Long Term Pressures and Impact of Aggregate Mining on the Environment at the Danube Alluvial Plain, Hungary

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In the last three decades, Hungary has undergone significant infrastructural development, especially around Budapest, which puts great pressure on nearby agglomerate reserves, including the excellent sand and gravel resources of the Danube Alluvial Plain, south of Budapest.

Surface mining of aggregates has created a growing number of mine lakes in the region, and the mining activity has escalated significantly in the 21st century. Some of the abandoned mining lakes are utilized for recreational purposes, such as fishing and swimming, while at some lakes groundwater dependent ecosystems have formed as well. The progression of mine pit lakes reached the limits of various nature conservation areas, such as the saline fields of Kiskunság National Park and other Natura 2000 SAC and SPA areas. On the other hand, the significantly decreasing groundwater level of the Danube-Tisza Interfluve (east of the area) raised serious concern, it is suspected that one of the causing factors is the extra evaporation of groundwater through the open water surface of the mining lakes. As a consequence, nowadays mining companies are required to backfill the pits, the mine waste and construction debris is used for it. To determine the extent of aggregate mining's role, a comprehensive study was initiated in the area.

Relevant geomorphological features were characterized using satellite images, which contributed to the understanding of shallow geology. Well log correlation and sequential stratigraphy were used to construct a geological model and to determine the adequate hydrostratigraphic units. The (near) natural hydrogeological conditions of the area were described using archive water level and water chemistry data. The temporal changes were evaluated by time series analysis of shallow groundwater levels and by sampling campaigns of groundwater and surface water bodies for main and trace elements.

These analyses and their results form the basis for building a conceptual model and help in assessing the impact of mining through numerical modelling. The numerical model facilitates the evaluation of the post-mining utilization possibilities (recreation, fishing or wildlife habitat) of the lake systems, and accordingly, the planning of the landscaping tasks of the lake and its surroundings, considering the reduction of evaporation.

The water balance of Hungary is negatively affected by climate change therefore the sustainable management of surface and subsurface water is becoming increasingly important, which highlights the significance of this research.

Author Biography

Nóra E Gál holds an MSc in Geology from Eötvös Loránd University, Budapest, and a PhD in Earth Sciences from University of Massachusetts at Amherst. She is a senior hydrogeologist at the Supervisory Authority for Regulatory Affairs, Geological Survey, Hungary. Her research is focusing on hydrogeochemistry, geochemical modelling, regional hydrogeology problems especially on karst areas, and geothermics. Her main publications focusing on karstwater of the Transdanubian Range, Geothermal resources of Hungary, CCS technology