

Artificial Recharge of Groundwater in a Coal Mining Area of Northeast Mexico

Carlos Gutiérrez-Ojeda, Head of Groundwater Department, Mexican Institute of Water Technology, Jiutepec, Morelos, Mexico

Coauthor: M. Martínez-Morales and G. Ortiz-Flores

ABSTRACT

Artificial recharge of groundwater has been successfully implemented to replenish extracted groundwater in a coal mining area of northeast Mexico. The aquifer is mainly composed of unconsolidated quaternary sediments and chinks, and is overlying at least 9 coal layers, 5 of which have economic value and are exploited using surface and subsurface coal mining methods. Surface coal mining requires the complete aquifer dewatering around the open-pit (40-70 m depth) for coal production. Since year 2002 several wells are used to capture groundwater flow towards the open pit, modifying the natural groundwater flow in the aquifer. Mining activities will continue up to the year 2012. Total groundwater extraction for dewatering purposes accounts ≈ 0.916 m³/s; 0.490 m³/s are distributed in a channel network in the direction of the Santo Domingo artificial recharge project, and 0.426 m³/s towards a second facility called the Aqueduct artificial recharge project. As soon as the extracted groundwater is on surface, a gravity driven system of open unlined channels diverts it to recharge sites. Each of these two recharge sites consists of several injection wells; gravity induced injections rates are typically 0.04-0.06 m³/s in each well.

In order to evaluate the mining effects on the aquifer, the Mexican Institute of Water Technology performed during the year 2004 a groundwater balance around the open pit, and a delineation of the affected area by mining activities (groundwater abstraction), which included piezometry, hydrometry, groundwater sampling, well drilling, geophysics and the implementation of a numerical model.

Water balance performed around the open pit showed that recharge efficiency is of 99.78. The area affected by the mining activities extends 1 km around the open pit according to the water table configuration and 3 km down gradient from the open pit, according to the geochemistry data. Numerical flow simulations also showed that the preexisting conditions before the mining activities will be reestablished by the year 2024.