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Water Resources Projects in Iraq: Medium and Small Storage Dams

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Abstract

Many medium and small dams were built in Iraq. These dams are distributed in three major areas. First is the northern area where many dams built in the period after 2003, even there are some that built in 1980s. Second, is the dams built in the eastern valleys, but these prove to be inefficient due to high rate of sedimentation even in the live storage. Third, is the dams in the western desert. These dams were highly exploited in 1970s and 1980s to harvest as much as possible in this large and promising area and providing the livelihood conditions to settle people. The area has no more projects due to security issues.

Keywords: Duhok Dam, Khasa Chai Dam, Wand Dam, Abyadh Dam.

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1. Introduction

Dozens of storage dams of medium and small capacity, and water harvesting dams are scattered throughout Iraq. These dams can be found in three main areas:

1. Mountainous and undulating region of Duhok, Erbil, Kirkuk and Sulaymaniyah governorates.
2. Eastern valleys area in Diyala, Wasit and Maysan governorates.
3. Western Desert area in Anbar, Najaf and Muthana governorates.

2. Small and Medium Storage Dams in the Northern Area

In Mountainous and Undulating areas, there are many dams, most of which were built after 2003. Data about number and existence of small dams in this territory is not precise; there are many dams, which are not registered by Iraqi Ministry of Water Resources. However, the most important known dams are:

1. Duhok Dam: is located Duhok valley, which is and earth fill dam with clay core. In 1978, the site of the dam was studied and designed by the Bulgarian company Akrocomplect. Implementation was started and completed in 1988. The dam is 60 meters high and length at the top is 613m. The dam has a storage capacity of 52 million cubic meters. The dam includes morning glory spillway with a discharge of $81m^3/s$. Figure 1 shows the spillway of Duhok Dam. There is also an irrigation outlet, a tunnel 2,035m long and 2m in diameter leading to the Duhok irrigation project.

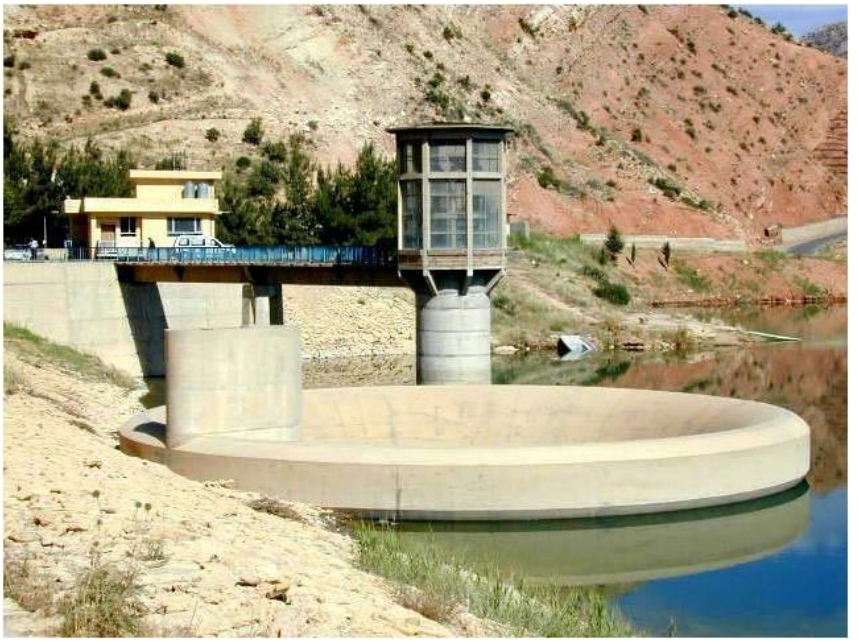

Figure 1: Spillway of Duhok Dam. (Source:[1]).

2. Harawa dam: The dam is located on the Harawa Valley in Sulaymaniyah governorate. The dam study was prepared by FAO in 2002. It is 22.5m high and 115m long, with storage capacity of 0.764 million cubic meters. It was completed in 2007.
3. Azmar Valley Dams: seven weirs on Azmar Valley in Sulaymaniyah governorate. It was completed in 2006.
4. Khasa Chai Dam: it is located on Khasa Chai Valley in Kirkuk governorate. It was made from earth fills with clay core. The height of the dam is 58 m. It is 2360m long. The storage capacity of The Dam Lake is 46.36 million cubic meters. Implementation was started in 2009 and completed in 2014.
5. Qashkan Dam: it is located on Qashkan Valley in Duhok governorate. The Dam designs were prepared by Center of Studies and Designs, Iraqi ministry of water resources, and the Implementation was carried out by General Commission of Dams and Reservoirs. The dam is 270 m long and the size of the dam lake is 1 million cubic meters. The dam includes a $6m^3/s$ discharge outlet.
6. Shirin Dam: it is located on Shirin Valley in Lailan district. It is a 426-meter-long earth fill dam. Storage capacity of 1.325 million cubic meters. It has an outlet of discharge $6.23m^3/s$. As well as a 50-meter-long spillway, with discharge capacity $203m^3/s$. The dam was completed in 2008.
7. Wand Dam: the dam is located on Wand River in Diyala governorate. The study on the dam was first submitted by the Bulgarian company Akrokompelket in 1979. It is 1342-meter-long earth fill dam, and 24m high. It includes non-gated spillway of 35m long and $140m^3/s$ discharge. The storage capacity of the lake is 37.82 million cubic meters. The dam was completed in 2013.
8. Belkana Dam: it is located on Belkana Valley in Kirkuk governorate. It is an earth fill dam with clay core. The dam is 277m long, and the operational storage of the dam is 0.89 million cubic meters. The dam has an opening of discharge $6.46m^3/s$. As well as, there is un-gated spillway of 35m long and discharge $207.9m^3/s$.
9. Shewasur Dam: the dam is located in Shwan district in Kirkuk governorate. It is 26 meters high and 333 meters long. Storage capacity is 4.45 million cubic meters. The dam was completed in 2016.
10. Bahiri Dam: the dam is located in Zawita area in Duhok governorate. It is one of the dams implemented by Duhok Irrigation Directorate and funded by a U.S. agency. The dam has a height of 18m and storage capacity of 0.38 million cubic meters.
11. Chaq-Chaq Dam: it is located in Sulaymaniyah governorate. The dam designs were completed by the Bulgarian company Akrokomplekt and implemented with funding from the international organizations prior to 2003. The dam collapsed due to a high wave in 2005.
12. Chali Dam: It is located on the Samaqully Valley east of Erbil. The dam reservoir has a capacity of 8.6 million cubic meters. It was opened in 2018.

13. Durger Ajam Dam: it is located in Duhok governorate within the valleys of the Khabur Basin. The dam is 15m high and has a storage capacity of 0.15 million cubic meters.
14. Kasnazan Dam: the dam is located in Erbil governorate within the valleys of the Great Zab Basin. It is 10m high and has a storage capacity of 0.32 million cubic meters.
15. Hamamuk Dam: it is located in the Koya area. The dam is 24m high and the storage capacity is 0.35 million cubic meters.
16. Hassan Kanoush Dam: it is located in the Chamchamal area. The dam is 15m high and storage capacity of 0.35 million cubic meters.
17. Bawa-Shaswar Dam: it is located in Koya area. The dam is 23m high and storage capacity of 4.4 million cubic meters [2, 3, 4, 5].

3. Small and Medium Storage Dams in Eastern Valleys

Eastern valleys are promising source of water storage and harvesting. The main problem in the region is the high rate of sediment load; hence, many dams were failed. More measures and fine tuning in selection of the dam site and erosion protection are needed. Other alternatives could be proposed as the underground reservoir, this requires a detailed investigations and data. The dams in this region are:

1. Qazaniyah Dame: it is located on the Harran Valley in Diyala governorate. The dam was studied by Euphrates Center and then studied by Tigris Center in 2004; both are directorate of Iraqi ministry of water resources. The dam is a 6.5-meter-high weir dam with lake of 0.9 million cubic meters capacity. It was completed in 2007. Also, the dam considered one of the dams that suffering from sedimentation.
2. Mandalay Dam: it is located on the Harran Valley in Diyala governorate. Studies were started in 2002 and completed in 2004. It is earth fill dam with clay core, 14m high and 1,316m long. The capacity of the dam lake is 3.63 million cubic meters. The dam has a 250-metre long spillway and discharge of 1,725m^3/s. Dam reservoir is almost full with sediments. Figure 2 shows a general view of Mandaly Dam Reservoir filled with sediments
3. Shihabi Dam: it is located on Shihabi Valley in Wasit governorate. The dam was implemented by Al-Rafidain Company, where the dam is a 275m long and 9 m high. It includes a 160-meter-long spillway. The capacity of the dam lake is 0.8 million cubic meters. Like other dams in the eastern valleys, the dam is filled with sediments.
4. Dwerej Dam: the dam is located on the Dwerej Valley in Maysan governorate. The dam is a concrete weir with other retention dam in the form of Gabions. The dam was carried out by Al-Rafidain Company and is 510m long and 9.5m high. The capacity of the dam lake is 1.87 million cubic meters. It was completed in 2015.
5. Badra Dam: it is located on Badra Valley in Wasit governorate. It is a concrete weir of 3m high and 800 meters long [3, 6].

Figure 2: General view of Mandaly Dam Reservoir filled with sediments. (Source:[7]).

4. Small and Medium Storage Dams in the Western Desert

Several dams were built during 1970s and 1980s in the western desert, the area is wide and promising for water harvesting and creating a new spots for living and agriculture in the middle of the desert. Unfortunately, the security issue in the region after 2003 resemble a challenge to continue with building such dams, the dams in this area are:

1. Husub Dam: the dam is located on Husub Valley, southwest of Najaf. The length of the dam is 1050m and its height is 11m. The size of the dam reservoir is 4.2 million cubic meters. It was completed in 2005.
2. Horan 2 Dam: it is located Horan Valley, northeast of the city of Rutbah. The dam is 650m long and 14m high and has a storage capacity of 4.9 million cubic meters.
3. Rutbah Dam: it is located in the Western desert. It is 848meter long earth fill dam, and the height is 19m. The dam has a storage capacity of 32 million cubic meters. It was completed in 1981.
4. Al-Ubailah Dam: it is located in the Western desert. It is a 500-meter-long earth fill dam, and the height is 11.5m. The dam has a storage capacity of 4 million cubic meters. It was completed in 1973.
5. Al-Aghri Dam: it is located in the Western desert. It is a 525-meter-long

earth fill dam, and the height is 11m. The dam has a storage capacity of 6 million cubic meters. It was completed in 1974.

6. Hussainiyah Dam: it is located in the Western desert. It is a 512-meter-long earth fill dam, and the height is 13.25m. The dam has a storage capacity of 6 million cubic meters. It was completed in 1976.
7. Shibaijah Dam: it is located in the Western desert. It is a 720-meter-long earth fill dam, and the height is 10.5m. The dam has a storage capacity of 8 million cubic meters. It was completed in 1977.
8. Rahaliyah Dam: it is located in the Western desert. It is a 440-meter-long earth fill dam, and the height is 13m. The dam has a storage capacity of 4 million cubic meters. It was completed in 1982.
9. Um Al-Tarfat Dam: it is located in the Western desert. It is a 990-meter-long earth fill dam, and the height is 11.6m. The dam has a storage capacity of 7 million cubic meters. It was completed in 1982.
10. Surry Dam: it is located in the Western desert. It is a 570-meter-long earth fill dam, and the height is 5m. The dam has a storage capacity of 0.3 million cubic meters. It was completed in 1976.
11. Abyadh Dam: it is located in the Western desert. It is a 448-meter-long earth fill dam, and the height is 20m. The dam has a storage capacity of 25 million cubic meters. It was completed in 2002.

5. Conclusion

The planning and implementation of small and medium dams are distinguished by several technical and administrative problems, especially after 2003, and the aspects referred to can be summarized as follows:

1. Some of dams in the mountainous and undulating region have been partially or totally collapsed due to high waves.
2. One of the most important difficulties in the eastern valleys is the highly sediments accumulation in reservoirs, example of what happened in Mandali and Badra, where the sediments filled 80-90% of their reservoirs after a few years of operation, and the Ministry of Water Resources has resorted to the removal of sediments by mechanical methods.
3. One of the most prominent aspects of the implementation of dams in Western Desert, a large and promising untapped area, is the issue of security instability; this had impact on the completion of many projects and hindered their completion.

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