

Thematic Mapping of Non-Saline Groundwater Quality in the Major Bedrock Aquifers of the Edmonton-Calgary Corridor

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Abstract

The Alberta Geological Survey (AGS) maps and quantitatively inventories non-saline and saline groundwater resources in Alberta. Though there is really only a single groundwater resource in Alberta with gradations of salinity, the AGS program structures its activities based on relative groundwater salinity to ensure a strong linkage between AGS outcomes and Alberta's policy and regulatory framework for groundwater.

In 2008, the AGS, in collaboration with Alberta Environment (AENV), began an inventory of groundwater resources within the Edmonton-Calgary Corridor (ECC). One of the products of this inventory is a series of thematic maps showing regional groundwater quality in the major bedrock aquifers of the ECC.

We assembled more than 20,000 chemical analyses of groundwater within the ECC available from AENV, AGS, the Alberta Research Council and the Energy Resources Conservation Board. Chemical analyses were culled using temporal, sampling interval, and geochemical criteria. We excluded chemical analyses performed earlier than 1980 and chemical analyses of samples collected from wells having open intervals greater than 15 metres. Our geochemical culling criteria were modified from those of Hitchon and Brulotte (1994) by requiring analytical values for all reported constituents (no calculated values), allowing for the presence of carbonate ion in analyses reporting a pH greater than 8.3, and omitting sample density as a culling criterion. Acceptable charge balance of chemical analyses was constrained to greater than or equal to -5% and less than or equal to +5%. We excluded samples having total dissolved solids greater than 4,000 milligrams per litre so as to represent groundwater quality in the non-saline areas of the bedrock aquifers. The culling process retained 4,835 usable chemical analyses for the bedrock aquifers of the ECC.

We created data sets by assigning usable chemical analyses to the major bedrock aquifers of the ECC based on well location and sampling depth. The resulting data sets contain information on groundwater quality within the Paskapoo, Horseshoe Canyon, Belly River, and Bearpaw aquifers. We used these data sets to produce maps showing concentrations of sodium, potassium, calcium, magnesium, chloride, and sulphate, total dissolved solids, total hardness as calcium carbonate, and total alkalinity as calcium carbonate within the upper 50 metres of each major bedrock aquifer. An additional map shows concentrations from 50 to 100 metres depth in the Horseshoe Canyon aquifer.

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References

Hitchon, B. and Brulotte, M., 1994, Culling criteria for "standard" formation water analyses: Applied Geochemistry, 9, 637-645.