Qosh Tepa Irrigation Canal and Its Effects on the Water Resources of the Neighboring Countries in Central Asia

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Abstract.

The Qosh Tepa Canal in northern Afghanistan has been under consideration since 1972. It diverts water from the Amu Darya to irrigate northern Afghanistan. The Canal starts in the Kaldar District of Balkh Province and ends in the Andkhoy District of Faryab Province. It measures 285 km in length, 100 meters in width, and 8.5 meters in depth. The Canal's design capacity is 650 m^3/s, with the potential to irrigate 545,000 hectares of farmland. While the project could significantly boost Afghanistan's agricultural productivity and food security, it also raises concerns about downstream water availability, ecological impacts, and regional water-sharing issues.

This paper explores the potential impact of the Canal on the region's water supply, agriculture, environment, and politics.

Mitigation strategies will focus on enhancing irrigation efficiency in Afghanistan, Uzbekistan, and Turkmenistan through canal lining, modern distribution methods, improved on-farm and off-farm water management, reducing conveyance losses, implementing joint monitoring programs for real-time flow data, and developing bilateral or multilateral agreements for fair water sharing.

Keywords: Qosh Tepa, Water Sustainability in Central Asia, Water Management, Aral Sea, Regional Cooperation

1. Introduction

Amu Darya (Darya means "river" in Farsi), Oxus (Greek), and Jaihoon (Arabic) has been the primary water source in Central Asia for millennia. The confluence of the Panj and Vaksh rivers, a few miles downstream from Shair Kahn Bandar in northern Afghanistan, marks the starting point of the Amu Darya. The Panj River itself originates from the mountain glaciers of Afghanistan and Tajikistan. The union of the Wakhandarya and Pamir rivers is commonly known as the source of the Panj; however, it's more logical to consider the Panj as a continuation of the Wakhandarya, with its source in Zor Kul lake in the Wakhan region of Afghanistan. The total length of the Wakhandarya-Panj is 1140 km, with the Panj itself measuring 921 km. (Rivers of Afghanistan, Year unknown). In the initial stages, the Amu Darya forms the boundary between Afghanistan and Tajikistan, then between Uzbekistan and

Afghanistan, and subsequently between Turkmenistan and Afghanistan. It eventually flows entirely into Turkmenistan and Uzbekistan, finally merging into the Aral Sea (see Figure 1).

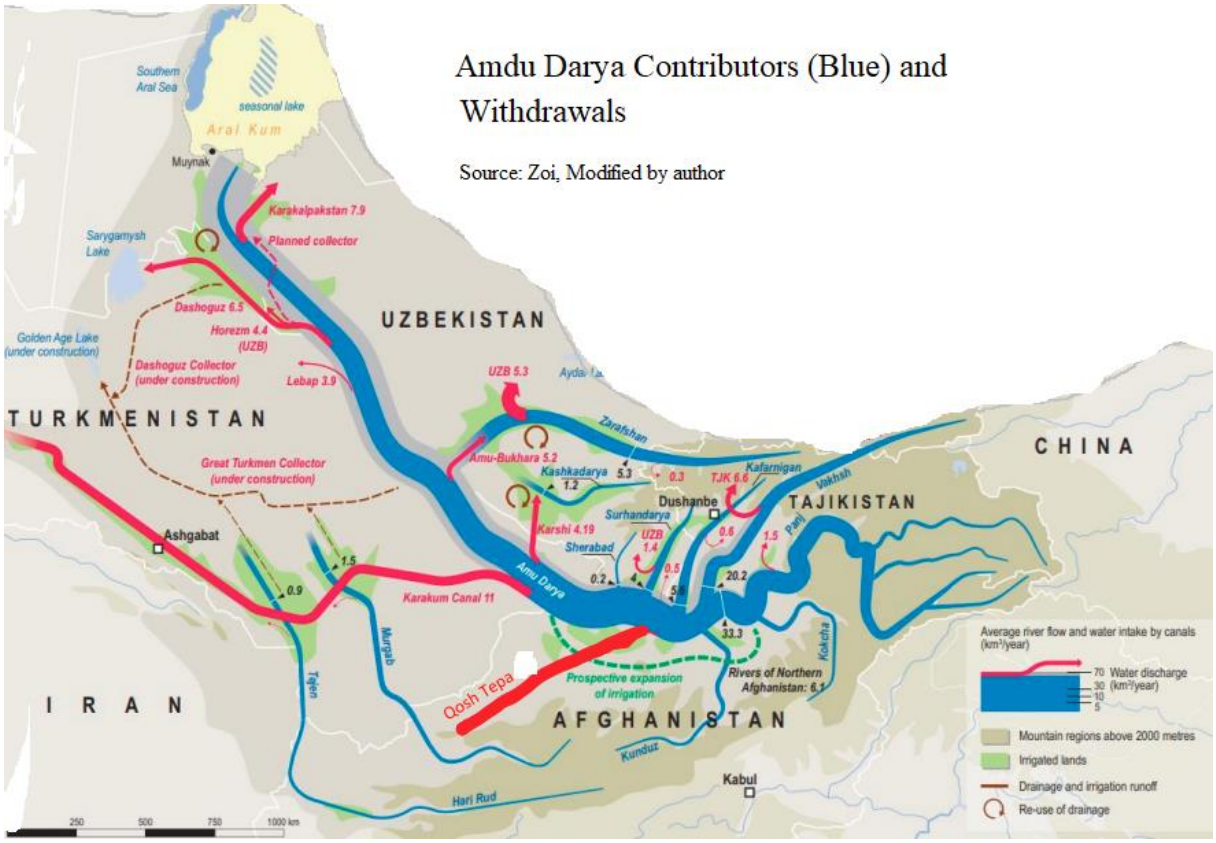
The Amu Darya has been a vital source of water for Agriculture and human sustenance since the beginning of human settlements along the river. Great civilizations have been developed and also destroyed along this river. The great cities of Balkh, Bukhara, Samarkand, and Khiva are all located in the vicinity of the Amu Darya. The Aral Sea, once the third-largest lake in the world (Wikipedia), was the recipient of water from the Amu Darya. However, beginning in the 1960s, with the development of extensive irrigation infrastructure in the Central Asian Republics (CAR) of the former Union of Soviet Socialist Republics (USSR), it shrank to 10% of its original size.

Figure 1: The Amu Darya Basin, Source: Zoi

1.1 Water Sharing from the Amu Darya

Before CAR gained independence, the USSR managed water distribution across its territory based on the energy and agricultural needs of each region. Soviet planners had a long-term goal to turn Central Asia into a cotton monoculture. They planned to divert a significant amount of water from the Amu Darya to irrigate the deserts of Uzbekistan and Turkmenistan. The main irrigation canals built to support agriculture in this area include, in Uzbekistan, the Karshi Canal, the Amu Darya-Bukhara Canal, and the Karakalpakstan Canal. On the Turkmenistan side, the Karakum Canal, the Lebap Canal, the Korezm Canal, and the Dashouz Canal are shown in Figure 2.

Figure 2: Water Contribution to and Extraction From the Amu Darya



The Soviets invested in hydroelectric power generation, HEP, in the upstream countries of Central Asia, such as Tajikistan and Kyrgyzstan, and in irrigation infrastructure in the downstream countries, like Uzbekistan and Turkmenistan. By doing so, they initiated a barter system of give-and-take. The downstream countries produce agricultural products and, in return, receive energy. To manage the water resources of the basin, the Soviet authorities developed a water distribution scheme known as Protocol 566, dated September 1987 (Ahmad & Wasiq, 2004). The available water was allocated to each according to the amount shown in Table 1.

Table 1: Water allocation based on Protocol 566, September 1987

Country	Limit (bcm/yr)	Percent Share, %	Average Annual Flow – bcm/yr	Percentage of Total
Afghansitan	0	0	17.0	23
Uzbekistan	29.6	48.2	5.1	7
Tajikistan	9.5	15.4	49.6	66
Kyrgystan	0.4	0.6	1.6	2
Turkmenstan	22.0	35.8	1.5	2
Total	**61.5**	**100**	**74.8**	**100**

The basis of water allocation in Protocol 566 was mainly the historical use of water for agricultural purposes (Ziganshina, 2022). Obviously, Afghanistan, the second-largest contributor to the Amu Darya flow after Tajikistan, was not included in the water-sharing agreement, as evidenced by Table 1.

Despite the Afghan government's attempts to initiate discussions with the Soviet authorities on water sharing, their efforts were unsuccessful (Naimi, 2012). After CAR's independence from the USSR, they agreed to continue the water-sharing deal in a meeting called the Almaty Agreement in 1992. However, Afghanistan was again excluded and not invited to this meeting, so it was left out of the water-sharing agreement.

Afghanistan finally decided to move forward on its own. It initiated the feasibility study for building the Qosh Tepa canal in 2018, almost four and a half decades after the conceptual design was first proposed in the 1970s. Construction of the Canal began in 2023.

2. The Qosh Tepa Canal

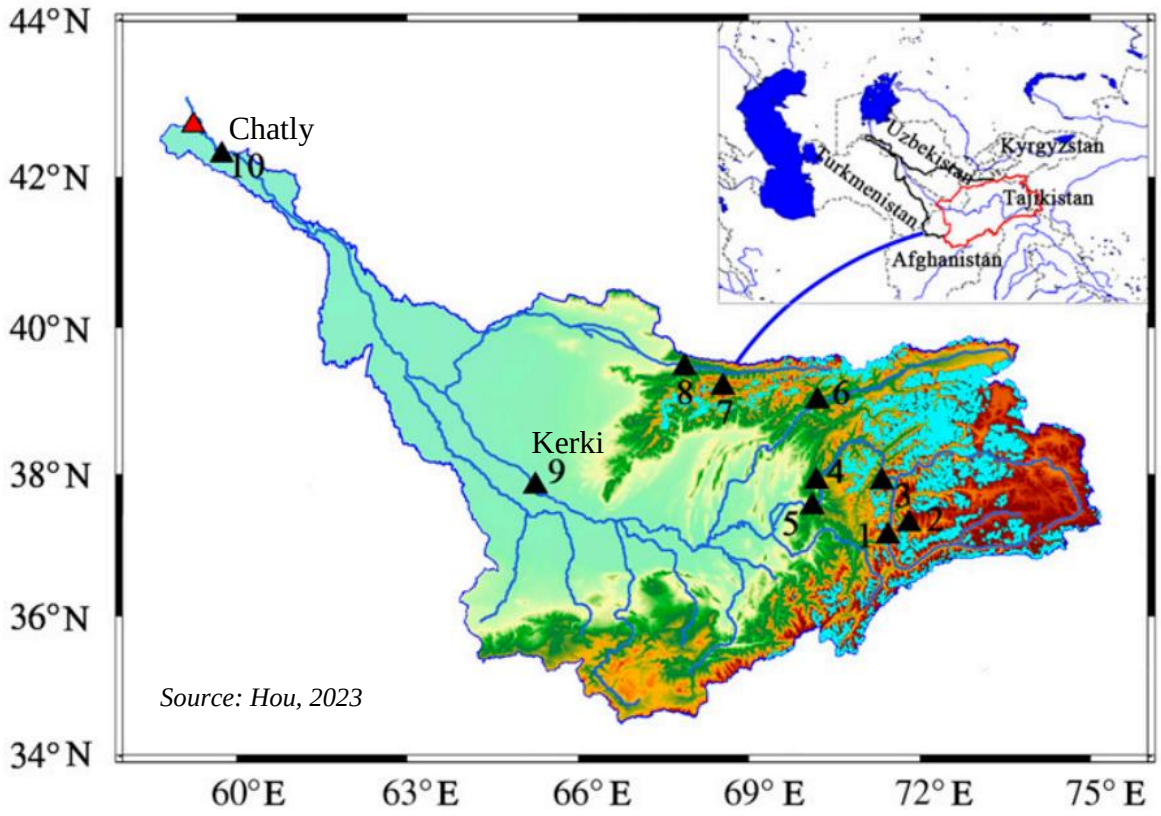
The Qosh Tepa Canal, shown in Figure 3, is an irrigation channel that will divert water from the Amu Darya to irrigate approximately 545,000 hectares of land in northern Afghanistan. The Canal was conceived in the 1970s during the presidency of President Daud Khan, the then-president of Afghanistan. It was planned to start at Khosh Tep near Kunduz in northern Afghanistan and deliver water to the northern provinces of Balkh, Jowzjan, and Faryab. With a length of 236 km, a width of 100 meters, and a depth of 8 meters, and with a design capacity of 650 cubic meters per second, it's one of the most extensive canals in the region.

Figure 3: Amu Darya and Qosh Tepa Canal

Source: Google, modified by author

For engineering purposes, the intake was relocated to Kardar District in Balkh Province, Northern Afghanistan. Construction of the Canal began in 2023 and has made significant progress toward the Andkhoy District in Jowzjan Province, which is considered the Canal's endpoint. To better understand water availability in the area, historical flow data from the Global Runoff Data Center (GRDC) at https://grdc.bafg.de/ has been plotted in Figures 5 and 6. These data show the historical annual flow for the Panj, Vaksh, and Amu Darya at two gauge stations, Kerki and Chatly, as illustrated in Figure 4 (Hou, 2023).

Figure 4: Gage Station Location at Kerki and Chatly



2.1 Vakhsh River

The Vaksh River originates in the mountains of Kyrgyzstan and, after traversing Tajikistan, joins the Panj River downstream from Shair han Bandar to form the Amu Darya. Flow data shown in Figure 5 covers the period between 19932 and 1967. The average annual flow during the recorded years is 20 km3 or bcm per year. The river has been extensively dammed for hydroelectric production. The famous dams are the Nurek Dam and Roghun Dam.

2.2 Panj River

The Panj River originates from the mountains of Afghanistan and Tajikistan. The confluence of the Wakhandarya and Pamir rivers is often considered the source of the Panj; however, it is more logical to view the Panj as a continuation of the Wakhandarya, with its source in Lake Zor Kul in the Wakhan region of Afghanistan. The total length of the Wakhandarya-Panj system is 1,140 km, with the Panj itself being 921 km long. (Rivers of Afghanistan, year unknown). Wakhandarya receives water from many tributaries, both large and small, from Afghanistan and Tajikistan, except for the Kokcha River. Satellite images (Google Earth) show several large and small water bodies that drain into both the Wakhandarya and Pamir rivers; however, there is no on-ground data on how these water bodies contribute to the Panj River, mainly because the Pamir region of Afghanistan is difficult to access.

Figure 5: Average Annual Flow for Vakhsh River

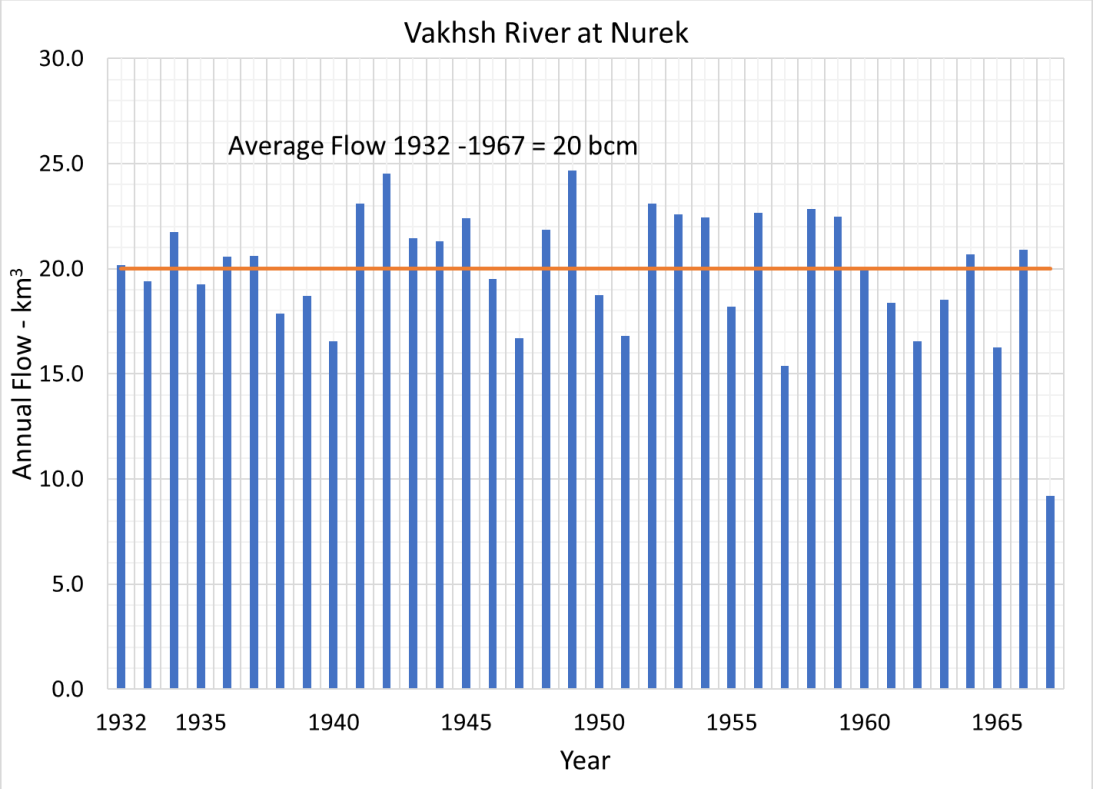


Figure 6: Average Annual Flow for Panj River

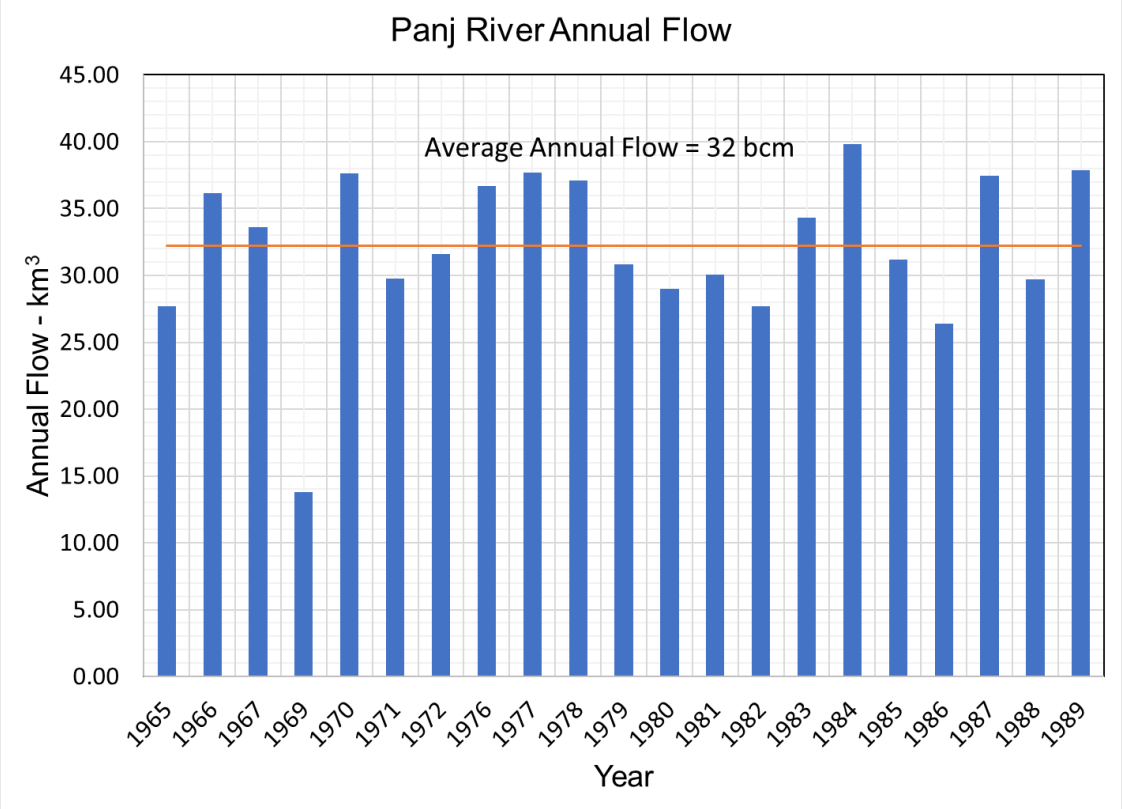


Figure 7: Average Annual Flow for Amu Darya at Kerki

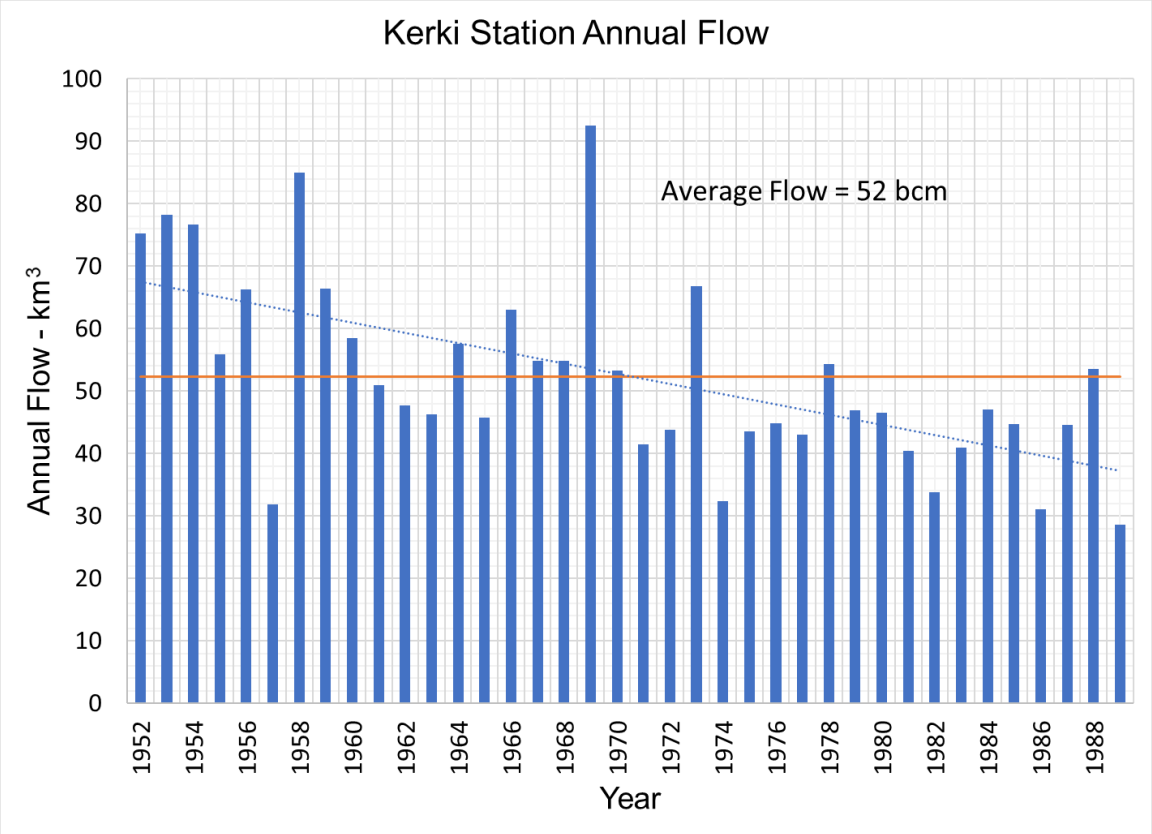
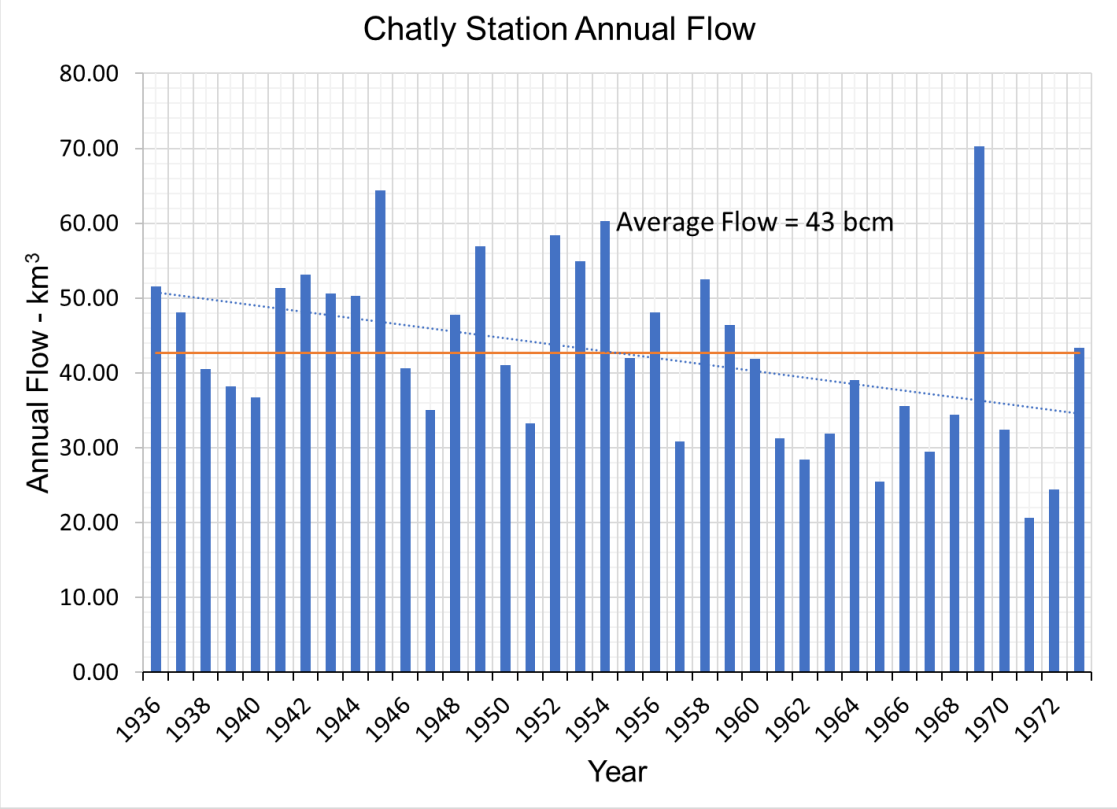


Figure 8: Average Annual Flow for Amu darya at Chatly



The first reliable gauge station on the Panj River is the Nizhny Station on the Tajik side, near Shair Khan Bandar in Afghanistan, which has available data in GRDC between 1965 and 1989. It has a near-stable average annual flow of 32 billion cubic meters. Data sharing, as is the case with most stations in Central Asia, ceased after the collapse of the Soviet Union and is no longer available for public consumption. Of the 32 billion cubic meters of water in the Panj River, a significant portion of the flow originates from Afghanistan.

2.3 Amu Darya

The Amu Darya forms where the Vaksh and Panj rivers meet, about 20 km downstream from Shair Kahn Bandar in northern Afghanistan. It is the largest river in Central Asia, with an average flow of 74 billion cubic meters annually (Ziganshina, 2022). The river's flow is heavily used for agriculture, and according to Micklin (1991), it is nearly drained. From its source near Shair Khan Bandar to Kerki in Turkmenistan, its main tributaries are the Kunduz River from Afghanistan and the Surkhandarya and Kafinihon from Tajikistan. From Kerki to the Aral Sea, there is no significant addition to the flow; only withdrawals occur.

Based on the riverflow data for the Amu Darya at Kerki (Figure 7), the annual average flow reaching Kerki is approximately 52 billion cubic meters (bcm). Two major withdrawals between Kaldar, the intake for Qosh Tepa, and Kerki are the Karakum Canal, at 11 billion cubic meters (bcm), and the Karshi Canal, at four bcm. Adding these to the 52 bcm results in approximately 67 bcm of water available at the Kaldar Qosh Tepa intake annually.

The annual design capacity of the Qosh Tepa Canal is 20 billion cubic meters (bcm); subtracting this from the 67 bcm available at Kaldar leaves 47 bcm for downstream countries. With strict water management schemes and the fact that Qosh Tepa would not always divert the whole design flow, it would be easier to adapt to the new situation of the Qosh Tepa Canal.

3. Potential Positive Impact of the Canal

The Canal would convert vast areas of dry land in northern Afghanistan into productive agricultural land, thus enhancing food security and reducing dependency on imports. Increased agrarian output would stimulate the rural economy, create jobs, and improve export potential. It would help alleviate rural poverty and promote local stability. When fully functional, the Canal will improve the livelihoods of nearly 600,000 people. On a regional level, it could expand trade with neighboring countries and, if handled properly, increase collaboration in sharing water data and expertise among Central Asian countries.

3.1 Possible Negative Impact on Downstream Countries

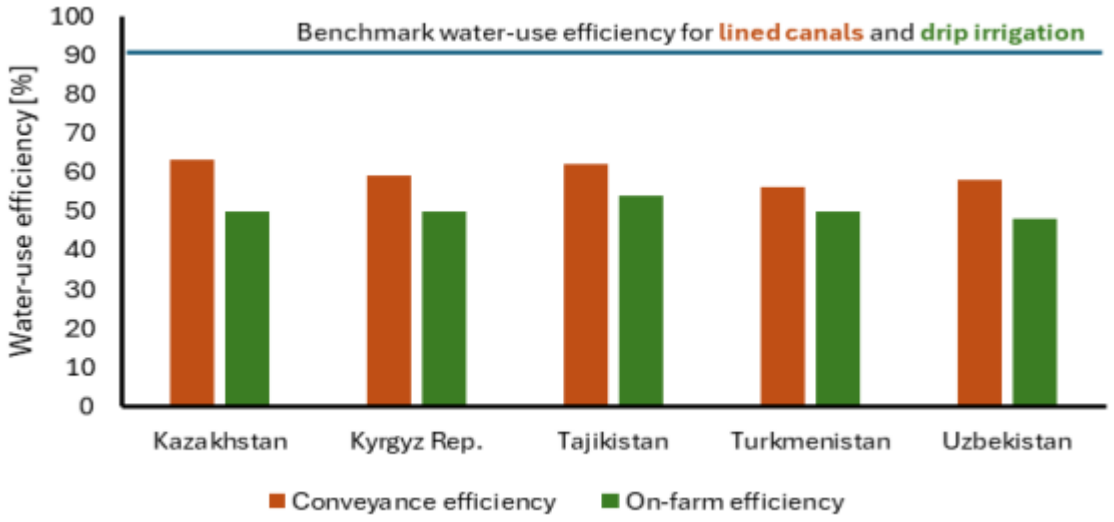
The Amudarya water resources are already exhausted. Without improvements in water management across the region, further diversions will reduce water supplies in Uzbekistan and Turkmenistan. Water shortages in the lower reaches of the Amu Darya could threaten agriculture in areas like Bukhara, Khorezm, Dashoguz, and Karakalpakstan. This may also worsen the Aral Sea crisis. It could also increase political tensions between Afghanistan and neighboring countries, especially during periods of low river flow. However, implementing

mitigation measures could lessen the negative impacts of the Canal and benefit all riparian countries.

4. Mitigation and Policy Recommendations

Improving water-use efficiency could save significant water, offsetting the diversion of water through Qosh Tepa. According to a study by the World Bank (World Bank, 2025), Conveyance water use efficiency and on-farm water use efficiency in CAR are approximately 60% and 40%, respectively, as shown in Figure 9.

Figure 9: Irrigation Water Efficiency in Central Asia



Source: The World Bank

Lined canals could improve efficiency by up to 90%; however, they should be applied judiciously, as canals often feed groundwater in many areas near them, and people may rely on it for their everyday use. Improved irrigation techniques, such as drip irrigation, facilitate the cultivation of crops that require less water. These measures have already been started in some CAR countries, but to a limited extent. Tempreature in the deserts of central Asia sometimes reaches close to 50°C, causing excessive evaporation in the conveyance system. The use of conduits and pipes should be encouraged.

Sharing data and being transparent would improve decision-making and allow for timely choices. Afghanistan is not a party to any water-sharing agreement and is therefore not bound by any water-sharing understanding, whether regarding the Amu Darya or the environmental crisis in the Aral Sea. In many discussions between CAR and international groups, Afghanistan has not been recognized as a major legitimate riparian country of the Amu Darya. To ensure a smooth transition from the current state to after the Canal is built, every effort should be made to encourage Afghanistan to join water-sharing agreements. Additionally, technical help should be provided in water management and canal construction to prevent repeating past mistakes made by other countries.

5.0 Conclusion

The Qosh Tepa provides Afghanistan with an opportunity to utilize water from the Amu Darya and assert its rightful water rights from the river. As a result, vast areas of northern Afghanistan will come under irrigation and will become agriculturally productive. It symbolizes Afghanistan's pursuit of food security and growth. However, without regional understanding and coordination, the Canal could deepen environmental and political tensions.

Sustainable management of water resources from the Amu Darya requires acknowledging the rights of regional countries, including Afghanistan, and fostering an environment of trust and mutual benefits. If all involved countries approach this Canal cooperatively, it could become a model for fair water sharing and governance in Central Asia.

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