Quantifying heterogeneity in variably fractured rock using hydrostructural domain approach, Gulf Islands, British Columbia

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A hydrostructural domain approach is used to derive hydraulic properties for the fractured bedrock aquifers of the Gulf Islands, British Columbia, Canada. Domains are defined using fracture intensity and modeled using a stochastic, discrete fracture network-equivalent porous medium (DFN-EPM) approach. Results show that the “highly” fractured interbedded sandstone and mudstone (<10 cm spacing) and fault and fracture domains have greater potential porosity than the “less” fractured sandstone (>1.0 m spacing) domain. The two highly fractured domains have an average permeability of $10^{-13}$ m$^2$ compared to $10^{-14}$ m$^2$ for the less fractured domain. The model results also show a westward decrease in transmissivity, porosity and permeability. This decrease appears to be associated with the hinge line of a large anticline. Independently collected pumping test data confirmed this interpretation. The DFN-EPM approach used in this thesis may have applications to other areas where groundwater resources in fractured rock aquifers are of interest.