Appendix G

Water Quality Monitoring Plan

NC Division of Water Quality
Water Quality Section
May 2004

MONITORING RECOMMENDATIONS FOR PHASE 2 OF THE STONEY CREEK LOCAL WATERSHED PLAN

This document outlines the Division of Water Quality's (DWQ) recommendations for chemical, physical and toxicological monitoring in the Stoney Creek watershed as part of Phase 2 of the Local Watershed Plan initiated in this area by the NC Ecosystem Enhancement Program. The monitoring described herein will be conducted by DWQ staff during the period June 2004 to March 2005.

This monitoring plan does not include recommendations for benthic macroinvertebrate community monitoring. Existing benthic monitoring data for the lower half of the Stoney Creek watershed are adequate. In the upper watershed, benthic community sampling is impeded by the low stream velocities and swamp characteristics of the area. DWQ's sampling protocols for benthos are inappropriate for these conditions. Extensive reconnaissance by DWQ in early 2004 failed to identify additional sites in the upper watershed at which benthic community monitoring could be conducted.

A. Chemical and Toxicological Monitoring

Very limited data are currently available on the concentration of water quality constituents during storms. Baseflow data exist for portions of Stoney Creek, but are limited for tributaries. Additional baseflow and storm monitoring are recommended for eight sites. Site locations, sampling frequencies and parameters are summarized in Table 1 and Figure 1 and are discussed further below. Sites designated as lower priority may be eliminated or sampled less frequently dependent upon resource constraints.

These sites are primarily intended to serve as synoptic locations for selected subwatersheds. This monitoring is intended primarily to document current water quality conditions. It will likely not be sufficient to isolate individual causes of degradation and specific pollution sources, although it will provide some information on these issues. DWQ's experience has been that attempts to identify specific causes and sources, especially in an urban setting, are very expensive, and are unlikely to be successful within the context of a short-term planning effort.

Previous monitoring (NCDWQ, 2003a) indicated that toxic impacts to macroinvertebrates in Stoney Creek are likely. Limited bioassays were conducted during that study, however, and tributaries were not sampled. To obtain additional data on the extent of toxic conditions, toxicity bioassays will be conducted at selected sites: Stoney Creek at Wayne Memorial Drive (near the site of a toxicity failure in the earlier study), and sites on two tributaries draining highly developed areas.

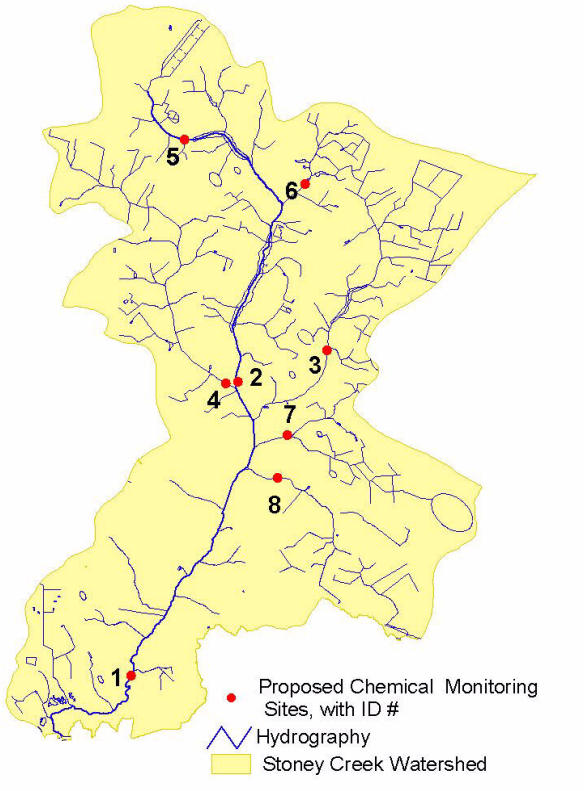
Table 1. Monitoring Recommendations for the Stoney Creek Watershed

Site #	Stream	Parameters	Flow	Minimum N	Frequency	Priority
1	**Stoney Ck @ Slocumb**	nutrients, field [1]	base	4	bimonthly	1
2	**Stoney Creek at Wayne Memorial Drive**	nutrients, metals, field	base	3	bimonthly	1
		nutrients, metals, residue, field	storm	2	- [2]	1
		toxicity	storm	2	-	1
3	**Reedy Branch at New Hope Road**	nutrients, metals, field	base	6	monthly	1
		nutrients, metals, residue, field	storm	3	-	1
4	**Howell Branch at Wayne Memorial**	nutrients, metals, field	base	6	monthly	1
		nutrients, metals, residue, field	storm	3	-	1
5	**Stoney Creek at Stoney Creek Church Road**	nutrients, metals, residue, field	storm	3	-	2
6	**Stoney Run at Stoney Creek Church Road**	nutrients, metals, residue, field	storm	3	-	2
7	**Billy Branch at Harding Drive**	nutrients, metals, field	base	6	monthly	1
		nutrients, metals, residue, field	storm	3	-	1
		toxicity	storm	3	-	1
8	**UT of Stoney Creek at Spence Avenue**	nutrients, metals, field	base	6	monthly	1
		nutrients, metals, residue, field	storm	3	-	1
		toxicity	storm	3	-	1

[1] Field parameters include dissolved oxygen, water temperature, specific conductance, turbidity, and pH.

[2] Storm sampling is contingent upon the weather and cannot be regularly scheduled.

Figure 1. Location of Proposed Stoney Creek Monitoring Sites



Individual sites are discussed below.

1. STONEY CREEK AT SLOCUMB STREET – An abbreviated chemical and physical parameter sampling regime (bimonthly nutrient sampling and field parameters at baseflow only) is recommended for the main stem of the creek at Slocumb Street to document current conditions. This monitoring will supplement data collected at this location during a previous investigation (NCDWQ, 2003a).

2. STONEY CREEK AT WAYNE MEMORIAL DRIVE – This site drains all of upper Stoney Creek. The catchment is largely agricultural and low density residential. An abbreviated chemical and physical monitoring regime (bimonthly nutrient and metals sampling plus field parameters at baseflow) would be useful to characterize conditions in upper Stoney Creek and verify whether nutrient levels are similar to concentrations in other parts of the upper watershed (Howell Branch and Reedy Branch). Storm sampling for the same parameters (plus residue) will also help characterize this part of the watershed. Toxicity during storm flow should be examined since the previous study indicated an unexplained bioassay failure just downstream.

3. REEDY BRANCH AT NEW HOPE ROAD – The watershed above this sampling point is a mix of agriculture and residential areas. No specific sources of water quality degradation have been noted in this area. Monthly collection of nutrient, metals and field parameter data during baseflow and for several events during storm flow (including residue) should sufficiently characterize the water quality in this subwatershed.

4. HOWELL BRANCH AT WAYNE MEMORIAL DRIVE – Similar to Reedy Branch, the same sampling regime should adequately characterize water quality here.

5. STONEY CREEK AT STONEY CREEK CHURCH ROAD – This site drains the Stoney Creek headwaters, an area consisting of mostly of agricultural land, some low-density residential areas and the Goldsboro Municipal Airport. Flow is likely minimal during a significant part of the year, and water quality data from this site will not be readily comparable to data from flowing streams. No baseflow sampling is recommended here but as a secondary priority, storm sampling is recommended to investigate potential inputs of nutrients, metals and sediment. Because Stoney Creek drains into a beaver impoundment soon after passing under Stoney Creek Church Road, it is unlikely that it contributes directly to stream conditions further down.

6. STONEY RUN AT STONEY CREEK CHURCH ROAD – This site is similar to Stoney Creek at Stoney Creek Church Road. It drains a small agricultural and residential catchment and enters beaver impoundments downstream of the road. Recommended monitoring is the same as the previous site.

7. BILLY BRANCH AT HARDING DRIVE – Billy Branch drains a highly urbanized area with agricultural land use in the headwaters. Basic parameters should be collected during baseflow and storm flow to characterize the subwatershed. The array of pollutants that enter the stream in a densely urbanizing area like this one is large. As a broad screening approach, toxicity testing during storm flow may help determine if concentrations of toxic substances are problematic in the stream, potentially impacting the biota.

8. UNNAMED TRIBUTARY OF STONEY CREEK AT SPENCE AVENUE – This tributary is slightly larger than Billy Branch but is quite similar in character. The downstream portion resides in an urbanizing area with strip malls and large parking lots, part of the eastward expansion of Goldsboro. Recommended monitoring is the same as for Billy Branch.

B. Dissolved Oxygen Study

Previous monitoring (NCDWQ, 2003a) indicated the low dissolved (DO) concentrations were widespread in the upper half of the Stoney Creek watershed. This monitoring was conducted during a prolonged period of below average stream flows, however. While low DO concentrations are not unusual in coastal plain waters, existing data are not adequate to characterize how typical these conditions are in the Stoney Creek drainage.

Accordingly, DO levels in the watershed will be investigated during the summer of 2004. In addition to the monitoring of DO during other ambient monitoring activities, DWQ will deploy data sondes (multiparameter probes with a datalogging capability) at approximately six sites in the watershed. Data sondes will typically be deployed for 3 to 5 day periods. Sites will be selected and sampled during the summer of 2004 based upon conditions in the watershed during that period. One to two deployments will occur per site, depending upon equipment availability.

C. Sediment Contamination Study

While toxic impacts to the benthic community were apparent during a previous study (NCDWQ, 2003a), there has been no prior investigation of whether sediment contamination may be a factor in those impacts. There is no a priori reason to suspect that there is a high likelihood of sediment contamination in this watershed (as may be suspected, for instance, downstream of some types of long-term industrial discharges). However potential sources of sediment contamination do exist, including a range or urban sources in the downstream part of the watershed, as well as agricultural chemicals, especially organochlorine pesticides, which were once widely used.

While assessment of sediment contamination does not appear to be a critical need in the Stoney Creek study area, it could enhance our understanding of toxicity issues in the watershed. Conventional analysis of sediments for chemical contaminants is very expensive, especially in situation where numerous types of pollutants are of potential interest and where high priority sites have not been previously identified. Portable organic vapor analyzers (OVAs) provide a method of screening sites for high levels of contaminants, so that conventional chemical analyses can be focused in these areas. OVAs can only detect certain types of analytes, however, so screening may not always be effective. DWQ does not currently have access to an OVA.

DWQ will explore alternative approaches to assessing sediment contamination, including possible access to OVAs. If screening using OVAs is practical, conventional sediment analyses may be carried out for selected analytes at sites that appear to have a high likelihood of contamination. If such screening is not practical, selected conventional chemical analyses (organochlorine pesticides, PCBs, PAHs) may be conducted at several synoptic locations.

D. Methods of Analysis

All samples will be surface grab samples. Baseflow is defined as a period of at least 48 hours without rainfall. The goal of storm sampling is to collect samples during the rising stage of the storm hydrograph. Storm samples will generally be collected manually although automatic sampling equipment may be used when available.

Water temperature, dissolved oxygen, pH, turbidity and specific conductance will be measured in situ using appropriate field instrumentation. Samples for other parameters will be submitted to the DWQ Laboratory Section for analysis. Chemical-physical monitoring will be conducted according to the procedures described in the Intensive Survey Unit's Standard Operating Procedures (SOP) manual (NCDWQ 2003b) and the DWQ Laboratory Section's sample submission guidance (NCDWQ, 2002). Current sample preservation requirements are available on-line at http://www.esb.enr.state.nc.us/lab/qa/collpreswq.htm. Analytical methods used by the DWQ Laboratory Section for the parameters covered by this monitoring plan (plus discretionary analyses that may be employed if needed) are listed in Table 2. Unanticipated sources of water quality degradation (ie-those suggested by toxicity testing) may require additional chemical testing not accounted for in the basic monitoring plan as outlined in Table 1.

Table 2. Laboratory Methods for Chemical Analyses

Parameter	EPA Method	APHA Method	Other Method	Practical Quantitation Limit (PQL)	Revision Date
Suspended residue	160.2	2540D		2 mg/L	3/13/2001
Suspended volatile residue	160.4			2 mg/L	3/13/2001
Suspended fixed residue	160.4			2 mg/L	3/13/2001
Turbidity	180.1	2130B		1NTU	3/13/2001
NH3 as N	350.1 and 350.2		QUIK CHEM 10-107-06-1-J	0.01 mg/L	7/24/2001
TKN as N	350.1 and 351.2		QUIK CHEM 10-107-06-2-H	0.20 mg/L	7/24/2001
NO2+ NO3 as N	353.2		QUIK CHEM 10-107-04-1-C	0.01 mg/L	7/24/2001
P total as P	365.1		QUIK CHEM 10-115-01-1-EF	0.02 mg/L	7/24/2001
Cadmium (Cd)	200.8/213.2			2.0µg/L	3/13/2001
Chromium (Cr)	200.8/200.7			25µg/L	3/13/2001
Copper (Cu)	200.8/220.2			2.0µg/L	3/13/2001
Nickel (Ni)	200.8/200.7			10µg/L	3/13/2001
Lead (Pb)	200.8/239.2			10µg/L	3/13/2001
Zinc (Zn)	200.8/200.7			10µg/L	3/13/2001
Silver (Ag)	200.8/272.2			5µg/L	3/13/2001
Aluminum (Al)	200.7			50µg/L	3/13/2001
Calcium (Ca)	200.7			0.10 mg/L	3/13/2001
Iron (Fe)	200.7			50µg/L	3/13/2001
Magnesium (Mg)	200.7			0.10 mg/L	3/13/2001
Manganese (Mn)	200.8/200.7			10µg/L	3/13/2001
Arsenic (As)	200.8/206.2			10µg/L	3/13/2001
Mercury (Hg)	245.1			0.2µg/L	3/13/2001

D. References Cited

NCDWQ. 2002. Guidance for Sample Submission. NCDWQ Laboratory Section.. April. [Available on-line at http://www.esb.enr.state.nc.us/lab/qa.htm]

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NCDWQ. 2003b. Intensive Survey Unit Standard Operating Procedures. Environmental Sciences Branch. August. [Available on-line at http://www.esb.enr.state.nc.us/isu.html]