

Regional Characterization of the Beverly Channel Aquifer in the Industrial Heartland Area, Fort Saskatchewan, Alberta



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ABSTRACT

The Beverly Channel Aquifer consists of pre-glacial deposits of the Empress Formation with a fining-upward sequence of gravels grading to sands and finally to silts and clays. The pre-glacial Beverly valley occurs over a large area, originating in the Rocky Mountains and trending east towards its confluence with the pre-glacial Helina valley near Cold Lake, Alberta. Where sufficient thicknesses exist, the pre-glacial deposits form an excellent aquifer with yields in the order of 160 to 650 m³/day and fair to good water quality (total dissolved solids ranging generally from less than 500 mg/L to about 1,000 mg/L). The aquifer has been, and continues to be, used as a source of water for domestic, agricultural, municipal and industrial purposes.

In the Industrial Heartland Area of Fort Saskatchewan, Alberta, the Northeast Capital Industrial Association (NCIA) has installed and maintained a network of 13 monitoring wells in the Beverly Channel Aquifer since 2005 with the purpose of defining and monitoring baseline conditions for the aquifer. This paper presents the results of 13 consecutive years of monitoring for water levels and water quality, which show remarkable consistency on a temporal basis, but with significant spatial variations within the aquifer. Stable isotope analyses of oxygen-18 (¹⁸O) and deuterium (²H) have been included since 2015 to help determine the origin(s) of groundwater at each of the monitoring locations in the Beverly Channel and the relative contribution of groundwater from bedrock.

Because the Beverly Channel is a discharge area for bedrock, the influence of bedrock water quality is noticeable in locations where remnants of the marine Bearpaw Formation are present, which leads to locally elevated chloride and sodium concentrations. At one location in particular (MW-02), chloride and sodium concentrations have been continually evolving, possibly indicating that the bedrock flux into the Beverly Channel is higher than the horizontal groundwater flow in the Beverly Channel Aquifer at that location and in recent times.