REGIONAL HYDROGEOLOGY OF NORTHEAST ALBERTA

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The hydrogeological study of formation waters in the northeastern part of the Alberta Basin (defined as the area from Twp 70-103 and from Rge 1-25 W4) is based on information from 12,475 wells, 3,187 formation-water analyses and 2,531 drill stem tests. Because the study area, covering approximately 76,000 km$^2$, is located at the feather edge of the basin, local topographic and physiographic features, particularly the Athabasca River system, exert a strong influence on the flow of formation waters in most of the aquifers.

The Lower and Middle Devonian aquifer system, beneath the regionally extensive Prairie Aquiclude, is characterized by topographically-driven flow updip to the northeast. This is opposed by buoyancy forces caused by salinity increase with temperature downdip to the southwest. The post-Prairie Devonian aquifers are characterized by transitional flow regimes. Because of erosion at the sub-Cretaceous unconformity and outcrop at the Athabasca River, local physiographic influences are superimposed on basin-scale regional flow in these aquifers. Inferred hydraulic communication between Beaverhill Lake, Cooking Lake and Grosmont aquifers is caused by Cooking Lake reefs penetrating the intervening shales of the Lower Ireton aquitard. Finally, the Cretaceous aquifers all can be described as having local flow regime characteristics with recharge in topographically high areas and discharge in low regions along the valleys of the Athabasca River system.

The flow of formation waters in northeastern Alberta has played an important role in the distribution of both local gas accumulations and the huge Athabasca oil sands deposits. Aspects of migration, trapping and subsequent biodegradation of hydrocarbons can be linked to the dynamic water system.