Groundwater Resources of the Kabul Basin, Afghanistan

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Joint Afghan-BGR-Project

commissioned by

Federal Foreign Office of Germany

Hydrogeology of the Kabul Basin
Federal Institute for Geosciences and Natural Resources (BGR)

- German Geological Survey advising the German Ministries in all geo-related matters
- Investigations concerning mineral and energy resources, groundwater, soil, environmental protection, engineering technology, geotechnics, geohazards
- Technical cooperation with developing and transitional countries focusing on institution and capacity building
- Geotechnical studies related to the disposal of radioactive waste
- Marine and polar research
- Seismology

- Some 700 permanent staff
- More than 400 scientist in 5 divisions (natural science, geosciences, engineers)
History of BGR Activities in Afghanistan

German Geological Mission Afghanistan (DGMA), 1959 to 1968
Geological mapping Central and Southern Afghanistan: 1959-1966
Advisors at the Afghan Geological Survey (AGS): 1966-1968
→ Geological Map of Afghanistan, Scale 1 : 500,000, 8 Maps

Hydrogeological Group of the DGMA, 1964-1967
Hydrogeology of the Kabul Basin
→ Characterisation of aquifers, hydrochemical analyses, geophysics, pump tests

Water supply Kabul, 1971 to 1978
→ Several reports, e.g. Afshar region

Improvement of groundwater protection, AA-Project 2003 to 2005
→ Assessment of groundwater Quality in the Kabul Basin
→ Training in the field of hydrogeology
Why is the present project restricted to the Kabul Basin?

Preconditions of project:
- difficult security situation
- limited financial resources
- limited number of project staff

Aim of project:
- derive methodology
- create a profound database on groundwater conditions
- transfer of knowledge and capacity building for drought preparedness and mitigation

Project serves as pilot project!
Scheduled BGR Activities 2005

Transfer of knowledge obtained in the previous project stages to decision makers and awareness rising concerning water problems for the general population

Transfer of results:

- mapping of groundwater quality
- which areas are affected by pollution?
- which immediate measures have to be taken?

→ creation of fundamentals for regional and town planning

Ongoing activities

- training of GIS experts at BGR in Hanover, Germany
- preparation of the digital geological map of Afghanistan (1 : 500,000)
First Question: What’s about Groundwater Quality?

For instance …….. microbiology

• roughly 50% of all wells are negatively affected

• irregular spatial distribution of microbially affected samples

….. but for other contaminants, e.g. nitrate, it looks similar
Possible Answer:
Negative Influence of Waste and Sewage on Groundwater Quality

Foto: Tünnermeier
Second Question: How much Groundwater is available?

Necessary input data:

- groundwater dynamics
- fluctuation of groundwater level
- infiltration and recharge

Only few records during 20 years of war

- old BGR records from former missions had to be used to derive first estimates on groundwater dynamics
- BGR uses its contacts to Russia to get hold of some Soviet data of that period

New measurements are needed!

Simple basic hydrological equation:

\[ P = R + E \]

Input data???

\( P = \) precipitation, \( R = \) runoff, \( E = \) Evaporation
German Governmental Support of the Water Sector in Afghanistan

OBJECTIVES

- Integrated Water Resources Management (IWRM), policy making
- Groundwater Resources and Quality
- Urban Water Supply and Sanitation
- Awareness Rising and Capacity Building
Outlook on future activities

Evaluation and quantification of groundwater resources is an indispensable prerequisite for any Integrated Water Resources Management (IWRM).

In addition it represents a necessary precondition for any sustainable future growth of Kabul City and any regional planning.

Input data are needed:

- reliable data on the present and future public water demand, combined with realistic figures concerning the growth of the population
- reliable estimates about the water demand of rehabilitated or planned industrial sites
- inventory of the existing privately used wells

All actions must be accompanied by legislative activities, e.g. the new water law.
Hydrological and Hydrogeological Input Data

• fluctuation of water table, recorded by automatic water level recorders, helps to calculate the storage of the aquifers
• re-establishment of discharge measurements of rivers as precondition to calculate the water balance
• rehabilitation of meteorological stations to collect hydrological data (precipitation, temperature, evaporation, snow cover, etc.)
• chemical analysis of precipitation, river water, soil and aquifer matrix
• isotope studies for hydrochemistry and groundwater recharge

→ conceptual groundwater model
Conceptual Groundwater Model of the Kabul Basin (in progress)

The model incorporates:

- simplified hydrogeological structures, rivers and impervious boundaries (e.g. mountains)
- allows for simulation of transient flow conditions
- considers variable boundary conditions in time and space
- calculates the overall water balance in the modelled area

Simulation of different scenarios of groundwater abstraction and climate conditions
All future activities have to match the Principles of the German Development Policy

Project Ownership and Support for Selfsupport

This means for instance:

 ✓ the Afghan partners shall be trained to install and maintain the 40 water level recorders supplied by BGR independently

 ✓ the Afghan partners will install and run a groundwater network on a regularly basis

 ✓ all data are collected and evaluated in an Afghan database