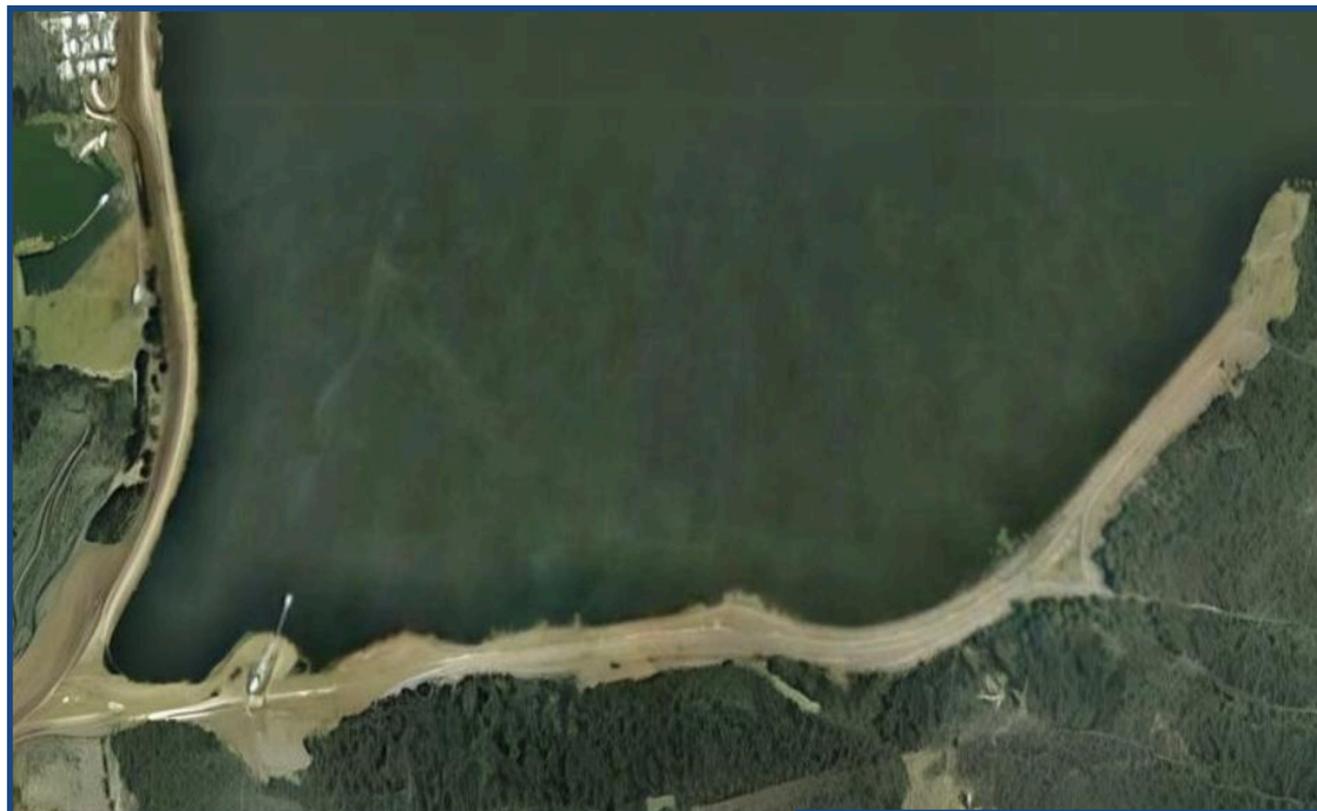


# DAM SEEPAGE INVESTIGATION TO FIND NINE SEEPAGE PATHS ALONG LEAKING DAM

Willowstick LLC



Location of Job Site and Survey

## Introduction

An Australian water utility faced a critical challenge when multiple seep locations were identified along a 4.5-kilometer section of one of its dams. To address the potential risk and ensure the integrity of the structure, the utility sought to gain a clearer understanding of the subsurface conditions contributing to the seepage. Specifically, they wanted to locate the areas where water was passing through or under the dam.

To achieve this, the Willowstick method was employed. This innovative approach involves energizing groundwater with an alternating electric current, which naturally concentrates in water-bearing pathways due to groundwater's higher electrical conductivity compared to surrounding materials. The resulting magnetic field, measured with sensitive instruments in a grid pattern across the surface, provides detailed data used to generate maps and 3D models of preferential water flow pathways.

This case study explores how the Willowstick method was effectively utilized to pinpoint seepage locations, offering valuable insights into the dam's subsurface water dynamics and supporting proactive mitigation efforts.

## SUMMARY

### LOCATION

Australia

### CHALLENGE

Willowstick was tasked with finding dam seepage along a four and a half kilometer dam. We would attempt to identify nine seepage paths that were known but not easily understood.

### SOLUTION

The Willowstick method identified seep zones and non-problematic areas, providing detailed maps and 3D models for informed decisions on mitigating seepage and safeguarding the dam.

### BENEFIT

The Willowstick method provided clear insights into seepage locations, enabling targeted repairs, saving time and resources.

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## Investigative Approach

The MMR method uses electrodes placed upstream and downstream of the investigation area. A low-voltage, low-amperage alternating current at 380 Hz is applied to the reservoir. Because groundwater is more electrically conductive than surrounding soil and rock, the current preferentially flows through seepage paths. This current produces a magnetic field that is measured at the ground surface using sensitive magnetometers.

The data is used to generate 2D maps and 3D Electric Current Distribution (ECD) models that define the location, depth, and orientation of preferential flow paths. The method requires no drilling, no heavy equipment, and no additional site personnel. It has been applied to hundreds of projects worldwide to identify seepage and groundwater flow conditions,

## Data Processing

A predictive model of the magnetic field was first developed to account for electrode placement, circuit configuration, and site topography. Field measurements were then compared to this baseline. By evaluating the differences, a Ratio Response Map was created that highlighted areas of anomalous current flow.

The ratio response data was further processed through inversion modeling to generate a 3D ECD model. This identified subsurface conductive zones, enabling the seepage flow paths to be traced from the reservoir beneath and around the dam to their downstream emergence points.

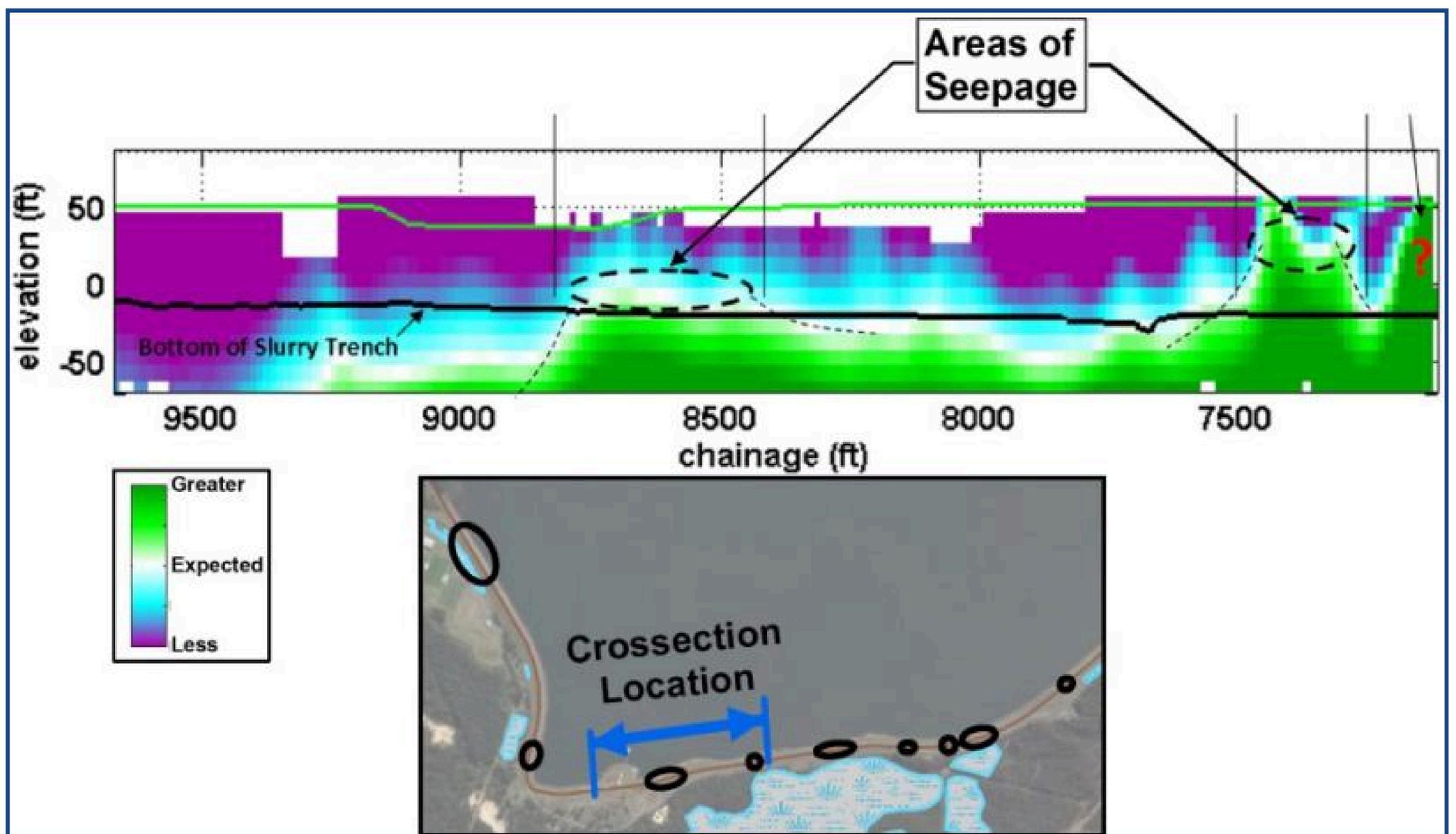


Image of Willowstick v.9 Instrument with Hemisphere GPS

## Conclusion

The Willowstick investigation successfully identified nine distinct seep zones along the dam's embankment, giving the water utility a clearer understanding of the areas where seepage was occurring. Equally important, the investigation also highlighted areas where seepage was not an issue, allowing the client to focus their resources on the problematic zones.

This comprehensive seepage investigation provided the client with valuable new insights and intelligence regarding the subsurface conditions at the site. With this enhanced understanding of the dam's internal water flow dynamics, the utility was able to make informed decisions on maintenance and mitigation strategies, ensuring the long-term integrity and safety of the structure. The data-driven approach, powered by the Willowstick method, proved to be a critical tool in managing the dam's seepage concerns efficiently and effectively.



Conclusion Image



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The logo features a stylized, light-colored graphic of three overlapping, curved shapes that resemble willow leaves or a branch, positioned above the brand name 'willowstick' in a lowercase, white, sans-serif font.