Chapter 9

Qweik River Basin

INVENTORY OF
SHARED WATER RESOURCES IN WESTERN ASIA (ONLINE VERSION)

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Qweik River Basin

EXECUTIVE SUMMARY

The Qweik River rises in Turkey and discharges in Syria, forming a closed drainage basin. Before the 1950s, the Qweik was the main source of freshwater for the city of Aleppo. However, the river and tributary springs have today run dry as a result of rising demand in Aleppo, the regulation of the river, and the over-exploitation of groundwater resources.

The Qweik currently flows partly intermittently before reaching Aleppo, after which it becomes a permanent carrier of wastewater generated from households and industries in the city.

Water from the Qweik has been used intensively for irrigation around Aleppo, posing a serious threat to public health and the environment. Syria initiated a project in 2006 to supply the river with freshwater from the Euphrates. Additional projects to construct wastewater treatment facilities are planned.

The Qweik River in Aleppo, Syria, 2012. Source: Harout Minassian.

BASIN FACTS

RIPARIAN COUNTRIES	Syria, Turkey
BASIN AREA SHARES	Syria 88% Turkey 12%
BASIN AREA	6,941 km^2
RIVER LENGTH	167 km
MEAN ANNUAL FLOW VOLUME	82 MCM
DAMS	3
PROJECTED IRRIGATED AREA	..
BASIN POPULATION	~5.5 million

MAIN AGREEMENTS

SYRIA – TURKEY (FRENCH MANDATE)	1921 – Franklin-Bouillon Agreement in which reference is made to the rule of equitable utilization and the importance of ensuring water supply to the city of Aleppo.

KEY CONCERNS

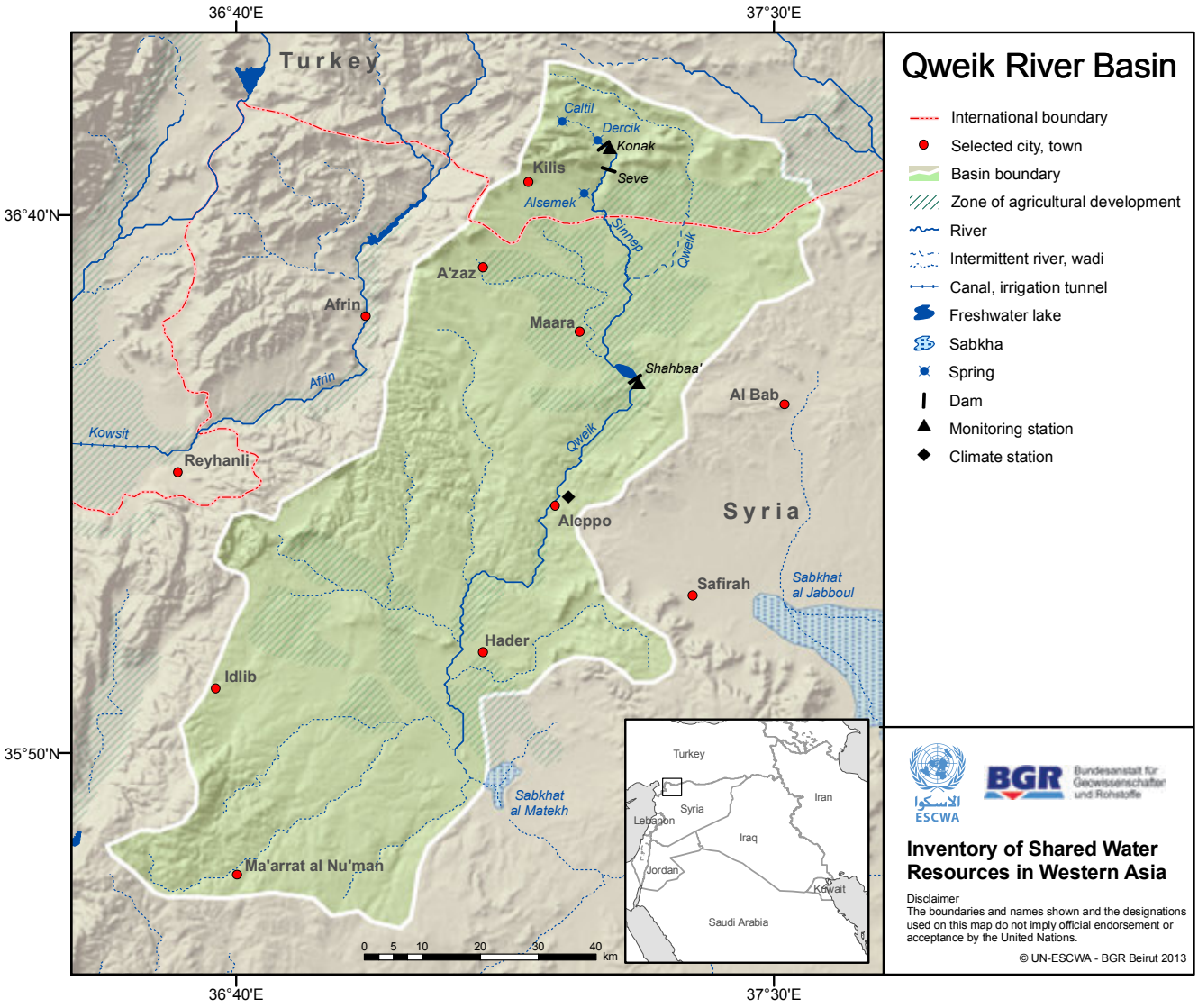
WATER QUANTITY

Water diversions and groundwater over-abstraction in the basin have caused most springs to dry up, turning the Qweik into an intermittent river in its upper reaches.

WATER QUALITY

The Qweik carries a mix of domestic-industrial, treated-untreated wastewater that has been used for irrigation since the 1980s, presenting potential risks of crop contamination. The geological setting of the basin also makes groundwater resources particularly vulnerable to contamination from agricultural drainage.

OVERVIEW MAP



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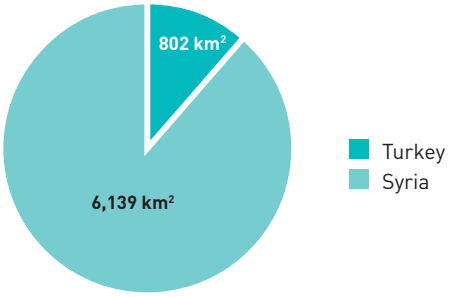
Geography

The Qweik River[1] is a closed[2] drainage basin shared between Turkey and Syria. The river originates in Turkey, and is joined by the Sinnep after the Syrian-Turkish border. It then flows further southward, discharging into the Sabkhat[3] al Matekh south of the city of Aleppo.

The Qweik Basin area is 6,941 km², of which 12% is located in Turkey (Figure 1). The main part of the basin is situated in northern Syria (88%).[4]

Figure 1. **Distribution of the Qweik Basin area**



Source: Compiled by ESCWA-BGR.

RIVER COURSE

The 167 km-long Qweik River originates in the Taurus Mountains in Turkey. It flows through Syria for 144 km and crosses the Turkish province of Kilis and the Syrian governorate of Aleppo, where it discharges into the Sabkhat al Matekh between the Syrian cities of Hader and Idlib (see Overview Map).

The Qweik Basin forms part of a larger closed basin called the Aleppo Basin.[5] The Qweik Basin borders on the Jabboul Basin to the east and the Orontes Basin to the west.

The Qweik is fed by several springs in Turkey including the Caltil, Dercik and Alsemek Springs, as well as other intermittent springs. One of its tributaries is the Sinnep stream.

CLIMATE

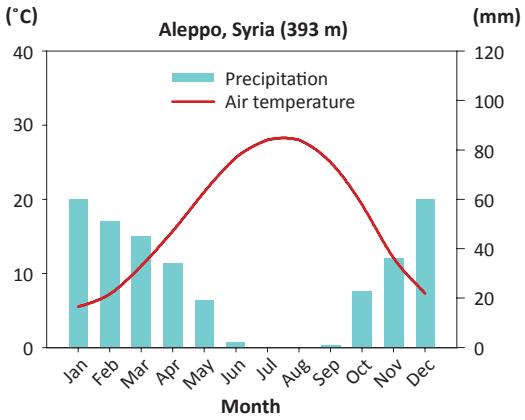
The climate in the Qweik Basin is moderately dry to dry, with more rain than in the south-east (predominantly Mediterranean climate with continental influence). Mean annual air temperature is around 20°C (Figure 2).

A Region of Orchards

Many place names in the Qweik catchment around Aleppo feature the word 'boustan' (orchard). Names such as Boustan Basha, Boustan Sheikh Taha, Boustan Qasr and Boustan Kleib testify to the region's rich agricultural heritage.

Winters are cool and wet with high levels of humidity; summer lasts from June to September with maximum temperatures of around 30°C. Mean annual precipitation is estimated between 250 and 500 mm (Table 1).[6]

Figure 2. **Climate diagram for Aleppo, Syria, in the Qweik Basin**



Source: Compiled by ESCWA-BGR based on data provided by WorldClim, 2011; Climate Diagrams, 2009; Phytosociological Research Center, 2009.

Table 1. **Basin areas and mean annual precipitation estimates**

BASIN	AREA (km²)	MEAN ANNUAL PRECIPITATION		SOURCE
		mm/yr	MCM/yr	
Qweik (Syrian part)	6,130	370	2,300	Wolfart, 1966.
Al Bab (Sabkhat al Jabboul)	4,800	250	1,200	
Qweik (Syrian part)	..	400-450	2,200	Selkhozpromexport, 1979.
Al Bab (Sabkhat al Jabboul)	..	300	1,200	
Qweik (Syrian part)	..	340	2,100	JICA, 1997.

Source: Compiled by ESCWA-BGR.

POPULATION

The Qweik Basin area has a population of about 5.5 million, including the densely populated city of Aleppo, which constitutes about 75% of the basin area's total population and is the main urban centre.[7] Over the last 60 years, Aleppo's population has grown dramatically from 320,000 in 1950 to about 2.2 million in 2004, a sevenfold increase.[8] Outside of Aleppo, the Qweik Basin is characterized as rural and agricultural.

Table 2. Estimated basin population

RIPARIAN COUNTRY	COUNTRY POPULATION (MILLIONS)	ESTIMATED POPULATION IN THE BASIN		SOURCE
		MILLIONS	AS PERCENTAGE OF TOTAL BASIN POPULATION	
Turkey	73.7	0.12	2.2	Turkstat, 2010.[a]
Syria	20.9	5.42	97.8	Central Bureau of Statistics in the Syrian Arab Republic, 2005.[b]
Total		5.53		

Source: Compiled by ESCWA-BGR.
(a) The population estimate for the area of the basin that lies in Turkey is based on a 2010 census and includes the population living in the Turkish province of Kilis.
(b) The population figure for the area of the basin that lies in Syria is based on a 2010 estimate and includes populations living in the Syrian governorates of Aleppo, Idlib and Hama, including cities such as Aleppo, Maara and Hader.

The city of Aleppo, Syria, 2010. Source: Bernard Gagnon.

Hydrological Characteristics

DISCHARGE AND FLOW REGIME

Continuous time series of discharge along the Qweik River were not available. Data collected for the period from 1958 to 2009 from different literature sources (Table 3) was insufficient for a conclusive hydrological analysis, due to data gaps, lack of information on location[9] and incompatible data sets.

The overall literature review suggests that until the early 1980s the mean discharge of the Qweik River and tributaries near the Syrian-Turkish border was in the range of 2-5 m^3/s (approx. 60-160 MCM/yr) with an average of around 3 m^3/s (approx. 95 MCM/yr).[10]

Water diversion and dam projects in upstream Turkey and Syria, paired with an intensification of irrigation from 1975 onward (but possibly also much earlier), are likely to have strongly impacted river flow at the border and in Aleppo, a city which used to rely on the Qweik for its water supply. As a result of abstractions and drought periods, the Qweik has reportedly dried up completely before Aleppo[11] as have many of the springs contributing to river flow in Syria.[12] In the 1980s, average discharge fell to 0.3 m^3/s (9.5 MCM/yr).

At the same time, the rapid urban growth of Aleppo has led to a rise in wastewater discharge into the Qweik, increasing flow rates downstream of the city. As Aleppo no longer extracts water from the Qweik River for domestic use and imports most of its drinking water supply from the Euphrates Basin,[14] the Qweik River has once again become a perennial river downstream of Aleppo due to wastewater discharges into the river.[15] Measurements carried out on 14 April 2004 estimated the river's upstream discharge at 2-3 m^3/s (lined canal section), and downstream discharge south of Aleppo at 5-6 m^3/s (Wdaihy gauge).

Table 3. **Summary of annual flow volume statistics for the Qweik River (1958-2009)**

YEAR	MEAN (m^3/s)	MEAN (MCM/yr)	MAXIMUM (m^3/s)	MINIMUM (m^3/s)	SOURCE
1958	2.5	78.8	60	—	Central Bureau of Statistics in the Syrian Arab Republic, 1958-2000.
1963	2.5	78.8	60	—	
1967	2.5	78.8	60	—	
1970	2	63.1	70	—	
1973	5	157.7	60	—	
1980	2.79	87.9	..	..	Kolars and Mitchell, 1991.
1982	0.3	9.5	7.8	—	Central Bureau of Statistics in the Syrian Arab Republic, 1958-2000.
1986	0.3	9.5	7.8	—	
1987	0.3	9.5	7.8	—	
1988	5	157.7	60	—	
1995	1.3	40.9	3.5	0.6	
1996	4.6	145.1	9.9	2.4	
1997-2000	3.4	107.2	..	..	
2002	1.7	53.6	2.2	1.1	Central Bureau of Statistics in the Syrian Arab Republic, 2003-2010.
2003	1.5	47.3	4.2	0.8	
2004	2.4	75.7	4.4	0.8	
2005	2	63.1	2.6	1.7	
2006	4.6	145.1	5.6	3.9	
2007	3.5	113.4	5.3	3	
2009	5.13	161.8	8.08	3.62	

Source: Compiled by ESCWA-BGR.

Since 2009, water from the Euphrates River has been diverted to the Qweik through an extension of the Maskaneh irrigation canal. Flow rates downstream of the insertion point will therefore not be comparable to historic values.

Downstream from Aleppo, the entire surface water flow (including effluents) is used for irrigation purposes.[16]

GROUNDWATER

Several springs in Turkey contribute to the flow of the Qweik River, including the Caltil, Dercik and Alsemek Springs (see Overview Map). There are also several seasonal springs on the Syrian side of the border, some of which used to be perennial. It can be assumed that groundwater is the main source of base flow in the Qweik River.

Together with the catchments of the Afrin, Sajour and Al Bab Rivers, the Qweik Basin overlies the wider Aleppo groundwater sub-basin.[17] In 1976, the Qweik Basin still had a positive groundwater balance.[18] However, 20 years later the deficit had reached 100 MCM/yr or 37%, as intensive agricultural development in the Aleppo sub-basin led to widespread over-exploitation of groundwater (Table 4).[19] Consequently, groundwater levels have dropped by 1-2 m/yr in many parts of the basin, and even up to 5 m/yr in certain places.[20]

Table 4. Groundwater balance in the Qweik Basin

STUDY PERIOD	AREA (km^2)	GROUNDWATER (MCM/yr)				SOURCE
		INPUT[a]	OUTPUT[b]	ABSTRACTION	BALANCE	
1976	5,190	252	242	200	+10	Selkhozpromexport,1979.
1993-1996	6,333	273	373	373	-100	JICA, 1997.

Source: Compiled by ESCWA-BGR based on Ministry of Irrigation in the Syrian Arab Republic, 2004.
(a) Lateral inflow + Recharge through precipitation + Irrigation return flow.
(b) Lateral outflow + Spring discharge + Base flow (river) + Abstraction.

Water Resources Management

Before the 1950s, the Qweik River was the main source of water for the city of Aleppo.[21] However, the regulation of the river (construction of dams, channels and diversions) and the over-exploitation of groundwater resources have resulted in the river and its tributary springs running seasonally dry.[22]

Today, the Qweik River is partly used for irrigation purposes, posing potential health hazards to consumers of cultivated vegetables that have been irrigated by polluted Qweik water.[23]

DEVELOPMENT & USE: TURKEY

The areas adjacent to the river on the Turkish side of the border are used for agriculture. Several water diversion and land irrigation projects have been implemented since the 1970s. There are also two dams on the Qweik: the Seve Dam and the Konak Dam. Both dams were constructed for irrigation purposes (Table 5).

DEVELOPMENT & USE: SYRIA

The Qweik River in Syria serves domestic, industrial and agricultural purposes. However, its use patterns have changed in recent decades.

Historically, the Qweik was Aleppo's main source of water, but the city's exponential growth over the last 60 years has severely affected the flow of the river, reducing it to a trickle of concentrated wastewater.[24] In a bid to address this worsening problem, the Syrian Ministry of Irrigation explored various options and launched a project in 2006 that included the construction of a canal that brings Euphrates water from Lake Assad to the Qweik River.[25] This canal receives 4 m^3/s of water from the Al Babeeri pumping station which distributes a total of 90 m^3/s of water from Lake Assad to various irrigation schemes. The Qweik River has thus been restored in Aleppo, with water filling the riverbed since 2009. While the bulk of water is released into the river to improve its quality, 1 m^3/s is used in the Sheikh Najjar industrial area which houses local businesses and light manufacturing.[26]

The water of the Qweik has also been used to supply a fruit canning industry at Idlib, two cement plants, a glass factory and a sugar plant.[27]

Large-scale irrigation in the Qweik Basin started around 1960 when the Syrian Government constructed the Shahbaa Dam close to the village of Maara. Ever since, the dam has supported part of the area's irrigation needs and domestic supply to adjacent villages. It is also used for flood control purposes (Table 5). In addition, a total area of 20,814 ha is irrigated in the Qweik Valley. In summer, 43% of this area is irrigated using 133 MCM of surface water; in winter, 31% of the area is irrigated using 26 MCM.[28] However, as the riverbed has also become a wastewater drainage channel, water quality has deteriorated, making it unsuitable for agricultural use.

WATER QUALITY & ENVIRONMENTAL ISSUES

Formerly a source of freshwater, the Qweik River currently acts as a carrier of wastewater generated in the city of Aleppo and its suburbs.[29] Water pollution is obvious both upstream and downstream of Aleppo, with households

Table 5. Dams in the Qweik Basin

COUNTRY	NAME	COMPLETION YEAR	CAPACITY (MCM)	PURPOSE[a]	BACKGROUND INFORMATION
Turkey	Konak (Goleti)	2006	..	I	-
	Seve	2005	..	I	Located on the Sinnep, a tributary of the Qweik.
Syria	Shahbaa	1968	12	FC, I	The dam is only operational during flood periods.

Source: Compiled by ESCWA-BGR based on General Directorate of State Hydraulic Works in Turkey, 2009; Radwan, 2006; Ministry of Irrigation in the Syrian Arab Republic, 2011; BGR and ACSAD, 1984.
(a) Irrigation (I) and Flood Control (FC).

and industries along the Qweik River directly discharging wastewater and untreated industrial waste into the river.[30] In addition, the Aleppo wastewater treatment plant that was built in 2002 discharges insufficiently treated effluents into the river.[31] The river thus carries a mix of domestic-industrial, treated-untreated wastewater that has been used for irrigation for over 25 years.[32] During the agricultural growing period, all sewage water is used for crop irrigation, amounting to 142-164 MCM/yr. In winter, the water is routed to Sabkhat al Matekh, where it evaporates or infiltrates into the subsurface.[33]

Water quality tests on the Qweik River in peri-urban Aleppo in 2009-2010 have shown extremely high levels of Total Phosphorus (TP), Total Nitrogen (TN), Biochemical Oxygen Demand (BOD) and faecal coliform bacteria, as well as a salinity (Electrical Conductivity) value exceeding the international guidelines for irrigation (Table 6).[34] Moreover, they also revealed high concentrations of heavy metals in the water, especially chromium (Cr) stemming from Aleppo's tannery industries.[35] This has resulted in crop contamination:[36] according to estimates, an area of about 20,000 ha around the city is irrigated with insufficiently treated wastewater.[37] The new canal that was completed in 2009 diverts Euphrates River water to the Qweik River in order to improve its quality during the summer months (mid-April until end of August).[38]

The contamination of the Qweik River also poses a risk to groundwater resources, as it runs along a geological fracture zone with high permeability. Pollutants contained in the wastewater are therefore likely to be leached to the groundwater through excess irrigation water from areas where insufficiently treated effluents are used, and where irrigation drainage systems are missing.[39]

Table 6. Mean salinity, nutrients and biological indicators in the Qweik River (2009-2010)

	SALINITY	NUTRIENTS		BIOLOGICAL INDICATORS	
	EC (µS/cm)	TP (mg/L)	TN (mg/L)	BOD (mg/L)	Faecal coliform (cfu/100ml)
Mean	..	7.2	38	182	..
Range	1,000-1,500	5-12	22-54	..	1,600,000-10,900,000
Guidelines[a]	<700 (irrigation)	0.075	2-6	3-6	0 (drinking water) 1,000 (irrigation) 10,000 (bathing)

Source: Compiled by ESCWA-BGR based on Sato et al., 2010; Sato et al., 2012.
(a) For further information on the different water quality parameters and their respective guidelines, see 'Overview & Methodology: Surface Water' chapter.

Agreements, Cooperation & Outlook

AGREEMENTS

There is no basin-wide agreement in place for the Qweik River, and the riparian countries have not addressed the water resources in the basin in any bilateral talks in recent years.

The last agreement was concluded in 1921 between Turkey (under the Turkish revolutionaries) and Syria (under the French Mandate) when the Qweik River had a much higher flow rate. The Franklin-Bouillon Agreement (Ankara Treaty)[40] states that the water of the Qweik is to be shared between Syria – especially to meet Aleppo's water needs – and Turkey, in such a way that is satisfactory to both parties. Further, it stipulates that if either party wishes to build any structure for use of the river, there should be an agreement to ensure the rights of both states.

COOPERATION

There is currently no cooperation between Syria and Turkey on the Qweik River.

OUTLOOK

Since 2009, the flow of the once-dry Qweik River has been restored in Aleppo, with water flowing through the city. Moreover, there are plans to construct several wastewater treatment plants in the basin in order to improve water quality and re-establish the possibility of recreational activities along the river.[41] However, with the ongoing crisis in Syria since March 2011 it is likely that most projects are currently on hold. Moreover, it can assumed that water infrastructure in the greater Aleppo area has been damaged.[42]

The Qweik in Aleppo, Syria, 2012. Source: Harout Minassian.

Notes

1. In Turkey, the river is referred to as the Balik River, which should not be confused with the Syrian Balikh, a tributary of the Euphrates. See The Institute of Mineral Research and Exploration of Turkey, 1962; Kolars and Mitchell, 1991, p. 111.
2. A closed (endorheic) basin does not naturally drain into the sea.
3. Sabkha is the Arabic word for salt-pan or clay flat.
4. Basin area was delineated based on topography and stream network (Lehner et al., 2008).
5. According to Wolfart, 1966, only the eastern part (ca. 4,000 km^2) of the Qweik catchment belongs hydrogeologically to the Aleppo sub-basin.
6. Wolfart, 1966; JICA, 1997.
7. Central Bureau of Statistics in the Syrian Arab Republic, 2005; Turkstat, 2010.
8. Central Bureau of Statistics in the Syrian Arab Republic, 2005.
9. It is, for example, unclear whether data is from locations upstream or downstream of Aleppo.
10. Kolars and Mitchell, 1991, p. 110-111. Radwan, 2006, speaks of a historic flow of approx. 3.1 m^3/s.
11. Kolars and Mitchell, 1991.
12. Ministry of Irrigation in the Syrian Arab Republic, 2004.
13. Radwan, 2006.
14. About 220 MCM/yr are imported from the Euphrates River, which is more than twice the 'natural' flow of the Qweik itself. According to Ministry of Irrigation in the Syrian Arab Republic, 2004, drinking water production for Aleppo was 625,000 m^3/d, of which around 8% is consumed outside Aleppo (and most likely outside the Qweik Basin). The water purification plant situated on the Qweik River has a capacity of approx. 200 MCM/yr. Due to technical problems, current actual capacity is only 127 MCM/yr.
15. Ministry of Irrigation in the Syrian Arab Republic, 2004.
16. Ibid.
17. Ministry of Irrigation in the Syrian Arab Republic, 2004, p. 83. The Al Bab or Al Dahab was a perennial endorheic river discharging south-east of Aleppo into Sabkhat al Jabboul before 1950. Today the river no longer flows perennially because of groundwater over-abstraction.
18. Selkhozpromexport, 1979.
19. JICA, 1997.
20. Ministry of Irrigation in the Syrian Arab Republic, 2004.
21. Kolars and Mitchell, 1991.
22. General Directorate of State Hydraulic Works in Turkey, 2010; ICARDA and IWMI, 2008.
23. Ministry of Irrigation in the Syrian Arab Republic, 2004.
24. Kolars and Mitchell, 1991; ICARDA and IWMI, 2008.
25. Ministry of Irrigation in the Syrian Arab Republic, 2010.
26. Ibid.
27. Kolars and Mitchell, 1991, p. 110.
28. Luijendijk, 2003.
29. ICARDA and IWMI, 2008.
30. Sato et al., 2012; Ministry of Irrigation in the Syrian Arab Republic, 2004.
31. Effluents discharged to the Qweik are generally untreated or treated with preliminary measures. Ministry of Irrigation in the Syrian Arab Republic, 2004.
32. Sato et al., 2010; Sato et al., 2011; Sato et al., 2012.
33. Ministry of Irrigation in the Syrian Arab Republic, 2004.
34. Sato et al., 2010; Sato et al., 2012.
35. Sato et al., 2010; Ministry of Irrigation in the Syrian Arab Republic, 2004; Sato et al., 2011. Chromium levels exceeded FAO water quality guidelines for irrigation.
36. ICARDA and IWMI, 2008; Ministry of Irrigation in the Syrian Arab Republic, 2004.
37. Ministry of Irrigation in the Syrian Arab Republic, 2004; Sato et al., 2012.
38. Ministry of Irrigation in the Syrian Arab Republic, 2010; ICARDA and IWMI, 2008; Sato et al., 2012.
39. Martin, 1999.
40. Hirsch, 1956.
41. Ministry of Irrigation in the Syrian Arab Republic, 2010.
42. The Epoch Times, 2012.

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