

Reservoir Seepage Detection Using Electrical Resistivity Tomography, Ground-Penetrating Radar and Multichannel Analysis of Surface Wave: A Case Study of Lower Huai Muang Reservoir, Chiang Mai Province, Northern Thailand

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Abstract

Geophysical surveys comprising electrical resistivity tomography (ERT), ground-penetrating radar (GPR), and multichannel analysis of surface wave (MASW) were conducted at the Lower Huai Muang reservoir in Chiang Mai province, northern Thailand. This reservoir experiences seepage problems, as it cannot retain water even during the rainy season. The geophysical surveys were employed to identify seepage locations and their causes. All geophysical surveys were conducted on the flat surface of the dam ridge to investigate its dam core and basement. Additionally, two ERT surveys were conducted in the reservoir floor area and across the main channel of the watershed to investigate subsurface geology in combination with geological surveys. The results of all geophysical surveys indicate that the dam core of the Lower Huai Muang reservoir is in normal condition. However, the main issue is located in the basement of the dam ridge beneath the dam core. The ERT and MASW sections show high resistivity values and low shear wave velocities (V_s), respectively. These findings suggest the presence of loose material or cavities within the basement. This interpretation aligns with the geological data in the area, which consists of unconsolidated sediment. Furthermore, the ERT surveys conducted in the reservoir floor area and across the main channel of the watershed confirm that the unconsolidated sediment layer may have a thickness exceeding 47 meters beyond the maximum investigation depth. The high permeability of this unconsolidated sediment layer could be causing the reservoir's inability to retain water effectively. In this study, the geophysical results provide valuable information about the dam's seepage locations, which is crucial for the reservoir's remediation.

Keywords: reservoir seepage, geophysical survey, electrical resistivity tomography, ground-penetrating radar, multichannel analysis of surface wave