Bathymetric Survey and Sedimentation Analysis of Lago Patillas, Puerto Rico, August 2019

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Abstract

Lago Patillas is a reservoir located in the municipality of Patillas, Puerto Rico. It was constructed in 1914 to provide water for irrigation to the surrounding area. The reservoir has a drainage area of about 66.56 square kilometers (km²) and a conservation pool (Grande de Patillas) and Río Marín Basins. The reservoir was constructed for the irrigation of croplands in the southern coastal plains of Puerto Rico. The reservoir has a surface area of 1.20 km² and a maximum conservation pool elevation of 63.88 m above the Puerto Rico Vertical Datum of 2002 (PRVD02). The reservoir was constructed in 1914, and its storage capacity was 17.64 million cubic meters (Mm³) in 1961. As stated in Soler-López (2010), the storage capacity was 8.86 Mm³ in 2010. The increase can probably be attributed to sediment infill. The reservoir has been subject to heavy rainfall events, which have led to the transport of large quantities of sediment to the reservoir. This study was conducted in 2019 to update the stage-volume data and to determine the sediment infill rates. The study also aimed to extend the bathymetric survey to include the new conservation pool elevation and to describe the methods used for the sedimentation survey.

Methods of Survey and Analyses

The August 2019 bathymetric survey was conducted by the U.S. Geological Survey using field procedures validated by the U.S. Army Corps of Engineers (USACE). The methods used for the bathymetric survey included the collection of elevation data, mapping, and the compilation of data. The elevation data were collected using a precision survey system (GPS) and a DGPS (Differential Global Positioning System) antenna mounted on a survey vessel. The data were referenced to the Puerto Rico Vertical Datum of 2002 (PRVD02). The survey results indicated that the storage capacity was 8.86 Mm³ in 2010. The increase can probably be attributed to sediment infill. The reservoir has been subject to heavy rainfall events, which have led to the transport of large quantities of sediment to the reservoir. This study was conducted in 2019 to update the stage-volume data and to determine the sediment infill rates. The study also aimed to extend the bathymetric survey to include the new conservation pool elevation and to describe the methods used for the sedimentation survey.

Storage Capacity: Sedimentation Rate, and Estimated Time to Zero Resource Storage

The reservoir capacity of Lago Patillas in 1961 was 17.64 Mm³, and the storage capacity was 8.86 Mm³ in 2010. The increase can probably be attributed to sediment infill. The reservoir has been subject to heavy rainfall events, which have led to the transport of large quantities of sediment to the reservoir. This study was conducted in 2019 to update the stage-volume data and to determine the sediment infill rates. The study also aimed to extend the bathymetric survey to include the new conservation pool elevation and to describe the methods used for the sedimentation survey.

Uncertainties in the Sedimentation Survey

The uncertainties in the sedimentation survey may be attributed to the accuracy of the elevation data, the precision of the survey system, and the methods used for the sedimentation analysis. The accuracy of the elevation data may be affected by the terrain, the water depth, and the weather conditions. The precision of the survey system may be affected by the survey vessel's movement, the surveyor's experience, and the equipment's maintenance. The methods used for the sedimentation analysis may be affected by the sediment characteristics, the sample collection, and the laboratory analysis. The uncertainties in the sedimentation survey may be reduced by improving the accuracy of the elevation data, the precision of the survey system, and the methods used for the sedimentation analysis.