

Modeling the Effects of Leachate-Impacted Groundwater on the Water Quality of a Large Tidal River

Authors : Emery Coppola Jr., Marwan Sadat, Il Kim, Diane Trube, Richard Kurisko

Abstract : Contamination sites like landfills often pose significant risks to receptors like surface water bodies. Surface water bodies are often a source of recreation, including fishing and swimming, which not only enhances their value but also serves as a direct exposure pathway to humans, increasing their need for protection from water quality degradation. In this paper, a case study presents the potential effects of leachate-impacted groundwater from a large closed sanitary landfill on the surface water quality of the nearby Raritan River, situated in New Jersey. The study, performed over a two year period, included in-depth field evaluation of both the groundwater and surface water systems, and was supplemented by computer modeling. The analysis required delineation of a representative average daily groundwater discharge from the Landfill shoreline into the large, highly tidal Raritan River, with a corresponding estimate of daily mass loading of potential contaminants of concern. The average daily groundwater discharge into the river was estimated from a high-resolution water level study and a 24-hour constant-rate aquifer pumping test. The significant tidal effects induced on groundwater levels during the aquifer pumping test were filtered out using an advanced algorithm, from which aquifer parameter values were estimated using conventional curve match techniques. The estimated hydraulic conductivity values obtained from individual observation wells closely agree with tidally-derived values for the same wells. Numerous models were developed and used to simulate groundwater contaminant transport and surface water quality impacts. MODFLOW with MT3DMS was used to simulate the transport of potential contaminants of concern from the down-gradient edge of the Landfill to the Raritan River shoreline. A surface water dispersion model based upon a bathymetric and flow study of the river was used to simulate the contaminant concentrations over space within the river. The modeling results helped demonstrate that because of natural attenuation, the Landfill does not have a measurable impact on the river, which was confirmed by an extensive surface water quality study.

Keywords : groundwater flow and contaminant transport modeling, groundwater/surface water interaction, landfill leachate, surface water quality modeling

Conference Title : ICWRM 2016 : International Conference on Water Recycle and Wastewater Treatment

Conference Location : Havana, Cuba

Conference Dates : November 24-25, 2016