Chapter 6
Cape Fear River Subbasin 03-06-06

Including: Morgan Creek, Bolin Creek, Booker Creek, Little Creek and University Lake

6.1 Subbasin Overview

Subbasin 03-06-06 at a Glance

Land and Water Area

Total area:	75 mi²
Land area:	74 mi²
Water area:	1 mi²

Population Statistics

2000 Est. Pop.: 23,470 people
Pop. Density: 315 persons/mi²

Land Cover (percent)

Forest/Wetland:	84%
Surface Water:	1.4%
Urban:	5.3%
Cultivated Crop:	0.6%
Pasture/ Managed Herbaceous:	8.6%

Counties

Chatham, Durham and Orange

Municipalities

Carrboro and Chapel Hill

Subbasin 03-06-06 is in the Carolina slate belt characterized by low flowing streams during summer months. Most of the watershed is forested with urban areas and development around Chapel Hill and Carrboro. Population is expected to grow by 55,000 people in counties with portions or all of their areas in this subbasin by 2020.

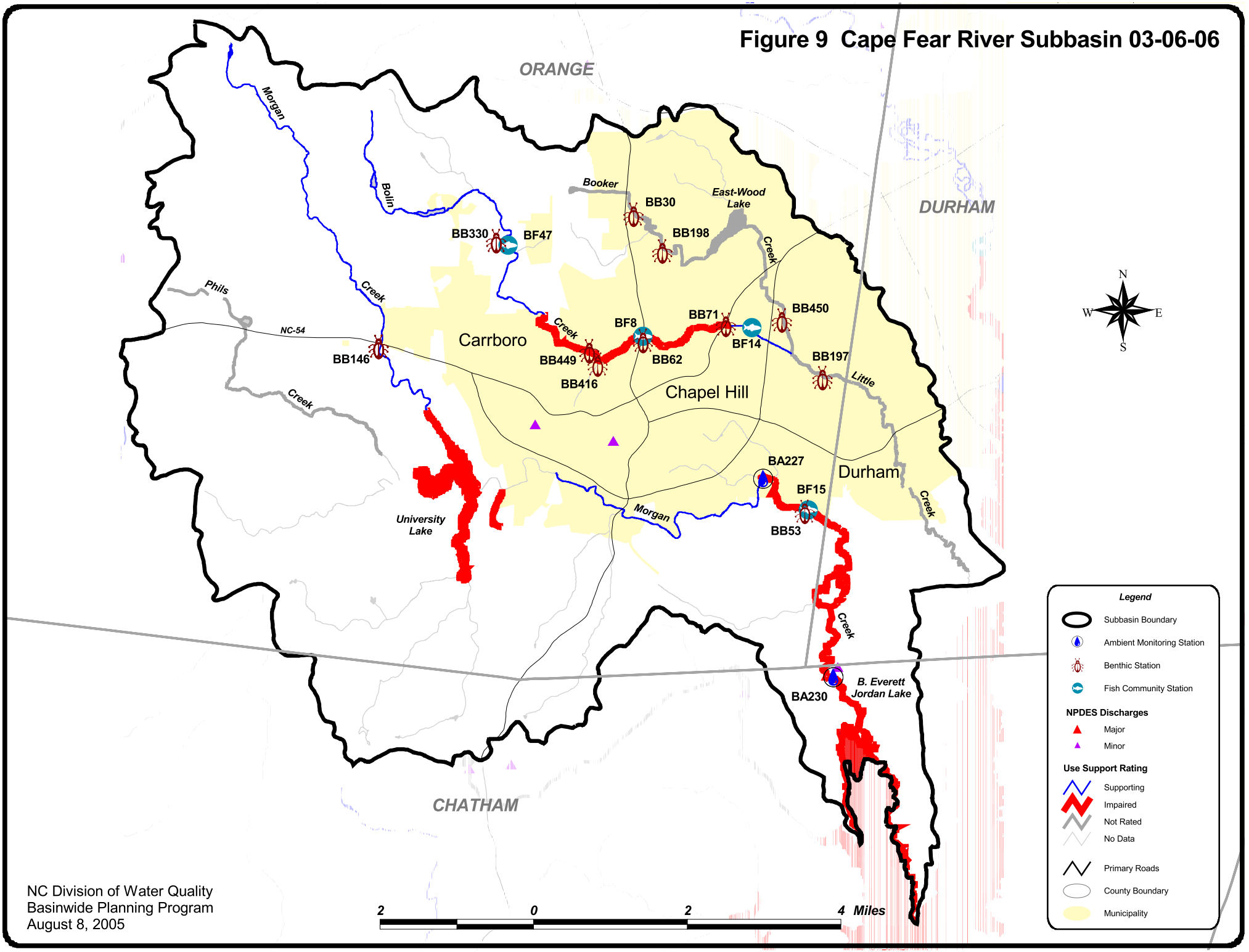
There are four individual NPDES wastewater discharge permits in this subbasin with a permitted flow of 14.8 MGD (Figure 9). The largest is Mason Farm WWTP (14.5 MGD). Refer to Appendix VI and Chapter 30 for more information on NPDES permit holders. Issues related to compliance with NPDES permit conditions are discussed below in Section 6.3 for Impaired waters and in Section 6.4 for other waters.

Carrboro and Chapel Hill are required to develop Phase II stormwater programs (Chapter 31).

There were 11 benthic community samples and four fish community samples (Figure 9 and Table 9) collected during this assessment period. Data were also collected from two ambient monitoring stations including one UCFRBA (Appendix V) station and one shared ambient station. Two reservoirs were also monitored. Refer to the *2003 Cape Fear River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html and Appendix IV for more information on monitoring.

Waters in the following sections are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, 303(d) Impaired waters list and the various tables in this basin plan. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

Figure 9 Cape Fear River Subbasin 03-06-06



NC Division of Water Quality
Basinwide Planning Program
August 8, 2005

Table 9 CAPE FEAR Subbasin 03-06-06

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
Bolin Creek													
16-41-1-15-1-(4)	WS-IV NS	0.9	FW Miles	**S**					ND			Habitat Degradation	MS4 NPDES
From US Hwy 501 Business to Little Creek					BF14	GF	2001						
Bolin Creek (Hogan Lake)													
16-41-1-15-1-(0.5)a	C NSW	5.3	FW Miles	**S**					ND				
From source to Pathway Drive					BB330	GF	2001						
					BB330	NR	2001						
					BB330	G	2000						
					BF47	G	2001						
16-41-1-15-1-(0.5)b	C NSW	3.1	FW Miles	**I**					ND				
From Pathway Drive to US Hwy 501 Business					BB449	F	2002						
					BB449	F	2001						
					BB449	P	2001						
					BB62	P	2002						
					BB62	P	2001						
					BB71	P	2001						
					BB71	P	2001						
					BF8	G	2001						
Booker Creek													
16-41-1-15-2-(4)	C NSW	1.2	FW Miles	**NR**					ND				
From dam at eastwood Lake to US Hwy 15					BB450	NR	2001						
					BB450	NR	2001						
16-41-1-15-2-(5)	WS-IV NS	0.9	FW Miles	**NR**					ND				
From US Hwy 15 to Little Creek					BB450	NR	2001						
					BB450	NR	2001						
Booker Creek (East-wood Lake)													
16-41-1-15-2-(1)	B NSW	3.5	FW Miles	**NR**					ND				
From source to dam at Eastwood Lake					BB198	NR	2001						
					BB198	NR	2001						
					BB30	NR	2001						
					BB30	NR	2001						

Table 9 CAPE FEAR Subbasin 03-06-06

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
Little Creek													
16-41-1-15-(0.5)	WS-IV NS	4.9 FW Miles	From source to a point 0.7 mile downstream of Durham County SR 1110	**NR**	BB197	NR	2001		ND				
					BB197	P	2001						
Morgan Creek													
16-41-2-(1)	Ws-II HQW	7.1 FW Miles	From source to a point 1.4 miles downstream of NC Hwy 54	**S**	BB146	G	2003		ND			Habitat Degradation	MS4 NPDES
					BB146	GF	2003					Habitat Degradation	WWTP NPDES
					BB146	GF	2003						
					BB146	NR	2003						
					BB146	NR	2002						
					BB146	E	2000						
					BB146	NR	2003						
16-41-2-(5.5)a	WS-IV NS	4.0 FW Miles	From Orange County SR 1919 to Meeting of the Waters	**S**	BA227	NCE			**NR***	BA227	NCE		
16-41-2-(5.5)b	WS-IV NS	4.1 FW Miles	From Meeting of the Waters to Chatham County SR 1726 (Durham County SR 1109)	**I**	BB53	F	2003		ND			Habitat Degradation	MS4 NPDES
					BF15	F	1999						
Morgan Creek (including the Morgan Creek Arm of New Hope River Arm of B. Everett Jordan Lake)													
16-41-2-(9.5)	WS-IV NS	836.2 FW Acres	From Chatham County SR 1726 (Durham County SR	**I**	BA230	NCE			**S**	BA230	NCE	Chlorophyll a	MS4 NPDES
					BL16	CE	Chlor a	66.7				Chlorophyll a	WWTP NPDES
Morgan Creek (University Lake)													
16-41-2-(1.5)	WS-II HQ	163.2 FW Acres	From a point 1.4 miles downstream of NC Hwy 54 to dam at University Lake	**NR**	BL15	NCE	Chlor a	100	ND			Chlorophyll a	Agriculture
Tanbark Branch													
16-41-1-15-1-3	C NSW	1.2 FW Miles	From source to Bolin Creek	**NR**	BB416	NR	2002		ND				

Table 9 CAPE FEAR Subbasin 03-06-06

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment				
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	Stressors	Sources

AL - Aquatic Life	BF - Fish Community Survey	E - Excellent	S - Supporting, I - Impaired
REC - Recreation	BB - Benthic Community Survey	G - Good	NR - Not Rated
	BA - Ambient Monitoring Site	GF - Good-Fair	NR*- Not Rated for Recreation (screening criteria exceeded)
	BL- Lake Monitoring	F - Fair	ND-No Data Collected to make assessment
	S- DEH RECMON	P - Poor	**Results**
		NI - Not Impaired	CE-Criteria Exceeded > 10% and more than 10 samples
	Miles/Acres	S- Severe Stress	NCE-No Criteria Exceeded
	FW- Fresh Water	M-Moderate Stress	
	S- Salt Water	N- Natural	

Aquatic Life Rating Summary

S	m	17.4	FW Miles
NR	m	11.8	FW Miles
I	m	7.2	FW Miles
NR	m	163.2	FW Acres
I	m	836.2	FW Acres
NR	e	5.0	FW Miles
ND		36.1	FW Miles

Recreation Rating Summary

NR*	m	4.0	FW Miles
S	m	836.2	FW Acres
ND		73.4	FW Miles
ND		163.2	FW Acres

Fish Consumption Rating Summary

I	e	77.4	FW Miles
I	e	999.4	FW Acres

6.2 Use Support Assessment Summary

Use support ratings were assigned for waters in subbasin 03-06-06 in the aquatic life, recreation, fish consumption and water supply categories. All waters are Impaired on an evaluated basis in the fish consumption category because of fish consumption advice that applies to the entire basin. In the water supply category, all WS classified waters (999.4 acres and 57.2 miles) are Supporting on an evaluated basis based on reports from DEH regional water treatment plant consultants. Refer to Appendix X for a complete list of monitored waters and more information on Supporting monitored waters.

There were 36.3 stream miles (46.9 percent) and 999.4 freshwater acres (100 percent) monitored during this assessment period in the aquatic life category. There were 7.2 miles (9.3 percent) and 836.2 acres (83.7 percent) of Impaired waters in this category.

6.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were either identified as Impaired in the previous basin plan (2000) or are newly Impaired based on recent data. If previously identified as Impaired, the water will either remain on the state's 303(d) list or will be delisted based on recent data showing water quality improvements. If the water is newly Impaired, it will likely be placed on the 2006 303(d) list. The current status and recommendations for addressing these waters are presented below, and each is identified by an assessment unit number (AU#). Refer to the overview for more information on AUs. Information regarding 303(d) listing and reporting methodology is presented in Appendix VII.

6.3.1 Bolin Creek [AU#16-41-1-15-1-(0.5) a and b and 16-41-1-15-1-(4)]

2000 Recommendations
The 2000 basin plan recommended that DWQ work with Chapel Hill as they develop a stormwater program to help improve water quality in Bolin Creek.

Current Status
Bolin Creek [16-41-1-15-1-(0.5)a] from source to Pathway Drive (5.3 miles) is Supporting aquatic life because of a Good-Fair benthic community rating at site BB330 and a Good fish community rating at site BF47, although intolerant fish species were absent from this site.

Bolin Creek [16-41-1-15-1-(0.5)b] from Pathway Drive to US 501 (3.1 miles) is Impaired for aquatic life because of a Fair benthic community rating at site BB449 and Poor benthic community ratings at sites BB71 and BB62. The fish community rating was Good at site BF8, although intolerant fish species were absent from this site. DWQ regional office staff indicates that grease clogging has caused sanitary sewer overflows that may have negative impacts on water quality in this segment.

A WARP study completed in June 2003 identified toxicity, low dissolved oxygen, organic enrichment, scour and widespread habitat degradation from sedimentation from storm sewers and runoff from impervious surfaces as stressors to the biological communities of Bolin Creek.

For more information on Bolin Creek, visit the Little Creek Watershed Assessment Report at http://h2o.enr.state.nc.us/swpu/.

Bolin Creek [16-41-1-15-1-(4)] from US 501 to Little Creek (0.9 mile) is Supporting aquatic life because of a Good-Fair benthic community rating at site BF14, although intolerant fish species were absent from this site and a high percentage of fish exhibited disease symptoms.

2005 Recommendations
DWQ will continue to monitor Bolin Creek. The WARP project also recommends retrofitting existing stormwater discharges and preventing increased sedimentation to the watershed during future development. DWQ will work with the Chapel Hill stormwater program to help identify stormwater retrofit opportunities. Further recommendations to protect streams in urbanizing areas and to restore streams in existing urban areas are discussed in Chapter 31.

Segment 16-41-1-15-1-(4) will be removed from the 303(d) list, and segment 16-41-1-15-1-(0.5)b will be added to the list based on data collected as part of the WARP study. TMDLs (Chapter 35) will be developed for identified stressors within 8-13 years of listing.

Water Quality Initiatives
In 2002, Carrboro received a $202,000 CWMTF (Chapter 34) grant to help purchase 28 acres along Bolin Creek. This watershed is also included in the NCEEP Local Watershed Plan for Morgan and Little Creeks, discussed under Little Creek in this chapter. The Final Local Watershed Plan for Morgan and Little Creeks, completed in 2004, may be viewed at: http://www.nceep.net/services/lwps/Morgan_Creek/morgan.htm

6.3.2 Booker Creek [AU# 16-41-1-15-2-(1), (4) and (5)]

2000 Recommendations
The 2000 basin plan recommended that DWQ work with Chapel Hill as they develop a stormwater program to help improve water quality in Booker Creek.

Current Status
Booker Creek [all segments] from source to Little Creek (5.6 miles) is Not Rated for aquatic life because benthic community ratings could not be assigned at sites BB198, BB30 and BB450.

A WARP study completed in June 2003 identified toxicity, low dissolved oxygen, organic enrichment, scour and widespread habitat degradation from sedimentation from storm sewers and runoff from impervious surfaces as being stressors to the biological communities Booker Creek. The study also indicates that the impoundments on Booker Creek are also a stressor to the biological community. For more information on Booker Creek, visit the Little Creek Watershed Assessment Report at http://h2o.enr.state.nc.us/swpu/.

2005 Recommendations
DWQ will continue to monitor Booker Creek. The WARP project recommends retrofitting existing stormwater discharges and preventing increased sedimentation to the watershed during future development. DWQ will work with the Chapel Hill stormwater program to help identify stormwater retrofit opportunities. Further recommendations to protect streams in urbanizing areas and to restore streams in existing urban areas are discussed in Chapter 31.

All three segments will remain on the 303(d) list of Impaired waters. TMDLs (Chapter 35) will be developed for identified stressors within 8-13 years of listing.

Water Quality Initiatives
This watershed is also included in the NCEEP Local Watershed Plan for Morgan and Little Creeks, discussed under Little Creek in this chapter. The Final Local Watershed Plan for Morgan and Little Creeks, completed in 2004, may be viewed at: http://www.nceep.net/services/lwps/Morgan_Creek/morgan.htm

6.3.3 Little Creek [AU#16-41-1-15-(0.5) and (3)]

2000 Recommendations
The 2000 basin plan recommended that DWQ work with Chapel Hill as they develop a stormwater program to help improve water quality in Little Creek.

Current Status
Little Creek [16-41-1-15-(0.5)] from source to downstream of SR 1110 (4.9 miles) is Not Rated for aquatic life because a benthic community rating could not be assigned at site BB197. This site previously received a Poor benthic community rating. Segment [16-41-1-15-(3)] (0.8 miles) has never been monitored and is in a swampy area associated with Army Corps of Engineers flow easements south of NC 54.

A WARP study completed in June 2003 identified toxicity, low dissolved oxygen, organic enrichment, scour and widespread habitat degradation from sedimentation from storm sewers and runoff from impervious surfaces as being stressors to the biological communities Little Creek. For more information, visit the Little Creek Watershed Assessment Report at http://h2o.enr.state.nc.us/swpu/. These creeks exhibit or are threatened with habitat degradation, sediment, fecal coliform bacteria, toxicity and low dissolved oxygen. Urban runoff and effluent from wastewater treatment are possible sources of degradation. In upper Morgan Creek, agriculture is also a possible source of degradation.

2005 Recommendations
DWQ will continue to monitor the Little Creek. The WARP project recommends retrofitting existing stormwater discharges and preventing increased sedimentation to the watershed during future development. DWQ will work with the Chapel Hill stormwater program to help identify stormwater retrofit opportunities. Further recommendations to protect streams in urbanizing areas and to restore streams in existing urban areas are discussed in Chapter 31.

Both segments will remain on the 303(d) list. TMDLs (Chapter 35) will be developed for identified stressors within 8-13 years of listing.

Water Quality Initiatives
The focus of the NCEEP local watershed planning activity is on upper Morgan Creek (30 square miles), lower Morgan Creek (19.9 square miles), and Little Creek (Booker and Bolin Creeks, with 24.6 square miles). The Local Watershed Plan recommends restoration and preservation projects through the implementation of:

- 25 Best Management Practices to treat water quality in 600 acres of priority subwatersheds
- 11 stream restoration projects to gain 28,000 linear feet of restored stream
- 137 priority preservation parcels to protect over 600 acres of priority habitat

In addition, proposed changes to local rules are advocated to support Low Impact Development and prevent future degradation from occurring in the watershed. The Local Watershed Plan for Morgan and Little Creeks, completed in 2004, may be viewed at: http://www.nceep.net/services/lwps/Morgan_Creek/morgan.htm

6.3.4 Meeting of the Waters [AU#16-41-2-7]

2000 Recommendations
The 2000 basin plan recommended that DWQ work with Chapel Hill as they develop a stormwater program to help improve water quality in Meetings of the Waters.

Current Status
This stream was not resampled during this assessment period, and previous benthic community ratings have been changed to Not Rated because the stream was too small to assign a rating. The stream is in a highly urbanized area of Chapel Hill. Meeting of the Waters will remain on the 303(d) list of Impaired waters.

Water Quality Initiatives
This watershed is also included in the NCEEP Local Watershed Plan for Morgan and Little Creeks, discussed under Little Creek in this chapter. The Final Local Watershed Plan for Morgan and Little Creeks, completed in 2004, may be viewed at: http://www.nceep.net/services/lwps/Morgan_Creek/morgan.htm

6.3.5 Morgan Creek [AU#16-41-2-(5.5)a and b]

2000 Recommendations
The 2000 basin plan recommended that DWQ work with Chapel Hill as they develop a stormwater program to help improve water quality in Morgan Creek.

Current Status
Morgan Creek [16-41-2-(5.5)a] from SR 1919 to SR 1726 at Meeting of the Waters (4 miles) is Supporting aquatic life because no criteria were exceeded at site BA227. This segment is Not Rated for recreation because the fecal coliform bacteria screening criteria were exceeded at site BA227.

Morgan Creek [16-41-2-(5.5)b] from Meeting of the Waters to SR 1109 (4.1 miles) is Impaired for aquatic life because of Fair benthic and fish community ratings at sites BB53 and BF15. The water was turbid at the sample site and smelled of sewage. Suitable aquatic habitat was limited to stream margins and woody debris as the stream bottom was entirely sand. This segment is Not Rated for recreation because the fecal coliform bacteria screening criteria were exceeded at site BA227, and because Mason Farm WWTP (NC0025241) and Carolina Meadows WWTP (NC0056413) had significant violations of fecal coliform bacteria permit limits during the last

two years of the assessment period. The violations at Mason Farm occurred during plant upgrades and are not ongoing.

2005 Recommendations
DWQ will continue to monitor Morgan Creek. The WARP project recommends retrofitting existing stormwater discharges and preventing increased sedimentation to the watershed during future development. The NPDES compliance process will be used to address the significant permit violations noted above. DWQ will determine if intensive sampling is needed to assess the fecal coliform bacteria standard in this creek (Appendix X). DWQ will work with the Chapel Hill stormwater program to help identify stormwater retrofit opportunities. Further recommendations to protect streams in urbanizing areas and to restore streams in existing urban areas are discussed in Chapter 31.

Segment 16-41-2-(5.5)b will remain on the 303(d)list. TMDLs (Chapter 35) will be developed for identified stressors within 8-13 years of listing.

Water Quality Initiatives
This watershed is also included in the NCEEP Local Watershed Plan for Morgan and Little Creeks, discussed under Little Creek in this chapter. The Final Local Watershed Plan for Morgan and Little Creeks, completed in 2004, may be viewed at:
http://www.nceep.net/services/lwps/Morgan_Creek/morgan.htm

The NCEEP has also completed 10 acres of riverine restoration in the Morgan Creek floodplain (Chapter 34).

6.3.6 Morgan Creek University Lake [AU#16-41-2-(1.5)]

Current Status
University Lake was Fully Supporting in the 2000 basin plan. University Lake (163.2 acres) is currently Not Rated for aquatic life because 100 percent of the three chlorophyll *a* samples exceeded the water quality criterion; however, not enough samples were collected to assign a use support rating. Nutrient levels in the reservoir were high and the lake has been hypereutrophic as noted in previous years. Dissolved oxygen saturation was elevated. Mild to severe algal blooms occurred throughout the summer months of 2003. Some of the blue-green algal blooms can cause taste and odor problems in treated drinking water.

2005 Recommendations
DWQ will continue to monitor University Lake. It is recommended that OWASA continue efforts to protect the water supply from nutrient loading that causes algal blooms.

Water Quality Initiatives
OWASA has continued to pursue funding to protect this watershed from further increases in nutrient loading. This watershed is also included in the NCEEP Local Watershed Plan for Morgan and Little Creeks, discussed under Little Creek in this chapter. The Local Watershed Plan for Morgan and Little Creeks, completed in 2004, may be viewed at:
http://www.nceep.net/services/lwps/Morgan_Creek/morgan.htm

6.4 Additional Water Quality Issues within Subbasin 03-06-06

The following section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

6.4.1 Jordan Haw River Watershed Nutrient Sensitive Waters Strategy

All land uses and discharges of wastewater and stormwater in subbasin 03-06-06 potentially contribute nutrients to Jordan Reservoir in subbasins 03-06-04 and 03-06-05. The reservoir is Impaired for aquatic life because chlorophyll *a* violated the standard in all segments of the reservoir. Refer to Chapter 36 for more information on this strategy.