

MODELING INVESTIGATION OF THE SUSTAINABLE GROUNDWATER YIELD FOR THE WIANG PA PAO AQUIFERS SYSTEM, NORTHERN THAILAND

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ABSTRACT

The Kok river basin situated in the Golden Triangle delta in northern Thailand is becoming to serve as an important regional trade hub for the Yunan Province, China, Myanmar, Laos P.D.R and Thailand, as laid out in the quadrangle economic cooperation policy. As a consequence of the latter, the Kok river basin is expected to experience some major economic growth in the near future which, despite its positive social impacts, should exert some environmental stress on the natural resources of the region, namely, water resources. Imminent climate change across the region as a whole may further exacerbate these adverse effects. Although groundwater is still at present time abundant in the Kok river basin and is supposed to support the water needed to sustain the envisioned future economic growth, no thorough investigation with regard to the quantity (yield) and the future sustainability of the groundwater resources in the basin exists up-to-date. Here we investigate this issue by means of a 3D numerical groundwater flow model (MODFLOW) for the Wiang Pa Pao aquifer basin – situated within the Kok river basin - , whereby the focus of the study is on the estimation of the future sustainable groundwater yield under external stresses on this aquifer, namely, groundwater pumping. Based on first observational results of a recent exploratory hydrogeological investigation of the Thai Department of Groundwater Resources (DGR), the aquifer system is modeled with a top unconfined aquifer layer and three underlying confined layers, each of them separated by an aquitard. The groundwater flow model is calibrated in steady-state and transient mode using observed piezometric heads for the various aquifer layers for the year 2009. The sustainable yield of the Wiang Pa Pao aquifers system is then computed based on a definition of the DGR whereby sustainable yield is “the maximum total pumping rate that ensures that the average piezometric head in each layer does not fall below a vertical distance of 20 meter from the land surface in the next 20 years”. Employing these constraints for the future heads, the transient MODFLOW computations result in a total sustainable yield of 168,219 CMD CMD for the Wiang Pa Pao Basin as a whole. Using a zone budget module within the groundwater model, the sustainable yields have then been calculated also sub-districtwise. Although still preliminary, the present modeling study should give policy makers a first tool at hand for future sustainable groundwater resources management in the Kok river basin.