

Pumping Test Analysis of Fourteen Depressurization and Injection Wells in the Basal McMurray Watersand, Fort McMurray, Alberta

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A winter drilling and aquifer testing program at the Canadian Natural Resources Limited Horizon Oil Sands Project (Horizon Project) was conducted between 2005 and 2007. The Horizon Project is a large (133,000 increasing to 235,000 barrels per day) open pit oil sands mine located approximately 70 km north of Fort McMurray, Alberta. The Basal McMurray Watersand Aquifer (Basal Aquifer) is the first Cretaceous formation unconformably overlying Devonian limestone. The Basal Aquifer was deposited in Devonian lows and resembles a complex river system with multiple tributaries and side channels. It immediately underlies the McMurray Oil Sand and thus requires depressurization in advance of mining.



Produced water is saline and corrosive and will therefore be disposed of by injection back into the Basal Aquifer approximately 5 km north of the area to be initially mined. The current plan is to transmit the saline water from the depressurization wells to the injection wells (IN wells) via a pipe(DP wells) line. Based on the hydrogeologic characteristics, the wells were tested at rates between 130 and 1080 m³/d (20 to 165 Imperial gallons per minute). The observed pump test results were classified into four main categories: 1. Ideal (Theis), 2. Positive (Recharge) Boundary, 3. Negative (Physical) Boundary, and 4. Negative (Degassing) Boundary.

This presentation will address the logistical challenges surrounding drilling and pumping test operations in extreme (-40°C) temperature conditions, as well as the analysis and interpretation of selected pumping test results. Finally, we will discuss lessons learned during this project that can be applied to projects in the future.

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Author Biographies

Justin Bourne, M.Eng., E.I.T. is a Hydrogeological Engineer with Jacques Whitford AXYS Ltd. He is a graduate of the University of British Columbia where he earned his M.Eng. in 2005. His combined background of civil engineering and hydrogeology gives him the ability to work on projects focusing on both surface water and groundwater systems. He has extensive experience performing aquifer pumping tests of various scales in challenging environments including sub-zero temperatures and flowing artesian wells on mountain slopes. His current area of interest is groundwater supply and management for the northern oil and gas industry.

Garry Chan, P.Geol. is a Principal/Senior Hydrogeologist with Jacques Whitford AXYS Ltd. He is a graduate of the University of Alberta where he completed his B.Sc. in 1983 and has been a consultant for over 20 years. Mr. Chan has been involved in hydrogeology projects across Canada and the United States. On several occasions, he has provided expert testimony at public hearings and litigation cases for projects in Western Canada. He is a senior technical reviewer for hydrogeology and environmental site assessment projects at Jacques Whitford AXYS Ltd.



William Csanyi, B.Sc. is a Hydrogeologist and Geologist with Canadian Natural Resources Limited. He is a graduate of the University of Alberta where he completed his B.Sc. in 2002. He focuses full-time on the Horizon Oil Sands Project north of Fort McMurray, Alberta, where he is currently based.

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