USGS
science for a changing world

Prepared under the auspices of the U.S. Agency for International Development

Streamflow Characteristics of Streams in the Helmand Basin, Afghanistan

Introduction

A majority of the Afghan population lacks adequate and safe supplies of water because of contamination, lack of water-resources management regulation, and lack of basic infrastructure, compounded by periods of drought and seasonal flooding. Characteristics of historical streamflows are needed to assist with efforts to quantify the water resources of the Helmand Basin.

The Helmand Basin is the largest river basin in Afghanistan. It comprises the southern half of the country, draining waters from the Sia Koh Mountains in Herat Province to the eastern mountains in Gardez Province (currently known as the Paktia Province) and the Parwan Mountains northwest of Kabul, and finally draining into the unique Sistan depression between Iran and Afghanistan (Favre and Kamal, 2004). The Helmand Basin is a desert environment with rivers fed by melting snow from the high mountains and infrequent storms. Great fluctuations in streamflow, from flood to drought, can occur annually.

Knowledge of the magnitude and time distribution of streamflow is needed to quantify water resources and for water management and environmental planning. Agencies responsible for the development and management of Afghanistan's surface-water resources can use this knowledge for making safe, economical, and environmentally sound water-resource planning decisions. To provide the Afghan managers with necessary streamflow information, the U.S. Geological Survey (USGS), in cooperation with the U.S. Agency for International Development (USAID), computed streamflow statistics for data collected at historical gaging stations within the Helmand Basin. The historical gaging stations used are shown in figure 1 and listed in table 1.

History of the Streamflow-Gaging Program in Afghanistan

River discharge measurements began in Afghanistan in the mid-1940s at a few sites. The number of sites increased over the years until the late 1970s. Measurements were discontinued soon after the Soviet invasion of Afghanistan in 1979. Until 1978, Afghanistan had a network of approximately 160 streamflow-gaging stations. No streamflow data were collected after September 1980 until recently. In 2005, three historical streamflow-gaging stations were reestablished in the Kabul Basin, and in 2008, much of the historic network is in the process of being reestablished.

Explanation of Station Summaries

Station summaries are presented in the report by Williams-Sether (2008). Summaries include a station description, streamflow statistics, and probabilities of streamflow occurrence. Because the statistical information listed in the report was created by data retrievals or from statistical program results, significant figures were not always rounded to USGS standards. Information found in the report includes:

1. manuscript (station description),
2. graph of the annual mean discharge for the period of record,
3. table of statistics of monthly and annual mean discharges,
4. graph of the annual flow duration,
5. table of monthly and annual flow duration,
6. table of probability of occurrence of annual high discharges,
7. table of probability of occurrence of annual low discharges,
8. table of probability of occurrence of seasonal low discharges,
9. table of annual peak discharge and corresponding gage height for the period of record, and
10. table of monthly and annual mean discharges for the period of record.

Table 1. List of streamflow-gaging stations for which streamflow statistics are published.

[ID, identification; USGS, U.S. Geological Survey]

Map number	Afghan ID number	USGS ID number	Station name
1	3-0.000-2M	324200068060000	Ghazni River near Shina
2	3-0.000-7M	333300068250000	Ghazni River at Ghazni Bridge
3	3-0.000-7S	333800068250000	Ghazni River at Nauburja
4	3-0.000-8W	334500068230000	Ghazni River below Seraj Reservoir
5	3-1.1L0-5T	330000068520000	Park River near Park Dasht
6	3-4.1L0-8T	330800069050000	Paltu River near Sarafsar
7	3-4.L00-1A	331600068420000	Paltu River above Sarde Reservoir
8	3-4.L00-2A	331800068370000	Jilga River below Sarde Reservoir
9	3-4.L00-7A	333500069130000	Jilga River at Gardez
10	3-4.L00-9T	334900069230000	Jilga River near Mechalghu
11	3-5.R00-3T	333100068210000	Syaghel River at Syaghel
12	3-8.1L0-1W	334600068210000	Barikab River above Seraj Reservoir
13	3-8.R00-1W	334601068210000	Sarab River above Seraj Reservoir
14	4-0.000-1M	310200061520000	Shele Charkh River near Zaranj
15	4-0.000-2M	304800061460000	Helmand River at Khwabgah
16	4-0.000-3M	301700062020000	Helmand River at Char Burjak
17	4-0.000-4M	302700063220000	Helmand River at Malakhan
18	4-0.000-5M	310800064110000	Helmand River at Darweshan
19	4-0.000-6M	313400064210000	Helmand River at Lashkargah
20	4-0.000-6S	314800064350000	Helmand River at Girishk
21	4-0.000-7M	321900065060000	Helmand River below Kajakai Reservoir
22	4-0.000-8M	324200065280000	Helmand River at Dehraout
23	4-0.000-9M	332300066170000	Helmand River at Gizab
24	4-0.000-10M	343000068160000	Helmand River at Gardandewal
25	4-1.21R-7A	323200067280000	Tarnak River near Shahjuy
26	4-1.222R-6A	320000067180000	Lora River near Shinkay
27	4-1.22R-1A	312600065550000	Arghastan River near Kandahar
28	4-1.2L0-5A	311300065570000	Dori River at Takhtapul
29	4-1.L00-1A	313000064230000	Arghandab River at Qala-i-Bust
30	4-1.L00-3A	313700065340000	Arghandab River near Kandahar
31	4-1.L00-4A	315000065520000	Arghandab River below Arghandab Reservoir
32	4-1.L00-5A	315700066020000	Arghandab River above Arghandab Reservoir
33	4-1.L00-6A	321000066270000	Arghandab River at Mizan
34	4-1.L00-9A	330800067280000	Arghandab River at Sang-i-Masha
35	4-13.R00-4A	341400066550000	Punjab River at Waras
36	4-14.R00-1A	342100067290000	Markhana River at Dahane Rishqa
37	4-16.R00-3A	343400068110000	Syashang River near Gardandewal
38	4-3.L00-2T	320300064500000	Sangin Wash (Seraj Canal) at Sangin
39	4-4.R00-2A	321700064460000	Musa Qala River near Musa Qala
40	4-5.L00-1A	323800065340000	Tirin River at Anarjuy/Dehraout
41	4-5.L00-4A	323800065560000	Tirin River at Tirin
42	4-5.L00-8A	325800066390000	Tirin River at Urosgan
43	4-6.R00-1A	325800065300000	Kaj River at Yakhdan
44	5-0.000-4W	315500063070000	Khash River at Dehmazang
45	5-0.000-5M	320900063260000	Khash River at Dilaram
46	6-0.000-3M	322200062040000	Farah River at Farah
47	6-0.000-4S	324500062370000	Farah River near Daulatabad
48	6-0.000-5M	325100062520000	Farah River near Petch Tangi
49	6-0.L00-1A	325100063180000	Malmand River near Shawalat
50	7-0.000-7M	333800062160000	Adraskan River at Adraskan
51	7-5.R00-1A	334200062170000	Rud-i-Gaz River near Adraskan

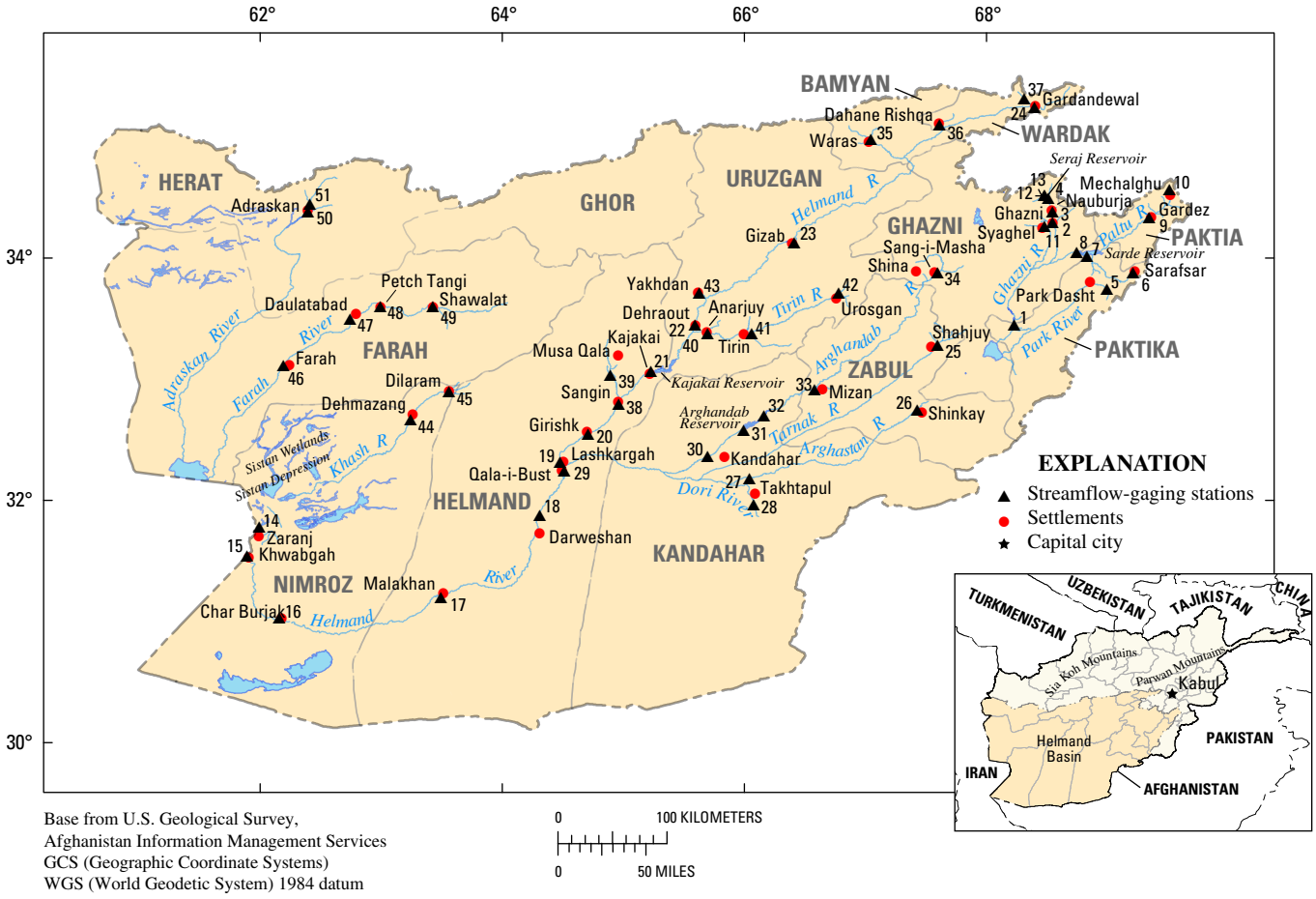

Figure 1. Location of streamflow-gaging stations for which streamflow statistics are published.

Data Considerations

The historical daily values used for the statistical analyses were obtained from Brigham (1964); Childers (1974); Democratic Republic of Afghanistan, Ministry of Water and Power Hydrologic yearbooks (date unknown, 1978, 1982); Democratic Republic of Afghanistan, Ministry of Irrigation and Water Resources Hydrologic yearbook (1985); and Republic of Afghanistan, Ministry of Water and Power Hydrologic yearbook (1977). The reliability of statistical calculations for a stream is related to the length of record available for that stream. The Hydrology Subcommittee of the Interagency Advisory Committee on Water Data (1982) recommends that at least 10 years of record be used for computing flood frequency estimates. However, the record length for gaging stations in Afghanistan varies substantially and periods of record less than 10 years were used in some instances so that preliminary statistics could be computed for all gaging stations. Subsequently, extreme high or low flows were included in the statistical analysis regardless of the length of record. Differences in statistical data for pre- and post-regulation periods were not addressed.

Report and Data Retrieval

The report (Williams-Sether, 2008) may be viewed and downloaded from the following link: *http://pubs.usgs.gov/ds/333/*. Daily values are available online from the U.S. Geological Survey National Water Information System Web Interface found at the following link: *http://waterdata.usgs.gov/nwis*. An agency code of USAID and the USGS identification numbers listed in table 1 are required to retrieve daily values. Annual peakflow data are not available online, but are listed in the online report. Daily values and annual peakflow data may also be requested from the U.S. Geological Survey North Dakota Water Science Center found at the following link: *http://nd.water.usgs.gov/*.

References Cited

Brigham, R.H., 1964, Compilation of hydrologic data, Helmand River Valley, Afghanistan through September 1960: U.S. Geological Survey, 234 p.

Childers, Dallas, 1974, Compilation of streamflow records, Helmand River Valley and adjacent areas, Afghanistan 1961–68: U.S. Geological Survey Open File Report 74–46, 144 p.

Democratic Republic of Afghanistan, Ministry of Irrigation and Water Resources, 1985, Hydrological yearbook 1979–1980, Part (I and II) Rivers of Indus and Helmand Basin (Kabul, Khuram, Helmand, and Ghazni): Institute of Water Resources Development, Afghanistan Hydrologic Data Report RO 211, 131 p.

Democratic Republic of Afghanistan, Ministry of Water and Power, date unknown, Hydrological yearbook 1961–1975, Part II–4B, Arghandab River basin: Water and Soil Survey Department, Afghanistan Hydrologic Data Report RO 215, 121 p.

Democratic Republic of Afghanistan, Ministry of Water and Power, date unknown, Hydrological yearbook 1961–1975, Part III, West flowing rivers (Khash, Farah, Adraskan, and Harirud): Water and Soil Survey Department, Afghanistan Hydrologic Data Report RO 219, 77 p.

Democratic Republic of Afghanistan, Ministry of Water and Power, date unknown, Hydrological yearbook 1962–1975, Part II–3, Ghazni River basin: Water and Soil Survey Department, Afghanistan Hydrologic Data Report RO 217, 109 p.

Democratic Republic of Afghanistan, Ministry of Water and Power, 1978, Hydrological yearbook 1961–1975, Part II–4A, Helmand River basin (excluding Arghandab River basin); Water and Soil Survey Department, Afghanistan Hydrologic Data Report RO 210, 244 p.

Democratic Republic of Afghanistan, Ministry of Water and Power, 1982, Hydrological yearbook 1976–1978, Part II, Rivers of Helmand Basin (Ghazni and Helmand); Water and Soil Survey Department, Afghanistan Hydrologic Data Report RO 212, 146 p.

Favre, R., and Kamal, G.M., 2004, Watershed atlas of Afghanistan: Kabul, Afghanistan, Afghanistan Information Management Service, 183 p.

Hydrology Subcommittee of the Interagency Advisory Committee on Water Data, 1982, Guidelines for determining flood flow frequency: Hydrology Subcommittee Bulletin 17B, 28 p., 14 appendixes.

Republic of Afghanistan, Ministry of Water and Power, 1977, Hydrological yearbook 1961–1975, Part III–5 to 7, Khash, Farah and Adraskan River basins: Water and Soil Survey Department, Afghanistan Hydrologic Data Report RO 223, 114 p.

Williams-Sether, Tara, 2008, Streamflow characteristics of streams in the Helmand Basin, Afghanistan: U.S. Geological Survey Data Series 333, 341 p.

— Tara Williams-Sether

USGS Afghanistan Project Product Number 177

This study was funded by Interagency Agreement 07C442100KB between the U.S. Agency for International Development and the U.S. Geological Survey.

Photographs courtesy of Donald C. Houk, advisor to the U.S. Agency for International Development; and Verne R. Schneider, U.S. Geological Survey.