UNCERTANTY ANALYSIS OF FAULTING AND FOLDING ON NEAR SURFACE AQUIFERS

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With advances in near surface geophysical techniques, notably Airborne Electromagnetics (AEM), great strides have been made in mapping near-surface (0-200m) hydrostratigraphy, including aquitards and aquifers. However, an important uncertainty in the mapping of groundwater systems and resource estimation is the potential impact of faults to;

- Generate fault parallel fracture transmissivity;
- Reduce across-fault permeability; and
- Provide connectivity from one aquifer to another across aquitards.

It is vital to differentiate between faults and fault propagation folds associated with “blind faults”. As AEM is an evolving technology a set of criteria based on sound structural geomechanical and structural geologic has been developed to discriminate between faults and folds.

Even with consistent and robust modeling there are fundamental uncertainties that require appropriate modeling using stochastic fault seal analysis. An extensive database of calibrations has been developed for the prediction of liquid hydrocarbon free water levels (FWL). Based on hundreds of hindcasting models FWL can be predicted with better than 10m accuracy.

Despite this high accuracy prediction the juxtaposition area of across fault reservoir vs reservoir juxtaposition can vary by two or three orders of magnitude. The juxtaposition area is a key term in the calculation of across- fault Darcy Flow. Variation in area is strongly nonlinear and dependent on accounting for the thickness of aquitards and variation along strike of fault displacement. It is vital that geologically valid faults are analyzed with the appropriate parameter uncertainty. Examples from the Broken Hill Managed Aquifer Project and the Sydney Basin will be used to illustrate the process.