

# An Assessment of Water Quality and Urbanization in the Gills Creek Watershed

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## **Abstract**

The Gills Creek watershed is a 76 square mile watershed that lies within Richland County, the City of Columbia and Fort Jackson, South Carolina. While much of the watershed within the City of Columbia has been urbanized for some time, there are portions that have experienced much growth in the last 10-15 years. According to the Midlands Council of Governments, the northeast area of Richland County, close to the headwaters of the watershed, is the fastest growing area of the County.

The headwaters of the Gills Creek begin at Hughes pond, northeast of Sesquicentennial State Park and flow south through Fort Jackson. A major tributary of Gills Creek is Jackson Creek, which begins in Sesquicentennial State Park. Jackson Creek and Little Jackson Creek then flow south through a highly urbanized area, mainly consisting of residential neighborhoods and shopping centers, and are impounded multiple times before flowing freely through the rural areas of southeast Richland County. Gills Creek flows into the Congaree River south of the Southeast Beltway Bridge. The South Carolina Department of Health and Environmental Control (SCDHEC) reported that 39% of the watershed was urban land in 2004 (SCDHEC 2004).

The SCDHEC has four monitoring stations within the watershed. Two are located on Gills Creek, one on Forest Lake, and one on Windsor Lake. All are listed as impaired waterbodies on the State's 303(d) list for recreational uses due to fecal coliform. At the site furthest downstream aquatic life uses are also not supported due to dissolved

oxygen (DO) concentration excursions and Windsor Lake aquatic life uses are not fully supported due to DO and pH levels.

This paper analyzes historical water quality data within the highly urbanized watershed by looking for changes in the water quality parameters over time. The water quality parameters chosen for analysis are fecal coliform and dissolved oxygen. These parameters were chosen because of their relationship to urbanization and because they are two sources of impairment in the Gills Creek watershed. Fecal coliform and dissolved oxygen both originate as non-point source pollutants and can be detrimental to aquatic and human health. The water quality data analyzed is from EPA's STORET database from the years 1972-2006. Urbanization is analyzed by comparing U.S. Census data for the years 1970, 1980, 1990, and 2000 and examining building permit data that has been tracked by the Midlands Council of Governments for the years 1981-2006.

The objective of this assessment is to determine if there are correlations between the presence of fecal coliform, low dissolved oxygen, and an increase in urbanization. The long-term goal of the project is to better understand the effects of urbanization, provide relevant historical data, and help guide policy decisions that may affect the watershed.

Statistical analysis of the water quality data has removed variability such as seasonality, temperature, and stream flow by using a General Linear Model. The resultant least squares means were used to run a time series analysis and test for autocorrelation, although none of the data had any autocorrelation. The slope and intercept were used to create a model that shows long-term trends.

Initial results have been highly variable and have shown that long-term trends of fecal coliform have decreased at two of the monitoring stations, and increased at the other two. Dissolved oxygen levels have decreased at all monitoring stations except the one furthest downstream that has had the most significant improvement of fecal coliform levels. Population levels of the entire watershed has increased by approximately 5,385 people over a 30-year period. Two of the sub-watersheds actually lost population that never returned during this time. The amount of buildings within the watershed have increased dramatically from 1981-2006. The total amount of permits issued is 8,240, much higher than the increase in population.

Further analysis will determine the type of building permits being issued and in which sub-watersheds they are being issued. Significant increases in buildings during a given time period will be compared to water quality levels to see if there is any correlation between the two. Additionally, research of local policies, such as stormwater practices and municipal wastewater processes will also be examined.