers
Watershed Boundary
County Boundaries
Municipalities
Conservation Land
WS-IV
Primary Roads
Biosolids Field
Major Non-Discharge
401 WQ Certification
Stormwater Permit
Minor WW Discharge
Animal Operation Permits
Wet Poultry
Swine
Monitoring Sites
Ambient
Fish Community
Benthic
USGS Gage
Use Support Ratings
Supporting
No Data
561
48
95
301
481
33
OB104
OF35
OB101
O4670000
O4680000
O4690000
Rocky Swamp
Jack Horse Sw.
Pope Br.
Fishing Creek
Black Swamp
Race Prong
Beaverdam Swamp
Pine Log Br.
Fishing Creek
0 1 2 4 6 8
Miles
N
Prepared by DWQ
Basinwide Planning Unit
October 2010

Beech Swamp 0302010204




Upper Fishing Creek 0302010203
Norlina
Middleburg
Warrenton
Rocky Cr.
Owens Creek
Horse Creek
Possumquarter Cr.
Fishing Creek
Matthews Creek
Long Br.
Phoebes Creek
O4300000
O4400500
OF15
Bridle Creek
OB100
Richneck Cr.
WARREN
VANCE
58
Mill Br.
Buffalo Creek
Long Branch
Reedy Br.
Gunters Creek
Hogpen Cr.
Maple Branch
401
HALIFAX
43
561
FRANKLIN
Centerville
O4480000
Fishing Creek
OB160
White Oak Swamp
Crooked Swamp
OF66
NASH
Watershed Boundary
County Boundaries
Municipalities
Conservation Area
Biosolids Field
401 WQ Certification
Swine Operation Permit
Minor Non-Discharge
Major WW Discharge
General SW Permit
Primary Roads
Monitoring Sites
Ambient
Fish Community
Benthic
Use Support Ratings
Supporting
Impaired
Not Rated
No Data
0 1 2 4 6 8
Miles
N
Prepared by DWQ
Basinwide Planning Unit
October 2010

Little Fishing Creek Watershed 0302010202



Macon
Littleton
Warrenton
WARREN
HALIFAX
NASH
Reedy Creek
Dowtins Cr.
Walkers Creek
Big Branch
Enon Branch
Bens Creek
Butterwood Creek
Bear Swamp
Bobbitts Branch
Little Fishing Creek
Porter Creek
Powells Creek
OF26
OB166
OF34
OF2
OB158
OB157
O4630000
OB103
903
158
401
58
48
4
561
481
43
0 1 2 4 6 8 Miles
N

- Watershed Boundary
- County Boundaries
- Municipality
- Conservation Area
- Primary Roads
- Minor WWTP Discharge
- Minor Non-Discharge
- Biosolids Field
- 401 WQ Certification
- General SW Permit

CAFO Permits
- Swine
- Cattle

Monitoring Sites
- Ambient
- Fish Community
- Benthic
- USGS Gage

Use Support Ratings
- Supporting
- Impaired
- Not Rated
- No Data

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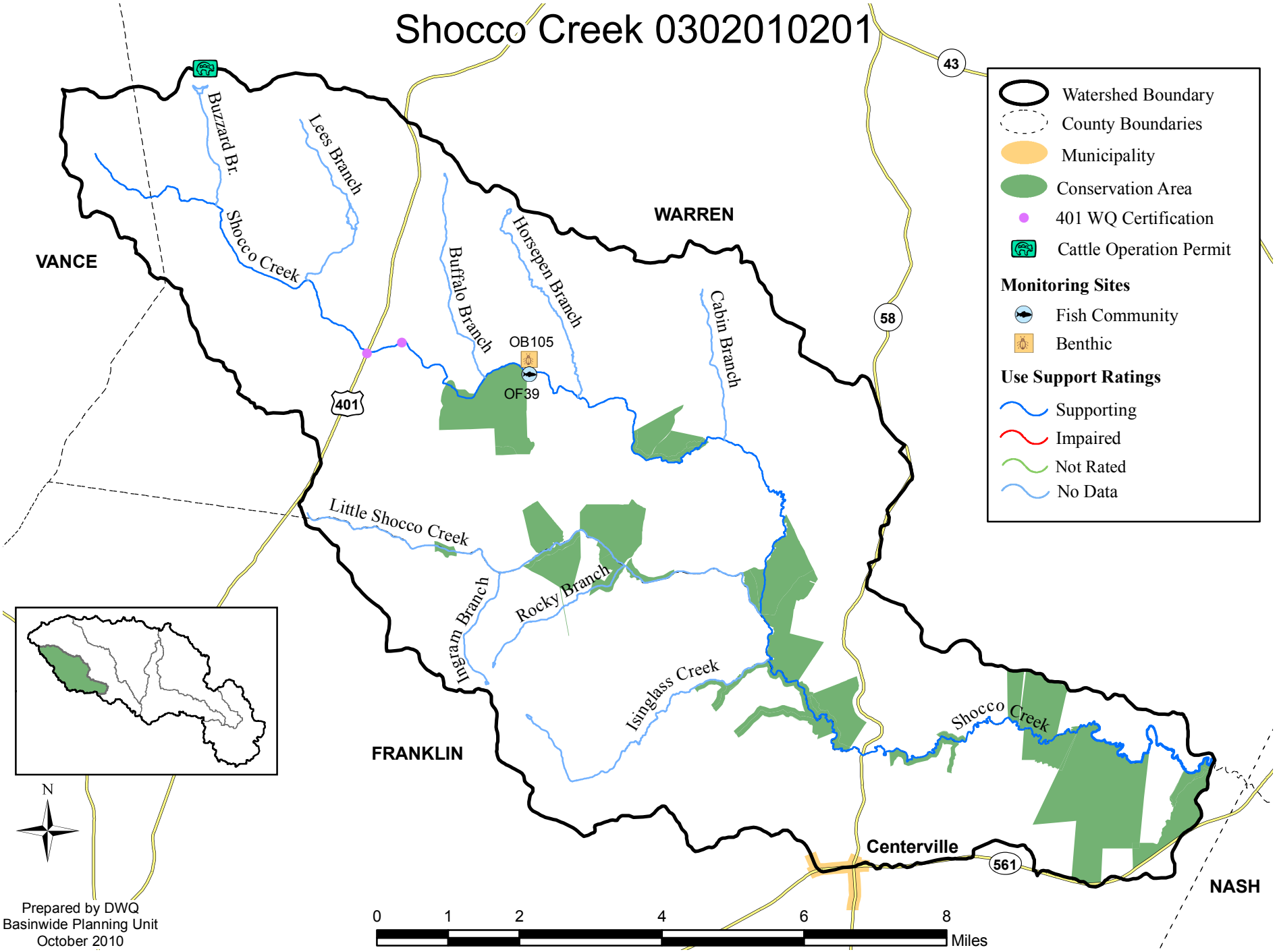
Basinwide Planning Unit
October 2010

Shocco Creek 0302010201



Prepared by DWQ
Basinwide Planning Unit
October 2010