

Hydrogeological Atlas of Faryab Province

This Atlas was prepared in 2013-2014 by staff of NORPLAN (a trading name of Asplan VIAK AS, Kristiansand, Norway) under the auspices of the project:

Capacity Building and Institutional Cooperation in the field of Hydrogeology for Faryab Province, Afghanistan

The project client is the Afghan Ministry of Rural Rehabilitation & Development (MRRD), and the project was funded by Norwegian NORAD.



Author David Banks (NORPLAN, Holymoore Consultancy Ltd.)

Data and assistance with figures were provided by

Data collection	Mohammed Hassan Saffi (DACAAR)
and facilitation	Mohammed Hadi (DACAAR)
	Ahmed Jawed (DACAAR)
	Jalil Anwari (MRRD)
	Ewaz Ali Poya (MRRD)
	Prof. Naim Eqrar (NORPLAN, University of Kabul)
	Ehsanullah Bayat (NCA)
GIS . Cartography	Prof. Shuaib Zarinkhail (NORPLAN, University of Kabul)
Project Management	Naqibullah Abrar (NORPLAN)
	Svein Stoveland (NORPLAN)
Geophysics diagrams	Andreas de Jong (NORPLAN, GeoSearch)
Hydrochemistry diagrams	Bjørn Frengstad (Norges geologiske undersøkelse)
Water analyses	Michael Watts (British Geological Survey)
	Cynthia Turner (British Geological Survey)
	NERC Isotope Laboratory, Keyworth, UK
Soil extractions	DACAAR wet laboratory, Kabul

We also acknowledge the assistance provided by colleagues in other Afghan Ministries in facilitating data provision, especially staff of the Ministry of Energy and Water (Dr Sayed Shaif Shobair and colleagues) and the Ministry of Mines (especially Fahim Zahir and Dr Naim Tookhey).

Contents and Key Diagrams



Chapter 1	Introduction. Faryab Province: A History of Water Resources
Figure 1.4	Administrative map; Faryab Province
Figure 1.5	Physiography of Faryab Province showing selected settlements
Chapter 2	Faryab: Location, Topography and Climate
Figure 2.2	Annual average air temperature
Figure 2.7	Annual average precipitation
Chapter 3	Faryab: River and Surface Waters
Figure 3.13	Surface water hydrology of Faryab Province
Figure 3.14	Hydrometry of Faryab Province
Chapter 4	Faryab: Geology
Figure 4.11	Geological map of Faryab Province
Chapter 5	Faryab: Hydrogeology
Figure 5.1	Springs of Faryab Province and adjacent areas
Figure 5.2	Wells and boreholes of Faryab Province and adjacent areas
Figure 5.12	Hydrogeological map of Faryab Province
Chapter 6	Faryab: Groundwater Levels and Flow
Figure 6.1	Mishkin's (1968) hydrogeological map of Andkhoi area
Figure 6.2	Point maps of groundwater levels, Faryab
Figure 6.14	Kriged map of groundwater levels, Faryab
Chapter 7	Faryab: Thermogeology
Figure 7.1	Map of groundwater temperatures in Faryab
Chapter 8	Faryab: Groundwater salinity
Figure 8.3	Map of groundwater electrical conductivity in Faryab
Figure 8.9	Kriged map of groundwater electrical conductivity in Faryab
Chapter 9	Faryab: Groundwater Hydrochemical Types
Figure 9.2	Durov diagram of groundwaters in Faryab
Figure 9.3	Map of dominant hydrochemical type in groundwater, Faryab
Chapter 10	Faryab: Groundwater Chemistry
Figure 10.2	Map of arsenic (As) concentrations in Faryab groundwaters
Figure 10.10	Map of fluoride (F ⁻) concentrations in Faryab groundwaters
Figure 10.13	Map of nitrate (NO ₃ ⁻) concentrations in Faryab groundwaters
Figure 10.25	Map of uranium (U) concentrations in Faryab groundwaters
Chapter 11	Faryab: Stable Isotopes in Groundwater
Figure 11.4	δ ² H vs. δ ¹⁸ O diagram for rivers and groundwaters, Faryab



Note on use of external materials

The authors have made particular use of two sets of data in the preparation of this report:

1. The work and data-layers resulting from the collaboration between the United States Geological Survey and the Afghan Geological Survey, especially:
 - the 1:250,000 geological maps of McKinney & Sawyer (2005), McKinney & Lidke (2005) and Wahl (2005).
 - the data layers described in Steinshouer et al.'s (2006) Open File report **OFR-2006-1179**

As publicly funded products published by the USGS, we have assumed that these represent public domain sources. We gratefully acknowledge the use of these invaluable data sources.

2. Google Earth imagery. As our primary intention in using these images is **not** to present the Google Earth images themselves, but rather to use them as a geographical reference background on which we project our own data, we claim that this falls within the definition of “reasonable and fair use” of these images.