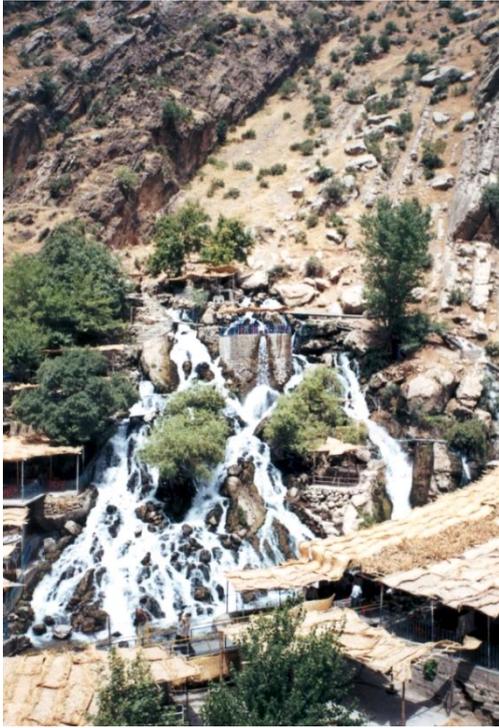


Country	MIKAS springs	Coordinates / Nearby City	Spring discharge (Q in l/s,min/av/max) / tapped or not	Criteria* in order / Main justification */ H-historic, A-aesthetic, S-scientific, E-Economic, Ec-ecologic	Data collected by
Iraq 	1. Bekhal	N 36°37'0.92" E 44°29'51.60" Z = 620 m asl  Rawanduz, Soran District, Erbil Governorate, Kurdistan Region	750 / 2000 / 17000  Spring not tapped until 2005, when small amount (c.300 l/s) pipelined and used for Soran (Diana) city as well as for local resort	<b>A, S, E, Ec</b>  <i>The gravity type spring issuing from massive and highly fractured limestones of Qamchuga and Bekhme (Cretaceous) fms. Covering the basin of 65 km<sup>2</sup>. The limestone layers are highly deformed and intersected by two faults, which directly predisposed the discharge points at steep slopes of Korak Mt. During low water season only few of them are active. Water is falling to very short and steep valley extended only hundreds of meters up to the confluence with the Rawanduz River. This famous spring with an impressive waterfall is a tourist attraction and small resort has been built around it. Apart from the actual use of part of its water for Soran, Bekhal has an important role for future water use and management, for both the central and northern Erbil Governorate.</i>	Zoran Stevanović
	2. Sarchinar	N 35°35'10.1" E 45°22'57.8" Z = 757 m asl  Sulaimani Governorate, Kurdistan Region	600 / 1500 / 7000  Spring was tapped in 1950s as one of the oldest intakes in the region. Minimum utilized 1000 l/s.	<b>E, S, A, H, Ec</b>  <i>The catchment of some 150 km<sup>2</sup> consists of karstified limestones of Kometan, Balambo, Qamchuga (Lower Cretaceous) fms. This is one of the oldest intakes with walled discharge points the very typical structure for ascending springs applied in this region. The spring is of vital importance for potable water supply of Sulaimani city, the capital of the sake name governorate. Spring has successfully followed the expansion of the city from 46,000 inhabitants in 1957 to about 400,000 in the 1980s. Nowadays, the city has more than two million inhabitants. To over-bridge the water shortage it was therefore necessary to use surface waters from the Dokan reservoir, located 70 km away. During high water period and maximal spring discharge (may reach 7 m<sup>3</sup>/s) springwater remains main source. During long extended summer months (usually no rains between April and October), along with water from the Sarchinar spring and Dokan reservoir, several thousand wells that have been mostly illegally drilled in the karst aquifer inside the city and its outskirts also support the domestic water supply.</i>	Zoran Stevanović, Salahaddin Saed Ali
	3. Zulum (Zalm, Zalum) - Ahmed Awa	N 35°19'2.53" E 46° 5'24.82" Z = 920 m asl  Khurmali,	350 / 800 / 8500  Spring water tapped for small HP station and downstream by	<b>A, E, S, C</b>  <i>The most impressive spring in the Sulaimani Governorate of Iraq draining the Triassic karst aquifer (Avroman fm), located at the head of the Ahmad Awa valley, northeastern of Khurmali (Thrust tectonic zone). It is locally also called</i>	Zoran Stevanović, Salahaddin Saed Ali

		Sulaimani Governorate, Kurdistan Region	pipelines for towns: Halabja (400 l/s) and Khurmal (200 l/s) (according to data from 2008)	<i>Zalum, or Zalm. It appears very close to the Iranian border and a significant part of its catchment is in Iran. The spring emerges from a large cave and flow out over the cascades for some 30 m making a very nice waterfall. At the foothill, a small hydropower plant (with its penstock parallel to the cascade) has been built using part of the flow. The Zulum waters are diverted into two irrigation channels and into pipelines installed for the gravity water supply of the towns of Halabja and Khurmal, and the village of Ahmed Awa. The behaviour of the spring hydrograph shows that this spring reacts strongly to the first rainfall events within the period continuing from the first steps through 15 days (Ali, 2008).</i>	
	4. Khanis	N 36°45'41.08" E 43°25'11.02" Z = 461 m asl  Atrush, Bavian, Dohuk Governorate, Kurdistan Region	20 / 150 / ?  <i>One of the globally oldest tapped springs and intakes (weirs) on nearby Gomel River established for spring and river water delivery to historical city of Ninevah (total channels and aqueducts length of &gt;50km).</i>	<b>H, S, A, Ec</b> <i>The spring and Khanis intake are linked to limestones of Pila Spi Fm. (Middle to Upper Eocene), one of the major karst aquifers in Iraq. The son of Sargon II, Sennacherib, who came to the Assyrian throne in 704 BC constructed canals and aqueducts and built a magnificent palace in Ninevah. Khanis is an impressive engineering work by the ancient Assyrian culture. It is fascinating that in those ancient days the emperor found that karst spring and mountainous river water were a much better solution than the surface water of the Tigris, which flows very close to the Nineveh city walls. A gigantic rock relief of King Sennacherib overlooks the Gomel River and the cliff faces are carved with man-made caves, rock sculptures, numerous ancient symbols and cuneiform inscriptions that depict the life and events that went on in relation to the water supply. There is no protection and reservation of the entire area of Khanis. In vicinity are the main Yezidis temple in Lalish (10 km) and world's famous Shanadar cave in which many archaeological excavations took place and Neanderthals skeltons found.</i>	Zoran Stevanović

**MIKAS – Bekhal**



*Bekhal spring in the low-water season*

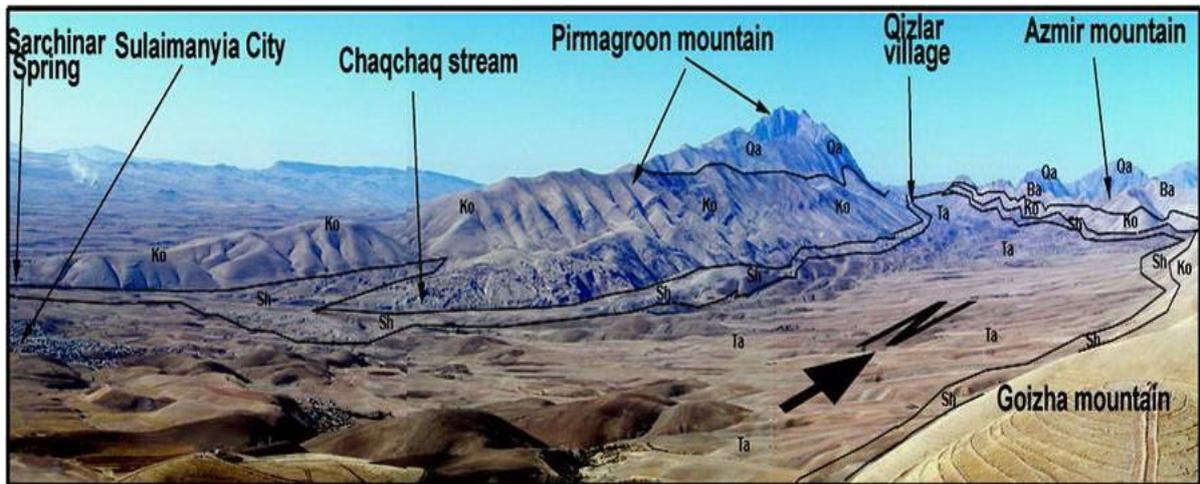


*Bekhal spring in the high-water season*



*Gali Ali beg water fall close to Bekhal – Khalifan. The famous national site used as a motif at one of Iraqi bills*

**MIKAS – Sarchinar**



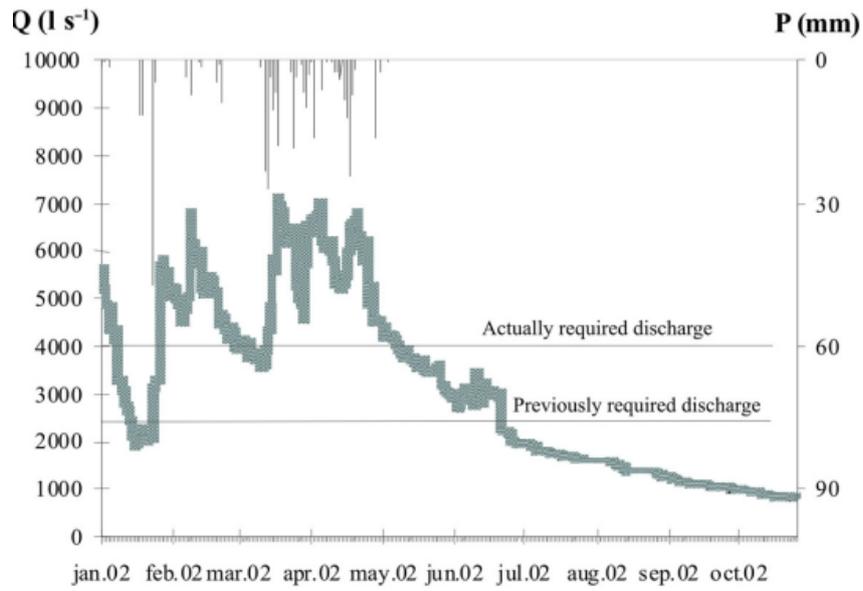
*Cross section of Pura Magroon Mt - Sarchinar (after Ali, 2008)*



*Pumping station of the ascending spring Sarchinar (photo: Z. Stevanović)*



*Spring overflow in Sarchinar resort area (Photo: S.S. Ali)*



*Spring hydrograph of Sarchinar spring with Sulaimani water demands in the year 2002 (after Ali et al., 2008)*

### MIKAS - Zulum



*Zulum spring water issuing under the large cliff (photo Z.Stevanović)*



Zulum spring in the wintertime (source: <https://www.khormal.com/2023/02/zalm.html> )

### MIKAS – Khanis



Reconstruction of Khanis aqueduct (after Jacobsen & Lloyd, 1935, redrawn)



*Monumental cliff with cuneiform inscriptions above Khanis spring (courtesy of A. Holm)*



*Khanis intake ruins (photo Z.Stevanović)*