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P.N. Mollema, M. Antonellini

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Water and (bio)chemical cycling in gravel pit lakes: a review and outlook.

P. N. Mollema^{a, b} and Antonellini M^a

^a University of Bologna, Department of Biological, Geological and Environmental Sciences, Ravenna Campus, Via San Alberto 163, 48123 Ravenna, Italy.

^b Technical University Delft, Department of Geosciences & Engineering, The Netherlands.

*Corresponding author: pmollema@gmail.com tel: ++390516257958

m.antonellini@unibo.it

Abstract

The world produces 1.7×10^8 metric tons of gravel and sand per year (USGS 2015) creating many gravel pit lakes that change the morphology and drainage pattern of catchments. Gravel pit lakes abruptly intersect the geologic layering creating an environment where surface and groundwater will interact and where elaborate food webs can develop. Here we preview previous work on gravel pit lakes and compiled a comprehensive hydrochemical database to compare the chemistry of gravel pit lake water with other types of surface and groundwater. Water budget calculations confirm that gravel pit lakes cause freshwater loss in temperate and Mediterranean climates where surface water evaporation is larger than the actual evapotranspiration of vegetated land that was replaced by the gravel pit lakes. Groundwater fed gravel pit lakes where evaporated water is replaced by groundwater are especially sensitive to climate change.

The gravel pit lakes included in this review have a relatively low acidity and high alkalinity most likely caused by weathering and leaching of carbonates in the catchment. The inflow of groundwater is a key process in gravel pit lakes with important consequences. The creation or presence of the gravel pit lakes may induce fluctuation of the up-stream water table which enhances groundwater flow and redox reactions in the soil. Groundwater rich in dissolved elements typically meets more alkaline water in gravel pit lakes enhancing the precipitation of metal oxides, calcite and other composite minerals including phosphorus (P), calcium (Ca) and carbon (C). Gravel pit

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