Electrical Resistivity Tomography for Seepage Detection at Huai Sai Khao Dam, Fai Kaeo Subdistrict, Phu Phiang District, Nan Province

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Abstract

This study employed a 2D electrical resistivity tomography (ERT) survey to investigate seepage detection at Huai Sai Khao Dam, Fai Kaeo Subdistrict, Phu Phiang District, Nan Province. The geophysical survey was conducted along 3 parallel survey lines on the dam crest, spaced 2 meters apart with each line spanning a length of 220 meters. Data acquisition utilized a dipole-dipole electrode array with an electrode spacing of 2 meter. The maximum investigation depth achieved was approximately 17.6 meters. Measured resistivity data were processed and inverted using the AGI EarthImager™ 2D software to generate 2D ERT profiles. These profiles were interpreted in conjunction with local geological data, embankment fill characteristics, and field observations of surface seepage location. The interpretation identified resistivity anomalies across the dam crest that potentially indicate seepage pathways. Notably, the majority of the detected seepage zones were concentrated at the interface between the embankment fill and the dam abutments. The findings of this study provide critical data for the subsequent rehabilitation and reinforcement of the dam structure.

Introduction

Huai Sai Khao Reservoir is an earth-fill dam, built in 1979 as part of a Royal Initiative Project. It showed signs of seepage at its downstream slope during a 2019 inspection. To ensure structural safety and efficient water storage, this study employs electrical resistivity tomography (ERT) to locate seepage zones. The findings will provide crucial data for targeted repairs and dam restoration.

Objective

To investigate potential seepage zones along the crest of the Huai Sai Khao Reservoir in Fai Kaeo Subdistrict, Phu Phiang District, Nan Province, using the ERT method.

Methodology

1. Field Data Acquisition

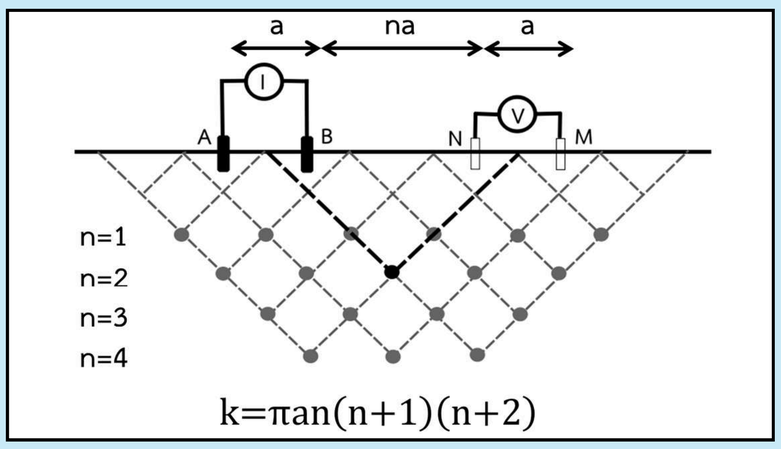


Figure 2. Dipole-dipole configuration.

A, B = Current electrode
N, M = Potential electrode
a = Electrode separation
n = 1, 2, 3, 4, ...
k = Geometry factor

Acquisition Parameters

No. of survey lines	3	
Line length	220	m
Minimum electrodes spacing	2	m

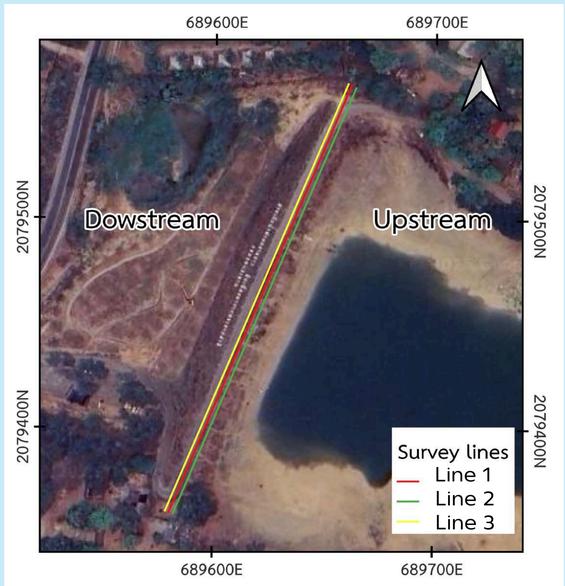
2. Data Processing

Collected data were undergone inversion processing using AGI EarthImager™ 2D software.

3. Data Interpretation

Determine the layer of geologic formation using inverted ERT profiles, geological data, and drilling hole data.

Data Acquisition



Map of ERT lines



Figure 3. ERT survey at Huai Sai Khao Dam.

Study area

Huai Sai Khao Dam is locate on Fai Kaeo Subdistrict, Phu Phiang District, Nan Province.

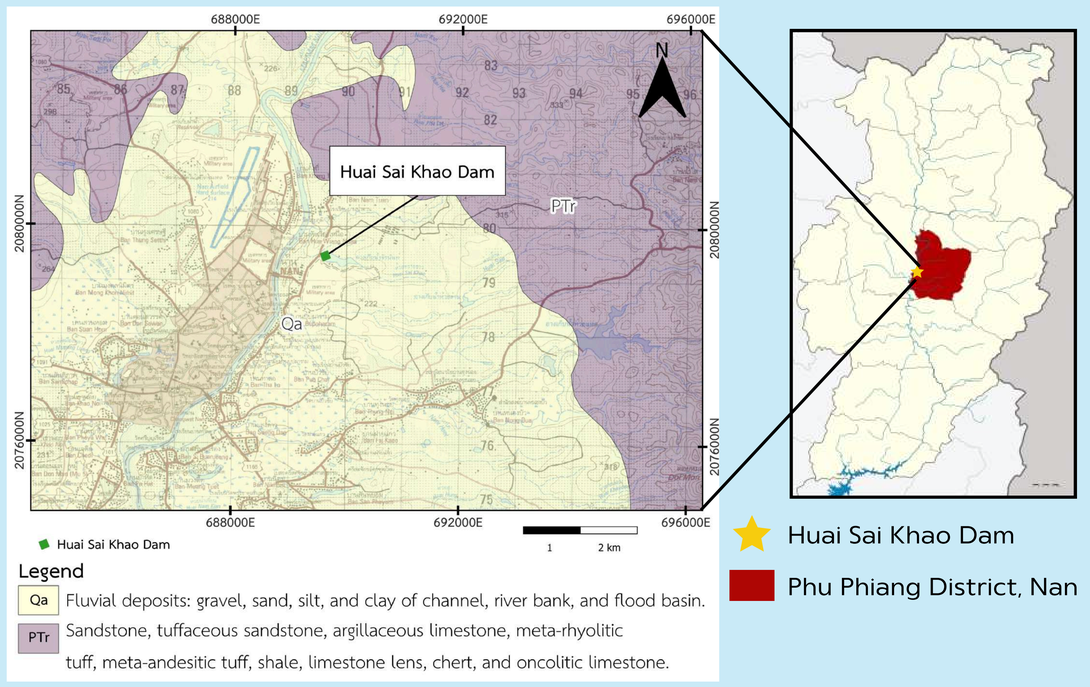


Figure 1. The geologic map of Huai Sai Khao Dam and adjacent area.

Results and Interpretation

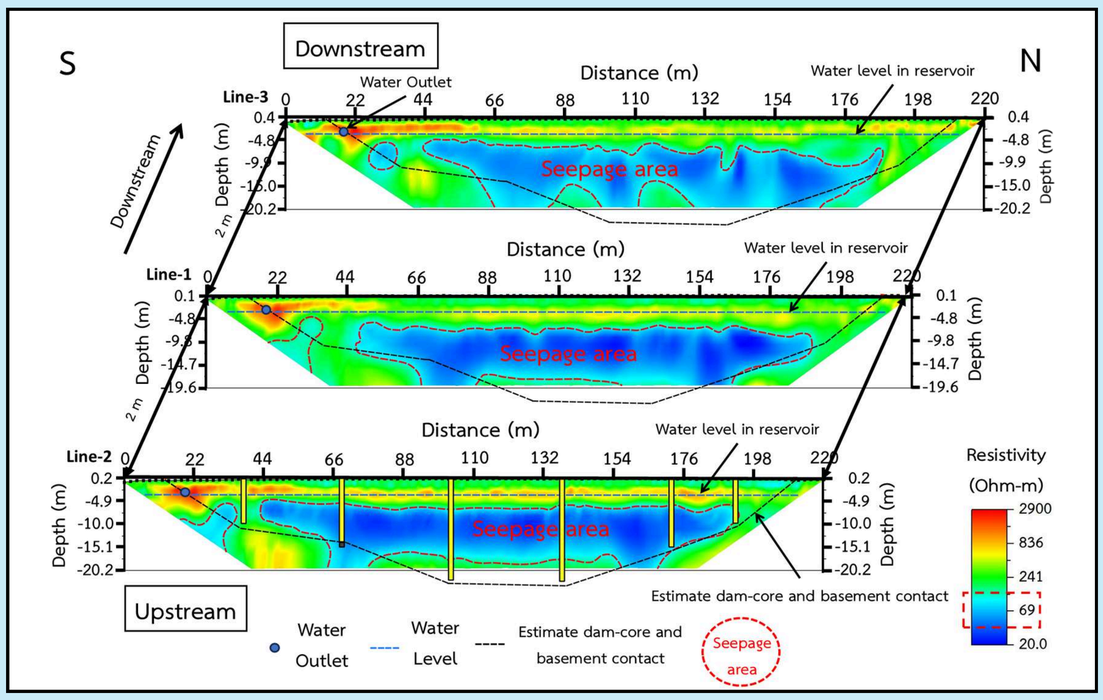


Figure 4. ETR profiles along with interpretation.

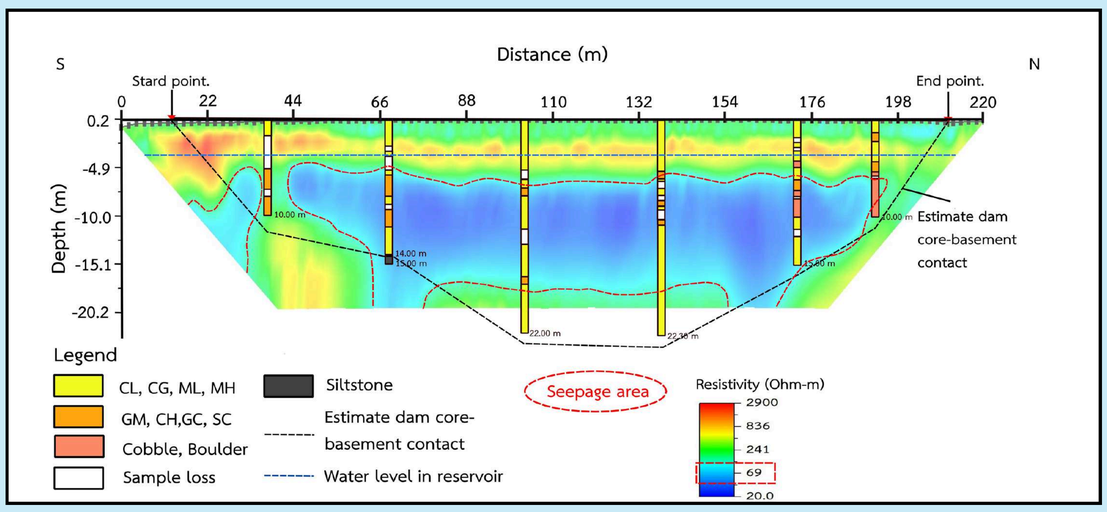


Figure 5. ERT profile of Line 2 along the dam center with boreholes.

Conclusions

The 2D ERT survey successfully identified subsurface resistivity anomalies that may indicate seepage pathways within the Huai Sai Khao Dam. Most potential seepage zones were detected near the interface between the embankment fill and the dam abutments. The results demonstrate that ERT is an effective non-destructive method for seepage detection and provide important information to support dam rehabilitation and reinforcement planning.

References

- Royal Irrigation Department. (2025). *Geological Investigation Report for the Embankment and Foundation of the Huai Sai Khao Reservoir Project under the Royal Initiative, Phu Phiang District, Nan Province*. Bangkok: Ministry of Agriculture and Cooperatives.
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Acknowledgement

I would like to extend our sincere gratitude to Mr. Sumeth Thima for providing valuable information about the Huai Sai Khao Dam, Asst. Prof. Dr. Suwimon Udphuay for his invaluable guidance and advice throughout this study, and 50th Anniversary Geology Fund, Chiang Mai University for financial support.