



Planning of water supply infrastructure on the basis of sustainable water resources management in Kayseri Metropolitan City, Central Turkey: A plan for the year 2050

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The metropolitan city of *Kayseri* is an ever growing settlement in central Turkey where the climate is semi-arid. The total population of the metropolitan is about 912 000 by the year 2010. Annually about 55 million cubicmeter of water for domestic use in the municipality is supplied by the Directorate of Water and Sewage Administration of the Kayseri Metropolitan Municipality, directly from groundwater resources. About one fifth of this amount is provided by a spring while the rest is pumped out through boreholes. The groundwater abstracted for use is of high quality owing to the volcanic rock aquifer. However, the aquifer extends beneath the settlement area of the metropolitan city. All the extraction wells are today surrounded by either houses, apartments and industrial complexes. Abandoned waste disposal sites have been located on the top of the aquifer. Being aware of the risk of groundwater pollution, the increasing demand for high quality water has lead the municipality to make a plan to maintain the high quality and sufficient water supply to the inhabitants for the year 2050. A hydrogeological study to appraise the groundwater resources in the area was conducted and the groundwater system is modeled to provide a sound basis for a sustainable use of the groundwater resources. The volcanic aquifer is recharged mainly by the snow-melt on the high Erciyes mountain and the remote recharge area is not suitable for human activities except the skiing resorts in some parts. The aquifer is well fractured and highly heterogeneous particularly due to the lava tubes and the slack material that produced during various phases of the volcanic activities. A major part of the volcanic rock aquifer is overlain by a moderately thick alluvial deposits which form a secondary aquifer in the region. However, the shallow groundwater in the alluvial aquifer is already contaminated by agrochemicals, fertilizers and waste waters during the period before the sewage system had been constructed. There is a delicate hydraulic balance between the contaminated upper aquifer and the lower volcanic aquifer. The two aquifers are separated by massive but slightly fractured basalt which acts as a semipervious layer. Therefore, it is essential to consider this hydraulic balance and the possible interaction between these two aquifers during exploitation of the volcanic aquifer. The groundwater flow and solute transport model was developed to simulate the hydraulic balance under different exploitation scenarios for the future. The model also considered the adverse impacts of the climate change on the groundwater resources in the area. A study on the impacts on climate change on the meteorological parameters in the Kayseri region has revealed that the precipitation will partly change in type, from snowfall to rainfall. This change is of utmost importance in the rate of recharge of the volcanic aquifer. The municipality utilizes a SCADA system in controlling the water supply network. The system is available for use in verification and validation of the mathematical model developed for the groundwater system in the area, which will help in developing strategies to reduce the running costs and water usage and maximize the efficient use of energy and water.

This paper demonstrates the efficiency of the use of hydrogeological studies as a basis for an efficient plan of water supply infrastructure of a metropolitan municipality in a semi-arid region in Turkey.