

# URBAN WATERSHED INITIATIVES: A CITY OF ATLANTA CASE STUDY

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**Abstract.** Watershed based initiatives are often proposed for water supply watershed protection or for growing areas in order to plan growth in ways that minimize impacts on water quality. However urban watersheds, once considered a lost cause, are receiving increasing attention as an opportunity to significantly improve water quality and the viability of our streams and rivers.

The City of Atlanta recently began an Urban Watershed Initiative to critically assess its watersheds and streams, and to develop watershed management plans to guide improvements. The Initiative is being directed by a Steering Committee and several Technical Committees in order to address the myriad of activities affecting an urban watershed.

## INTRODUCTION TO URBAN WATERSHEDS

Urban watersheds and their streams are often affected by many different factors, including severe erosion and sedimentation from increased runoff and construction, combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), septic tanks, illegal discharges, leachate, air pollution, and urban storm water runoff. As a result of these factors, the water quality in the streams is often impaired.

However the biological health of the streams is often affected more by the habitat changes in the stream due to urbanization than degradation in water quality. Riparian areas adjacent to streams are often disturbed. Sedimentation smothers potential aquatic habitat; canopy shade is removed by construction; and high peak storm flows generated by impervious areas erode bank habitat.

Therefore an integrated approach is needed to address the problems of urban watersheds. An assessment of the habitat, the biological community, and pollutant loadings in the streams is necessary to properly assess the impacts of these factors. The integrated assessment of these impacts is

the key to developing an effective, efficient watershed management strategy.

## BACKGROUND

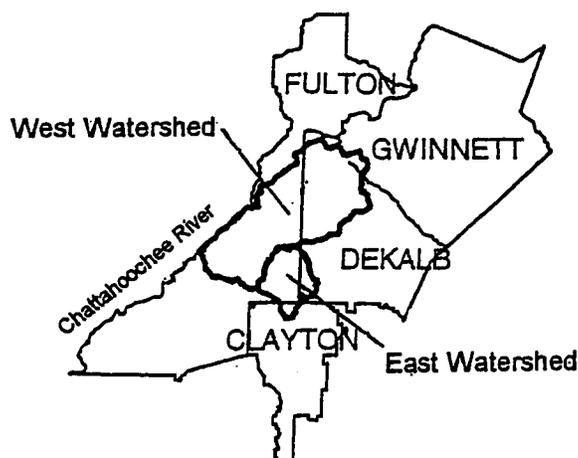
**City of Atlanta.** The City of Atlanta is at the center of a metropolitan area of approximately 3 million persons, although it has only 420,000 persons residing within its corporate boundaries. The City is approximately 132 square miles in area.

Atlanta is located in the Piedmont geologic region, which means the topography is hilly and the soil is prone to erosion when exposed. The City is also bisected by the subcontinental divide, with water to the west of the divide flowing to the Chatta-hoochee River and thence to the Gulf of Mexico, and water to the east of the divide flowing eventually to the Atlantic Ocean.

**Watersheds and Water Quality.** In 1996 the City started the Urban Watershed Initiative in response to concerns over the amount of pollution contributed to streams from storm water, CSOs, and other diffuse sources. The Initiative covered the entire City, as well as portions of watersheds in DeKalb, Fulton, Gwinnett, and Clayton Counties that contribute to the streams traversing the City.

The West watersheds are tributary to the Chattahoochee River, and encompass approximately 194 square miles. The East watersheds include the South River and its tributaries down-stream to the point where the South River crosses underneath I-285, and encompass approximately 41 square miles. Figure 1 shows the study area and major corporate boundaries.

**Public Involvement and Education.** The City of Atlanta Division of Wastewater Services (DOWS) recently embarked on an effort to involve the public in its significant projects and ongoing activities. The public involvement activities include coordination with neighborhood,



**Figure 1. Study area.**

environmental, and business groups; focus groups for specific project activities; newsletters on DOWS activities; and many others. Because Atlanta residents' everyday activities greatly affect these watersheds, public involvement and education were deemed critical to the Urban Watershed Initiative.

## IMPLEMENTATION

**Project Approach and Results.** The Urban Watershed Initiative included the following major components:

- Public involvement/education
- Existing data collection
- Habitat assessment
- Biological assessment
- Pollutant load analysis
- Impacts assessment
- Alternatives analysis
- Watershed management plan

The consultants for the East Watershed Initiative are CH2M HILL and Khafra Engineers. The consultants for the West Watershed Initiative are W.L. Jordan and Camp Dresser & McKee.

The approach uses information on the habitats, the biological communities observed, and the estimates of pollutant loads to identify the most important factors impairing the streams. In this manner the options for improving the streams can be selected and evaluated in the most efficient and effective manner. The result is a

watershed management plan that integrates habitat improvement, biological improvement, and reductions in pollution.

In the following sections each of the major components will be briefly described, along with some preliminary results from the effort.

**Public Involvement/Education.** In addition to the ongoing public involvement activities that DOWS performs, a Steering Committee was formed for the Urban Watershed Initiative. The purpose of the Steering Committee is to provide the overall direction for the initiative by developing the goals and objectives for the effort. The Steering Committee also serves as a communication link between the constituencies represented and the DOWS. The Steering Committee includes members from many groups including:

- Atlanta Chamber of Commerce
- Atlanta Planning Advisory Board (APAB)
- Atlanta Regional Commission
- DeKalb Civic Coalition
- DeKalb County
- DOWS
- Environmental Protection Agency (EPA)
- Fulton County
- Georgia Environmental Protection Division
- Greater Atlanta Developers Council
- Jackson Lake Homeowners Association
- Safely Treating Our Pollution (STOP)
- Sierra Club
- U.S. Army Corps of Engineers
- Upper Chattahoochee Riverkeeper
- West Point Lake Association

Technical Committees have also been formed to work on the details of the initiative. Committees have been formed to work with the DOWS and consultants concerning public education, water quality, and geographic information systems (GIS). The technical committees meet more frequently, receive more detailed information, and provide more technically focused direction than the Steering Committee.

In addition, DOWS has incorporated information on the watershed initiative into existing information mailouts. A watershed initiative newsletter was created, and is distributed throughout the area. Currently an information update specific to each City Council district and state legislative district is being created to summarize watershed activities and information in a manner responsive to elected officials' needs.

**Existing Data Collection.** The consultants gathered and summarized existing water quality, hydrologic, hydraulic, land use, system operation, and other data for use in the initiative.

**Habitat Assessment.** Detailed habitat assessments were performed at approximately 50 sites in the West Watershed and 40 sites in the East Watershed. The habitat assessments included field surveys of the sites, photographs, and completion of detailed habitat characterization forms. The results were cross-checked for quality control by the various survey teams.

The results were summarized in tabular format for use in the impacts assessment. The results indicate that many stream segments are heavily impacted by sediment, erosion of banks is common, and the riparian area along the stream has been disturbed in many cases. Litter and debris also is a significant aesthetic problem. Several illicit discharges were identified and reported.

However a number of good habitat areas were identified that show promise for the future of the watershed. For example, on Intrinishment Creek, which flows adjacent to a landfill, the habitat quality was good because of the runoff controls (i.e. detention ponds) required to keep sediment from entering the stream. And the upper reaches of Nancy Creek show good habitat quality in spite of Perimeter Mall upstream.

**Biological Assessment.** Biological sampling was performed at 11 sites in the East Watershed, in addition to two reference sites on the Little Towaliga River (north of Macon). The reference sites also served as references for the East Watershed habitat assessment.

Benthic macroinvertebrate sampling was performed at all sites using a modified rapid bioassessment protocol (Plafkin, et. al. and Georgia DNR). Fish sampling was performed at four sites in the East Watershed and at one of the reference sites. Biological sampling was not included in the original West Watershed scope, however a limited amount of biological data from previous sampling efforts was available. A biological sampling effort similar in nature and magnitude is planned, contingent on funding, for the West Watershed.

The results from the biological assessment in the East Watershed were presented to the Water Quality Technical Committee on February 11, 1997. The preliminary results showed few sensitive macroinvertebrates. All benthic sampling stations were categorized as moderately or severely impaired, with percent comparability to the appropriate reference stations ranging from 33 percent to 5 percent.

Concerning the fish sampling, the Index of Biotic Integrity (IBI) score for the reference station on the Little Towaliga River was 56 (excellent). Seventeen species were collected representing a range from high level predators (redeye bass and grass pickerel) to bottom feeders (flat bullhead and striped jumprock). The South River sites both received scores of 26 (very poor-poor). On the South River the predators were lower level (redbreast and green sunfish). The Intrinishment Creek sites were not scored because only two fish were collected at one site and none at the other.

Fish tissue was also analyzed with respect to FDA action levels and EPA screening levels. All concentrations at study and reference sites were well below these levels. Interestingly, the levels closest to the EPA screening values were for the predators at the reference site (0.36 mg/kg mercury compared with an EPA screening value of 0.6 mg/kg). Mercury was not detected in any of the fish tissue samples in the East Watershed. However the predators in the reference site were higher level, and therefore provided greater opportunity for bioaccumulation.

**Pollutant Load Analysis.** The pollutant load analysis is driven by land use. Land use and impervious surface dictate the volume of runoff generated during rainfall events as well as the concentration of the pollutants in the runoff. ARC land use GIS coverages were used to model land use for each watershed area. Event mean concentrations (EMCs) were developed for each land use type and parameter based on actual storm water monitoring data from the Atlanta region.

Storm water simulation models were then used to develop annual and event runoff volumes. These volumes were applied to the EMCs to develop pollutant loads for each subwatershed. Combined sewer areas were modeled separately to determine overflow volumes, and unique EMCs were developed based on monitoring data specific to each CSO. Pollutant loads were also estimated for base flow in the streams.

**Impacts Assessment.** The impacts assessment combines the results of the existing data, habitat assessment, biological assessment, and pollutant loads analysis. The observed impacts are characterized and correlated to a combination of the known stressors in the assessment and the regulatory framework.

Concerning pollutant loads, CSOs are the largest source of fecal coliforms. However base flows indicated elevated levels as well, identifying a need for additional investigation of illicit discharges. Other pollutants (organics, nutrients, metals, etc.) are relatively evenly distributed among pollutant sources. In addition, the estimated pollutant

loadings in the basin are consistent with observed water quality.

The evaluation of existing water quality data revealed that fecal coliform standards are exceeded throughout the watershed, during both dry and wet weather periods and upstream and downstream of CSOs. Zinc criteria are also exceeded during some wet weather events both upstream and downstream of CSOs. However other criteria exceedances were not consistently observed. For example, the dissolved oxygen standard is met consistently.

The evaluation of aquatic life and habitat revealed that habitat conditions range from poor to excellent. However severe biological impairment (benthos and fish) was observed at all stations sampled. Severe habitat degradation (erosion and sedimentation) was a primary contributor at many sites, yet even sites with excellent or good habitat showed biological impairment. The results indicate that some impairment is due to water quality, particularly poor quality base flow conditions exacerbated by episodic spills, leaks, and dumping.

Because of the nature of the dry weather impacts, the city is developing a near term priority plan to help track down and remove illicit connections, educate citizens and business concerning dumping to streams and storm drains, reduce litter and refuse, and improve and protect habitat and riparian areas.

**Alternatives Analysis.** Based on the results of the impacts assessment, options for improving the streams can be efficiently developed. The alternatives will be evaluated based on the criteria developed by the Steering Committee, and the potential improvements as indicated by the impacts assessment.

Because all of the observed impacts in the East Watershed were so severe, moderate impacts are lacking that would assist in developing quantitative relationships between indicators and improvements. For example, statistical relationships could be developed relating habitat scores to biological indices, allowing optimization of improvements. Other potential indicators include pollutant loading rates per unit area for key pollutants such as sediment, metals and nutrients.

The city plans to perform a similar impacts assessment on the much larger West Watershed, which would provide a greater range of habitat and biological conditions and facilitate developing the desired relationships.

**Watershed Management Plan.** The recommended alternatives will be integrated into a watershed management plan. The purpose of the plan is to focus and coordinate activities in the watersheds to improve the streams. The

plan will also allow planning for long-term capital improvements and effective monitoring of streams for problems and improvement.

## CONCLUSIONS

The City of Atlanta's Urban Watershed Initiative is designed to address the health of streams on a watershed basis. In this manner the solutions developed are more effective, efficient, and less costly, because they focus on the greatest opportunities for real improvement. The initiative provides an opportunity to significantly improve water quality and the viability of our streams and rivers.

Because urban streams are affected by so many different factors, a public involvement and education program is critical to the initiative's success. The Steering Committee and technical committees provide the input of stakeholder groups and the general public in performing the work. These groups are the key to the successful implementation of the resulting watershed management plan.

## ACKNOWLEDGMENTS

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