

## **Effects of Water Saturation on a Resistivity Survey of an Unconfined Fluvial Aquifer in Columbus, MS**

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**Abstract.** An electrical resistivity survey was conducted of an unconfined fluvial aquifer in Columbus, MS. The aquifer is composed of an upper 3 m thick flood plain facies consisting of clay and silty-clay filled channels and silty-sand, and a lower 5 m thick braided stream facies consisting of sandy-gravel. A survey conducted in 2002 imaged the aquifer in a drained state. It was re-surveyed in 2004 when saturated. The geometry and positions of the two surveys are identical, so changes in resistivity are a direct result of aquifer saturation.

The data was inverted to produce cross sections of resistivity in the saturated and drained aquifer. The difference in resistivity shows that water saturation decreases resistivity in the upper flood plain facies by 0 to 600 ohm-m, with the greatest change outside the channels in the silty-sand splay deposits. In the channels, the resistivity remains approximately unchanged. This is attributed to the low permeability of the clay, which does not allow water to enter the channel fill. In the braided stream facies, resistivity increases with saturation by 0 to 1100 ohm-m. The largest increases are in the poorly sorted gravel-bearing deposits.

These results suggest that resistivity images of drained outcrops provide a reliable analog that can be used for interpretation of buried, saturated aquifers. The method is most reliable as a clay indicator and less reliable for poorly sorted deposits. Channel and major lithologic boundaries at this location are well constrained in both the saturated and unsaturated state.