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Use of vertical electrical resistivity profiles to characterize the riverbed of losing-disconnected rivers

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There are few field techniques available to estimate infiltration rates from losing-disconnected rivers, where infiltration rates are often constrained by the presence of clay layers with a low hydraulic conductivity. It is hypothesized that, in this environment, the bulk of the infiltration would occur in 'hotspots' where the clay layer is thin or absent. Infiltration was estimated over a 2 km section of Billabong Creek (Murray-Darling Basin, Australia) using vertical electrical sounding (VES) resistivity to characterize the continuity and thickness of the riverbed clay layer. Both a towed in-river survey over the whole study reach and three fixed array measurements at the shoreline at selected areas were used. Using locations with measured high and low resistivity, the resistivity profiles were constrained by coring the riverbed to measure vertical variations in riverbed texture, porewater content and porewater salinity. The VES showed that the clay layer was continuous along the study reach and varied in thickness between 1 m and >4 m. Using a simple steady-state model, infiltration rates along the study reach were estimated to vary between 1700 and 7800 m^3 km^{-1} $year^{-1}$, with an average of 3400 m^3 km^{-1} $year^{-1}$. This methodology can provide independent estimates of infiltration rates at a scale suitable for the calibration of regional groundwater models.