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INTEGRATED FLOW SYSTEM ANALYSIS IN GLACIATED TERRAIN, SOUTH-CENTRAL ONTARIO

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Water resource management initiatives benefit from an integrated approach where all water-related data, information, geologic/hydrogeologic interpretation/knowledge and analysis tools (i.e. numerical flow models) are readily available within what can be termed an analysis system. This analysis system is then used to develop a conceptual model of the flow system for the area of interest. A key feature of an analysis system, and the conceptual model, is that the components are subject to refinement as new data and information become available. An integrated water resource analysis system, and conceptual model, has been generated for much of south-central Ontario (28,500 km^2; 11,000 mi^2) along the north shore of Lake Ontario.

Similar to many mid-latitude regions globally, south-central Ontario has been subjected to repeated glacial and interglacial cycles leading to a complex three-dimensional arrangement of geologic deposits, and by extension hydrostratigraphic units. The problem of developing the regional hydrogeologic architecture is exacerbated by variable data quality and coverage. Mapping the extent of aquifers and aquitards involves not only interpreting geologic descriptions and environments but also incorporating other information such as groundwater levels, pumping test response, and groundwater chemistry including isotopes and tracers. The determination of hydraulic properties for hydrostratigraphic units is scale dependent and also has scale of application implications. The key geologic settings or environments that occur within the study area include glacial (till), interglacial (glaciolacustrine/glaciofluvial), subglacial (tunnel channel erosion and deposition) and bedrock valleys carved into shale and limestone. Monitoring sites have been established in various geologic settings to understand how these different areas behave hydraulically, and to test and provide calibration targets for numerical flow models.

This paper discusses the development of the study area conceptual model that includes quantifying the three-dimensional geologic and hydrogeologic environment. Key components addressed include the assignment of hydraulic properties, the regional correlation of hydrostratigraphic units, and the use of isotopes and tracers to estimate flow system dynamics.

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