Geophysical Research Abstracts,
Vol. 10, EGU2008-A-01513, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-01513
EGU General Assembly 2008

Developing a generic system dynamics watershed (GSDW) model to assess the hydrologic performance of reconstructed and natural watersheds

N. Keshta, A. Elshorbagy and **I. El-Baroudy**

Centre for Advanced Numerical Simulation (CANSIM), Department of Civil & Geological Engineering, University of Saskatchewan, Saskatoon, SK S7N 5A9 Canada
(IBE140@mail.usask.ca / Fax: (306) 966-5427 / Phone: (306) 966-5348)

The mining of oil sands involves the stripping and salvage of surface soil layers followed by the removal of the saline/sodic overburden in order to gain access to the oil mines. The oil sands industry has committed to reconstructing the disturbed watersheds to replicate the performance of the natural soil horizons and to reproduce the various functions of the natural watersheds. The selection of the texture and thickness of the reconstructed soil cover layers is based primarily on the concept that all covers must have a sufficient available water holding capacity (AWHC) in order to supply sufficient moisture for vegetation over the growing season.

In order to assess the performance of the various cover alternatives; a Generic System Dynamics Watershed Model (GSDW) is developed. The main advantage of the GSDW model is that it is a tool that can test various reconstructed watersheds as well as natural ones. Its conceptual representation is a combination of physical and empirical formulas. The model is capable of handling up to six layers of soils with different physical properties and thicknesses. The GSDW model has the ability to simulate relevant terrestrial hydrology processes; e.g. rainfall interception, evapotranspiration, runoff, and vertical and lateral soil water movement. Also, particular attention has been given to the parameterization to be kept as simple as possible and reliant on widely available relevant data.

The model performance was evaluated based on reconstructed and natural watersheds

in semi arid regions to simulate soil moisture content and actual evapotranspiration based on a set of metrological and soil data collected on daily basis. The first study area is located to the north of Fort McMurray, northern Alberta, Canada, which consistes of two reconstructed sites; the SB30 site, which is compromised of 20 cm of peat overlying 80 cm of till overlying saline sodic shale; and the SWSS site, which is constructed of 20-40 cm of peat mineral mix over 30 cm of clay loam textured glacial till over tailing sands. The second study area is a natural watershed from the former Boreal Atmosphere Exchange Study (BOREAS); an area of roughly 1000 km by 1000 km covering a large portion of Saskatchewan and Manitoba, Canada. Both the reconstructed and the natural sites are well instrumented to permit tracking of hydrologic changes.

This paper demonstrates the capabilities of the GSDW model as a generic and comprehensive model that can be easily applied to a wide spectrum of reclamation watersheds. The GSDW model can be used as a decision support tool for evaluating and comparing the effectiveness of different alternative designs for reconstructed watersheds.