NC Division of Water Quality
Planning Section – Modeling & TMDL Unit
Technical Memorandum

February 15, 2005

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FROM: George Hunt, Modeling & TMDL Unit

RE: Monitoring Plan for Falls of the Neuse Reservoir (Neuse River Basin)

This study has been initiated at the request of the Director of the Division of Water Quality of DENR based on recent chlorophyll *a* data. Currently available data indicate that there may be violations of the chlorophyll *a* standard, therefore this plan has been designed as a TMDL study. This study will be an official study of the reservoir and is designed to fulfill the following purposes:

1. To provide data necessary to complete a TMDL study on the waterbody if the waterbody is included on the 303(d) list.
2. To provide data for parameters not normally collected as part of the lake ambient monitoring program. These data are parameters utilized heavily in modeling frameworks and are therefore necessary to complete a detailed modeling study.

This is a 22-month plan for data collection as part of a TMDL process. This monitoring study will collect data continuously from March 2005 through December 2006. This time frame will allow for the capture of spring, summer and fall seasons in two separate years, which are critical times for algal growth.

The data to be collected in this study and the subsequent modeling analysis will allow the DWQ to determine the extent of impairment of the reservoir. The study is also designed so that an approximate measure of its nutrient loading capacity may be made in order to aid DWQ in the management of both point and nonpoint sources. A summary of the

scope of the monitoring plan can be found in Table 2. Please let me know immediately if some aspect of the study will be difficult or impossible to obtain.

Lake Monitoring

This special study should begin in March 2005 and continue through December 2006. Sampling events should be conducted twice each month, as close to every other week as possible, during this period, for a total of approximately 48 sampling events. At the end of the study, all special study data should be provided to the Modeling & TMDL Unit, with a transmittal memorandum at the completion of the study. Special study data should be provided in an electronic format compatible with MS Excel or MS Access. If possible, updates should be sent to the Modeling & TMDL Unit in an electronic format compatible with MS Excel approximately every three months. Information collected during the cross-section study should be provided to the Modeling & TMDL Unit in an electronic format compatible with MS Excel as soon as the data has been processed. These quarterly updates and the separate request for cross-section data are asked for so that the modeling process can begin as soon as possible, as time is critical on this project.

Spatial Coverage.

Sample all ten existing monitoring stations (i.e., NEU010, NEU013, NEU013B, NEU0171B, NEU018E, NEU019C, NEU019E, NEU019L, NEU019P, NEU020D). Coordinates (i.e. latitude and longitude) should be obtained for all sampling sites prior to beginning sampling in March to allow verification of site accessibility and latitude/longitude information. Latitude/longitude is required for all sampling points. Total number of locations: 10

Parameters.

- Physical parameters: depth profiles of dissolved oxygen, water temperature, pH, and conductivity. Secchi depth should also be included as a physical parameter. These data should be collected along with the chemical data bi-weekly, as stated previously. During the first year of the study period, one sampling event of lateral measurements of the physical parameters should be taken. Along the cross sections described in the following paragraph take three measurements of physical data, including one measurement in the middle of the waterbody, one measurement at the right side of the waterbody, and one measurement at the left side of the waterbody. This data is necessary to test a lateral-average assumption. The timing of this lateral data collection can be at the discretion of the collectors, however, it is preferred if the data is collected when the water level in the reservoir is as close to normal pool elevation as possible. If resources and time allow, a second lateral data collection should occur during the second year of sampling.

- Chemical parameters: total phosphorus, total dissolved phosphorus, orthophosphorus, ammonia, TKN, nitrite & nitrate, BOD5, total solids, total suspended solids, turbidity. Biological Parameters: chlorophyll a. All chemical and biological parameters should be taken from the photic zone, i.e. twice the secchi depth.

Cross Sections.

Measure the bathymetry at every location located on the included map. There are ten (10) cross sections shown, one at every station (See Figure 1). If resources and time are scarce, then the cross-section measurement at Beaverdam Lake should not be performed. Cross-sectional data should be taken during the first year and as close to normal pool elevation as possible. Notes describing the lake bottom should be recorded at each of the cross sections (e.g. rocky, sandy, muddy, tree stumps).

Phytoplankton Data.

Phytoplankton assemblages at four sites should be assessed for structure (i.e. taxa identification and dominance), density and biovolume. Assemblages should be assessed three times a year, once during spring (i.e. March or April), once during summer(i.e. July or August) and once during fall (i.e. October or November) for a total of six (6) sampling events. The four sites selected for assessment are: NEU013, NEU018E, NEU019P and Beaverdam Lake NEU019C. A total of twelve samples should be analyzed per year and a total of twenty four samples analyzed for the 22-month study.

Continuous Temperature Data.

Using the temperature thermistors, continuous temperature should be measured at three stations using a total of 13 thermistors. Table 1 shows a summary of requested thermistor sampling.

Table 1. Summary of Thermistor Sampling

Station	Number of Thermistor at Station	Depths to Place Thermistors (meters)
NEU010	3	1,3,5
NEU018E	4	1,3,5,7
NEU020D	6	1,3,5,7,9,11

Thermistors should be set to record temperature every two hours and should be deployed for the entire scoping period from March 2005 to December 2006. If resources are lacking for this schedule, monitoring should be conducted for a minimum of 10 weeks. It is suggested that the thermistors initially be deployed for a 1-week period after which field staff can retrieve the devices and record the data. Field staff can then evaluate the success of the field method prior to obtaining additional weeks of data.

Sediment Oxygen Demand and Nutrient Flux.

Sediment oxygen demand (SOD) and nutrient flux should be measured at four different locations on two separate occasions. The stations where SOD and nutrient flux should be measured are: NEU013, NEU018E, NEU019P, and Beaverdam Lake (NEU019C). These sites should be sampled once each in the summer of each year. Total number of sediment samples to be analyzed: 8.

Table 2. Summary of lake samples for scoping study

Media	Type of analyses	No. of sites	No. of sampling events over period	No. of samples to be processed
Surface water	All chemical parameters listed above	10	48	480
	Physicals	10	48	480
	Cross-sections & Lateral Physicals	9(10)	1	N/A
	Algae	4	6	24
	Continuous Temperature	3	Continuous, 13 *in-situ* Tidbits	N/A
Sediment	SOD	4	2	8
	Benthic nutrient flux (TN and TP)	4	2	8

Watershed Monitoring

This section includes monitoring plans for both the ambient program and Intensive Survey. There are no monitoring coalition stations within this watershed to assist with study development.

Ambient:

Duration. March 2005 to December 2006

Frequency. The minimum monitoring frequency for all stations is two times per month, with 10 to 14 days between events, for the desired parameters. If resources allow, a more ambitious weekly monitoring program should be pursued. Number of sampling events per year: 20 in 2005, 24 in 2006.

Spatial coverage. The following stations should have this enhanced monitoring: J0770000 (Eno River @ US 501 nr Durham), J0820000 (Little River @ SR1461 nr Durham), J1100000 (Flat River @ SR1004 nr Willardsville), J1210000 (Knap of Reeds Creek at WWTP Outfall nr Butner), J1330000 (Ellerbee Creek @ SR1636 nr Durham), and J1890000 (Neuse River @ SR2000 nr Falls). Figure 2 shows the locations of these stations. Total number of stations: 6

Parameters. The following parameters should be included in the enhanced monitoring: nitrogen series (ammonia-nitrogen, nitrate/nitrite-nitrogen, TKN-nitrogen), total phosphorus, and TSS. This enhanced monitoring should not replace standard ambient monitoring including physicals and metals.

Intensive Survey (or Ambient Monitoring)

Duration. March 2005 to December 2006

Frequency. The monitoring frequency for all tributary chemical stations is once every two months, as close to every other month as possible. If resources are not available for an every-other-month schedule, quarterly is acceptable.

Spatial coverage. The following stations should be monitored: Little Lick Creek at Fletcher Chapel Road, Lick Creek at Kemp Road, Ledge Creek at Peed Road, Beaverdam Creek at Horseshoe Road, and if resources allow, Horse Creek at Thomson Mill Road. Note that EEP will also be conducting a special study on Little Lick Creek. Thus, monitoring may be accomplished using a combination of resources. Total number of stations: 4(5)

Parameters. The following chemical parameters should be included: physicals (i.e., DO, pH, temperature, conductivity), nitrogen series (ammonia-nitrogen, nitrate/nitrite-nitrogen, TKN-nitrogen), total phosphorus, and TSS. Cross-section and flow information should also be collected at each site.

Hydrology. For the Knap of Reeds Creek site, establish a rating curve. This curve can then be utilized by the ambient monitoring staff, increasing the data available for this watershed. The minimum monitoring frequency for Knap of Reeds Creek (J1210000) velocity and flow is monthly. If resources allow, install a pressure transducer to measure continuous stage at this location.

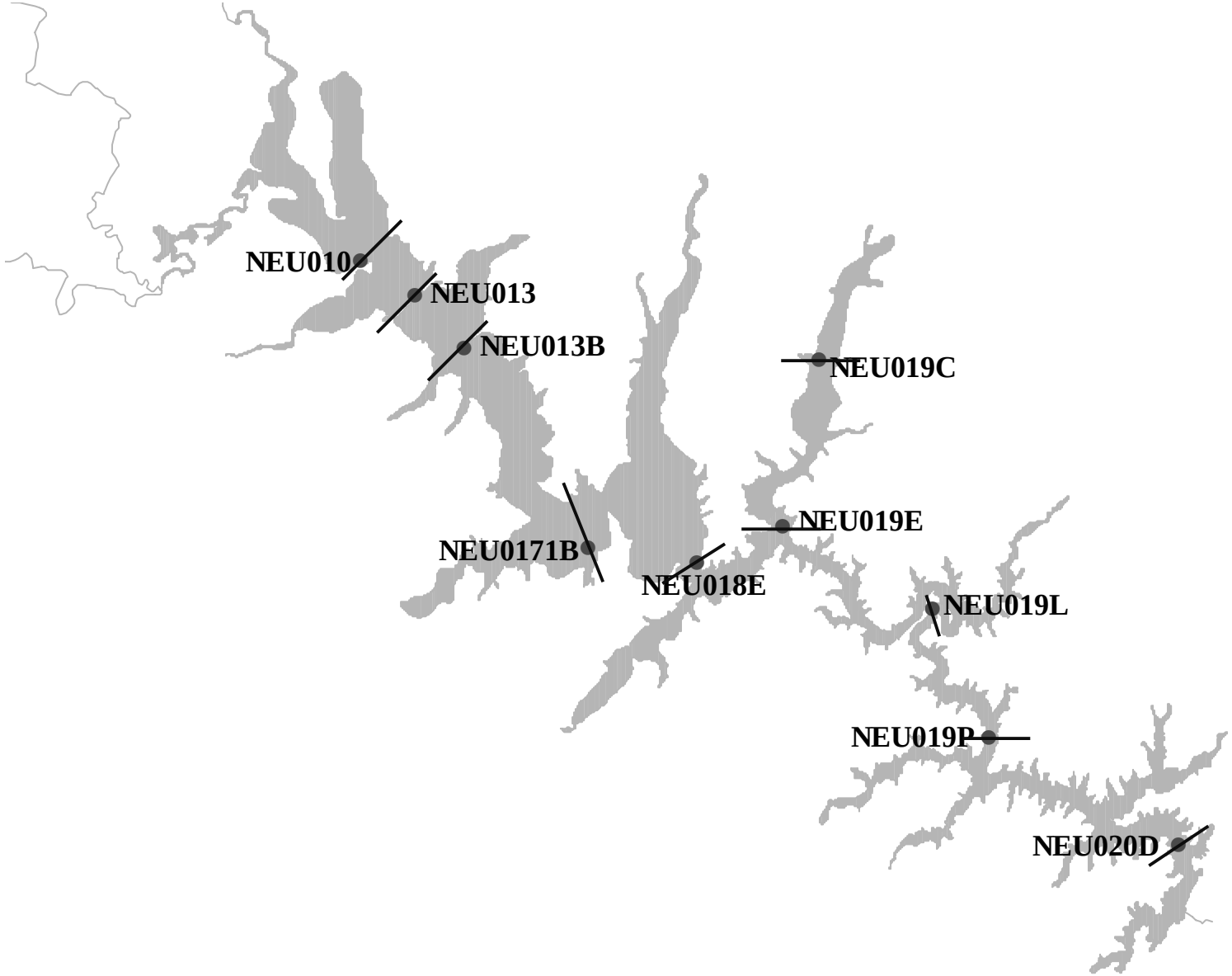

Figure 1. Falls of the Neuse Reservoir with locations of sampling sites.

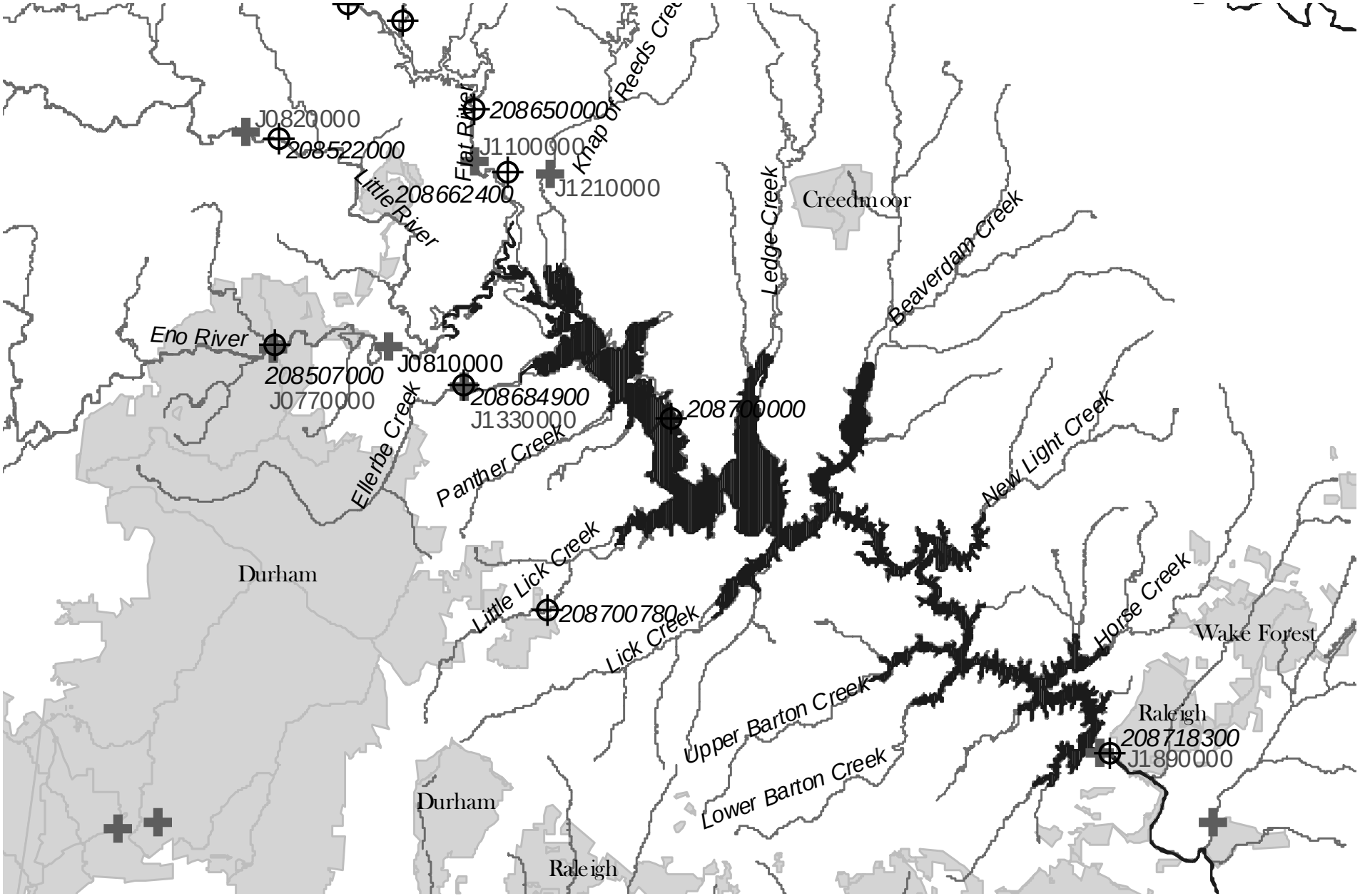

Figure 2. DWQ Watershed Monitoring Stations.