WATER-QUALITY MONITORING IN GWINNETT COUNTY

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INTRODUCTION

In 85 percent of streams and 99 percent of lakes in Georgia that do not meet designated uses, nonpoint sources of contaminants are the cause (Georgia Environmental Protection Division, 1999). Gwinnett County, in Metropolitan Atlanta, Ga., continues as one of the most rapidly growing areas in the United States. Nonpoint-source pollution is highly complex, because it arises from varied, dynamic, and interrelated sources—especially in areas of urban growth. Nonpoint-source pollution and its relation to rapidly changing land-use conditions is a major concern in Gwinnett County. Water-quality degradation or improvement due to changes in watershed land use and management typically occur over time scales of years. However, water-quality conditions have high variability over the short term, and both acute and chronic conditions are important. Understanding the various changes and processes that affect water quality requires a watershed-monitoring program that includes intensive, long-term monitoring of streamwater quality and watershed characteristics.

The U.S. Geological Survey (USGS), in cooperation with Gwinnett County, Department of Public Utilities, established a water-quality monitoring program in 1996 to assess and analyze the impacts of nonpoint-source contaminants. The program provides water-quality information that can aid land and water-resource managers to make informed resource management decisions that can affect water quality. The Gwinnett County monitoring program includes the development of a network of real-time, continuous water-quality stations augmented with water-quality sampling and analysis of likely contaminants. Long-term monitoring will quantify and describe the fluctuation of pollutants within a stream. Analysis of water quality within a stream, over time, will define possible water-quality trends in the watershed; thereby identifying how land use and development may impact a watershed. Also, the real-time, continuous water-quality network may aid in timely decision making on watershed management. This paper describes the current water-quality monitoring program in Gwinnett County.

Scope and Study Area

Gwinnett County is located in the Piedmont physiographic province of Georgia in one of the most rapidly growing areas in the Unites States (U.S. Bureau of Census, 1991). Gwinnett County is a mostly headwater area where streams drain into one of three major river basins—the Chattahoochee, Ocmulgee, and Oconee. Land use varies greatly throughout the County; how-ever, residential land use is more than 50 percent of the County's total land area when grouping all classes of residential land use. The monitoring network includes 12 monitoring stations located within watersheds of the Chattahoochee, Ocmulgee, and Oconee River basins. These stations will provide real-time continuous, water-quality data in watersheds that represent a wide range of land-use conditions and drain more than 70 percent of Gwinnett County. Six stations have operated since 1996, and six additional stations are being added in 2001.

METHODS

Watershed selection

The Gwinnett County water-quality monitoring network is listed in table 1 and shown in figure 1.

Twelve watersheds were selected for the monitoring network based on watershed characteristics, such as basin size, and land use. Smaller watersheds typically have a dominant land use and fewer total types of land use—this simplifies recognizing relations between observed water quality and land use. Also, smaller watersheds have fewer variables that affect runoff processes including small tributary networks that are minimally affected by widely varied rainfall distribution. However, a watershed should be large enough to have all basic watershed processes, so that water-quality monitoring results can be transferable to other watersheds in the region. Larger watersheds also have longer runoff events making it easier to collect better quality and larger quantity storm samples. Watersheds in the network include North Fork Peachtree Creek where 49 percent of land use is commercial, industrial, and transportation/communications; No Business Creek where 44 percent of land use

Table 1.Water-quality monitoring network, Gwinnett County, Georgia, 2001

Station number	Stream name and location	River basin	Drainage area (square miles)
02207120	Yellow River at State Route 124 near Lithonia, Ga.	Ocmulgee	160
02207185	No Business Creek at Lee Road near Centerville, Ga.	do.	8.7
02207385	Big Haynes Creek at Lenora Road near Snellville, Ga.	do.	17.8
02207400	Brushy Fork Creek at Beaver Road near Loganville, Ga.	do.	8.03
02208150	Alcovy River at New Hope Road near Grayson, Ga.	do.	28.2
02217274	Wheeler Creek at Bill Cheek Road near Auburn, Ga.	Oconee	1.32
02218565	Apalachee River at Fence Road near Dacula, Ga.	do.	5.67
02334480	Richland Creek at Suwanee Dam Road near Buford, Ga.	Chattahoochee	9.35
02334580	Level Creek at Settles Bridge Road near Suwanee, Ga.	do.	8.33
02334885	Suwanee Creek at Buford Highway near Suwanee, Ga.	do.	46.8
02335350	Crooked Creek at Spalding Drive near Norcross, Ga.	do.	6.66
02336030	North Fork Peachtree Creek near Doraville, Ga.	do.	5.05

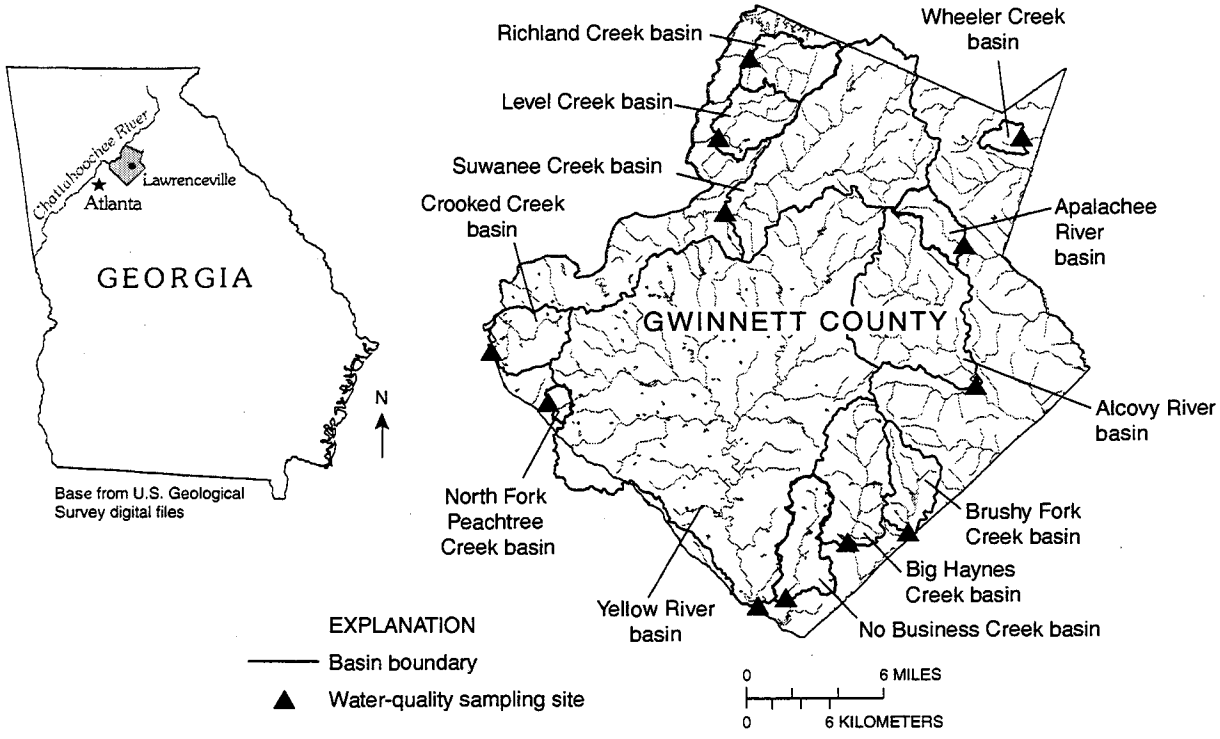

Figure 1. Gwinnett County streamwater-quality monitoring network, 2001.

is established, low density residential areas; and Wheeler Creek where 45 percent of the land is undeveloped. The Wheeler Creek watershed provides an opportunity to begin monitoring before urban land-use changes increase in the basin, and provides a basis for comparisons with more developed watersheds. The percentage of land use for each watershed where water-quality monitoring sites are located, by river basin, is presented in table 2.

Sampling and Monitoring of Watersheds

Long-term monitoring of stream-water quality involves the collection and analysis of baseflow (or dry-weather) samples, stormflow samples, and the continuous measurement of physical and water-quality parameters. Water-quality samples are collected seasonally. During each season—defined as summer or winter season—three stormflow and three baseflow samples are collected. At 6 of the 12 sites, storm-composite samples are collected on a flow-weighted basis using an automatic sampler for the duration of the storm event. At the remaining 6 sites, storm samples are collected using the USGS equal-width increment protocol (Wilde and others, 1998) and typically are obtained during periods when the storm runoff is increasing. Samples are analyzed for the following constituents and parameters:

- Turbidity
- Biological oxygen demand (BOD)
- Chemical oxygen demand (COD)
- Hardness total
- Total suspended solids (TSS)
- Total dissolved solids (TDS)
- Nitrates-nitrites (NO_3-NO_2)
- Ammonia nitrogen (NH_3-N)
- Total Kjeldahl nitrogen (TKN)
- Phosphorus
- Dissolved phosphorus
- Total organic carbon (TOC)
- Cadmium (dissolved)
- Copper (dissolved)
- Lead (dissolved)
- Zinc (dissolved)

Table 2. Percent of land use for monitored watersheds, by river basin, Gwinnett County, Georgia, 2001
[Data derived from Atlanta Regional Commission's 1995 land-use coverage]

River basin	Name of stream tributary	Land use (in percent)								
		Agriculture	Commercial, Industrial, and Transportation, Communications, and Utilities (nonresidential areas)	Estate, Residential	Residential–medium to high density	Residential–low to medium density	Park land	Paved roads, streets, and highways	Undeveloped land	Water
Chattahoochee	Crooked Creek	0	36	0	16	15	0	13	19	0
Do.	Level Creek	0	3	20	3	38	1	9	26	0
Do.	North Fork Peachtree Creek	0	49	0	17	11	1	15	6	0
Do.	Richland Creek	0	15	13	5	23	3	7	34	0
Do.	Suwanee Creek	1	11	21	2	18	2	10	34	0
Ocmulgee	Alcovy River	0	11	25	1	22	0	8	32	0
Do.	Big Haynes Creek	0	4	15	0	50	2	8	20	1
Do.	Brushy Fork Creek	0	5	44	1	24	1	6	18	1
Do.	No Business Creek	0	8	12	1	44	7	9	18	0
Do.	Yellow River	0	14	10	9	35	3	12	17	1
Oconee	Apalachee River	3	2	17	0	23	10	5	38	0
Do.	Wheeler Creek	0	0	28	2	16	0	9	45	0

When water-quality monitoring began in 1996, the Georgia Department of Natural Resources, Environmental Protection Division (GaEPD) water-quality standards required that total (unfiltered sample) metal concentration be reported. However, GaEPD water-quality standards changed in 2000 requiring that dissolved metal concentrations (0.45 micron (μ) capsule filtered sample) be reported (Georgia Environmental Protection Division, 2000). Dry-weather (baseflow) samples collected at Big Haynes Creek and Brushy Fork Creek also will be analyzed for concentrations of chromium, iron, manganese, and color. All sample collection, sample processing, and sample analysis follow quality assurance and control protocols outlined in the National Field Manual for the Collection of Water-Quality Data 1998 (Wilde and others, 1998). In addition to water-quality sampling, the following parameters will be recorded at 15-minute intervals at all 12 sites using an insitu data sonde and data logger—streamflow; rainfall, temperature, specific conductance, and turbidity. Real-time, continuous data are important in watershed management because immediate observation of processes occurring within a watershed can be monitored. Recorded data is transmitted via satellite to the USGS, Atlanta, Ga., and selected parameters are updated on the World Wide Web, Georgia District home page (**http://ga.water.usgs.gov**) every four hours. During extreme storm events, the sites are programmed to transmit data on a more frequent interval. Real-time data will help define current conditions and enable watershed managers to make timely, informed management decisions. USGS personnel also will be able to prioritize sampling efforts during storm events and identify potential water-quality concerns.

Water-Quality Analyses

Water-quality data are used to define the conditions and processes occurring within a watershed and can point to potential sources of water-quality degradation. Determination of pollutant contaminant sources may assist in understanding the impact that various land uses have on a watershed. Also, observing water-quality changes through time may serve to quantify how land-use changes impact water quality and provide a measure of the effectiveness of various Best Management Practices used within a watershed. Water-quality analyses also provide information on background concentrations, short-duration (event), seasonal, and long-duration water-quality changes, and the yield of selected constituents from watersheds having different land uses and characteristics.

SUMMARY

In areas of urban growth, nonpoint-source pollution is highly complex because it arises from varied dynamic, and interrelated sources, especially in areas of urban growth. Nonpoint-source pollution and its relation to rapidly changing land-use conditions is a major concern in Gwinnett County, Ga. In an effort to address this concern, the USGS, in cooperation with Gwinnett County, Department of Public Utilities, developed a long-term watershed-monitoring program in 1996. The program includes watershed selection, long-term monitoring of streamwater quality and watershed characteristics, developing a real-time water-quality network, and analysis. With this plan in place, water-resource managers will have hydrologic data needed to make timely and informed decisions regarding the use of Best Management Practices and other watershed-management practices.

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