DRAFT Proposal for an investigation of: ***Nutrient loads and monitoring strategies for streams in Durham, North Carolina***

BACKGROUND

The City of Durham lies within the watersheds of Falls Lake and Jordan Lake. Both lakes serve as public water supplies and are classified as "impaired" due to high levels of chlorophyll-*a*, indicative of nutrient over-enrichment. Their watersheds are subject to nutrient-management strategies designed to reduce nitrogen and phosphorus loads from diverse sources including urban stormwater, wastewater, and agriculture.

The City of Durham Stormwater Services (DSS) is tasked with implementing best management practices to reduce nutrient inputs from stormwater in the Falls Lake and Jordan Lake watersheds. To track progress toward these goals, the DSS conducts routine monthly sampling at several urban stream sites and uses these data to compute annual mass loads of nitrogen and phosphorus. However, load estimates based on these data have high uncertainty. In an attempt to reduce uncertainty, DSS increased sampling frequency to twice monthly; however, this strategy did not improve (i.e., reduce uncertainty) load estimates. Alternative sampling approaches that include high-flow events and times outside of normal working hours may be needed to compute loads with higher confidence.

PROBLEM

Current monitoring practices used by DSS produce nitrogen and phosphorus loads with high levels of uncertainty. DSS seeks an evaluation of whether alternate monitoring strategies will allow their agency to compute nutrient loads with greater confidence. This information is critical for DSS to track progress toward nutrient-reduction goals, as well as to conduct an effective and cost-efficient monitoring program.

OBJECTIVES

The goal of the proposed study is to provide DSS with updated nitrogen and phosphorus load estimates for two urban streams, using water-quality data collected across a full range of flow conditions and at times that previously have been under-represented. Sensitivity analysis will evaluate how alternative sampling scenarios influence the loading estimates, and how these effects vary among the three streams.

APPROACH

This study will include one stream in the Falls Lake watershed and one stream in the Jordan Lake watershed (table 1). Streamflow data are available for these sites from USGS real-time gages.

Table 1. Proposed study sites in Durham, North Carolina. [TBD, to be developed.]

USGS station no.	Site location	River basin
TBD	Ellerbe Creek at West Murray Avenue at Durham, NC (streamflow from USGS 0208675010, Ellerbe Creek at Club Boulevard at Durham, NC)	Upper Neuse
02097280	Third Fork Creek at Woodcroft Parkway near Blands, NC	Upper Cape Fear

The 28-month study will be conducted in two phases, as follows:

Phase 1 (months 1-15)

1. Compile and analyze DSS water-quality sampling schedules, data, and load estimates to discern potential data gaps
2. Install automated samplers; conduct water-quality gap sampling; review and approve project data

Phase 2 (months 16-28)

3. Compute nitrogen and phosphorus loads using LOADEST or similar method
4. Evaluate alternate monitoring strategies to maximize confidence in load estimates
5. Prepare final report and present findings to DSS

For task 2, a total of 24 environmental samples will be collected manually and with automated samplers at each stream in order to collect samples that target the full range of streamflow. Field parameters (temperature, pH, specific conductance, and dissolved oxygen) will be measured *in situ* for manually collected samples. Water samples will be analyzed for nutrients (nitrate plus nitrite, total ammonia plus organic nitrogen, and total phosphorus). In addition, 2 blank and 2 replicate samples will be collected at each stream for quality-control purposes. All data collected by the USGS will be archived in perpetuity in the USGS National Water Information System (NWIS) database.

Periodic progress updates will be made to DSS. The USGS will publish a report documenting techniques used for data collection and analysis, as well as the study findings. Reports receive extensive technical review prior to approval for publication by the Director, USGS. An oral presentation of the study results will be provided to the DSS upon completion of the draft report, and to other interested parties if requested.

BUDGET

The total funding for the 28-month study is approximately $240,000 (table 2). To advance the USGS mission of providing reliable scientific information to the Nation and to help offset the total project costs, the USGS proposes to contribute $95,000 in matching funds, subject to the availability of Federal funds. A summary of the costs for each phase of the project is shown in table 2.

Table 2. Proposed budget summary.

Project phase	DSS Funding	USGS Match
Phase 1: Analysis of DSS sampling and loads; Water-quality gap sampling; USGS data review and approval (months 1-15)	$90,000	$50,000
Phase 2: Compute loads; evaluate effects of alternative monitoring strategies on load estimates; prepare report and present findings to DSS (months 16-28)	$55,000	$45,000
TOTAL	**$145,000**	**$95,000**