

Geophysical Exploration for Water Resources in Buried Valleys in Western Canada

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Most of Western Canada is devoid of extensive regional aquifers. In the Prairie Provinces, while most large cities rely on surface water, smaller municipalities generally rely on groundwater. In such cases, buried valley aquifers are often the only viable source of a large yield groundwater source. Other than municipalities, many mines, power plants, farmers, oil and gas operations, and various industrial facilities also rely on water supplies derived from buried valley aquifers. Most of these aquifers are difficult to identify and delineate. Usually, they are covered by a significant thickness of till varying from 10 m to greater than 50 m, making air photo identification usually ambiguous, and often impossible. Even where the valleys can be approximately delineated from existing borehole information, air photo interpretation, airborne geophysical data, or legacy oil and gas seismic reflection data, most of the valley fill may be silt and clay, and easily accessed information may not be sufficient to identify high yielding aquifers within the buried valleys. This paper will describe the systematic and integrated use of a variety of surface geophysical techniques in exploring for, and delineating buried valley aquifers, including high resolution seismic reflection, time domain EM, fixed frequency EM, electrical resistivity tomography, and moving on-water resistivity streamers. Case studies will be presented from Saskatchewan, Alberta, and British Columbia. Case study applications will include municipal water supply, oil and gas source water, agricultural supply, and mine dewatering.