



QUANTIFYING THE WATER BUDGET FOR COLES LAKE, NORTHEASTERN BC



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Both natural cycles and anthropogenic greenhouse gas emissions from human activities have warmed the earth by dramatically increasing concentrations of heat-trapping gases in the atmosphere. As a result, the global average surface air temperature has risen 0.7°C during the 20th century (IPCC 2007); although this amount of warming may seem relatively minor, various studies indicate that this rise in global air temperature has had profound consequences for humans and the environment. Canada is not exempt from this situation and there is strong evidence within the international scientific community that climate change has wide effects on the Canadian environmental, economic, and social sectors. British Columbia (BC) is one of the western Canadian provinces that has been highly affected by climate change (e.g., greater warming and changes in the precipitation regime) (Warren et al. 2004). This warming has had a considerable impact on the hydrological cycle and water resources, which are known as a major resource for the operation and growth of oil and gas industries in this province. This current research is focused in the Fort Nelson area, located in Northeastern BC. Shale gas exploration and development have led to a large demand for surface freshwater from the region's lakes, wetlands, and rivers. The town of Fort Nelson has had considerable experience with large oil and gas industrial projects as this industry has been a major contributor to the region's economy. Therefore, water supply is not only at risk due to global warming but is also exacerbated by oil and gas industry activities.

Quicksilver is one of the main oil and gas companies in this region, playing an important role in the Fort Nelson economy. Rapidly increasing oil and gas operations of Quicksilver have created a greater interest in developing a comprehensive water management plan for Coles Lake, their current source of freshwater used in hydraulic fracturing ("fracking"). Therefore, it is extremely important to provide baseline water budget information for Quicksilver to continue their activities while not disrupting the environmental balance in this area. To that end, work has been initiated by the BC government, Ministry of Forests, Lands, and Natural Resource Operations (FLNRO) and the University of Northern British Columbia (UNBC) in collaboration with Quicksilver. The main objective of this research is to provide a comprehensive water budget for Coles Lake so that Quicksilver may extract appropriate amounts of surface water without detrimental impacts to the natural environment. Therefore, this Coles Lake proposal is designed and prepared in detail to achieve this objective. This proposal contains a brief overview of past research, characteristics of the study area, research objectives and questions, and methodology. The methodology section specifically includes discussions of an appropriate water balance method along with availability of climatological data, rain and snow information, lake level and fluxes, evaporation quantification, and shallow groundwater inflow/outflow fluxes. Furthermore, apart from examining the short term (one water year) water balance for Coles Lake, regional and historical contexts for Coles Lake will be discussed.