WATER RESOURCES AVAILABILITY IN KABUL, AFGHANISTAN, A conceptual simulation integrating climatologic, hydrogeologic, geochemical, and remotely sensed data

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The availability of adequate water resources is vital to the rebuilding of Kabul, Afghanistan which is experiencing increasing numbers of refugees and rapid population growth. Increased groundwater withdrawals have resulted in widespread drying of wells in recent years, an increasingly used source for domestic and agricultural water supply. Potential climate change and observations of increasing temperatures, earlier runoff and snowmelt, and diminishing glaciers have led to heightened concerns for water availability.

The U.S. Geological Survey (USGS), with support from the U.S. Agency for International Development (USAID), began collaboration with the Afghanistan Geological Survey and Ministry of Energy and Water on water-resource investigations in 2004. This collaboration has led to the compilation of historic and recent water-resources data, creation of monitoring networks, and analysis of remotely sensed data. The study completed in 2009 provides an assessment of groundwater availability through the use of hydrogeologic data analysis and conceptual groundwater flow simulation. Data elements include population density, climate, snowpack, geology, surface water, ground-water levels, water quality, and isotopic information, and water use.

This study provides an understanding of the geohydrologic framework, water quality, and recharge characteristics of the Kabul Basin. Based on CFC, tritium, and stable hydrogen and oxygen isotopic data, most water in the shallow aquifer appears to be recharged post 1970 by snowmelt-supplied leakage from streambeds and some late winter precipitation. Some recharge occurs through groundwater inflow through the adjacent mountains that form the basin. Most groundwater flows through a shallow, less than 100-m thick, highly productive aquifer that is contaminated locally due to a lack of waste treatment. Water in the deeper, 1,000-m thick aquifer is much older and may provide a limited source of water for municipal use. Figure 1 presents an integration of the sources of recharge, estimates of the hydraulic properties of the aquifers, and thickness of the unconsolidated sediments, to provide a representation of the potential water availability in the Kabul Basin. Changing climate conditions appear to be altering the seasonal recharge pattern creating a longer dry season and reducing water availability. This study provides information and tools necessary to make improved decisions regarding future water resource management in Kabul.

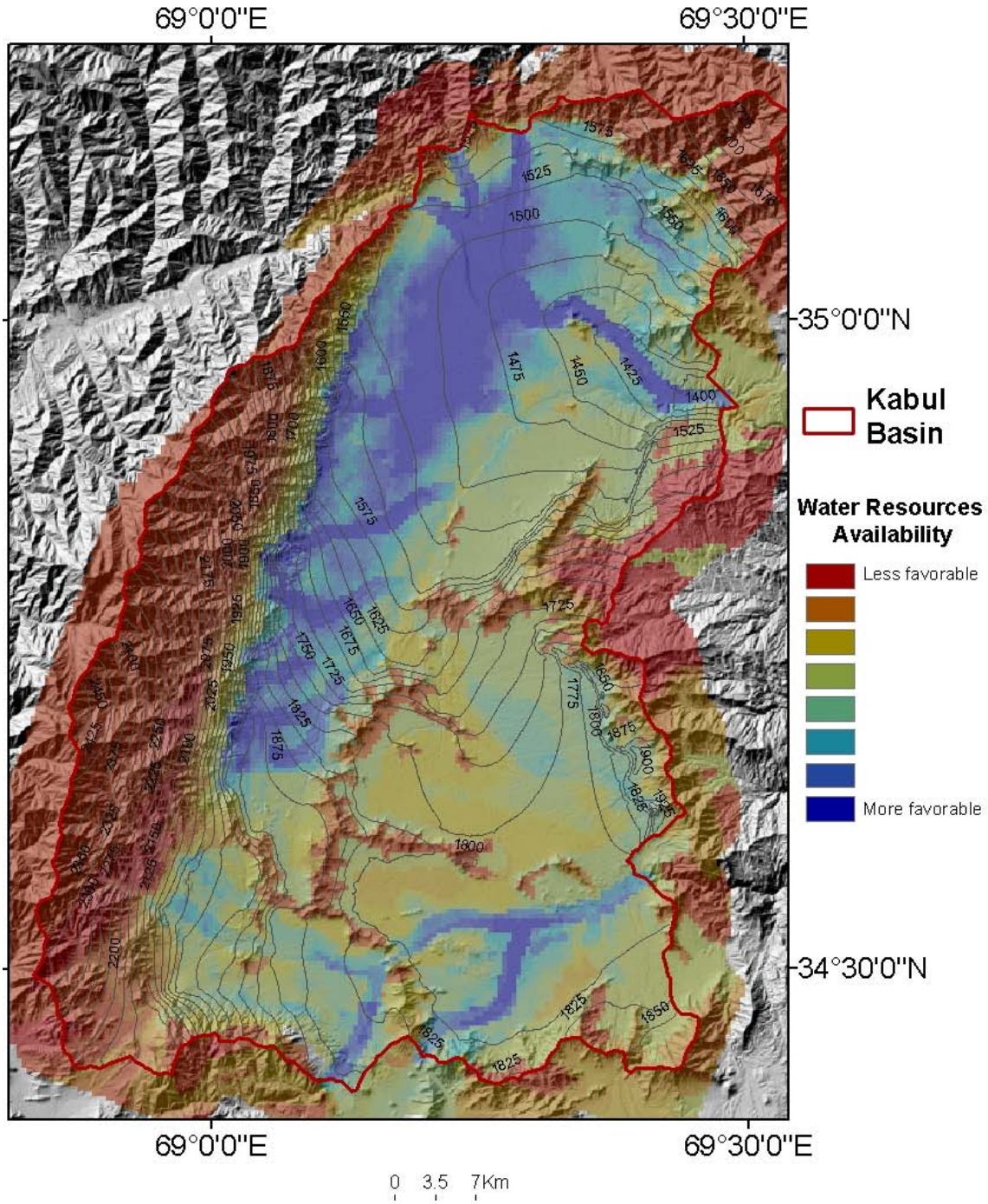

Figure 1. Water-resources availability based on an integration of estimated hydraulic properties, stream leakage, irrigation leakage, inflows from mountain fronts, and aquifer thickness, in the Kabul Basin, Afghanistan. Simulated twenty-five meter head contours are shown.

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