VULNERABILITY AND LONG-TERM SUSTAINABILITY OF SURFACE WATER IN THE STATE OF GEORGIA

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Abstract. Rising demands for surface water for irrigated agriculture, domestic (municipal) consumption, and industry are forcing stiff competition over the allocation of Georgia's scarce surface water. Population continues to grow in Georgia, and as a result, over-use and pollution of the State's surface water supplies are also taking a toll on the natural environment and pose increasing risks for many species of life.

Accordingly, over the past five years, concern about the vulnerability and long-term sustainability of surface water has increased across the State. The surface water vulnerability includes water quantity and quality issues. Long-term sustainability means that enough water is available, with appropriate water resources planning and management, to support ecosystems and human populations over time, and that the supply of water is naturally replenished.

This paper explores the issues of surface water vulnerability and how we can avoid surface water allocation crisis if appropriate policies and strategies are formulated and acted on. In order to avoid catastrophe over the long term, it is highly important to consider not only managing the State's water resources better but also managing demand better.

INTRODUCTION

In recent years, beginning with initial attempts by such special interest groups as the ecologists, the surface water allocation process has undergone a dramatic change. All interested parties, including those expressing a concern for future generations, have demanded not only the right to be heard, but also that the State's surface water allocation process itself be the one best adapted to arrive at a result which would balance fairly the competing interests of all groups.

Over the past three years or more, I have had a unique opportunity to participate in many decisions in which surface water allocation has come directly into conflict with the interest groups. Needless to say, each of the interest groups is handicapped in its assessment of water development by the lack of what is essential to sound judgement: evidence as to what actually happens after a project is in operation. The overwhelming proportion of studies of water developments is normative. Needs are presented, and plans are outlined and found to be economically and technically feasible. Rarely is there any comprehensive analysis of the full set of consequences of the water development – physical, biological, and social. However, the handicap of lack of evidence is no impediment to confident judgement. What is especially significant about it is that the State's officials never overlook the mounting concern over the environmental matters.

It has now become apparent that the impact of decisions on surface water allocation could determine the long-term sustainability of surface water in Georgia. In the hope that there is a lesson to be learned from my experiences, I have decided to present this paper to reflect some important issues concerning Georgia's surface water resources.

VULNERABILITY OF GEORGIA'S SURFACE WATER

There are no rivers that flow into Georgia. Therefore, the State's water availability directly depends on in-State rainfall to maintain stream-flows and replenish reservoirs and groundwater. The geological formations in the northern half of the State have prevented any significant quantities of groundwater from being available as typical wells produce from 12 to 15 gallons per minute (gpm) up to 100 gpm. However, in the southern half of the State, on the Coastal Plain, typical wells produce 1,000 to 1,200 gpm of high quality water. Consequently, water users in North Georgia depend mostly on surface water while almost all the water users in South Georgia depend on ground water for water supply. This implies that the northern half of Georgia has limited surface water because the headwaters of the State's major rivers are located there.

The rapid population growth of Georgia is stressing the State's surface water resources. The northern half of the State must meet the water supply needs of a rapidly growing population in spite of the fact that the supply of surface water is finite. Rapid growth has also increased the amount of treated wastewater (point source pollution) and non-point source pollution entering streams, rivers, and lakes.

Beyond the impact of population growth itself, the demand for surface water has been rising in response to industrial development, increased reliance on irrigated agriculture, and massive urbanization. At the same time, increased environmental awareness is placing more emphasis on maintaining a healthy environment for people as well as nature. Today, the volume of surface water withdrawn for human use and economic activities polluting surface water resources can affect the ability of aquatic ecosystems to survive. The aquatic ecosystems, e.g. wetlands, lakes and rivers, are critical habitats for a variety of threatened species.

Water Quality Issues

The extent to which surface water is vulnerable to pollution is dependent upon the point and non-point sources of pollution. Point sources of pollution (discharges of treated municipal and industrial wastewater) located along water bodies used to be the primary reason for most water quality violations. Today, however, the non-point sources of pollution have the largest impacts on streams, rivers and lakes. Non-point sources of pollution (runoff from impermeable surfaces, fields, and lawns) are the origin of mud, litter, bacteria, pesticides, fertilizers, metals, oils, suds and a variety of other pollutants being washed into streams, rivers and lakes. The quality of Georgia's surface water is evaluated by whether or not it meets established standards and supports designated uses. As required by Sections 305(b) and 303(d) of the Federal Clean Water Act, Georgia's waters are classified into designated uses such as fishing, recreation, drinking water, or wild and scenic. For each water use classification, in-stream water quality standards are used to determine if the waters fully support, partially support, or do not support their designated uses. Accordingly, degraded water quality due to water pollution threatens water supplies, streambeds and aquatic habitats.

Water Supply Issues

Georgia receives on an average about 50 inches of precipitation each year, but not uniformly over time and space, with human demands for surface water being the highest when the rainfall is the least. Metropolitan Atlanta, in North Georgia, is the State's largest population center and has experienced continuous rapid growth, thereby increasing the demand for surface water. In southwest Georgia, growing agricultural irrigation and other uses have driven up surface water demand. Georgia's industrial demand for surface water is already substantial and likely to increase.

Adequate quantities of surface water supply for meeting Georgia's basic demands are a prerequisite for existence, health and economic development. In fact, as economic development increases, in most instances, the demand for water will also increase on a per capita basis for personal, commercial and agricultural purposes. According to Kundell and DeMeo, there are several concerns associated with Georgia's current and future surface water supply interests and these are: 1) factors relating to an increasing demand for water from limited sources specific to Georgia; 2) meeting the projected future water supply demands, which will be increasingly difficult and probably expensive; and 3) apportionment of water among the states for water supply which is under negotiation with Alabama and Florida for the Apalachicola-Chattahoochee-Flint (ACF) and with Alabama for the Alabama-Coosa-Tallapoosa (ACT) River basins. The interstate compacts could set the limits on the amount of water that will be available from these river basins to meet water supply needs for parts of northern and southwestern Georgia. Regardless of the outcome of the compacts, Georgia faces increasing, and often competing, demands for a limited water supply.

SUSTAINABILTY OF GEORGIA'S SURFACE WATER

Over the past 30 years, water resources management in the State of Georgia has evolved from a relatively straightforward methodology to a complex procedure. This can be illustrated by the planning of a community water supply. Traditionally, the first step was to project the needs of the population and industry for water, usually by extrapolating historical trends. The next step was to determine the yield and the quality of various surface water sources. This process involved not only the application of formulas but also much engineering judgement and experience, with the least-cost solution being adopted. Historically, the municipal and county governments had been able to accomplish water resources management on their own.

However, in order to guarantee sustainable surface water supply and environmental quality, surface water resources management is now broadly based. Instead of focusing on a single project to meet a specific defined requirement, all needs and opportunities for water resources development are considered on a river basin basis. A river basin can simply be defined as the entire tract of land area drained by a river and its tributaries. There are 14 major river basins in the State of Georgia, namely, Altamaha, Chattahoochee, Coosa, Flint, Ochlockonee, Ocmulgee, Oconee, Ogeechee, St. Marys, Satilla, Savannah, Suwannee, Tallapoosa and Tennessee River basins.

Evaluation of the surface water resources of a river basin requires a determination of the general characteristics of the basin. All available data on the climate, hydrology, ecosystem and topography of the basin are used to determine water availability. The type of industrial, agricultural, and residential development and the predicted growth rates are necessary information. An evaluation of the natural resources of the river basin and the impact of their development on the hydrology and economy of the basin are additional requirements. Accordingly, Georgia is unique in terms of water resources and environmental permitting in that it has a very centralized permitting process under the Department of Natural Resources/ Environmental Protection Division (EPD). The EPD's authority to allocate surface water withdrawals is a commonly used and effective mechanism for requiring water conservation and drought contingency plans from every municipal or industrial surface water withdrawal permit applicant. The enforcement of the water conservation plan insures that a user is actively trying to reduce water use while the enforcement of the drought contingency plan insures that the user is prepared to react to a drought.

Increasing water demand from ever-growing population and unpredictable climate change has the potential to exacerbate surface water resources stress. Management techniques, particularly those of integrated river basin management, can be applied to changing surface water availability and thus lessen vulnerabilities. The geographical and hydrological area is the point of reference for integrated river basin management (IRBM). The IRBM is a response to conventional resource management, and is assumed advantageous if compared to traditional sector based decision-making. Three features are considered essential for IRBM:

1. IRBM is watershed-based, and it manages natural resources as they relate to their socio-economic environment.
2. IRBM relies on cooperation, partnership and negotiated conflict solving between different political jurisdictions, stakeholders and the public at large.
3. IRBM intends to generate a common understanding of problems and a consensus for action in order to find development options that are ecologically, economically and socially accepted.

Potential adaptive responses to IRBM include both supply-side (i.e., changes in surface water supply) and demand-side (e.g., differential pricing, public awareness campaigns, and statutory requirements) approaches and would offset some, but not all, of the impacts on water users and aquatic ecosystems. Other frequently identified adaptation responses will include: 1) water conservation measures by all users; 2) greater emphasis on planning and preparedness for droughts and severe floods; 3) expanded efforts at water quality protection from agricultural, industrial, and human wastes; 4) collective monitoring efforts for water quality and quantity and climate; and 5) improved procedures for fair allocation of surface water withdrawals within basins and political jurisdictions, taking in-stream ecosystems into account.

The use of water demand management (WDM), which characterizes a paradigm shift from supply-oriented to demand-driven and demand-responsive approaches, is another key to utilize for mitigating surface water vulnerability and avoiding further damage to aquatic ecosystems. WDM is considered an important option available to reduce stress on the natural resource basis; its objective is to get more use out of already accessible surface water sources (get more out of every drop wherever it is used). It comprises economic instruments (e.g. water pricing, tariff setting, effluent and water withdrawal charges), reduction of unaccounted for water by controlling and repairing leaks in treatment and distribution networks, reuse of municipal treated wastewater, water saving devices, accompanied by public awareness and information campaigns.

Finally, since agriculture accounts for nearly 70% of all the water withdrawn from streams, rivers, and lakes for human use, the greatest potential for conservation lies with increasing irrigation efficiencies. Most irrigation systems waste water. Although some of the water that is lost in inefficient irrigation systems returns to streams or aquifers, where it can be tapped again, water quality is invariably degraded by pesticides, fertilizers, and salts that run off the land. Drip irrigation is one technique that can improve irrigation efficiencies, thus saving water and protecting the land. Drip irrigation consists of a network of porous or perforated piping usually installed on the surface or below ground, which delivers water directly to the root zones of the crops. This technique is very expensive but it keeps evaporation losses low, at an efficiency of about 95% (Postel, S.). Drip irrigation systems cut water use by an estimated 40% to 60% compared with gravity systems (Postel, S.).

CONCLUSION

Balancing the needs of people in Georgia with the capacity of the natural resource base over the long term is a central challenge in surface water resources management. Integrated river basin management of surface water resources coordinates development in a given basin so that individual water development projects do not work at cross-purposes. Water demand management provides a good transition from a supply to a demand-driven approach. The agricultural sector is not only the largest water consumer in terms of volume; it is also the sector with the lowest water use efficiency. The key objectives are to analyze the two management approaches thoroughly as a means to meet the State's future surface water needs and its long-term surface water sustainability.

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