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GIS-based models of potential groundwater loading in glaciated landscapes: considerations and development in Lower Michigan

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Abstract.–Biological, chemical, and physical attributes of aquatic ecosystems are often strongly influenced by groundwater delivery. Nonetheless, access to predictions of groundwater contributions to rivers, lakes, and wetlands at a scale useful to resource managers is generally lacking due to the data requirements of current groundwater models. In this paper, we implement and validate a simple, terrain-based approach for predicting groundwater delivery to streams and other surface water systems using mapped data within a GIS environment. Model output was calculated in units of m day^{-1} for every 30 m^2 grid cell across Lower Michigan. Validation of the models was performed by accounting for variance in observed low flow yields (48-54%), summer stream temperatures (23-40%), and rates of channel discharge accrual (59-65%). This modeling approach has been useful in describing spatial variation in groundwater contributions to general patterns of stream flow, thermal characteristics, and biotic communities at hundreds of specific sites across Lower Michigan. Such terrain-based ground water modeling can provide the regional "big picture" perspective many resource managers, planners, and policy makers require.