

SUSTAINABLE WATER RESOURCES MANAGEMENT BY GEORGIA UTILITIES: CLAYTON COUNTY WATER AUTHORITY

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Abstract: CCWA utilizes a comprehensive approach to managing the county's limited water resources. Integrating water reclamation, water production, and watershed management provides a sustainable process that protects water resources in a cost efficient manner. Through the development of twenty year Master Plans strives to meet the future needs of our customers and maintain a high quality water resource to become a sustainable utility. Drinking water is taken from local water bodies, recaptured, treated and returned in a manner that provides additional environmental benefits and can be recycled for future use as potable water.

INTRODUCTION

Sustainable can be defined as "to keep in existence or maintain" and when related to a living organism it can mean "to supply with necessities or nourishment; to provide for." Both of these definitions can be applied to the management of water utilities because clean water supplies in adequate amounts are necessary to sustain man and industry and to provide for the long term it must be kept in existence or maintained. From a resource management or environmental perspective, sustainability usually refers to the wise use of the resource without diminishing its value to man and the natural environment.

At the Clayton County Water Authority (CCWA), we believe this means managing our water resources as a single resource that is used for many purposes. We accomplish this in a sustainable manner by developing 20 year Master Plans to address future community and environmental needs.

Clayton County lies in the southern portion of the rapidly growing metro Atlanta area. The world's busiest airport, Hartsfield-Jackson Atlanta International Airport lies in the northern end of the County. Clayton County's population exceeded 236,000 in the 2000 census. Clayton County continues to grow along with the remainder of the metro Atlanta area. Additional raw water withdrawals and increased wastewater discharges are more and more difficult to obtain in the Atlanta area because of limited supplies and tri-state water conflicts between Georgia, Alabama and Florida.

Clayton County Water Authority's (CCWA) 2000 Master Plan identified constructed wetlands for water reclamation and indirect potable reuse as the preferred method of managing our limited water resources in the future. This alternative will provide additional wastewater treatment capacity, improve the quality of our reclaimed water and reduce the maintenance and operations burden of spray irrigation land application. Constructed wetlands provide the advantages of requiring less land for treatment, greatly

reduced operations and maintenance costs, and continued reliance on natural systems for high quality water reclamation. CCWA will expand and upgrade all four of our water reclamation facilities and add constructed wetlands at two locations that will discharge to existing drinking water reservoirs. Advanced disinfection has also been added to each of CCWA's water production plants (WPPs) to insure the safety of our water supplies.

CCWA has a 20 year history of indirect potable reuse in connection with one of the country's first large forested land application systems for treated wastewater disposal. Over 2,500 acres of forested land have been irrigated with treated wastewater since 1980 in the upstream portion of one of CCWA's drinking water reservoirs. This activity significantly increased the yield of this watershed and supplemented raw water supplies during periods of drought.

CCWA's watershed and stormwater management program is integrated throughout the water and wastewater treatment systems. Through stream restoration, environmental monitoring, and public education, CCWA is able to protect our drinking water sources and sustain our utility and water resources for the long term.

PLANNING FOR SUCCESS

Since it's inception in 1955, the CCWA has been developing Master Plans to insure water and wastewater services were developed in an efficient manner to meet our customer needs. As time has progressed, CCWA has understood the need to protect the limited water resources in the County not only for our customer needs but for the health of the resource itself. The most recent Master Plan, prepared in 2000, provided a capital improvement blueprint for the next twenty years and highlighted the need for watershed protection and stormwater management. The development of these plans and the determination to stick to the plan has made CCWA a successful, award winning utility. CCWA provides water for one of the most densely developed Counties in the State while being geographically small and located along the subcontinental divide at the upstream end of watersheds (Figure 1). This means there is great demand on a very limited resource.

In the late 1970's, CCWA had to deal with the knowledge that their treated wastewater discharge along with others in the upper end of the Flint River basin were having a very negative effect on the Flint River. The CCWA planning process identified land application of treated wastewater in a watershed that contained its only raw water reservoir as the best way to improve water quality in the Flint River and supplement raw water supplies for a growing urban county. Significant improvements were realized in the Flint River as a result of this and the removal of other treated

wastewater discharges. The Flint River improved to the extent that it could serve as an additional raw water supply source for the County.

provide a long term water supply while protecting and enhancing our natural environment.

CONSTRUCTED WETLANDS FOR WASTEWATER TREATMENT

Constructed wetlands have become a widely used technique for treating and recycling wastewater that also provides wildlife habitat and recreational opportunities (U.S. EPA, 1993). Wetlands utilize numerous natural processes to remove pollutants involving sun, wind, soil, plants and microorganisms (Figure 2). According to Kadlec and Knight in their comprehensive textbook on treatment wetlands the residual pollutants remaining in pretreated wastewater “become a resource for the wetland biota, which transforms these raw materials into biomass, new soil, or harmless atmospheric gases” (Kadlec and Knight, 1996). Wetland performance for wastewater treatment is well documented with one of the best data sources being the North American Treatment Wetland Database (NADB, 1993) created for the U.S. EPA. A summary of average annual outflow concentrations are listed below in table 1.

Wetlands for wastewater treatment can be grouped into three general categories:

- 1) restoration of natural wetlands;
- 2) subsurface flow constructed wetlands; and
- 3) surface flow constructed wetlands.

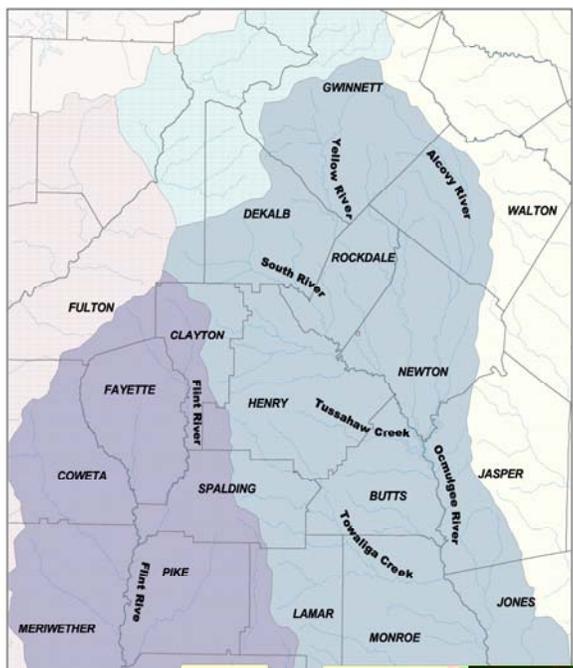


Figure 1. Clayton County watershed setting.

The development of the 2000 Master Plan included a realization that watershed and stormwater management needed to be a key aspect of the plan even though these activities had been handled in a limited manner by the County’s development and zoning departments. In association with permit renewals and modifications, the CCWA conducted comprehensive watershed assessments of the County’s watersheds and water resources. This process confirmed that the water resources in Clayton County were limited and significantly impacted by urbanization. Some streams were already on the State’s listed of impacted waters (303d list) and most of the streams in the more developed northern half of the County were not meeting the biological and habitat criteria for the “fishing” designation. In response to these findings, a water quality improvement plan was developed by walking and inventorying over 90 miles of streams in Clayton County. The plan identified the most impacted streams and then improvement plans, including stream restoration, were developed to address the most significantly impacted streams.

The 2000 Master Plan also identified a significant shift in the Water Authority’s approach to water reclamation. Treatment wetlands were identified as the best alternative for continuing the Authority’s reliance on natural treatment systems while improving our operating efficiencies and minimizing capital costs compared to other alternatives. Plans were developed to transition from land application to discharge into constructed treatment wetlands and then back to CCWA raw water reservoirs for later use as drinking water supplies. The 2000 Master Plan provided a sustainable approach to managing water resources in Clayton County to

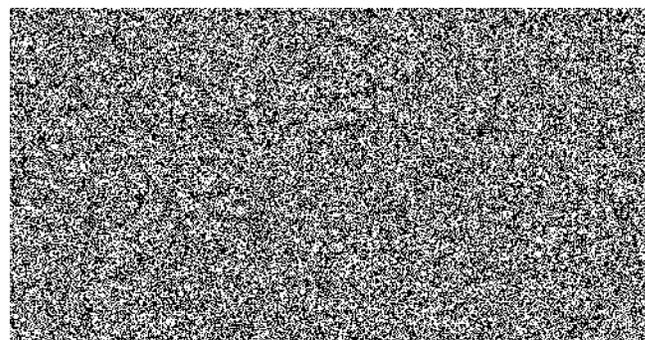


Figure 2 – Wetland Treatment Processes.

Table 1 – Long-Term Average Annual Outflow Concentration (mg/l) for Lightly Loaded Surface Flow Wetlands in the NADB.

LOCATION	BOD ₅	TSS	NH ₄ -N	Total N	Total P
Eastern Service Area, FL	1.2	3.0	0.07	1.45	0.09
Iron Bridge, FL	2.0	2.8	0.18	0.95	0.08
Bear Bay, SC	1.9	2.7	0.27	2.35	0.40
DesPlaines, IL	-	5.2	0.03	1.34	0.02
Hidden Lake, FL	3.0	13.0	0.05	0.66	0.16

*Data from NADB, 1993 as summarized in Table from “Treatment Wetland Conceptual Plan,” CH2M Hill, 2000

The Authority chose to construct surface flow wetlands as a final polishing step for reclaiming treated wastewater. These wetlands are constructed to allow a shallow layer of water to flow across the surface through densely growing wetlands vegetation. Intermittent deep water zones help to distribute the water evenly and minimize short-circuiting. However, the surface area of deep zones is minimized to prevent the production of solids (algae, duck weed, etc.).

Constructed wetlands offered a natural treatment system that required less land and much lower maintenance and operation costs. It requires approximately 100 acres of land to spray irrigate 1 mgd of treated wastewater, while surface flow constructed wetlands can treat 1 mgd on 15 to 25 acres of land depending on the desired effluent quality. This provided the option of utilizing the Authority's existing Huie Land Application System (LAS) and converting portions of the site to constructed wetlands, increasing our capacity up to 4 times that of the original area. The first phases of construction include converting enough area to wetlands to provide 15 mgd of wetlands treatment capacity and keeping enough of the LAS in service to provide 9 mgd of treatment. This will allow the Authority to increase treatment capacity by 4.5 mgd without purchasing additional property.

Constructed wetlands do require higher levels of pretreatment than land application systems to meet wasteload allocations for receiving streams. The three Authority water reclamation facilities that will discharge to constructed wetlands have all been upgraded and expanded. The Shoal Creek plant was upgraded and expanded from 2.1 mgd to 4.4 mgd and the LAS site is being completely replaced by constructed wetlands treatment. The discharge from these wetlands will be captured and pumped to a nearby Authority reservoir. The Panhandle Road wetlands treatment system was constructed on a sloping site with 22 wetland cells and three separate flow paths (Figure 3). This allows for the flexibility of shutting a flow path or wetland cell down for maintenance if needed.

Indirect Potable Reuse

Upon completion of all proposed treatment wetlands, the Authority will be reclaiming up to 20 mgd of water through our constructed wetlands and recycling this water to our raw water reservoirs for

Figure 3. Aerial view of Panhandle Road constructed wetlands facility.

eventual use as drinking water, this is referred to as indirect potable reuse. The Authority has taken a number of steps to insure that we are providing the safest drinking water possible while making efficient use of existing supplies.

CCWA has a 20 year history of indirect potable reuse in connection with one of the country's first large forested land application systems for treated wastewater disposal. Over 2,500 acres of forested land have been irrigated with treated wastewater since 1980 in the upstream portion of one of CCWA's drinking water reservoirs. This activity significantly increased the yield of this watershed and supplemented raw water supplies during periods of drought. A yield study prepared for the Water Authority's Blalock reservoir downstream of the land application system demonstrated that up to 70% of the reclaimed water applied to the site through irrigation returned to the reservoir as stream

flow (Law Engineering, 1998). The Water Authority's 2000 Master Plan approach to water reclamation created the opportunity for increasing indirect potable reuse. This is an especially valuable alternative because of the probability that future increases in raw water withdrawals will be very difficult to obtain. The Authority's approach to evaluating and developing a plan for indirect potable reuse included the following steps:

- 1) Identifying appropriate water reclamation technologies for indirect potable reuse;
- 2) Review of plans by independent industry experts and regulatory agencies;
- 3) Enhancing drinking water treatment facilities;
- 4) Developing plans to protect existing raw water supplies through watershed protection;
- 5) Developing and implementing appropriate water quality monitoring programs;
- 6) Developing and implementing public relations and educational programs.

Wastewater is treated in an advanced secondary mechanical treatment facility and then discharged to treatment wetlands or land application sites. The discharge from these facilities then flows or is pumped to one of the Authority's raw water reservoirs. The wetlands and land application system provide an environmental barrier between the plant discharge and the water source.

The Water Authority has taken steps to improve treatment at our drinking water plants as well. Advanced disinfection facilities utilizing ultraviolet light have been installed at all three water plants in addition to the traditional chlorination disinfection facilities. This was one of the first applications of its kind at a drinking water facility in the U.S. and also acts as an additional treatment barrier for reclaimed water. The Water Authority also conducts extensive surface water and distribution system monitoring for water quality including evaluating the presence of exotic or difficult to detect organic compounds and has found no cause for concern. CCWA is also participating in several research projects related to drinking water quality and some of the newer pollutants of concern including endocrine disruptors and pharmaceutical compounds.

WATERSHED AND STORMWATER MANAGEMENT

A final piece of the water resources management puzzle is protecting the water quality and habitat in our water supplies through a comprehensive watershed and stormwater management plan. Healthy, clean streams are not only important for our natural ecosystem but also mean less treatment costs and water quality concerns for water treatment. CCWA worked with the County and the six Cities in the County to develop a comprehensive watershed management plan. A result of the plan was a four-pronged approach:

- New development controls – zoning, development criteria and stream buffer requirements are among the devices used to address new development;
- County-wide programs – greenspace purchases, public education, and household hazardous waste collection are some activities that fit into this category;

- Restoration of streams that are already significantly impacted either from a water quality or biological perspective; and
- Comprehensive water quality and biological monitoring to evaluate progress or identify problems.

Significant progress has been made in all these areas. CCWA just completed its second stream restoration project and almost a mile of significantly impacted stream has been improved and should result in improved biological conditions, water quality and lesser streambank erosion.

CCWA is also in the process of adding stormwater management to its responsibilities, having signed an intergovernmental agreement with the County to take responsibility for all stormwater management functions, both water quality and quantity issues. This is appropriate as the State utilizes the NPDES permits held by the Authority to enforce stormwater management and water quality requirements. It is also appropriate that the agency most concerned with water resources would take the lead in this initiative. CCWA is in the process of developing a stormwater utility fee that will equitably fund stormwater management and watershed protection activities.

CONCLUSION

The CCWA's approach to water resources management is to take a holistic approach to managing water as a single resource whether dealing with stormwater, wastewater or drinking water. This approach has led to the development of a sustainable plan for the management of the County's limited water resources in a way that maximizes benefits for all stakeholders.