Goose Creek Watershed Management Plan Addendum Final Report for Fiscal Year 2022

Prepared by Mecklenburg County Water Quality Pollution Prevention Program July 27, 2022

Purpose

The purpose of the Watershed Management Plan (WMP) Addendum is to guide restoration, retrofitting, and preservation efforts aimed at achieving specific goals for improving water quality conditions in Goose Creek such that these waters meet or exceed their State designated uses and are no longer rated as impaired on 303(d) lists.

This WMP Addendum documents activities in the Goose Creek Watershed between July 2021 and July 2022.

The Goose Creek watershed is located in Mecklenburg County and Union County, North Carolina. The headwaters of the watershed originate in Mecklenburg County and flow into Union County and into the Rocky River. Stevens and Duck Creeks, which originate in Mecklenburg County, are both tributaries to Goose Creek. Stevens Creek flows into Goose Creek at the Mecklenburg-Union County line west of Stevens Mill Road while Duck Creek joins Goose Creek just upstream of Brief Road. Figure 1 shows the location of the Goose Creek watershed within Mecklenburg and Union Counties.



Figure 1 - Goose Creek Watershed

The WMP was developed and implemented in 2009.

Approximate Event Timeline for the Goose Creek Watershed

June 30, 1993: Carolina Heelsplitter included on the Endangered Species list. Goose Creek named as habitat for a small population.

January 17, 1997: Completion of the Recovery Plan for the Carolina Heelsplitter.

- 1999: A countywide stream buffer system was established in 1999 as part of the Surface Water Improvement and Management (S.W.I.M.) strategy, otherwise known as S.W.I.M. buffers. According to S.W.I.M., streams have the primary natural function of conveying storm and ground water, storing floodwaters and supporting aquatic and other wildlife. The buffer is the vegetated land adjacent to the stream channel, which functions to protect water quality by filtering pollutants and to provide both storage for floodwaters and suitable habitat for wildlife. The Mint Hill SWIM buffer ordinance was adopted July 20, 2000 and protected all streams draining 50 acres or more. Mint Hill's Post Construction ordinance took effect on June 30, 2007 and increased buffer widths on most streams.
- March 14, 2000: NC Environmental Management Committee (EMC) decision to approve the Innerbasin water transfers (IBT) with conditions. Condition #3 placed a "...moratorium on the installation of new interbasin transfer water lines... into the Goose Creek subbasin...until the impacts of additional urban growth on the (Carolina heelsplitter) are fully evaluated." This ruling effectively halted expansion of the supply of public water in the Goose Creek Watershed.
- August 20, 2001: Mitigated Finding of No Significant Impact Charlotte- Mecklenburg Utilities Proposed Increase in Interbasin Transfer from the Catawba River Basin to the Rocky River Basin.

April 2005: Final Goose Creek Total Maximum Daily Load (TMDL) submitted to USEPA

- July 8, 2005: USEPA Approval of Goose Creek Fecal Coliform TMDL
- August 10, 2006: Letter from NCDENR to Mecklenburg County, Mint Hill, Stallings and Indian Trail requiring the development of a Water Quality Recovery Program for implementation of the Goose Creek Fecal Coliform TMDL.
- September 15, 2006: NC Court Decision (Filed October 13, 2006) requiring, among other things, that the NPDES permits for Stallings, Indian Trail, Mint Hill and Mecklenburg County be reopened and amended to include measures to protect the Carolina Heelsplitter. Among these are water quality standards for ammonia, copper, nitrate-nitrite and phosphorus. The document identifies standards presented in Table 1.

Tuble IF Goobe erten water Quanty Standards								
Constituent	Chronic Standard	Acute Standard						
Phosphorus	0.1 mg/L							
Nitrate-nitrite	0.4 mg/L							
Copper	2.2 ug/L	3.6 ug/L						
Ammonia	0.5 mg/L	1.75 mg/L						

Table 1: Goose Creek Water Quality Standards

- June 30, 2007: Mint Hill implemented the Post Construction Ordinance that required 100-foot buffers on all dashed (intermittent) streams on USGS topographic maps and 200-foot buffers on all solid (perennial) streams on USGS topographic maps. The Post Construction Ordinance was replaced by the Site-Specific Management Plan (developed by NCDENR) for the Goose Creek Watershed on February 1, 2009. Both ordinances apply but the more stringent requirement must be met. Properties developed from June 30, 2007 through February 1, 2009 are required to conform to the Post Construction Buffers.
- February 1, 2009: The Goose Creek Site Specific Management Plan was adopted on February 1, 2009 and applies to the entire Goose Creek Watershed. The expressed purpose of the ordinance is to protect the endangered Carolina Heelsplitter Mussel. The ordinance places specific controls on all new development in the watershed including the following:

1. Controls stormwater for all projects disturbing more than one acre. These requirements include the removal of 85% TSS and control and release of the 1 year 24-hour storm at pre-development rates.

2. Controls discharges from WWTPs. No new WWTP discharges will be permitted.

3. Controls toxicity to streams for specific parameters. Ammonia is to be reduced to 0.5 mg/L from all discharges to Goose Creek.

4. Maintains riparian buffers. All waterbodies within the 100-Year Floodplain will have a 200-foot buffer, other waterbodies will have a 100-foot buffer. These buffers are essentially the same as the Post Construction Buffers.

August 2010 through March 2011: Septic System Inspections - The Goose Creek Watershed is unique in Mecklenburg County as far as it is largely devoid of sanitary sewer lines and on-site septic systems are the primary method of sewage disposal. A septic system inspection program was initiated on August 2010 and ran through March 2011. Inspections were performed by Mecklenburg County Ground Water and Wastewater Services. Out of an estimated 1,480 systems in the watershed, 1,422 were able to be inspected. Of the systems inspected, a total of 13 were found to be non-compliant, a rate of 1%.

November 11, 2011: Cattle Exclusion from Goose Creek at 12601 Bain School Road -

A cattle exclusion project was completed in the Mint Hill jurisdiction of Goose Creek in November 2011. The project included securing an alternative water supply (private well), fencing to keep approximately 40 cattle out of the creek, and the planting trees to establish a 50' buffer between the pasture and the creek.

May 20, 2020: The Board of County Commissioners voted to adopt the revised Mecklenburg County Surface Water Pollution Control Ordinance which would include the portions of the Goose Creek Watershed in Mecklenburg County and Mint Hill. The Ordinance was updated to include a ban on the use of pavement products with high levels of polycyclic aromatic hydrocarbons (PAH).

Completed Capital Improvement Projects

The goal of Mecklenburg County's Water Quality Capital Improvement Program is to stabilize stream channels and restore in-stream habitat conditions to promote stream designated uses.

Stream restoration projects typically address problems with vertical stability and lateral stability within the channel. This instability enlarges the channel through bank and bed erosion, thereby destroying the local aquatic ecosystem. To achieve ecological uplift, the three primary geomorphic variables (i.e., pattern, profile, and dimension) that dictate functionality must be considered.

- Pattern is the sinuosity or meander geometry of a stream channel.
- Profile is the longitudinal slope of the stream channel.
- Dimension is the two-dimensional, cross section of a channel.

According to the U.S. Army Corp of Engineers, restoration is the process of converting an unstable, altered, or degraded stream corridor, including adjacent riparian zone and floodprone areas, to its natural stable condition considering recent and future watershed conditions. Full restoration is often not possible because most projects have constraints. Examples of constraints to improving pattern include the presence of utilities and adjacent development. Improvements to the profile of the stream are often constrained by culverts and flooding concerns.

Enhancement activities generally will include some activities that would be required for restoration. These activities may include in-stream or streambank activities, but in total fall short of restoring one or more of the geomorphic variables. Restoration and enhancement approaches considered for this study are summarized below.

Stream Restoration

- Addresses all three parameters: pattern, profile, and dimension.
- Functionality is restored and quasi-equilibrium is achieved according to the channel evolution model.
- Riparian buffer restoration is included.

• Because of existing culverts and flooding concerns, a new floodplain will be excavated at the stream's existing elevation. Earthwork costs will be reduced by constructing floodplain benches in the existing over-widened channel.

Goose Creek Raingarden Project – Fall 2005

A grant was obtained by CMSWS with the goal of reducing the discharge of non-point source pollutants from land development activities and improving water quality conditions in Goose Creek. Specifically, the grant seeks to protect habitat for the Carolina heelsplitter through the completion of retrofitting LID structures into existing developments within the Goose Creek watershed in Mint Hill. These structures also serve as demonstration projects for the use of LID techniques. Educational signage was incorporated into the demonstration projects to promote the proper implementation of LID.

The first of the project sites is located at the Mint Hill Park on Fairview Road. The 52acre park located in the headwaters of the Goose Creek watershed has approximately 3 acres of impervious surface, including a large parking area. It has soccer and baseball fields, tennis and handball courts, a playground, and nature trails. Prior to the project, a curb and gutter system conveyed storm water from parking lots, trails and outbuildings to a detention basin before discharging into Goose Creek. The project re-routed storm water from 4.9 acres through LID BMPs. The other LID demonstration project is located at the Bain Elementary School in the Goose Creek watershed within the Town of Mint Hill. This project treated previously untreated runoff from approximately 1 acre of parking lot with a raingarden.

Stevens Creek Stream Restoration Project – May 2021

The Stevens Creek Stream Restoration Project was completed in September 2019. This project was officially listed as completed in May of 2021 after all of the repairs and enhancements were made. CMSWS will continue to work with the U.S. Fish and Wildlife Service to monitor mussel populations added to the geocell habitat areas created during the restoration.

The project is located from I-485 upstream to Thompson Road and extends upstream to the south of Yarmouth Road in Mint Hill, NC. At some point in the past, nearly all of the streams in Mecklenburg County, including Stevens Creek, were straightened to facilitate rapid drainage from agricultural operations. After the agricultural use, the watershed developed slowly through the mid to late 1900's into its current land use configuration. The watershed draining to the project is comprised of 60% residential (primarily large lot single family residential), 2% commercial/industrial, 7% transportation (I-77) and approximately 31% undeveloped (or underdeveloped land – primarily agricultural and forest land). Most of the development occurred prior to the requirement of post-construction controls, therefore no water quality or quantity controls were installed. Substantial degradation has resulted from the exposure of the stream channel, disturbed a

century earlier by the straightening, to the increased storm water flow rates and velocities associated with this development.

The project area is comprised of three stream reaches; however it exhibits several consistent traits as follows:

1) Most of the entire project area has been straightened at some point in the past;

2) Extreme erosion throughout the project area from stream over-widening. Generally, the stream is stable vertically;

3) Pool areas are filling with coarse sand; and,

4) Buffer areas are reasonably intact, however there are significant numbers of invasive species.

This project provided opportunities for and succeeded in improving the dimension and profile of the stream and creating more natural riffle-pool sequences using structures to establish and maintain bed-form features. A stable cross-section was constructed throughout the project area by laying back the banks where appropriate and installing floodplain benches as necessary. A section of the stream was moved from its current location onto public land designated as a nature preserve so that buffers and a proper floodplain can be established over time. This project also provides an opportunity to remove invasive species and replant with native riparian species. The ultimate, long-term goals of this project are to re-introduce some form of a stable "natural" channel to this stream segment, educate the public about restoration concepts, and reconnect the public with surface water resources. An ancillary benefit of the project may be to reduce flood elevations of several residences along Yarmouth Road; however, the completed project did not have this result in Stevens Creek. In some instances, the FEMA 100-year elevation may be lowered with construction, but in the Stevens Creek project it was not. Minor storms 2- and 10-year events would need a lower level, but the 100 year remains the same. The lower section of Stevens Creek below the confluence actually saw a slight rise of a couple tenths of a foot, which results in the FEMA needing to be remapped. This is in process now by ESP and Stantec consultants.

In addition to the stream restoration, the project incorporated additional stream stabilization techniques that were specifically designed to facilitate the reestablishment of the native mussel fauna to the restored reach. The US Fish and Wildlife Service, North Carolina Wildlife Resources Commission, North Carolina State University, and other partners have developed techniques to propagate and rear many different species of mussels, but have had limited success with reestablishment of the propagated individuals back in to stream segments where the bedload may be disturbed by erosive forces during high flows. A full stream restoration, such as the one completed on Steven's Creek, provides a unique opportunity to evaluate the placement of bedload stabilization structures intended to provide the stability necessary for the successful placement of propagated mussels, with the intended goal to provide the conditions for their long term natural reproduction in the stream. NFWF funds were used to design and install six (6) bedload stabilization structures within the larger stream restoration project area. The

specific location of the structures is identified on the project plans. Monitoring of the structures is currently being planned.

The Mecklenburg County Storm Water Services Stream Restoration Ranking System (SRRS) evaluates and monitors FEMA regulated reaches within the County that are ranked with the poorest channel stability and instream habitat. The goal of the restoration projects is to stabilize stream channels and restore habitat conditions so that as water quality improves, the stream will be able to support a diverse aquatic community, including macroinvertebrates and fish. SRRS scores use reach specific field collected channel stability (Dimension, Pattern, and Profile) and habitat data (EMHAP).

Table 2 below shows the current SRRS scores on this project. Stevens Creek will be walked later in 2022 for its second post-construction monitoring year (MY2). The maximum total SRRS score a reach can receive is 300.

Stage	Total Score	Stream Dimension	Stream Profile	Buffer Quality	Bank Stability and Nutrients	Habitat Counts	Habitat Quality	Bank Veg Protection	Baseflow	Sinuosity
Pre- construction	169.16	22.23	31.35	18.07	18.06	20.34	18.4	10.6	14.01	16
Potential Uplift	257.86	40	37.14	16.07	35.64	23.94	32	35.06	18.01	20
Post- Construction MY 1	279.18	36.63	35.22	17.74	32.68	40	40	40	16.91	20

 Table 2: Stevens Creek Restoration Project SRRS Scores

Planned CIP Projects

There are currently no new projects in the Feasibility (Cashflow) Phase for the Goose Creek Watershed. There are two streams being considered for evaluation under the Stream Restoration Ranking System (SRRS) in this watershed: a section of Goose Greek and a section of Duck Creek. As of July 2022, these branches have not been evaluated.

Development

Demographics

Table 5 – Goose Creek Watersheu Demographies							
2010 Population	2016 Population	2020 Population	Population	Percent			
			Change	Change			
6,527	6,832	7,123	291	4.26% Increase			

Table 3 – Goose Creek Watershed Demographics

Impervious Area

When the WMP was completed, impervious areas were estimated based upon land use. This method of estimating impervious areas was inaccurate. In 2011, Mecklenburg County began digitizing actual impervious areas based upon aerial photographs. The increase of impervious areas in the Goose Creek Watershed are shown below.

2011	0016	2015	2020	0001	1	. .	D
2011	2016	2017	2020	2021	2022	Imperviou	Percent
Impervi	Impervi	Impervi	Impervi	Impervi	Impervi	s Areas	Change
ous	ous	ous	ous	ous	ous	Change	2021 to
Area	Area	Area	Area	Area	Area	2021 to	2022(Ac
(Acres)	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)	2022(Acr	res)
						es)*	
557	610	616	655.94	662.41	669.13	6.72	1.01%
							increase

 Table 4 – Goose Creek Watershed Impervious Area

*The increase in impervious surface area is a combination of all land-use types.

Service Requests

From July 13, 2021, until July 27, 2022, Water Quality staff have responded to 6 separate service requests in the Goose Creek basin. These service requests were for a variety of problems including sewage discharges, buffer violations, failed septic systems, spilled paint, and erosion control violations on construction sites. A summary of the service requests is shown below. Additional information about each service request may be viewed by searching for the inspection number or the service request number in the Cityworks server. There are no active storm water or erosion control construction projects within the Goose Creek watershed.

SR#	Date Closed	Inspector	Location	Municipality	Activity Type	Incident Type	Land Use Type	Material Released
102934	9-Sep-21	Eubanks	7512 Whitmire Ln	Mint Hill	Service Request	Buffer Violation	Single- family Residential	N/A
106902	11-Oct-21	Spidel	8634 Quarters Ln	Mint Hill	Service Request	Accidental Spill	Single- family Residential	Sewage – CMU
130752	29-Mar- 22	Thao	8402 Fairview Rd	Mint Hill	Service Request	Discharge/ Dump	Mixed Use	Sewage – Septic
133839	9-May-22	Eubanks	3535 Mintwood Dr	Mint Hill	Service Request	Buffer Violation	Single- family Residential	N/A
134551	4-May-22	Bass	Lawyers Rd at I485	Mint Hill	Service Request	Accidental Spill	Transportat ion Corridor	Paint
144050	22-Jun-22	Eubanks	16107 Thompson Rd	Mint Hill	Service Request	Buffer Violation	Single- family Residential	N/A

 Table 5 – Goose Creek Watershed Service Requests

Policy Changes

No new policy changes have been implemented in this Watershed. The most recent major policy changes are listed in the event timeline presented in the background section of this report.

Public Property Acquisitions

There was a single property acquisition in FY22 to a public agency. Publicly owned properties are listed in Table 6 below.

	-					
Parcel	Size	Owner		Address		Date of
Number	(Acres)					Sale
19717251	0.00	CITY OF CHARLOTTE	8212	WHITE ASH	СТ	2/23/2016
19717318	0.75	CITY OF CHARLOTTE	8634	QUARTERS	LN	2/23/2016
19716323	0.00	CITY OF CHARLOTTE	8310	QUARTERS	LN	2/23/2016
19505176	0.15	CITY OF CHARLOTTE		STONEY MEADOW	DR	2/23/2016
19717252	0.00	CITY OF CHARLOTTE	8398	SILVER MAPLE	LN	2/23/2016
19517147	2.14	CITY OF CHARLOTTE		THOMPSON	RD	2/23/2016
19518199	2.26	CITY OF CHARLOTTE	11915	SHADY OAK	СТ	2/23/2016
19505648	1.04	CITY OF CHARLOTTE	4125	PIAFFE	AV	2/23/2016
19701146	23.48	CHARLOTTE-	11524	BAIN SCHOOL	RD	5/6/2015
		MECKLENBURG BOARD				
		OF EDUCATION				
19704137	1.86	DEPT OF	7509	ALLEN BLACK	RD	6/14/1991
		TRANSPORTATION				

 Table 6 – Goose Creek Watershed Public Parcels

19720199	0.27	DEPT OF TRANSPORTATION		FAIRVIEW	RD	6/23/1992
19514208	0.74	DEPT OF TRANSPORTATION		LINEVIEW	DR	6/4/1991
19523204	0.30	DEPT OF TRANSPORTATION		MARSHALL HOOKS	RD	10/17/1996
19720106	1.56	DEPT OF TRANSPORTATION	9216	FAIRVIEW	RD	6/23/1992
19514129	5.07	DEPT OF TRANSPORTATION		COUNTRY WOODS	DR	4/5/2001
19706218	0.45	DEPT OF TRANSPORTATION		LAWYERS	RD	5/2/1997
19514183	0.46	DEPT OF TRANSPORTATION	5501	COUNTRY WOODS	DR	12/12/1990
19514196	3.48	DEPT OF TRANSPORTATION		THOMPSON	RD	12/21/1991
19704138	0.51	DEPT OF TRANSPORTATION	9202	WILL HOLLOW	LN	8/1/1997
19511208	0.27	DEPT OF TRANSPORTATION	14617	IDLEWILD	RD	2/29/1996
19514101	48.71	MECKLENBURG COUNTY		THOMPSON	RD	12/7/2015
19503106	60.19	MECKLENBURG COUNTY	4130	WELL	RD	12/17/2001
19517148	2.40	MECKLENBURG COUNTY		THOMPSON	RD	7/1/2009
19722103	140.27	MECKLENBURG COUNTY	10631	FAIRVIEW	RD	3/12/2015
19503104	30.49	MECKLENBURG COUNTY	4101	MINTWOOD	DR	12/14/2001
19524101	187.17	MECKLENBURG COUNTY		THOMPSON	RD	7/3/2001
19517156	1.73	MECKLENBURG COUNTY		THOMPSON	RD	12/31/2002
19523106	40.29	MECKLENBURG COUNTY	14925	HOOKS	RD	7/3/2001
19720111	5.16	TOWN OF MINT HILL	9032	FAIRVIEW	RD	12/3/2005
19720113	0.49	TOWN OF MINT HILL THE	8920	FAIRVIEW	RD	10/13/1995
19720112	52.68	TOWN OF MINT HILL (THE)	8800	FAIRVIEW	RD	6/8/1990
19720108	0.74	TOWN OF MINT HILL	9130	FAIRVIEW	RD	9/20/2005
19720117	2.17	TOWN OF MINT HILL		LEISURE GARDEN	LN	12/14/2005
19720106	1.56	TOWN OF MINT HILL	9216	FAIRVIEW	RD	6/6/2019
19720107	1.31	TOWN OF MINT HILL	9200	FAIRVIEW	RD	9/20/2018
19720118	9.37	TOWN OF MINT HILL		ALLEN BLACK	RD	9/6/2018
13533195	3.059	CITY OF CHARLOTTE		PALOMINO	DR	6/2/2021

Progress Toward Goals

 Table 7 – Goose Creek Watershed In-Stream Water Quality Goals

In-Stream Water Quality Goals					
1. TSS ≤ 0.3 tons/ac/year					

2. Benthic Macroinvertebrates = Fully Supporting				
3. Fish = Fully Supporting				
4. Attainment of fecal coliform standard (200 CFU/100 ml)				
5. Attainment of ammonia end of pipe goal of 0.5 mg/L				

Continued Monitoring of the Goose Creek Watershed

Water quality monitoring has been conducted in the Goose Creek watershed since the 1970s. Monitoring has included the following data collection efforts:

a. <u>Fixed Interval Monitoring.</u> Fixed interval monitoring was conducted at MY9 (Goose Creek at Stevens Mill Road) and MY14 (Duck Creek at Tara Oaks Drive) on a monthly basis throughout the fiscal year.
b. <u>Macroinvertebrate Samples.</u> Macroinvertebrate samples and MHAP data werewas collected at MY9.

c. Figures 1 through 3 below show graphically Fecal Coliform sampling results at the MY9 site.

Two (2) sections of Goose Creek in Mecklenburg County (AU Numbers 13-17-18a and 13-17-18b are subject to a fecal coliform TMDL with a WLA assigned to storm water that was approved on July 8, 2005. According the approved NC 2018 305(b) report, the two (2) TMDL segments of Goose Creek are currently meeting the fecal coliform criteria. Mecklenburg County has been assigned responsibility for compliance with this TMDL on behalf of the Phase I and Phase II jurisdictions in Charlotte-Mecklenburg. CMSWS maintains a fixed interval monitoring site (MY9) located where Stevens Mill Road crosses Goose Creek in Union County. In calendar year 2021, fecal coliform counts at this station ranged from 154 to 1,630 Colony-Forming Units per 100 milliliters of water (CFU/100 ml) with a geometric mean of 394.51 CFU/100 ml. Two (2) of the 18 samples collected in 2021 (11%) exhibited concentrations at or below 200 CFU/100 ml. Three (3) pollution sources were identified and eliminated as a result of the water quality monitoring in the Goose Creek TMDL watershed in 2022. The sources were a sewage discharge from a wastewater treatment plant, a failed septic system discharging onto the ground, and a large paint spill that discharged onto a road. The latter two spills were resolved before reaching surface waters. Table 5 provides location details on these eliminated point-source pollutants (SR#s 160902, 130752, 134551). Table 8 provides a summary of this data from 2015 through 2022. Figures 2 and 3 provide a comparison of fecal coliform data indicating some improvement over time. Note that FY2022 only provides data through July and does not represent the full calendar year.

Year	Geometric Mean	# Compliant	# Non- Compliant	Total Samples	% Compliant	% Non- Compliant
2015	544.41	4	11	15	27%	73%
2016	454.057	10	9	19	53%	47%
2017	607.12	10	9	19	53%	47%

Table 8 - CMSWS Fecal Coliform Data for Site # MY9 on Goose Creek

2018	678.67	11	8	19	58%	42%
2019	427.19	11	8	19	58%	42%
2020	423.22	4	11	15	27%	73%
2021	513.89	2	16	18	11%	89%
2022	394.51	0	10	10	0%	100%



Figure 2 – Fecal Coliform Compliance



Figure 3 – Fecal Coliform Data from MY9



Figure 4 – Fecal Coliform Geometric Mean

Mean fecal coliform levels in Goose Creek exhibited small decreases from 2021 to 2022. Additionally, the percentage of samples complying with applicable fecal coliform standards has decreased over the past several years at 200 CFU/100 ml. However, at a standard of 400 CFU/100 ml the percentage of samples in compliance has been increasing over the past few years. The existing BMPs for these watersheds therefore appear to be effective at identifying and eliminating pollution sources in compliance with TMDL requirements. These BMPs will continue to be implemented in FY2022.

MY9 Goose Creek at Stevens Mill Road

Ammonia-Nitrogen

In the Goose Creek watershed, a protective biological water quality standard has been established for chronic and acute exposure as seen in Table 9.

Table 7 – Diviogical Water Quality Stanuaru							
Analyte	Acute Standard						
Ammonia	0.5 mg/L	1.75 mg/L					

Table 9 – Biological Water Quality Standard

Monthly grab samples are collected at site MY9 and analyzed for a variety of analytical parameters which include ammonia-nitrogen. Figure 5 shows ammonia-nitrogen concentrations recorded at MY9 from July 2006 through June 2022.



Figure 5 – Ammonia-Nitrogen Concentrations from MY9

For this assessment period, there has been no documented exceedances of the chronic or acute water quality biological standard for ammonia at MY9. The laboratory method detection limit (MDL) is 0.1 mg/L, and 98% of the samples collected have been below the MDL.

Benthic Macroinvertebrates

Benthic macroinvertebrate surveys are conducted on an annual basis to assess the abundance and diversity of the biological community. Table 10 summarizes the benthic macroinvertebrate data that has been collected from site MY9 from July 2006 – September 2021.

	NCDI	EPT	EPT T IT		Bioclass	
Date	NCBI	Species	Total Taxa	Organisms		
7/21/2006	6.46	12	40	408	Fair	
7/27/2007	6.72	9	55	254	Fair	
8/8/2008	6.51	15	57	339	Fair	
7/10/2009	6.33	9	55	247	Fair	
7/9/2010	6.43	10	35	312	Fair	
7/22/2011	6.34	12	53	260	Fair	
9/17/2012	6.99	8	42	232	Fair	
8/16/2013	6.52	11	52	453	Fair	
8/27/2014	6.59	11	59	374	Fair	
9/1/2015	6.23	10	37	213	Fair	
8/31/2016	7.08	9	36	223	Fair	
8/22/2017	6.27	11	36	269	Fair	
8/7/2018	6.22	11	44	286	Good-Fair	
7/11/2019	6.24	10	46	447	Good-Fair	
7/21/2020	6.23	12	51	468	Fair	
9/9/2021	6.63	8	34	221	Fair	

 Table 10 – Benthic Macroinvertebrate Summary Data from MY9

From 2006 to 2017, the bioclassification of the benthic macroinvertebrate community at MY9 has been designated as a Fair Rating. Biological data collected in 2018 and 2019 has shown an improvement in the bioclassification rating from Fair to Good-Fair. An improvement in the bioclassification occurs when there is an improvement in the diversity and abundance of the more pollution intolerant benthic macroinvertebrate species reflecting an improvement in water quality conditions. Data collected in 2020 and 2021 dropped the bioclassification back down to Fair.

Fish

Fish community surveys are conducted on a 4-year rotation at site MY9. Table 11 summarizes the fish community data that has been collected at this site.

Date	NCBI	NCBI Rating	# of Species	# of Fish
9/10/2009	52	Good	16	299
10/1/2013	46	Good-Fair	15	380
5/11/2017	44	Good-Fair	18	364
6/10/2021	52	Good	16	372

Table 11 – Fish Summary Data from MY9

The NC Index of Biotic Integrity (NCIBI) is a measure of the structure and health of a stream's fish community. The NCIBI integrates data about species richness and composition, trophic composition, fish abundance and condition. The fish survey that was conducted in 2009 had an NCIBI Rating classification of Good while the two subsequent surveys had a Good-Fair Rating. In 2021, the NCBI Rating improved to Good. This index

change is not necessarily indicative of degrading water quality conditions at MY9. Instead, a stream with good water quality but poor fish habitat would receive a lower NCIBI score. With only four (4) data points, it is not possible at this time to determine whether the change in NCIBI rating is a factor of poorer water quality condition and/or stream habitat.

MY14 Duck Creek at Tara Oaks Drive

Ammonia-Nitrogen

Monthly grab samples are collected at site MY14 and analyzed for a variety of analytical parameters which include ammonia-nitrogen. Figure 6 shows ammonia-nitrogen concentrations recorded at MY14 from August 2008 through June 2022.



Figure 6 – Ammonia-Nitrogen Concentrations from MY14

For this assessment period, there has been no documented exceedances of the acute water quality biological standard for ammonia at MY14. Although there were two single concentrations that exceeded the chronic standard, this would not be considered a violation of the standard since the methodology for calculating the chronic standard requires that samples be collected over a 4-day window and averaged. The laboratory method detection limit (MDL) is 0.1 mg/L, and 99% of the samples collected have been below the MDL.

Benthic Macroinvertebrates

Benthic macroinvertebrate surveys are conducted on an annual basis to assess the abundance and diversity of the biological community. Table 12 summarizes the benthic macroinvertebrate data that has been collected from site MY14 from August 2010 – August 2021.

Date	NCBI	EPT Species	Total Taxa	# of Organisms	Bioclass
8/16/2010	6.59	8	30	184	Fair
7/8/2011	5.95	10	43	496	Fair
7/11/2012	6.06	10	34	298	Fair
7/19/2013	5.88	8	38	287	Fair
7/2/2014	6.36	10	42	201	Fair
7/20/2015	7.17	5	31	242	Poor
7/22/2016	7.01	4	31	218	Poor
8/3/2017	6.48	9	31	155	Fair
7/12/2018	6.38	11	40	205	Fair
8/6/2019	6.12	9	33	266	Fair
8/6/2020	6.37	6	29	104	Fair
8/4/2021	6.53	8	42	406	Fair

 Table 12 – Benthic Macroinvertebrate Summary Data from MY14

During the 2015 and 2016 assessment period, a marked change in the NCBI and number of EPT species was observed which resulted in a change in overall bioclassification from Fair to Poor. A review of habitat data that was collected in conjunction with the macroinvertebrate assessments did not show any significant habitat or stream flow changes that would explain these two assessments years. It is suspected that the impairment of the biological community may be a result of degraded water quality condition caused by a pollution problem. Located upstream of this monitoring site is Ashe Plantation Wastewater Treatment Package Plant. This plant was owned and operated by a private entity until it was acquired by Charlotte Water in 2016. Prior to the plant's acquisition, a number of issues had been reported that may have contributed to degraded water quality conditions.

Fish

Fish community surveys are conducted on a 3-year and 4-year rotation at site MY14. Table 13 summarizes the fish community data that has been collected at this site.

Date	NCBI	NCBI Rating	# of Species	# of Fish
9/30/2011	48	Good	12	173
10/12/2015	32	Poor	10	267
5/3/2018	40	Fair	12	245
6/23/2022	46	Good-Fair	11	727

Table 13 – Fis	h Summary	Data from	MY14
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The fish survey that was conducted in 2011 had an NCBI Rating classification of Good while the two subsequent surveys conducted in 2015 and 2018 had Poor and Fair Ratings, respectively. As discussed in the benthic macroinvertebrate data summary section,

observed impacts to the biological community during the 2015 - 2016 periods may be attributed to degrading water quality conditions originating from the Ashe Plantation WWTP. In 2022, the NCBI Rating classification increased to Good-Fair.

Additional BMPs Implemented for the Goose Creek TMDL in FY2022

During FY2022, the following additional activities were completed to reduce fecal coliform bacteria levels and enhance water quality in the Goose Creek watershed:

- Routine fixed interval monitoring was conducted monthly at sites MY-9 (Goose Creek – Stevens Mill Road) and MY-14 (Duck Creek – Tara Oaks Lane). Monthly samples were analyzed for 16 parameters including fecal coliform and E. coli.
- Beginning on November 1, 2021 and concluding on April 25, 2022, CMSWS staff walked approximately 127.7 stream miles in the Phase II jurisdictions, including 7.54 in the Goose Creek basins. There was one (1) dry weather flow (DWF) noted, but the flow was too low to collect fecal coliform and total phosphorus samples. Three (3) reference reaches, one (1) beaver dam, one (1) wetland, and three (3) potential buffer violations were recorded. Four (4) new outfalls were inventoried, and twelve (12) existing outfalls were reinspected.
- 3. On July 13, 2022, Health Department records were reviewed, and one failed septic system was found in the Goose Creek Watershed in 2022. This failed septic system was located at 8402 Fairview Road in Mint Hill. The issue was resolved, and the service request was closed on March 29th, 2022.

Adaptive Management

The Water Quality Program should continue implementing the Watershed Management Plan. Fixed Interval Monitoring, Benthic and Fish Monitoring, and stream walks could be expanded to other sections of the watershed. Stream restoration and enhancement opportunities are challenging due to the inability to obtain easements. Opportunities to partner with other government agencies and the Towns to implement stream restoration projects should continue to be investigated.

The Stevens Creek Stream Restoration project and the Stevens Creek Lift Station, Force Main, & Gravity Sewer project should have significant positive impacts to water quality within the Goose Creek Watershed. It may take several years for the impacts of these projects to be realized; however, water quality monitoring is continuing to develop a baseline in which to measure future data.