APPLICATION OF RESERVOIR SIZING TECHNIQUES IN GEORGIA

William P. Martello[1] and Pamela S. Burnett[2]

AUTHORS: [1]Environmental Engineer, [2]Water Resources Specialist, Jordan, Jones & Goulding, Inc., Engineers and Planners, 2000 Clearview Avenue, N.E., Suite 200, Atlanta, Georgia 30340.
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Water resource issues have become a significant topic in the 1980's and this is especially true in Georgia. The Georgia Environmental Protection Division ("EPD") has been changing the way it approaches water resource allocations and approvals of reservoir sizing to meet future demands. Numerous methods have been suggested to determine the reservoir storage capacity required to meet a specified demand. All of these methods are based on what is termed the storage equation. Simply put, the amount of required storage is equal to the streamflow into a reservoir minus the system demands. The focus of this discussion will be on the methods used to predict streamflow. It is important to maintain a time sequence of events in these predictions and this can best be done with stochastic hydrology.

Stochastic hydrology provides a means of estimating the probability of sequences of low flow periods during a specified future period of time. Some of the examples of reservoir sizing techniques commonly utilized will be reviewed and a case study will be presented in order to compare the results from these various techniques. The Log-Pearson Method has been recommended for use by federal agencies for flood analysis and was adopted by the United States Water Resources Council in 1967. This method assumes a Log-Pearson Type III distribution of flow events. The recommended procedure is to convert the data series to logarithms and then compute the mean, standard deviation, and skew coefficient in order to compute the values for various return periods.

The Beard Method is a method discussed in "Hydrologic Engineering Methods for Water Development" and attributed to Mr. Leo Beard. This method ranks the minimum recorded flows and then plots the probabilities for low flow events using regression analysis. This method was used by the Corps of Engineers in the "Northeast Georgia Water Resources Management Study."

Another approach to reservoir sizing is to utilize significant drought events. In this method, worst case records of low flow events, such as the 1954/1955 drought in Georgia, are used as the critical design period.

The United States Geological Survey ("U.S.G.S.") has developed an alternate approach in their publication "Storage Requirements for Georgia Streams." This approach utilizes statistical profiles of Georgia streams that are based on regional averages. A series of curves were developed that represented storage required as a ratio to mean annual flow volume. A Gumbel Type I extreme value distribution was the basis for the U.S.G.S. method.

The Sequent-Peak method is more reliable with long flow records and is also commonly used with lengthy synthetic data. It can further be used to simulate actual reservoir performance if adequate streamflow data exists. In this method, the cumulative sums of flows minus demands are calculated. The interval between the initial peak and the lowest trough is calculated as the required storage. This is continued throughout the period of record and the largest value of required storage is determined.

A comparison of the results from these various techniques will be compiled for a case study in Athens, Georgia. The City of Athens obtains raw water from both the North Oconee and Middle Oconee Rivers with drainage basins above the intakes equal to 150 and 400 square miles respectively. The U.S.G.S. maintains a continuous stream gaging station on the Middle Oconee River near Athens and approximately 50 years of data will be utilized in the analysis.