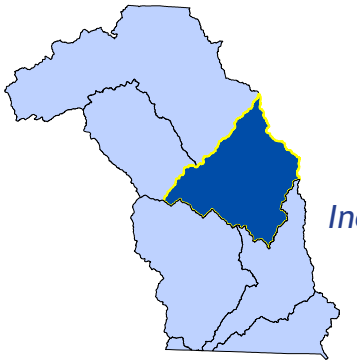


Yadkin River

Subbasin HUC: 03040103

Includes High Rock Lake, Tucker Town Reservoir, Badin Lake and tributaries

Water Quality Overview

Of the monitored streams, 59 percent are supporting aquatic life, while 37 percent do not meet the standards and are rated as impaired. Of the monitored lakes, 37 percent are also impaired. These impairments closely follow population and land development patterns. Habitat degradation is the stressor that accounts for the largest percentage of stream impairments, while nutrient enrichment is negatively impacting the lakes. A major study is underway to develop a total maximum daily load for High Rock Lake to identify possible nutrient reduction actions.

Watershed at a Glance

Counties

Cabarrus, Davidson, Forsyth, Guilford, Montgomery, Rowan, Randolph, Stanly

Municipalities

High Point, Thomasville, Randleman, Lexington, Spencer, East Spencer, Salisbury, Granite Quarry, China Grove, Rockwell, Denton, Asheboro

Permitted Facilities

NPDES WWTP:	
Major	10
Minor	39
NPDES Nondischarge:	22
NPDES Stormwater:	
General	184
Individual	11
Phase II	6
Animal Operations:	42

Stream Summary

Total Streams:.....787mi
.....31,523 ac
Total Monitored:.....328 mi
.....30,975 ac
Total Supporting:.....192 mi
.....12,783.3 ac
Total Impaired.....119.8 mi
.....11,344.6 ac
Total Not Rated: .....16.1 mi
.....6,847 ac
Total No Data:.....458.4 mi
..... 548.3 ac

General Description

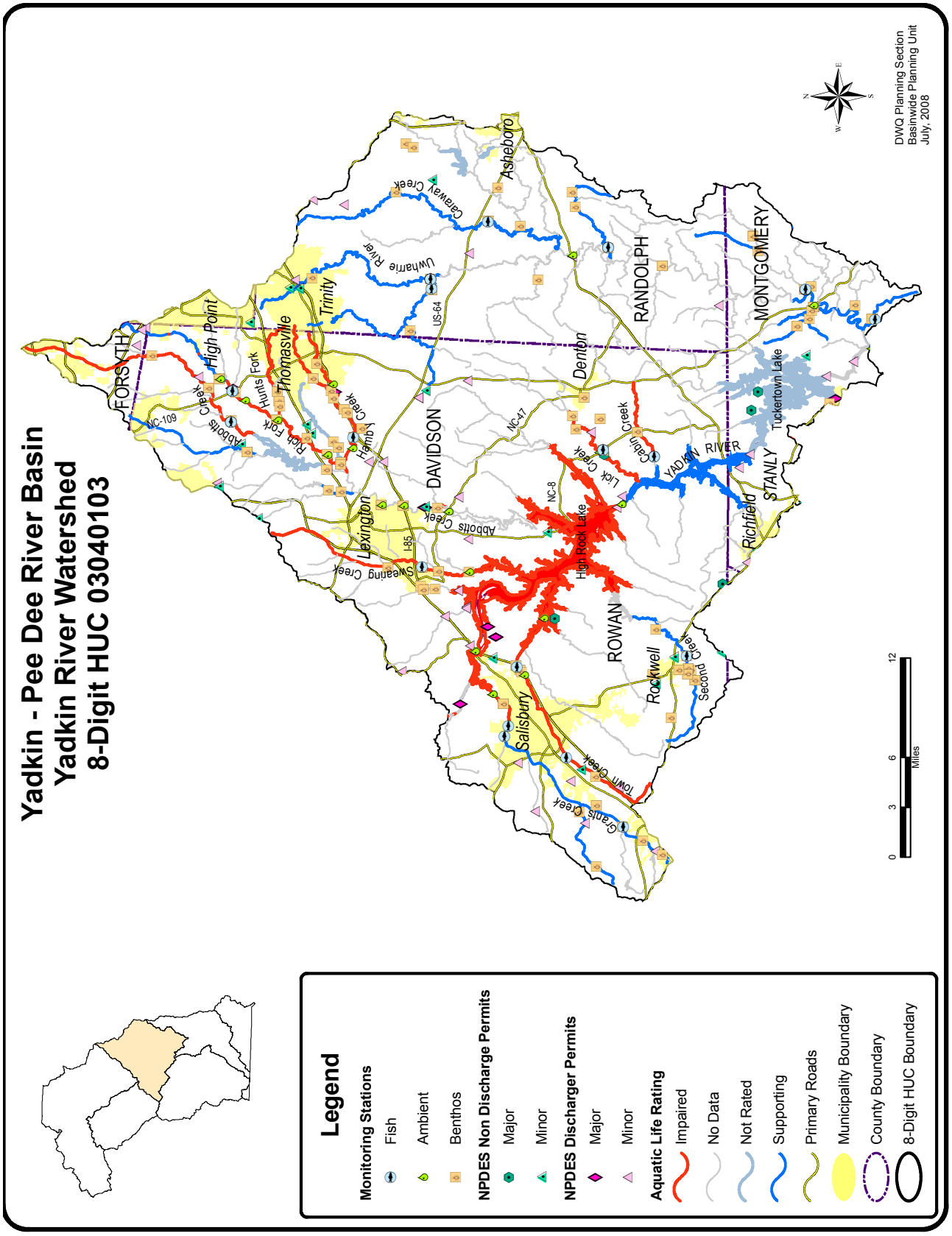
The Yadkin River Watershed is roughly bounded on the north by High Point, Thomasville, Lexington and Salisbury. The drainage contains High Rock Lake, Tuckertown Reservoir, and Badin Lake. Major tributaries include Abbotts Creek and the Uwharrie River. Much of the eastern portion drains the relatively undeveloped area forming the Uwharrie National Forest. Most of the streams in this watershed are located in the Carolina Slate Belt portion of the piedmont ecoregion. These streams usually have a rocky substrate and may experience very low flow during drought conditions. Agricultural land use affects most streams outside of the urban areas.

The Abbotts Creek watershed starts just south of Kernersville and flows south through Lexington and empties into High Rock Lake. Smaller streams in the watershed are Rich and Hunts Forks and Swearing and Hamby Creeks, which drain High Point, Thomasville, and the west side of Lexington. This watershed is located primarily in Davidson County and is bisected by the industrial and commercial US 64 and I-85 corridors. This area has easily eroded soils. Consequently, streams in areas of urban or agricultural land use are affected by sediment inputs, and have large amounts of coarse sand.

The largest municipalities in the subbasin are Lexington, Thomasville, and Highpoint. The largest discharger is the City of High Point's WWTP with a permitted flow of 6.2 MGD into Rich Fork. Other large municipal WWTP dischargers are Thomasville (4 MGD to Hamby Creek) and Lexington (5.5 MGD to Abbotts Creek).

The upper Uwharrie River watershed, primarily in Randolph County, includes portions of the municipalities of High Point, Thomasville, Archdale, Randleman, and Asheboro. The lower portion of the watershed, in southern Randolph and northwestern Montgomery counties, is within the Uwharrie National Forest. Most of the subbasin is forested or used for agriculture. The Uwharrie River is within the piedmont Carolina Slate Belt ecoregion, but some tributaries draining the Uwharrie Mountains have montane characteristics. Certain geological subdivisions of the Carolina Slate Belt appear to have ecological significance. The sandiest streams were observed in the northern portion of the subbasin. More rocky streams were observed in the southern portion of the watershed.

Figure 3-1. Yadkin River HUC 03040103



Current Status and Significant Issues

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 9 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes in detail water quality standards for each waterbody ***classification***. For a general discussion of water quality parameters, potential issues, and rules please see "***Supplemental Guide to North Carolina's Basinwide Planning***: Support Document for Basinwide Water Quality Plans"

Figure 3-1. shows monitoring station locations and impaired streams for the Yadkin River subbasin.
Appendix A. provides descriptions of all monitored waterbodies in the subbasin.
Appendix B. provides a summary of each ambient data monitoring station.
Appendix C. provides summaries of biological and fish assessment monitoring sites.

General Biological Health

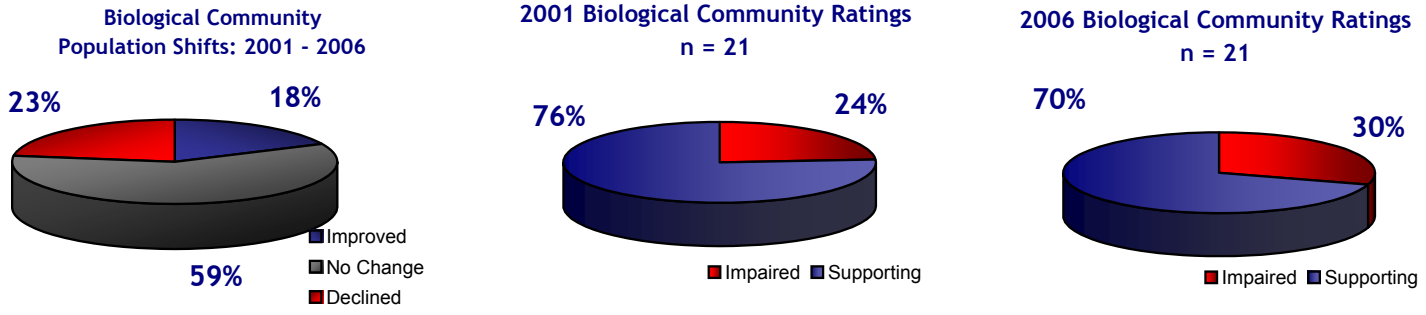
Fourteen sites were sampled for benthic macroinvertebrates in this HUC in 2006 (Figure 3-1).

Among these, four sites (Grants Creek, Swearing Creek, Little Uwharrie River, and Uwharrie River at SR 1406) showed improved bioclassifications compared with 2001 sampling, seven sites retained the same bioclassification as 2001, and two sites (Lick Creek and Uwharrie River at SR 1143) showed degraded bioclassifications compared to 2001. Dutchmans Creek, not rated in 2001 was rated Excellent in 2006. None of the sites improved or degraded more than one level of bioclassification.

Eleven sites were sampled to evaluate fish populations. No site showed an improved bioclassification, three sites retained their 2001 classification, and three sites (Cabin Creek, Rich Fork, Abbotts Creek) showed degraded classification compared to 2001. Five additional fish sites were sampled for the first time in 2006.

Leonards Creek (Davidson County), previously sampled as a basinwide site was not sampled in 2006 due to low flow conditions. Similarly, Rich Fork at Davidson County SR 2005 was not sampled for benthos during 2006 due to excessive depth caused by operations of sand-dipping operations. It is likely that the latter site will therefore be discontinued.

Figure 3-2. Biological Health Summary



Overall, the basinwide sampling effort in the HUC 03040103 increased by 23 percent. The percentage of Impaired streams increased by 6 percent.

Fourteen sites were sampled for benthic macroinvertebrates in this HUC in 2006. Among these, four sites (Grants Creek, Swearing Creek, Little Uwharrie River, and Uwharrie River at SR 1406) showed improved bioclassifications compared with 2001 sampling, seven sites retained the same bioclassification as 2001, and two sites (Lick Creek and Uwharrie River at SR 1143) showed degraded bioclassifications compared to 2001. Dutchmans Creek, not rated in 2001 was rated Excellent in 2006.

Eleven sites were sampled to evaluate fish populations. No site showed an improved bioclassification, three sites retained their 2001 classification, and three sites (Cabin Creek, Rich Fork, Abbotts Creek) showed degraded classification compared to 2001. Five additional fish sites were sampled for the first time in 2006.

The Yadkin River basin was experiencing moderate to severe drought conditions in 2001, which had the potential to reduce the impacts from nonpoint sources and magnify the impacts from point source discharges. This below average flow regime in the basin should be considered when looking at changes in the 2006 monitoring cycle. In these conditions, nonpoint source pollution impacts are generally reduced while point source pollution has a more significant impact.

Special Studies

UT Second Creek

This stream (near Dutch Creek Rd) in Rowan County was sampled in January 2002 for possible removal from the 303(d) list of impaired water. This creek was the former site of the Town of Rockwell's WWTP. The WWTP ceased discharging into UT second creek in 1996. Both upstream and downstream segments were rated Not Impaired. (BAU memo B-020328)

Town Creek

A TMDL study was done on Town Creek in June 2004 to characterize the possible stressors impacting the stream. Urban impacts from upstream were characterized as a major cause of degraded water quality. (BAU memo B-040916) The stream was sampled again in September 2006 for possible removal from the impaired streams list. Located below an inactive WWTP outfall in Spencer, NC, it was determined the stream remains impacted. (BAU memo B-070129a)

Second Creek

Second Creek in Rowan County was sampled in September 2006 to document and characterize the water quality before animal operations are expanded in its watershed. The stream was found to be relatively unimpacted at SR 2370. (BAU memo B-070129a)

Little Creek

Little Creek in Rowan County was sampled in September 2006 for possible removal from the impaired streams list. It was discovered that the stream was erroneously put on the 303(d) list. Little Creek has never been sampled for fish; and benthic sampling in 1990 resulted in a Not Impaired rating. The stream was assigned a Good-Fair bioclassification as a result of the 2006 benthic collections and is categorized as impacted because of habitat degradation, but it is not impaired.

Fish Community Urbanization Study

Grants Creek at SR 1506 and at SR 1910, and Second Creek at SR 2338 in Rowan County, as well as Swearing Creek at SR 1104 (Davidson County), were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study (unpublished data).

Swearing Creek, NC 47, Davidson County

This site was resampled in 2002 to determine whether the stream should be placed on North Carolina's 303(d) list. This site received a Fair rating, which verified the Fair rating it received in 2001. (BAU Memo B-021001) The stream is rated as impaired with habitat degradation and low dissolved oxygen as the stressors to its aquatic life.

Hamby Creek TMDL Stressor Study

A TMDL stressor study was conducted at seven sites in the Hamby Creek watershed in Davidson County in May 2003. Results of this study suggest that the cause of impairment in Hamby Creek appears to be chemical and/or physical pollutants in the form of toxic chemicals from urban runoff and nutrient inputs. (BAU Memo B-031016)

Planning Section Requests

Three additional benthic sites were requested by the Planning Section for sampling in 2006. Samples from these streams were needed to see if impairment is still warranted. Hunts Fork at SR 1787 and Rich Fork at SR 1755 are on North Carolina's 303d impaired streams list. In 2006, Hunts Fork received a Fair rating, Rich Fork was rated Good-Fair and Hamby Creek at SR 2025 received a Poor bioclassification. (BAU Memorandum B-061114)

Abbotts Creek, SR 1735, Davidson County

At the request of Winston-Salem Regional Office, Abbotts Creek was sampled near the Davidson/Wilkes County line to provide baseline data prior to construction of a Dell computer plant. This site was borderline Good-Fair/Good. (BAU Memo B-061114)

Yadkin TMDL Stressor Study

A TMDL stressor study was conducted at eight sites in Subbasin 03-07-07 (Davidson County) in May and September 2006. Overall, five of the sites received Good-Fair ratings, two received Fair ratings (Abbotts Creek at SR 1243, Hamby Creek at SR 2017) and one received a Poor rating (Hamby Creek at SR 2025). (BAU Memo B-060108)

Lick Creek TMDL

Two benthic sites were sampled in 2003 because Lick Creek was considered impaired from its source to a point one mile upstream of Davidson County SR 2501, not far above the confluence with the Yadkin River. Both sites received a Good-Fair rating. (BAU MemoB-040212)

Uwharrie River

A site on the Uwharrie River at NC 109 was sampled in March 2005 by both DWQ and Duke Energy biologists as a quality assurance measure comparing methods of both groups.

Uwharrie River EEP Study

Per a request received by the Biological Assessment Unit (BAU) from Ecosystems Enhancement Program (EEP) staff, seven benthos sites were sampled in May 2006. The reference site, Barnes Creek received a bioclassification of Excellent; five study sites earned bioclassifications of Good (Uwharrie River at SR 1406 and SR 1564, Little Uwharrie River at SR 1405, Brier Creek at SR 1402, and Caraway Creek at SR 1524 and one site, Caraway Creek at Randolph SR 1331), earned a bioclassification of Good-Fair.

Habitat Degradation

Many streams in this subbasin are impaired or impacted by habitat degradation. In most cases habitat is degraded by the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. Naturally erodible soils in this region make streams highly vulnerable to these stressors.

Many tools are available to address habitat degradation including; ***urban stormwater BMPs, agricultural BMPs***, ordinance/ rule changes at the local, state, and federal levels, volunteer activism, and education programs. Figure 3-3 illustrates a general process for ***developing watershed restoration plans***. This process can and should be applied to streams suffering from habitat degradation. DWQ has begun such a process in Grants Creek. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

Figure 3-3

Table 3-1. Monitored Streams Impaired and Impacted by Habitat Degradation

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Potential Source	Miles
12-119-(1)	Abbotts Creek	03-07-07	WS-III	X		Stormwater Runoff	18.8
12-119-(6)	Abbotts Creek	03-07-07	C	X		Stormwater Runoff	8.0
12-119-5-(1)	Brushy Fork	03-07-07	WS-III		X	Stormwater Runoff	9.5
12-127-(2)	Cabin Creek	03-07-08	WS-IV	X		Impoundment	5.8
						Natural Conditions	
12-110a	Grants Creek	03-07-04	C		X	Stormwater Runoff	19.7
					X	General Agriculture/Pasture	
12-110b	Grants Creek	03-07-04	C		X	Stormwater Runoff	1.2
					X		
12-119-7-4	Hamby Creek	03-07-07	C	X		Impoundment	11.1
						Impervious Surface	
12-110-3	Little Creek	03-07-04	C		X	General Agriculture/Pasture	6.5
12-119-7a	Rich Fork	03-07-07	C		X	Impervious Surface	8.5

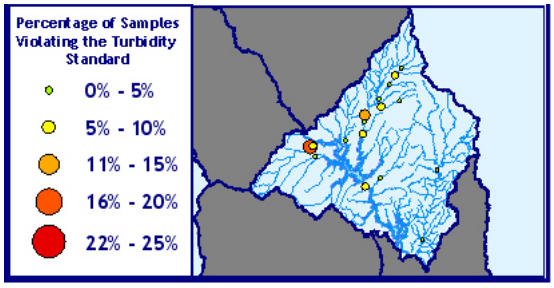
Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Potential Source	Miles
					X	General Agriculture/Pasture	
12-119-7b	Rich Fork	03-07-07	C	X		Stormwater Runoff	12.1
12-117-2	Second Creek	03-07-04	C		X	Industrial Site	13.5
12-113	Swearing Creek	03-07-07	C		X	Stormwater Runoff	14.4
12-115-3	Town Creek	03-07-04	C	X		Impervious Surface	15.4
13-2-(0.5)	Uwharrie River	03-07-09	WS-III		X	Stormwater Runoff	18.3
						Total	**162.8**

Ambient Water Quality

Turbidity

Turbidity violations are common throughout hydrologic unit 03040103 (Figure 3-4). 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 water treatment systems, and fill reservoirs. (USEPA, 1999 and Waters, 1995). Sand and silt were noted in the stream substrate at many of the biological sample sites in this hydrologic unit. Turbidity concentrations have trended downward over the last assessment cycle. The exact cause of this decline cannot be determined, but it is likely a combination of reduced runoff due to drought and implementation of agriculture BMPs.

Figure 3-4. Turbidity Violations



Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. Impervious surfaces and stormwater runoff appear to be driving the turbidity problems in this hydrologic unit. This trend is seen by comparing turbidity violations (Figure 3-4) to human population concentrations (Figure 3-6). Soils in this area are highly erodible and the increased volume and intensity of stormwater runoff from urbanizing watersheds cause significant streambank erosion. As stream velocity slows, the eroded soils are deposited on the streambed. As a result, huge sediment deposits are developing in the backwaters of High Rock Lake. The deposits restrict boat navigation, threaten water supply intakes, and may increase the damage caused by flooding. This trend demonstrates the importance of ***protecting and conserving stream buffers and natural areas***.

To appropriately address turbidity and sediment problems in the Yadkin River hydrologic unit, an assessment to determine the contribution of human accelerated erosion sources relative to natural processes should be undertaken. Much of this assessment will be addressed through the development of a High Rock Lake TMDL. In the meantime, all reasonable efforts to reduce or eliminate human sources of erosion should be implemented immediately. These efforts can be organized by developing watershed restoration plans based on the process outlined in Figure 3-3. Plans are needed for each watershed listed below.

Table 3-2. Monitored Streams Impaired and Impacted by Turbidity

Assessment Unit	Name	Subbasin	Class	Impaired	Impacted	Source	Length/ Area	Units
12-119-(6)	Abbotts Creek	03-07-07	C	X		Stormwater Runoff	8.0	Miles
						Agriculture/Pasture		
12-118.5b	Abbotts Creek Arm of High Rock Lake	03-07-07	WS-V;B	X		Stormwater Runoff	5.9	Miles
12-110a	Grants Creek	03-07-04	C		X	Construction	19.7	Miles
						MS4 NPDES		
						WWTP NPDES		

Assessment Unit	Name	Subbasin	Class	Impaired	Impacted	Source	Length/ Area	Units
12-110b	Grants Creek	03-07-04	C	X		Agriculture/Pasture	1.2	Miles
						MS4 NPDES		
						WWTP NPDES		
12-(108.5)b	YADKIN RIVER (including upper portion of High Rock Lake below normal operating level)	03-07-04	WS-V	X		Stormwater Runoff	5,569	Acres
						Total	**34.8**	**Miles**
						Total	**5,569**	**Acres**

Fecal Coliform Bacteria

Fecal Coliform concentrations often exceeded 400 colonies/100ml in the Yadkin River Watershed (Figure 3-5). 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. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A. 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. Fecal coliform concentrations trended downward over the last assessment cycle. The exact cause of this decline cannot be determined, but it is likely a combination of reduced runoff due to drought, implementation of agricultural BMPs, and sewer infrastructure improvements. However, concentrations remain elevated and further work remains to be done. Additional funds will be necessary to continue implementing these improvements.

Figure 3-5. Fecal Coliform Bacteria Violations

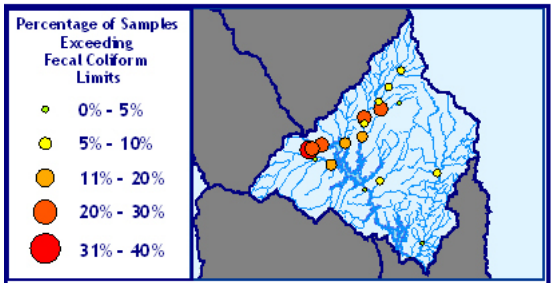


Table 3-3. Monitored Streams Impaired and Impacted by Fecal Coliform

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Source	Miles
12-119-(6)	Abbotts Creek	03-07-07	C		X	Stormwater Runoff	8.0
						Agriculture/Pasture	
12-110b	Grants Creek	03-07-04	C		X	Stormwater Runoff	1.2
12-119-7-4	Hamby Creek	03-07-07	C		X	Failing Septic Systems	11.1
						MS4 NPDES	
						WWTP NPDES	
12-119-7a	Rich Fork	03-07-07	C	X		Failing Septic Systems	8.5
						Natural Conditions	
						Agriculture/Pasture	
						MS4 NPDES	
						WWTP NPDES	
12-119-7b	Rich Fork	03-07-07	C		X	MS4 NPDES	12.1
						WWTP NPDES	
						Agriculture/Pasture	
						Failing Septic Systems	
						Total	41.0

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-nitrogen (NH3-N), total Kjeldahl nitrogen (TKN) and nitrite+nitrate nitrogen (NO2+NO3-N). Phosphorus is measured as total phosphorus. When nutrients are introduced to an aquatic ecosystem from municipal and industrial treatment processes, or runoff from urban or agricultural land, the excessive growth of algae (algal blooms) 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 NH4OH, a form toxic to fish and other aquatic organisms.

High Rock Lake is impaired by nutrient related stressors. The majority of the lake is demonstrating the symptoms described above. DWQ and many local stakeholders are involved in the development of a TMDL that will address these impacts. Implementation of this TMDL will be difficult and costly. Local governments and citizens at large should begin implementing measures to reduce nutrient loads to High Rock Lake immediately.

Table 3-4. Impaired or Impacted Waters by Stressors Indicating Nutrient Enrichment

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Stressor	Source	Length/ Area	Units
12-118.5	Abbotts Creek Arm of High Rock Lake	03-07-07	WS-V;B	X		Chlorophyll a, High pH	Stormwater Runoff	9.6	Miles
1 3 - 2 - 3 - 3 - (0.7)	Back Creek (Back Creek Lake)	03-07-09	WS-II;		X	Chlorophyll a	Stormwater Runoff	0.6	Miles
						Nutrient Impacts			
12-119-7-4	Hamby Creek	03-07-07	C		X	Nutrient Impacts	WWTP NPDES	11.1	Miles
12-126-(3)	Lick Creek	03-07-08	WS-IV		X	Nutrient Impacts	WWTP NPDES	7.1	Miles
12-126-(3)	Lick Creek	03-07-08	WS-IV	X		Low Dissolved Oxygen			
12-119-7b	Rich Fork	03-07-07	C		X	Low Dissolved Oxygen	Stormwater Runoff	12.1	Miles
12-117-(3)	Second Creek Arm of High Rock Lake	03-07-04	WS-IV; B	X		Chlorophyll a , High pH	Stormwater Runoff	894.9	Acres
12-113	Swearing Creek	03-07-07	C		X	Low Dissolved Oxygen	Stormwater Runoff	14.4	Miles
12-115-3	Town Creek	03-07-04	C	X		Nutrient Impacts	MS4 NPDES WWTP	15.4	Miles
13-2-3-3-2-2-(2)	Unnamed Tributary to Cedar Fork Creek (Lake Bunch)	03-07-09	WS-II;		X	Chlorophyll a	Unknown	0.6	Miles
12-(114)	YADKIN RIVER (including lower portion of High Rock Lake)	03-07-04	WS-IV; B	X		Chlorophyll a, High pH	Stormwater Runoff	4,870.1	Acres
12-(124.5)a	YADKIN RIVER (including lower portion of High Rock Lake)	03-07-04	WS-IV; B,CA	X		Chlorophyll a, High pH	Stormwater Runoff	10.8	Acres
12-(124.5)b	YADKIN RIVER (including upper portion of Tucktertown Lake)	03-07-04	WS-IV; B,CA		X	Low Dissolved Oxygen	Impoundment	3.5	Miles
12-(108.5)b	YADKIN River (including upper portion of High Rock Lake below normal operating level	03-07-04	WS-V	X		Chlorophyll a	Stormwater Runoff	5,568.8	Acres
							Total	**74.4**	**Miles**
							Total	**11,344.6**	**Acres**

Table 3-5. Monitored Streams Impaired and Impacted by Other Stressors

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Stressor	Source	Length/ Area	Units
12-119-7-4	Hamby Creek	03-07-07	C	X		Toxic Impacts	Stormwater Runoff	11.1	Miles
12-119-7-4-1	North Hamby Creek	03-07-07	C	X		Toxic Impacts	Stormwater Runoff	5.8	Miles
12-117-(3)	Second Creek Arm of High Rock Lake	03-07-04	WS-IV; B		X	Temperature	Natural Conditions	894.9	Acres
							Impoundment		
12-115-3	Town Creek	03-07-04	C	X		Toxic Impacts	Stormwater Runoff	15.4	Miles
12-(114)	YADKIN RIVER (including lower portion of High Rock Lake)	03-07-04	WS-IV; B		X	Temperature	Impoundment	4,870.1	Acres
							Total	32.3	Miles
								5,765.0	Acres

See: *Yadkin Ambient Monitoring System Report* and *Yadkin Basinwide Assessments* for more information regarding specific monitoring sites.

TMDLs

A TMDL or **Total Maximum Daily Load** is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

A TMDL provides a detailed water quality assessment that provides the scientific foundation for an implementation plan. An implementation plan outlines the steps necessary to reduce pollutant loads in a certain body of water to restore and maintain human uses or aquatic life. Plan implementation is usually voluntary. The development of TMDL implementation plans is often the best method to improve water quality. The following TMDLs have been completed in the Yadkin River hydrologic unit and should be adopted by all residents and local governments within the watershed. Allocations defined in these TMDLs will be incorporated into water quality permits as appropriate.

Table 3-6. Finalized TMDLs in the Yadkin River Watershed

Waterbody	Pollutant	Link	Final TMDL Date
Grants Creek	Fecal Coliform	*Final TMDL*	Sept. 27, 2002
Fourth Creek	Fecal Coliform	*Final TMDL*	Dec. 19, 2001
Rich Fork and Hamby Creeks	Fecal Coliform	*Final TMDL*	Apr. 28 , 2004

High Rock Lake TMDL

High Rock Lake is impaired due to violations of the turbidity and chlorophyll *a* standards. Therefore, DWQ has initiated a TMDL development process for the lake. As discussed above, turbidity and sedimentation are a significant water quality issue in this hydrologic unit. Much of the sediment and nutrient inputs arrive from upstream via the Yadkin and South Yakin hydrologic units. The sediment generated in these hydrologic units contributes directly to the water quality impairment observed in High Rock Lake. In addition to sediment, runoff from these hydrologic units delivers substantial nutrients to High Rock Lake that lead to chlorophyll *a* violations. Residents and government agencies in the Yadkin River Headwaters should be active in the TMDL development process for the lake and continue implementing nonpoint source pollution reduction strategies.

Population and Land Use

Population distribution and land use patterns are highly variable in this hydrologic unit. Land use varies from generally undisturbed in the southeastern portion to decidedly urban in the northern portion of the watershed around the I-85 corridor. The population distribution closely follows this pattern. The highest population densities are located around Thomasville, Lexington, and Salisbury. The agricultural and forested regions in the southeastern part of the watershed have much lower population densities.

Stream impacts closely follow the population density and land use patterns. They are more common in agriculture areas than in the forested headwaters and most concentrated in the urban centers (Figure 3-6 & 3-7). Development pressure is increasing around the lake shoreline and urban centers. Research suggests that streams begin to degrade when watershed imperviousness reaches 10 percent of the total land area. DWQ's own data indicates degradation may begin at even lower levels of imperviousness. These trends demonstrate the importance of *protecting and conserving stream buffers and natural areas.*

Figure 3-6. Population Density in 2000

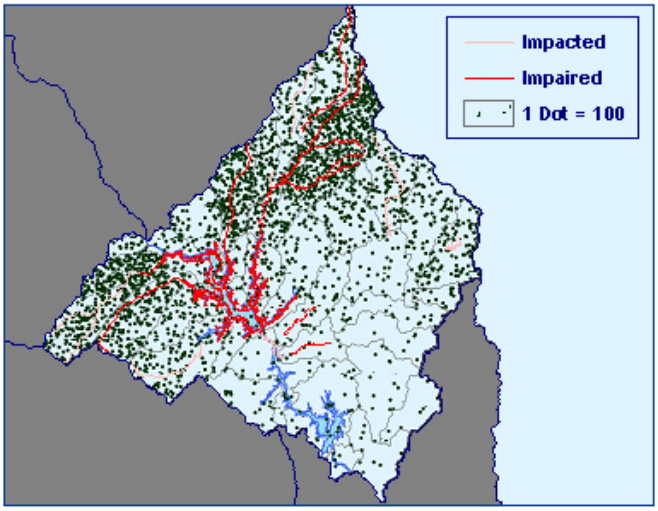
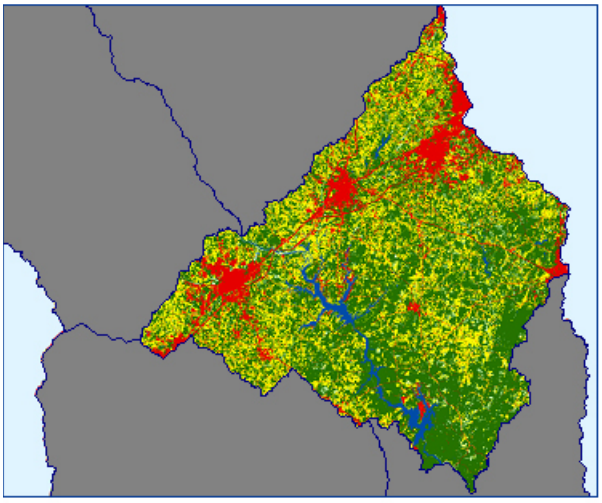


Figure 3-7. Land Use in 03040103



Local Initiatives

Cooperative Conservation Partner Initiative

The Cooperative Conservation Partnership Initiative (*CCPI*) is a voluntary program established to foster conservation partnerships that focus technical and financial resources on conservation priorities in watersheds of special significance. See the ***Rapid Watershed Assessment*** completed for the Yadkin River subbasin for more information.

Section 319-Grant Program

The ***Section 319 Grant Program*** was established to provide funding for efforts to reduce nonpoint source (NPS) pollution, including that which occurs though stormwater runoff. The U.S. Environmental Protection Agency provides funds to state and tribal agencies, which are then allocated via a competitive grant process to organizations to address current or potential NPS concerns. Each fiscal year North Carolina is awarded nearly 5 million dollars to address nonpoint source pollution through its 319 Grant Program. Thirty percent of the funding supports ongoing state nonpoint source programs. The remaining seventy percent is made available through a competitive grants process.

319 grant funds have been allocated to support the High Rock Lake TMDL. No other 319 projects have been awarded in this watershed. Any of the impaired streams listed above are candidates for 319 funding. Interested parties should contact the ***Basinwide Planning Program*** to discuss potential projects.

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 some investments in the Yadkin River Hydrologic Unit. Figure 3-8 shows the distribution of projects to date in the watershed and Table 3-7, at the end of this document, includes a list of projects and their cost. These projects include land acquisitions and capital improvements to wastewater and stormwater infrastructure.

Figure 3-8. CWMTF Projects

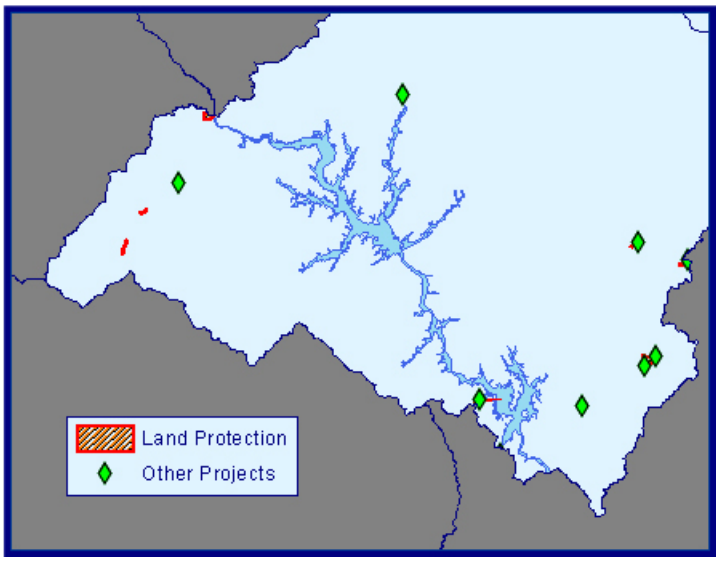


Table 3-7. CWMTF Funded Projects (9/1/2001-8/31/2006)

Project Number	Application Name	Proposed Project Description	Amount Funded
2001A-010	Environmental Impact RC&D- Camp Barnhardt BSA/Badin Lk Land Acq	Purchase a permanent conservation easement of 142 acres on Badin Lake. Proceeds from the sale of the easement will be used to replace a failing septic tank system at the existing Boy Scouts Camp. Includes an additonal 142 acres in donated CE.	$708,000
2002A-012	LandTrust for Central North Carolina- Acq/ Poison Fork & Barnes Cr.	Acquire 235 acres through fee simple purchase along Poison Creek and its tributaries. CWMTF would fund purchase of 64% of the tract.	$200,000
2004B-019	LandTrust for Central North Carolina- Acq/ Uwharrie Farms Conservation Project, Uwharrie River	Protect through a permanent conservation easement 120 ac of farmland along the Uwharrie River. CWMTF funds to purchase a working forest easement on the riparian 26 acres and upland 94 ac to be managed under federal Farm & Ranchland Preservation Program.	$150,000
2004B-511	Lexington, City of - WW/ Reclaimed Wastewater, Abbotts Creek	Design, permit & construct a 0.3 MGD wastewater treatment facility to "scalp" wastewater from an existing outfall, treat to reuse standards, & irrigate a golf course on a seasonal basis. Project will reduce total discharge to Abbotts Ck & High Rock Lake.	$1,206,000
2005B-601	Handy Sanitary District - Septic/ Failing On-Site Systems and Decommissioning of WWTPs, Badin Lake	Install a low pressure wastewater collection system (~50 mi. of line) along shores of Badin Lake to serve 2,100 residences (including many failing septic systems). Decommission two land application treatment facilities and pump waste to Troy's WWTP.	$3,000,000
This list does not include: regional or statewide projects that were in multiple river basins, or projects that were funded and subsequently withdrawn.			

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stream degradation in the Yadkin River Hydrologic Unit. 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. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

Financial incentives are provided through ***North Carolina's Agriculture Cost Share Program***. The ***Division of Soil and Water Conservation*** in the Department of Environment and Natural Resources administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 3-8 shows the number of projects implemented and in the Yadkin River Hydrologic Unit and the dollar amount invested. Table 3-9 shows the water quality benefits realized from that investment.

Table 3-8. ACSP Project Expenditures In the Yadkin Hydrologic Unit

	Erosion Reduction/ Nutrient Loss Reduction in Fields		Sediment/Nutrient Delivery Reduction from Fields		Stream Protection from Animals			Proper Animal Waste Management		
12-digit HU	Total Implemented	Cost	Total Implemented	Cost	Total Implemented		Cost	Total Implemented		Cost
030401030100	98.1 ac.	$14,444			131.5 units	9,760 LF	$88,597	1 unit		$10,000
030401030200	372.1 ac.	$31,316	663.9 ac.	$11,950	16 units	9,585 LF	$32,613	2 units		$11,546
030401030300	202.39 ac.	$24,688			26 units	14,265 LF	$67,440	1 unit		$2,967
030401030400	101.1 ac.	$9,595			1 unit		$6,906	3 units		$62,276
030401030500	136.7 ac.	$17,039						7 units		$144,536
030401030501										
Total		$97,082		$11,950			$195,556			$231,325

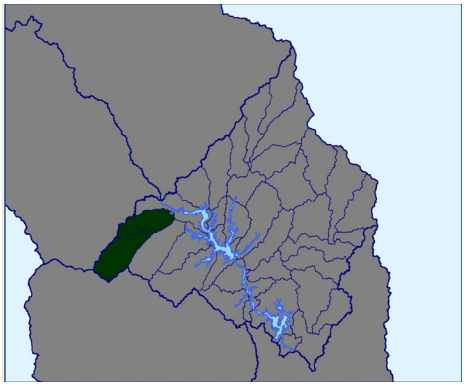
Table 3-9. NC ASCP Water Quality Benefits

	Water Quality Benefits				
	Soil Saved (tons)	Nitrogen Saved (lbs)	Phosphorus Saved (lbs)	Waste-N Managed (lbs)	Waste-P Managed (lbs)
030401020100	633	9,745	1,988	5,580	1,980
030401020101	3,368	48,815	54,288	15,016	12,994
030401020200	1,968	6,690	3,148	648	548
030401020300	2,167	9,560	5,577	80,840	102,160
030401020400	253	12,566	12,566	146,973	177,941
030401020500					
Total	8,389	87,376	77,567	249,057	295,623

References

U.S. Environmental Protection Agency (USEPA) 1999. Protocol for Developing Sediment TMDLs. First Edition. EPA 841-B-99-044. U.S. EPA, Office of Water, Washington D.C.

Waters, T.F. 1995. Sediment in streams—Sources, biological effects, and control. American Fisheries Society Monograph 7. American Fisheries Society, Bethesda, MD.



Grants Creek

HUC: 030401030101 & 030401030102
Part of the Yadkin River Watershed: HUC 03040103

This document is a working draft and will be updated as information and resources become available

Overview

The Grants Creek Watershed is located in central Rowan County and includes portions of China Grove, Landis, Salisbury, and Spencer. Land use in the watershed consists primarily of forest (34%), urban (31%), and agriculture (25%). Major NPDES dischargers include Fieldcrest Cannon (inactive 6/30/2005) and the City of Salisbury Wastewater Treatment Plant.

Grants Creek first appeared on the NC 303(d) List of Impaired Waters in 1998. Fecal coliform bacteria, turbidity, and sedimentation were identified as problem parameters. Urban and agriculture were generally identified as possible pollution sources, but no specific nonpoint sources were isolated. Significant impacts were noted from the City of Spencer WWTP and City of Salisbury Grants Creek WWTP. In 1998, the Grants Creek WWTP was relocated to the Yadkin River. In 2002, the Spencer WWTP was decommissioned and all flows were diverted to the Grants Creek WWTP.

Grants Creek remains impaired from SR1910 to the confluence with the Yadkin River because of fecal coliform and turbidity violations. Habitat degradation remains a problem through out the watershed.

Watershed at a Glance

County:
Rowan

Municipalities:
China Grove, East Spencer, Spence, & Salisbury

Permitted Facilities

NPDES WWTP:	
Major	0
Minor	5
NPDES Nondischarge:	0
NPDES Stormwater:	
General	15
Individual	0
Phase II	3
Animal Operations:	1

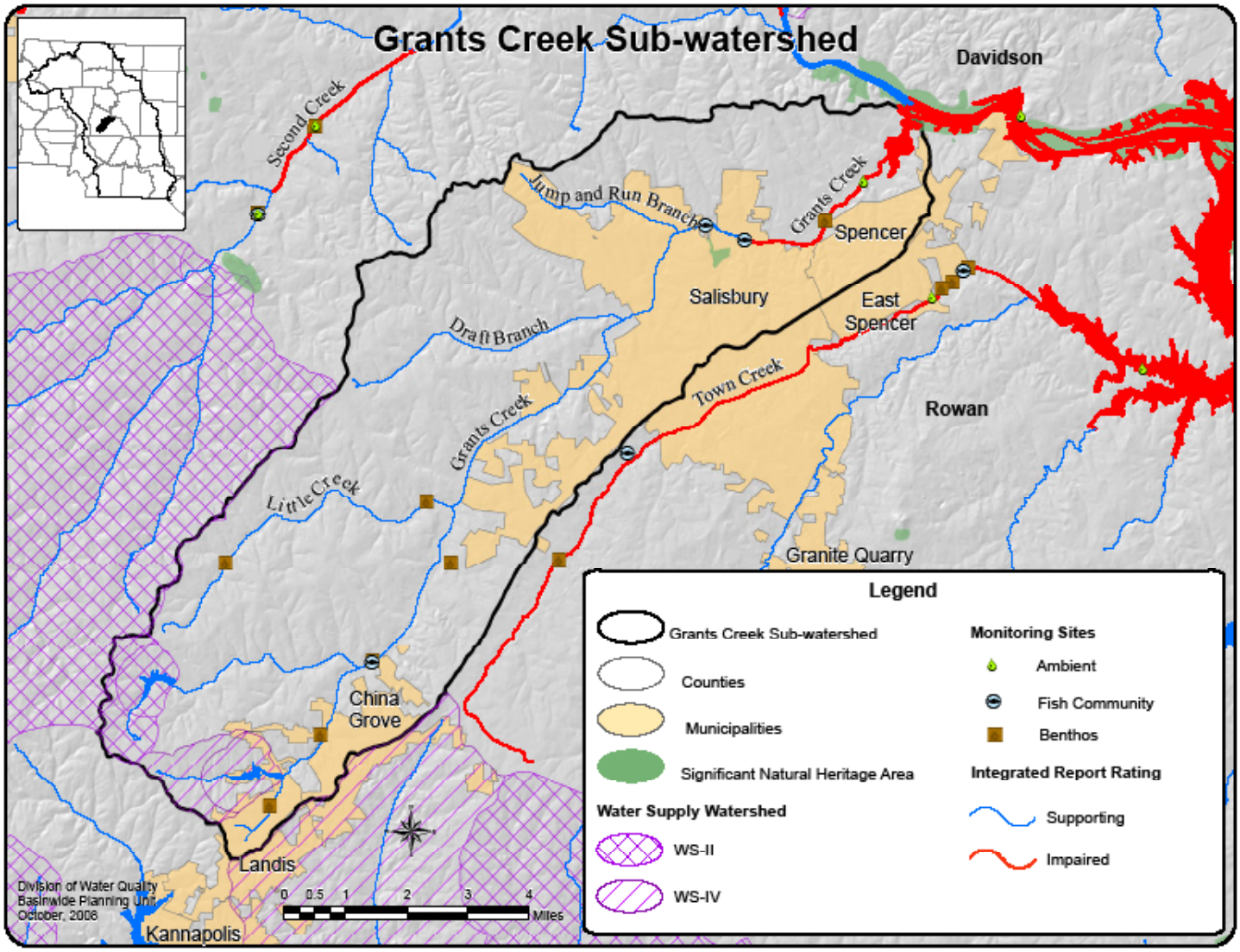
In 2007, the DWQ selected Grants Creek for a concentrated restoration effort. The current status of this project is compiled here to comply with ***EPA's watershed restoration plan guidance***. Thus, this document will provide DWQ and all interested partners with an ongoing resource to guide future restoration projects. It is organized according to the nine key elements EPA has identified as requirements for a ***well-designed watershed implementation plan***.

Grants Creek Watershed Restoration Plan Working Draft

Information & Education

DWQ is in the process of developing a novel new distribution system for its basinwide plans. The system uses intuitive search and navigation functions available in Google Earth™ to produce an easily accessible public portal for document retrieval and data distribution. The document storage structure supports quick and easy updates as water quality conditions change and local restoration efforts advance. Additionally, the Google Earth™ platform visually links water quality concepts to existing land use patterns using aerial photography and generally familiar features (roads, municipalities, county boundaries, etc.). Regular updates to the Grants Creek Watershed Restoration Plan will be delivered to the public through this system.

Local governments in the Grants Creek Watershed are required to maintain a public education and outreach program under their ***Phase II stormwater permits***. These programs can serve as another avenue to distribute information contained in this plan.



Monitoring – Programs, Results, & Future Plans

Long Term Monitoring Programs
The DWQ Environmental Sciences Section (ESS) and the Yadkin-PeeDee River Basin Association (YPDRBA) maintain long-term monitoring programs for a variety of biological, chemical, and physical data. Data from these programs originally revealed the water quality impairment in Grants Creek. A summary of each follows.

Benthic Macroinvertebrate Monitoring

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom substrates of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since macroinvertebrates have life cycles of six months to over one year, the effects of short-term pollution (such as a spill) will generally not be overcome until the following generation appears. The benthic community also integrates the effects of a wide array of potential pollutant mixtures.

Criteria have been developed to assign a bioclassification to each benthic sample based on the number of different species present in the pollution intolerant groups of Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies), commonly referred to as EPTs; and a Biotic Index value, which gives an indication of overall community pollution tolerance. Different benthic macroinvertebrate criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina. Bioclassifications fall into five categories ranging from Poor to Excellent.

Table 1. Benthic Monitoring History

Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPTBI	BioClass
Grants Cr	SR 1910	Rowan	12-110	8/9/2006	87	18	6.4	6.0	Good-Fair
				8/7/2001	72	13	6.6	6.3	Fair
Little Cr	SR1512	Rowan	12-110-3	9/27/2006					Good-Fair
UT Grants Cr	SR 1500	Rowan	12-110	8/28/2001	34	14	5.3	4.6	Not Impaired

Fish Assessments

The condition of the fish community is one of the most meaningful indicators of ecological integrity to the public. Fish occupy the upper levels of the aquatic food web and are both directly and indirectly affected by chemical and physical changes in the environment. Water quality conditions that significantly affect lower levels of the food web (such as benthic macroinvertebrates) will affect the abundance, species composition and condition of the fish population. Three types of fish assessments are conducted by DWQ: fish community, fish tissue and information about fish kills.

Scores are assigned to fish community samples using the North Carolina Index of Biotic Integrity (NCIBI). The NCIBI uses a cumulative assessment of 12 parameters or metrics. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score.

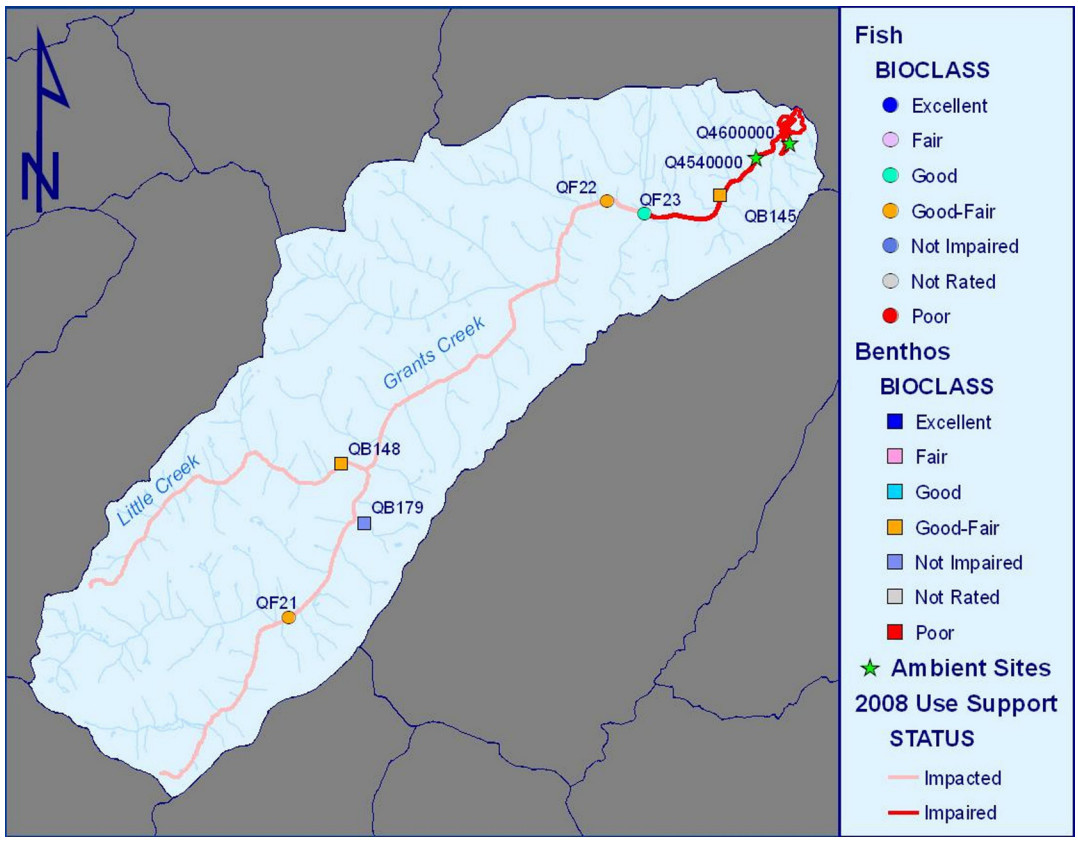
Table 2. Fish Community Monitoring History

HUC/Waterbody	Station	County	Index No.	Date	NCIBI Score	NCIBI Rating
Grants Cr	SR 1506	Rowan	12-110	07/08/04	42	Good-Fair
Grants Cr	SR 2200	Rowan	12-110	05/02/01	42	Good-Fair
Grants Cr	SR 1910	Rowan	12-110	07/08/04	48	Good

Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine sample stations strategically located for the collection of physical and chemical water quality data. The program has been active for over thirty years. Stations are visited at least monthly for the collection of a variety of physical, chemical, and bacterial pathogen samples and measurements. The Grants Creek Restoration Plan focuses on fecal coliform bacteria, turbidity, and total suspended solids (TSS) at the two ambient monitoring stations in the watershed. The two stations are maintained in duplicate by DWQ and the YPDRBA.

Figure 2. Monitoring Station Locations & Ratings



Data for these ambient monitoring sites and key are shown below.

Location: GRANTS CRK AT SR 1915 NR SALISBURY
Station #: Q4540000 **Hydrologic Unit Code:** 3040103
Latitude: 35.70718 **Longitude:** -80.43608 **Stream class:** C
Agency: NCAMBNT **NC stream index:** 12-110

Time period: 10/05/2005 to 12/06/2006

	# result	# ND	Results not meeting EL EL	#	%	%Conf	Percentiles Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	15	0	<4	1	6.7		3.8	4.9	6.5	9.2	10.4	11.7	11.7
	15	0	<5	1	6.7		3.8	4.9	6.5	9.2	10.4	11.7	11.7
pH (SU)	15	0	<6	0	0		6.1	6.1	6.2	6.5	7	7.6	7.6
	15	0	>9	0	0		6.1	6.1	6.2	6.5	7	7.6	7.6
Spec. conductance (umhos/cm at 25°C)	15	0	N/A				49	77	129	137	166	183	187
Water Temperature (°C)	15	0	>32	0	0		6.7	6.9	8.2	12.2	21.9	23.8	24.7
Other													
TSS (mg/L)	5	0	N/A				2.8	2.8	2.9	6	41.5	68	68
Turbidity (NTU)	15	0	>50	3	20	94.4	4.9	5.1	7.6	11	20	218.4	306
Nutrients (mg/L)													
NH3 as N	15	7	N/A				0.02	0.02	0.02	0.02	0.05	0.08	0.12
NO2 + NO3 as N	15	0	N/A				0.06	0.06	0.14	0.26	0.44	0.57	0.72
TKN as N	15	1	N/A				0.2	0.2	0.26	0.33	0.42	0.87	1.4
Total Phosphorus	15	0	N/A				0.03	0.03	0.04	0.05	0.08	0.31	0.51
Metals (ug/L)													
Aluminum, total (Al)	5	0	N/A				210	210	225	440	6745	13000	13000
Arsenic, total (As)	5	5	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	5	5	>2	0	0		2	2	2	2	2	2	2
Chromium, total (Cr)	5	5	>50	0	0		25	25	25	25	25	25	25
Copper, total (Cu)	5	2	>7	2	40		2	2	2	2	23	24	24
Iron, total (Fe)	5	0	>1000	3	60		150	150	395	1100	9150	17000	17000
Lead, total (Pb)	5	4	>25	0	0		10	10	10	10	14	19	19
Mercury, total (Hg)	5	5	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	5	4	>88	0	0		10	10	10	10	12	14	14
Zinc, total (Zn)	5	3	>50	2	40		10	10	10	10	786	1500	1500

Fecal coliform (#/100mL)

# results:	Geomean	# > 400:	% > 400:	%Conf:
15	331	6	40	98.2

Location: GRANTS CRK AT SR 1915 NR SALISBURY
Station #: Q4540000 **Hydrologic Unit Code:** 3040103
Latitude: 35.70718 **Longitude:** -80.43608 **Stream class:** C
Agency: YPDRBA **NC stream index:** 12-110

Time period: 01/15/2002 to 12/12/2006

	# result	# ND	Results not meeting EL EL	#	%	%Conf	Percentiles Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	85	0	<4	0	0		5.2	5.5	6.1	7.2	8.8	10	11.6
	85	0	<5	0	0		5.2	5.5	6.1	7.2	8.8	10	11.6
pH (SU)	85	0	<6	0	0		6.7	6.7	6.8	7	7.4	8	8.2
	85	0	>9	0	0		6.7	6.7	6.8	7	7.4	8	8.2
Spec. conductance (umhos/cm at 25°C)	84	0	N/A				88	107	116	140	168	222	271
Water Temperature (°C)	85	0	>32	0	0		5.6	7.1	12.1	20.2	23.4	26.7	29.1
Other													
Turbidity (NTU)	60	0	>50	3	5		2.2	5.2	7.1	11	19.8	33.8	120

Fecal coliform (#/100mL)

# results:	Geomean	# > 400:	% > 400:	%Conf:
60	106	5	8	

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

Mooresville Regional Office Special Study

The monitoring programs described above indicate chronic water quality problems in Grants Creek. Fish and benthic samples show the biological community is significantly degraded, and the ambient data indicate Impairment due to fecal coliform bacteria and turbidity standard violations. While this data represents the overall poor health of Grants Creek, they do not isolate likely pollution sources. In 2007, the DWQ – Mooresville Regional Office began a special study to specifically identify pollution sources. MRO staff sampled the creek at several locations along its length to determine where significant pollutant loads are entering the stream. The results to date are shown in Table 3.

Table 3. Mooresville Regional Office Special Study Results

Station	Location	Date	Fecal (CFU/100 mL)	Turbidity (NTU)	pH (SU)	DO (mg/L)	Cond. (mS/cm)	Temp. (°C)	Comments
MROGC002	3rd Street/Hollywood	6/6/2007	400	5.1	7.57	7.79	129.0	21.4	AMS and YPDRBA station
	3rd Street/Hollywood	7/19/2007	170	5.7	7.83	5.54	187.5	23.4	
	3rd Street/Hollywood	8/20/2007	250	6.6	7.35	3.21	315.2	24.2	
	3rd Street/Hollywood	10/3/2007	67	5.6	7.06	4.03	366.1	19.4	
MROGC002A	UT to Grants	6/6/2007	290	11	7.98	7.67	98.0	26.1	Runoff from cow pasture
	UT to Grants	7/19/2007	NS	NS					
	UT to Grants	8/20/2007	NS	NS					
	UT to Grants	10/3/2007	NS	NS					
MROGC003	Cow & Horse	6/6/2007	2000	140	7.44	8.45	115.0	20.5	Grants Creek between the cow and horse pasture runoff
	Cow & Horse	7/19/2007	NS	NS					
	Cow & Horse	8/20/2007	NS	NS					
	Cow & Horse	10/3/2007	NS	NS					
MROGC004	7th Street	6/6/2007	500	5.9	7.39	9.23	129.0	20.4	
	7th Street	7/19/2007	130	5.6	7.48	6.04	200.1	23.6	
	7th Street	8/20/2007	90	3.6	7.49	4.58	316.5	24.4	
	7th Street	10/3/2007	270	2.2	7.22	5.13	419.2	18.9	
MROGC005	Below Golf Course	6/6/2007	900	8.6	7.42	10.00	127.0	20.2	Grants Creek below Golf Course
	Below Golf Course	7/19/2007	NS	NS					
	Below Golf Course	8/20/2007	NS	NS					
	Below Golf Course	10/3/2007	NS	NS					
MROGC006	Old Mocksville	6/6/2007	930	9.4	7.29	9.48	106.0	19.7	Start of 303(d) Impairment
	Old Mocksville	7/19/2007	230	7.8	7.51	6.82	162.5	24.2	
	Old Mocksville	8/20/2007	180	13	7.27	3.88	298.9	24.7	
	Old Mocksville	10/3/2007	350	3	7.19	5.20	416.5	18.3	

Station	Location	Date	Fecal (CFU/100 mL)	Turbidity (NTU)	pH (SU)	DO (mg/L)	Cond. (mS/cm)	Temp. (°C)	Comments
MROGC007	Innes Street	6/6/2007				NS			
	Innes Street	7/19/2007	260	8.4	7.42	5.50	171.6	23.9	
	Innes Street	8/20/2007	420	7.4	7.28	3.16	400.8	24.5	
	Innes Street	10/3/2007	300	2.2	7.01	3.98	425.6	18.2	
MROGC007A	Jump and Run	6/6/2007				NS			Tributary to Grants Creek - Possible Ag fecal source
	Jump and Run	7/19/2007	350	11	7.20	8.09	140.9	25.6	
	Jump and Run	8/20/2007	NS			NS			
	Jump and Run	10/3/2007	NS			NS			
MROGC008	Statesville Rd	6/6/2007				NS			
	Statesville Rd	7/19/2007	180	7.9	7.31	6.79	158.2	25.3	
	Statesville Rd	8/20/2007	67	6.4	7.07	3.18	232.3	25.2	
	Statesville Rd	10/3/2007	33	11	7.16	4.20	215.7	20.9	
MROGC009	Old Wilkesboro	6/6/2007				NS			In park downstream of Statesville yard waste site
	Old Wilkesboro	7/19/2007	270	10	7.45	6.62	84.9	25.0	
	Old Wilkesboro	8/20/2007	280	8.1	7.20	2.76	257.6	280.0	
	Old Wilkesboro	10/3/2007	47	8.4	6.97	4.58	367.6	21.7	
MROGC010	Hwy 150	6/6/2007	NS			NS			
	Hwy 150	7/19/2007	NS			NS			
	Hwy 150	8/20/2007	470	7.6	7.30	4.36	186.4	24.6	
	Hwy 150	10/3/2007	330	7.3	6.90	4.14	233.2	17.9	
MROGC016	Rowan Mill Road	6/6/2007	NS			NS			Added to determine impact between Airport Rd and Hwy 150
	Rowan Mill Road	7/19/2007	NS			NS			
	Rowan Mill Road	8/20/2007	NS			NS			
	Rowan Mill Road	10/3/2007	230	7.9	7.06	5.14	212.0	18.6	
MROGC011	Airport Road	6/6/2007	NS			NS			
	Airport Road	7/19/2007	NS			NS			
	Airport Road	8/20/2007	72	7.3	7.30	3.43	153.0	25.5	
	Airport Road	10/3/2007	NF			NF			
MROGC012	Corriher Gravel Road	6/6/2007	NS			NS			China Grove
	Corriher Gravel Road	7/19/2007	NS			NS			
	Corriher Gravel Road	8/20/2007	170	9.9	7.40	5.46	144.0	27.7	
	Corriher Gravel Road	10/3/2007	49	7.4	7.13	7.04	165.1	23.0	
MROGC013	Mt Moriah Church Rd	6/6/2007	NS			NS			Landis
	Mt Moriah Church Rd	7/19/2007	NS			NS			
	Mt Moriah Church Rd	8/20/2007	190	1.4	7.30	5.68	169.8	24.9	
	Mt Moriah Church Rd	10/3/2007	51	1.3	7.00	8.17	166.6	20.1	

Station	Location	Date	Fecal (CFU/100 mL)	Turbidity (NTU)	pH (SU)	DO (mg/L)	Cond. (mS/cm)	Temp. (°C)	Comments
MROGC014	Ryder street	6/6/2007	NS	NS					Parkdale Mills Cooling Discharge
	Ryder street	7/19/2007	NS	NS					
	Ryder street	8/20/2007	NS	NS					
	Ryder street	10/3/2007	110	1	6.54	7.44	230.8	20.0	
MROGC015	Blume Street	6/6/2007	NS	NS					Grants Creek Headwaters - Landis
	Blume Street	7/19/2007	NS	NS					
	Blume Street	8/20/2007	NS	NS					
	Blume Street	10/3/2007	230	4.1	6.29	6.64	90.4	19.2	
> 200 CFU/100 mL	*NS = Not Sampled*	*NF = No Flow*							

Cause & Source Identification

Cause of Impairment

Ongoing studies beginning in 1998 clearly show excessive turbidity and fecal coliform bacteria concentrations cause impairment in Grants Creek.

303(d) List of Potential Sources by Report Year

Potential sources are identified using Best Professional Judgment based on available information. The ***North Carolina 303(d) list*** is updated in even numbered years.

Table 4. Potential Sources

Potential Sources	1998	2000	2002	2004	2006	2008
Municipal Discharge	X	X	X			X
Construction	X	X	X			X
Agriculture	X	X	X	X	X	X
Unknown				X	X	

TMDL Findings

Turbidity

Turbidity is a measure of water clarity and is reported in Nephelometric Turbidity Units (NTU). Therefore, turbidity is not measured in terms of concentrations and cannot be directly converted into loadings required for developing load reductions. For this reason, total suspended solids (TSS) were selected as a surrogate measure for this TMDL. The ***Grants Creek Turbidity TMDL*** found that a 31 percent reduction in total suspended solids (TSS) is required in order to meet the water quality standard for turbidity. Both point and nonpoint sources are responsible for the elevated TSS concentrations, but general nonpoint sources and municipal separate storm sewer systems (MS4s) were the greatest turbidity contributors. The TMDL did not identify specific sources within these general categories.

Fecal Coliform Bacteria

The ***Grants Creek Fecal Coliform Bacteria TMDL*** found that various nonpoint sources; including livestock grazing, manure application, and urban areas, were the greatest fecal coliform bacteria contributors. The TMDL did not identify specific sources within these general categories. In order to reach the water quality target of 200 cfu/100ml, with a 25 cfu/100ml explicit margin of safety, the non-point source fecal coliform loading needs to be reduced by 33%-60% for the various sources in dry weather conditions and 85%-97% reductions in wet weather conditions. The TMDL allocation model shows that the reduction scenario that meets the 200 col./100ml geometric mean standard also meets the instantaneous standard of 400 col./100ml.

MRO Study Conclusions

Describe pollution sources and other concerns identified in the MRO study. turbidity findings – Yadkin main stem influence, fecal assessment. SSOs, DMR performance, etc. To be completed

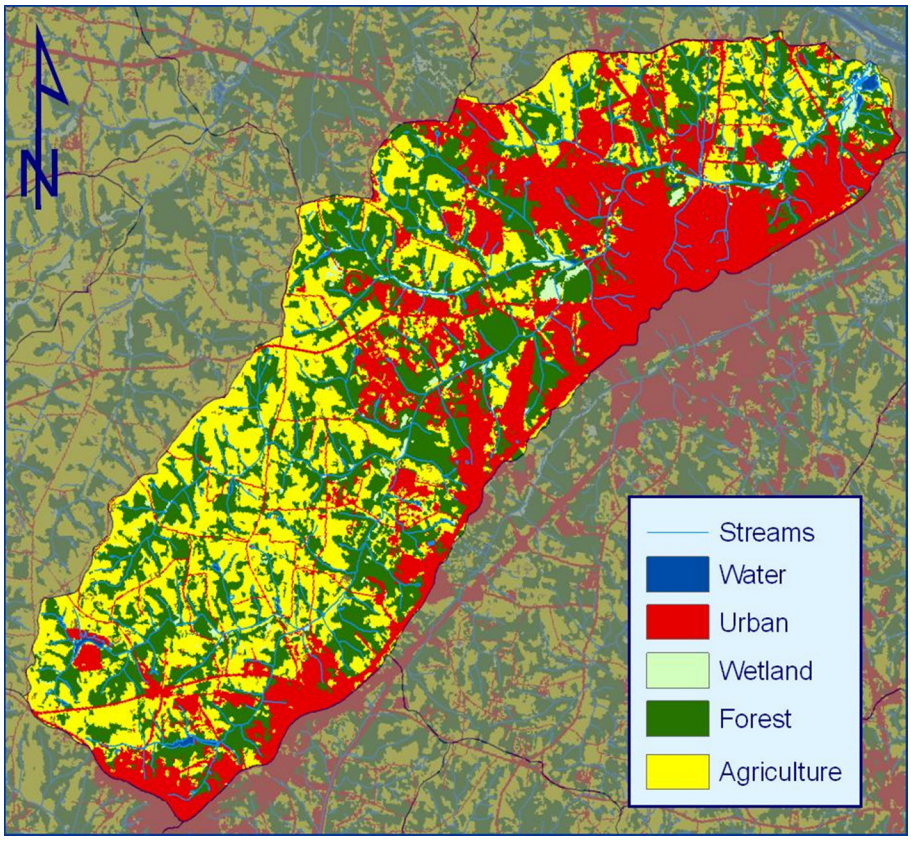
Additional Information

Information from SWCDs

Future Monitoring Needs

- Tributary assessments
- Flow for trends and load calculations
- Ongoing DWQ Ambient to document success.

Figure 3. Land Cover in the Grants Creek Watershed



Load Reduction Estimates

Turbidity Total Maximum Daily Load

DWQ completed a Turbidity Total Maximum Daily Load (TMDL) for Grants Creek in 2006. The full TMDL report can be viewed here: *http://h2o.enr.state.nc.us/tmdl/documents/YadkinTMDLReport_Approved.pdf*

Turbidity is not a concentration and, as a measure, cannot be directly converted into loadings required for the TMDL. Total suspended solids (TSS) was therefore selected as the surrogate measure for turbidity and used to develop the TMDL target and limits (USEPA 1999).

Table 5. Turbidity TMDL Summary

Pollutant	Existing Load	WLA_2	LA_4	MOS_3	TMDL	Percent Reduction $_5$
TSS (tons/day)	8.03	0.683	4.17	0.68	5.54	31.0%

Notes:

1. Total Maximum Daily Load (TMDL) = maximum amount of a pollutant that a water body can receive and still meet water quality standards and an allocation of that amount to the pollutant's sources.
2. Waste Load Allocation (WLA) = Pollutant load assigned to NPDES Permit holders.
3. Margin of Safety (MOS) = Unassigned pollutant load to compensate for potential measurement and modeling error.
4. Load Allocation (LA) = Pollutant load assigned to all other sources combined, including nonpoint sources; LA = TMDL – WLA – MOS.
5. Percent reduction represents overall TMDL reduction - calculated as: (Existing Load –TMDL)/Existing Load
6. TMDL represents the average allowable load between the 95th and 10th percent recurrence interval.

Fecal Coliform Bacteria Total Maximum Daily Load

DWQ completed a fecal coliform bacteria TMDL for Grants Creek in 2002. The full TMDL report can be viewed here: *http://h2o.enr.state.nc.us/tmdl/Docs_TMDL/Grants%20TMDL%20final.pdf*

DRAFT

Table 6. Fecal Coliform Bacteria TMDL Summary [1]

Total Maximum Daily Load (TMDL)	Sources	Wet Weather Fecal Coliform Loading Reductions	Dry Weather Fecal Coliform Loading Reductions
Wasteload Allocation (WLA)	Waste Water Treatment Plant	0%	0%
Load Allocation (LA)	High Density Development	94%	33%
	Low Density Development	94%	33%
	Livestock Grazing/Manure Application (Pastureland)	97%	60%
		85%	40%
	Manure Application (Cultivated)	97%	60%
	Wildlife	0%	0%

1. Loading allowed at critical condition:
   a. Wasteload Allocation (WLA): 1.75 x 10^{11} cfu per 30 days
   b. Load Allocation (LA): 2.18 x 10^{13} cfu per 30 days
   c. Margin of Safety: Explicit margin of safety of 25 cfu/100ml.

Expected Reductions from Management Measures

These will be calculated as specific management measures are implemented. For example: Cattle exclusion fencing installed: 2000ft. fencing @ .05tons sediment reduced/year = 100 tons/year.

Management Measures

Existing Management Programs

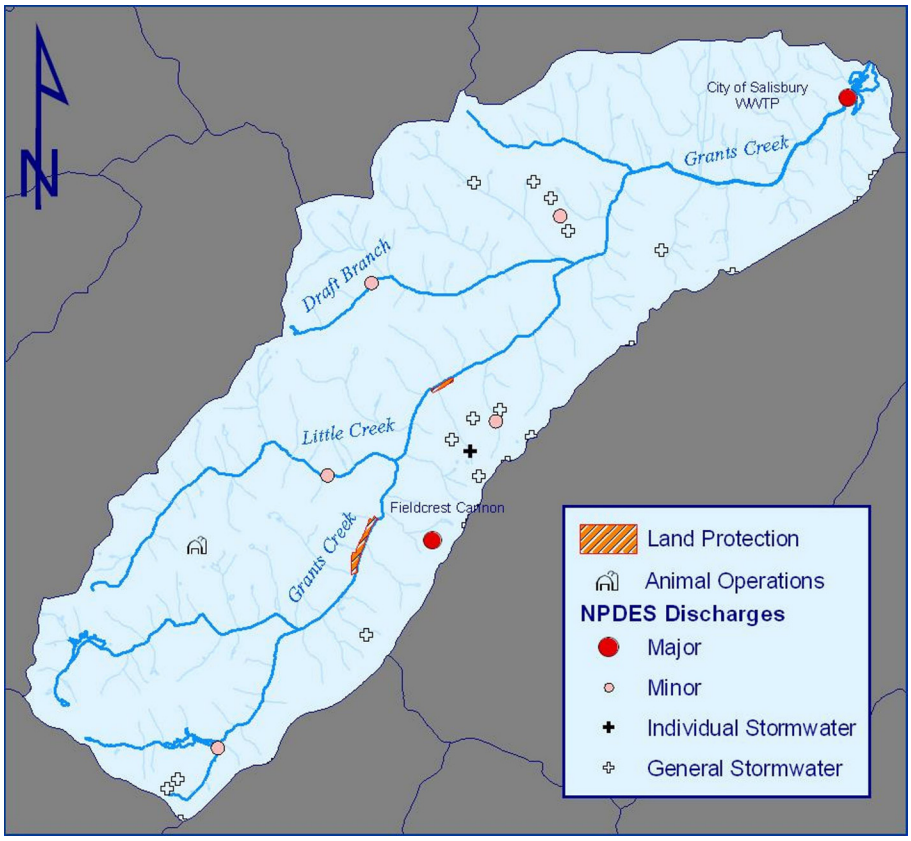
National Pollutant Discharge Elimination System (NPDES)

All wastewater discharges to surface waters in the State of North Carolina must receive a permit to control water pollution. The Clean Water Act of 1972 initiated strict control of wastewater discharges with the responsibility ofenforcement given to the Environmental Protection Agency (EPA). The EPA then created the National Pollutant Discharge Elimination System to track and control point sources of pollution. The primary method of control is by issuing permits to dischargers with limitations on wastewater flow and constituents. The EPA delegated permitting authority to the State of North Carolina in 1975.

The ***NPDES Unit*** is responsible for the issuance of wastewater discharge permits. This process includes determining the quality and quantity of treated wastewater that the receiving stream can assimilate, incorporating input from stream modeling, collaborating with Regional Office staff, and evaluation of the discharger's location.

Where appropriate, the NPDES program establishes limits for flow (quantity discharged), conventional pollutants (BOD, pH, TSS, fecal coliform, oil & grease, etc.), toxicants (metals, volatile organics, etc.), and non-conventional pollutants such as ammonia and nutrients.

Figure 4. NPDES Permits Sites



Delegated states have the authority to establish state water quality standards that can be more stringent than federal standards established by EPA

In addition to administering the NPDES program in North Carolina, there is also the responsibility of enforcement of the discharge limitations. The penalty for discharging without a permit is a fine of up to $25,000 per day.

Table 7. Permitted Discharges in the Grants Creek Watershed

Permit Number	Permit Owner	Facility	Permitted Flow (MGD)	TSS (mg/l) Daily Max	TSS (mg/l) Weekly Average	TSS (mg/l) Monthly Average	Fecal Coliform (col/100ml) Weekly Average	Fecal Coliform (col/100ml) Monthly Average	Fecal Coliform (col/100ml) Daily Max
NC0027502	Town of Landis	Landis WTP	No Limit	45		30			
NC0023884	Town of Salisbury	Grants Creek WWTP	20		45	30	400	200	
NC0034703	Rowan-Salisbury Schools	Knollwood Elementary School	0.011	45		30		200	400
NC0037184	Lakeside Investment Properties	Oak Haven Mobile Home Park	0.006	45		30		200	400
NC0042439	Westside Swim & Racquet Club	Westside Swim & Racquet Club	0.003	45		30		200	400
NC0049905	Inman Asphalt	Inman Asphalt-Salisbury	No Limit	67.5		45			
NC0004286*	Fieldcrest Cannon	Plant 16	0.05	135		39			

* Permit NC0004286 is inactive as of 6/30/2005

Table of NonDischarge and Animal Op permits.

NPDES Phase II Stormwater Permitting

The Phase I and II stormwater permitting programs were established under the federal Clean Water Act and then delegated to the NC Division of Water Quality [DWQ] for implementation. The Phase I stormwater program began in 1990 and applies to NC local governments that had populations of 100,000 or more at that time (Raleigh, Durham, Fayetteville/Cumberland County, Charlotte, Winston-Salem, Greensboro). Each subject local government now implements a stormwater management program that includes public education, illicit discharge detection and elimination, and water quality monitoring. The Phase II stormwater program applies to local governments that have been selected by automatic designation, state designation, or petitioning.

EPA regulation (***40CFR 122.34***) requires permittees at a minimum to develop, implement, and enforce a stormwater program designed to reduce the discharge of pollutants from the MS4 to the maximum extent practicable. The stormwater management program must include these six minimum control measures:

1. Public education and outreach on stormwater impacts
2. Public involvement/participation
3. Illicit discharge detection and elimination
4. Construction site stormwater runoff control
5. Post-construction stormwater management in new development and redevelopment
6. Pollution prevention/good housekeeping for municipal operations.

The following governments in the Grants Creek Watershed are designated Phase II communities: China Grove, Landis, Salisbury, and Rowan County. To date, ***Landis*** (draft) and ***Salisbury*** have received Phase II permits. The ***Stormwater Permitting Unit*** manages this program.

Section 404 & 401 Water Quality Certification Program

Section 401 of the Clean Water Act delegates authority to the states to issue a 401 Water Quality Certification for all projects that require a Federal Permit (such as a Section 404 Permit). The “401” is essentially a verification by the

state that a given project will not degrade Waters of the State or otherwise violate water quality standards.

If the U.S. Army Corps of Engineers determines that a 404 Permit is required because a proposed project involves impacts to wetlands or surface waters, then a 401 Water Quality Certification is also required. The Corps also determines which type of permit is applicable to the work: a Nationwide, Regional, General, or Individual Permit. For each of the Nationwide, Regional or General Permits, a matching General Certification must be issued by DWQ in order for the Permit to be valid. An Individual 401 Water Quality Certification is necessary if an Individual 404 Permit is required.

The ***401 Oversight/Express Permitting Unit*** is responsible for issuing these certifications.

Management Needs to Support Restoration

This is where we list specific 'Next Steps'. These will be identified as MRO and other studies find specific problems to correct. Possibilities might include…

- BMP installations
- Public outreach
- Enforcement actions
- Infrastructure repairs
- Flow measurements for loading calculations
- Trend calculations at ambient sites
- Responsibilities: Local Gov, DWQ, SWCD, EEP…?

Existing Restoration and Protection

?

Evaluation Criteria : Documenting Success

Fecal coliform bacteria and turbidity Impairments in Grants Creek are based on data collected at the ambient monitoring stations #4540000 (YPDRBA) and #4600000 (DWQ).

Turbidity

A stream is Impaired when readings exceed the state standard (50NTU) in more than 10 percent of the samples in a 5-year time period. The restoration project will be considered successful when the turbidity standard is violated at the above stations in less than 10 percent of the samples over a 5-year evaluation period. Interim improvements will be determined by trend calculations at these stations. Trend calculations will be adjusted for flow and seasonal variation. Supplemental evidence of improvement will be gained by monitoring the health of biological communities at existing fish and benthic sites in the watershed. As turbidity levels decrease, improvements in the habitat score and bioclassification at these sites are expected.

Fecal Coliform Bacteria

Fecal coliform bacteria Impairment is based on the concentration of fecal colonies/100ml in five samples collected over a 30-day period (5n30 sample). The stream is Impaired if the geometric mean is greater than 200 col./100ml or if a single sample exceeds 400 col./100ml. The restoration project will be considered successful when a 5n30 sample does not exceed these values.

Technical & Financial Assistance Estimates

These are things needed to implement management measures.

Table 8. Future Needs

Need	Cost	Responsible Party	Potential Funding Source
Future Study		MRO	319
Modeling		Planning	3119
BMP Design& Implementation		NRCS	CWMTF
Tributary Assessments		SWCD	205J
Infrastructure Repairs		Landis, Salisbury	CWMTF, Local Government, CG&L

Implementation Schedule

To be completed, table below is an example only.

Table 9. Sample Implementation Schedule

Task	Responsible Party	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08
Apply for CWMTF Grant	Planning												
MRO Study	MRO												
Public Outreach	Planning												
Plan Ag BMP Installations	NRCS												
Install Ag BMPs	SWCD												
Plan Infrastructure Repairs	Contractor												
Infrastructure Repair Construction	Contractor												
Achieve Water Quality Standards													
Progress Assessment													

Milestones

List of our targets and achievements

- Completed MRO study
- NPDES changes
- Grant Applications Submitted
- 303d lists
- Permit updates
- Enforcement Resolutions
- X number of Ag BMPs installed
- X number of Stormwater Retrofits

References

U.S. Environmental Protection Agency (USEPA) 1999. Protocol for Developing Sediment TMDLs. First Edition. EPA 841-B-99-044. U.S. EPA, Office of Water, Washington D.C.