

Carters Lake
Nutrient Study Plan Outline

**Georgia Department of Natural Resources
Environmental Protection Division
Watershed Protection Branch
Watershed Planning & Monitoring Program
4220 International Parkway
Suite 101
Atlanta, Georgia 30354**

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Background

Two segments of Carters Lake have been listed as impaired for chlorophyll *a* on Georgia's draft 2006 and 2008 303(d) list. These include the Coosawatee Embayment and Midlake sites. The purpose of this study is to collect data to develop, calibrate, and validate three water quality models of the Carters Lake watershed in the Upper Coosa River Basin to be used in developing a Total Maximum Daily Load (TMDL) for chlorophyll *a*. The three models to be used in the TMDL development process are:

- Loading Simulation Program in C++ (LSPC)
- Environmental Fluid Dynamics Code (EFDC)
- Water Quality Analysis Simulation Program (WASP)

The Georgia Environmental Protection Division (GAEPD) and the will conduct the fieldwork in 2008. The Carters Lake modeling work will be done by GA EPD's contractor in 2009.

Detailed Study Plan Development

This study plan outline provides a starting point for planning the work needed to successfully model the Carters Lake watershed. The GAEPD will develop additional details, as necessary; to outline the data collection needs for this study.

The data collection for the Carters Lake Watershed will extend south from the re-regulation lake at Talking Rock Creek at Highway 136, north on Mountaintown Creek at Sam Hill Road, and east on Tickanety Creek at Macedonia Road and will include:

- Watershed flow data
- Water quality sampling
- Continuous water quality monitoring
- Wastewater treatment facility sampling and data collection
- Special studies

Each module is discussed in further detail in the paragraphs below. Quality Assurance and Quality Control Plans and Procedures will be considered and integrated in each module specific study plan.

Module 1: Watershed Flow. This module includes the operation and maintenance of three continuous USGS flow gages in the watershed. These include one on the Coosawattee River near Ellijay, GA, on Mountaintown Creek at GA Hwy 282, and Talking Rock Creek near Hinton, GA. The data from these gages will be used either directly as model input to the lake model or to calibrate the watershed model. EPD will also monitor flow and develop rating curves at four additional locations in the watershed. The data from these sites will be used to determine a relationship between gauged and ungauged streams. These data will also be used in calibration of the LSPC watershed model.

Module 2: Water Quality Sampling. This module includes the collection and analysis of discrete water quality samples at locations throughout the Carters Lake watershed. EPD will collect water samples twice a month from 22 rivers and tributaries in the watershed. These data will be used to calibrate the LSPC watershed model and will provide valuable information for assessing the water quality in the areas. The samples will be analyzed for BOD₅, TKN, NH₃, NO₂-NO₃, total phosphorus, ortho-phosphate, and TOC. The following field measurements will also be taken: pH, DO, temperature, and conductivity and tape-downs will be made at the time of sample collection.

In addition, EPD will also collect in-lake data at the two standard monitoring sites and one non-standard site from the re-regulation lake. Vertical pH, DO, temperature, and conductivity profiles will be measured. A depth composite water samples from the photic zone will be collected and analyzed for chlorophyll a, nutrients (see above), and fecal coliforms. In addition, the light penetration will be determined using a Li-Cor and a secchi depth will be measured. These data will be used for water quality assessment and to calibrate the WASP model.

USGS will also collect monthly water quality samples at two major lake tributaries, which include the Coosawattee River near Ellijay, GA, and Mountaintown Creek at Hwy 76. These samples will be analyzed for BOD₅, TOC, TKN, NH₃, NO₂-NO₃, total phosphorus, ortho-phosphate, TSS, fecal coliform, pH, DO, temperature and conductivity.

Module 3: Continuous Water Quality Monitoring. This module includes the installation and maintenance of continuous water quality monitors at two locations in Carters Lake. The location of these monitors is as follows: the Coosawattee River and at the midlake site upstream of Woodring Branch. The continuous water quality monitors will be installed and maintained for the duration of the growing season (April-October). The monitors will record DO, temperature, conductivity, pH, and depth at one-hour intervals. These data will be used in the calibration of the WASP Model for the lake.

Module 4: Wastewater Treatment Facility Sampling and Data Collection. This module includes the compilation of data from wastewater treatment plants and sampling of major and minor dischargers during the study period. The

discharge monitoring reports (DMRs) and/or operating monitoring reports (OMRs) for the wastewater treatment facilities in the study area will be reviewed and data compiled as needed. In addition, all dischargers will be sampled to provide data that may not be available in the discharge monitoring reports. This sampling work will also provide a quality assurance check for sampling and analytical work done by each discharger. EPD will sample the major dischargers twice and the minor dischargers once during the study period.

Module 5: Special Studies. This module includes specialized studies that will be conducted by the USEPA. Algal growth potential tests will be used to determine the limiting factor. This information is required for the WASP model.

Meteorological data will be obtained from available meteorological stations. These data will include barometric pressure, air temperature, relative humidity, dew point, rainfall evaporations, wind speed, solar radiation, and cloud cover. All available data will be managed in the GAEPD Water Resources Database (WRDB). This will include stream flow and gage information, discrete water quality data, continuous water quality data, NPDES permit limits, discharge monitoring reports, water intake reports, and meteorological data.

Water Quality Modeling

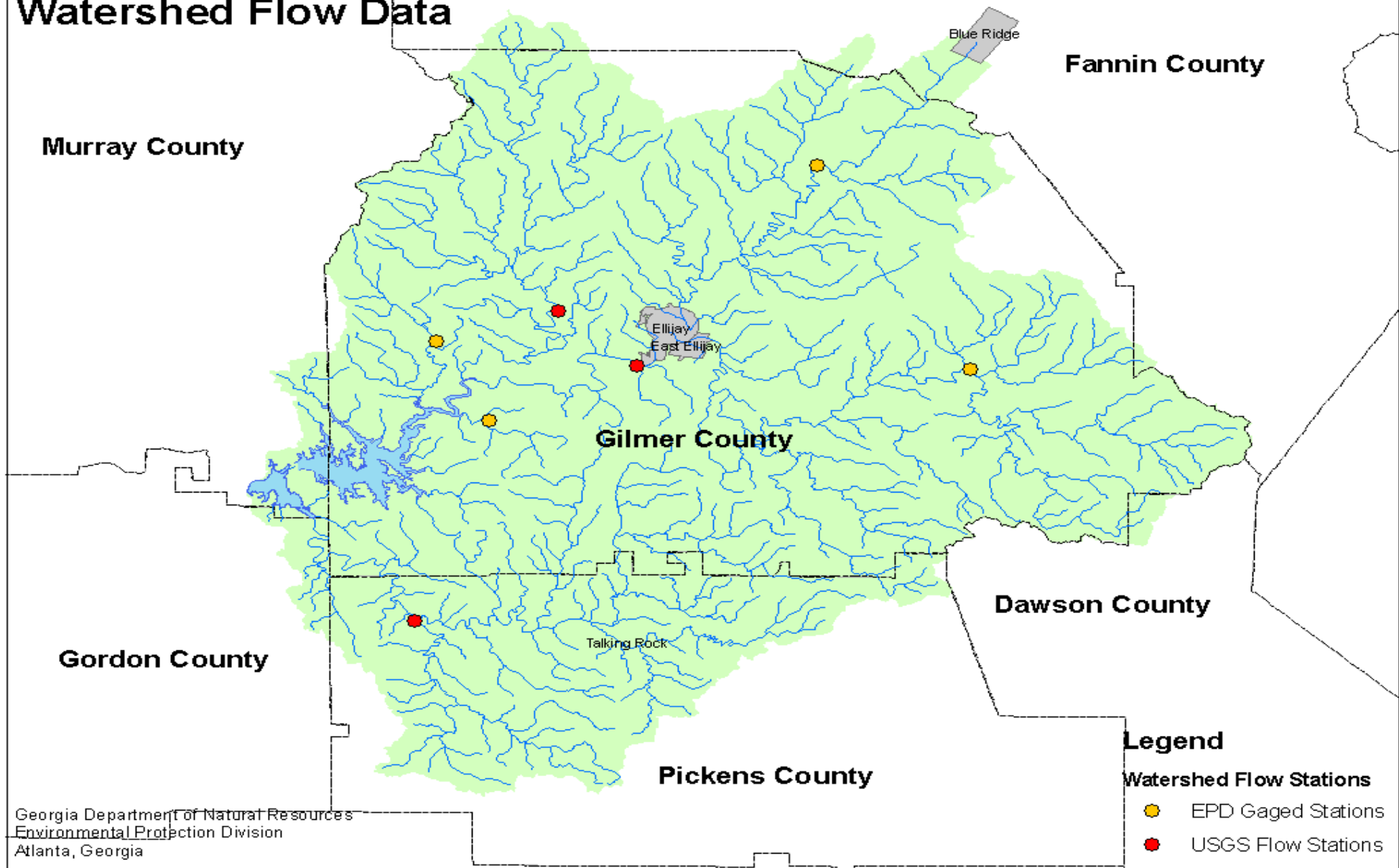
This task includes the development, calibration, and validation of three water quality models. These models will be used to develop the Total Maximum Daily Load (TMDL) for nutrients in Carters Lake

A watershed model for Carters Lake will be developed using the Loading Simulation Program in C++ (LSPC). This model will include point and non-point sources of nutrients. The watershed model will simulate the effects of surface runoff on both water quality and flow and will be calibrated to available data. The results of this model will be used as tributary flow inputs to the hydrodynamic model, Environmental Fluid Dynamics Code (EFDC), which will be used to simulate the transport of water into and out of the lake. The third model is the EPA Water Quality Analysis Simulation Program (WASP). It will be used to simulate the fate and transport of nutrients into and out of the lake and nutrient uptake by phytoplankton. The growth and death of phytoplankton is measured through the surrogate parameter chlorophyll a. The data collections outlined in this Study Plan are intended to provide the basis for developing, calibrating, and validating these three models.

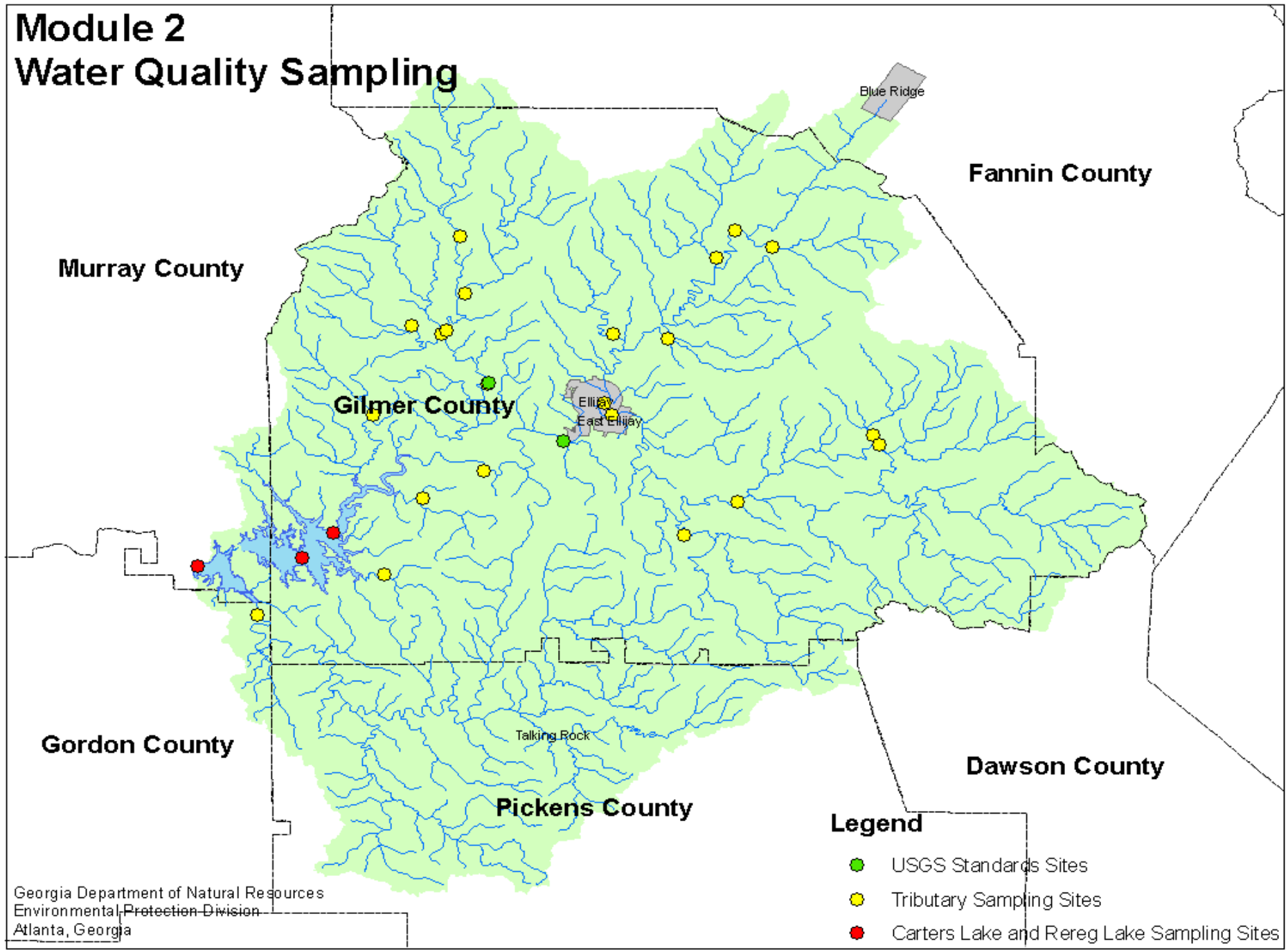
Project Schedule

The GAEPD and USEPA will conduct fieldwork to collect data needed for the Carters Lake Nutrient Study during 2008. All models will be calibrated and linked in 2009. The Carters Lake nutrient TMDL will be drafted in 2010.

Module 1 Watershed Flow Data



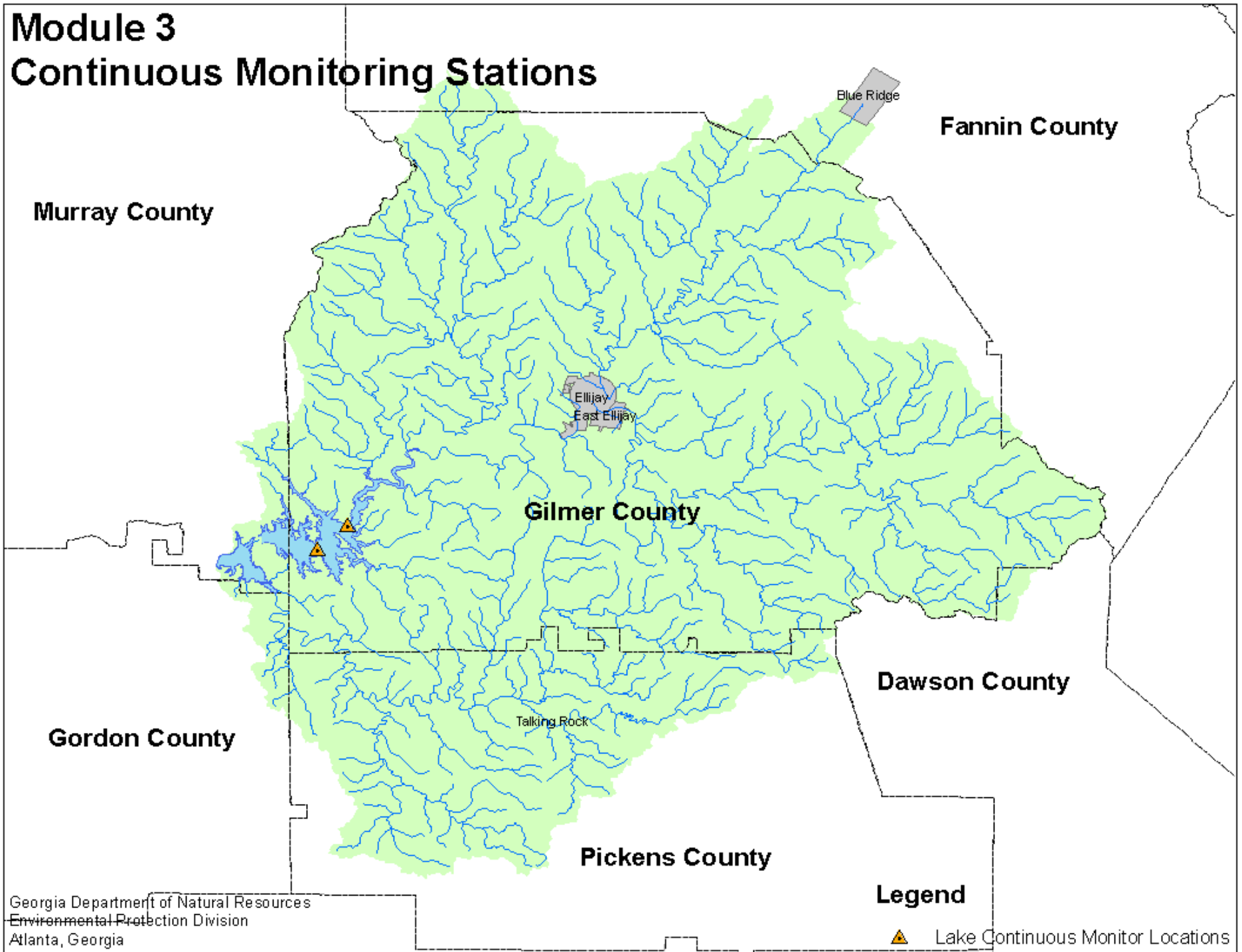
Module 2 Water Quality Sampling



- Legend**
- USGS Standards Sites
 - Tributary Sampling Sites
 - Carters Lake and Rereg Lake Sampling Sites

Module 3

Continuous Monitoring Stations



Georgia Department of Natural Resources
Environmental Protection Division
Atlanta, Georgia

Legend

▲ Lake Continuous Monitor Locations

Module 4 Wastewater Treatment Facilities Sampling

