Water Resources Management In Iraq: An Overview

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- Geography of Iraq
- Water Resources in Iraq
- How to Sustainably Manage the Water Resources in Iraq
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Historical Background

- Old Iraq is called Mesopotamia
- Historically, the main sources of water in Iraq are rivers Tigris and Euphrates
- These rivers contributed to the development of the old civilizations such as Assyrian and Sumerian..etc

- Theses civilizations were settled near the banks of rivers Tigris and Euphrates
- In the book of Genesis, these rivers formed the Paradise of Eden at downstream

Geography of Iraq

- Iraq is located in Southwest Asian and it is bounded by Syria and Jordan from the West, Turkey from the North, Iran from the East and Saudi Arabia from South and Southwest, Kuwait and Arabian Gulf from South

- The total area of Iraq is 437,065 km^2, the country has high, rugged mountains along its border with Iran and Turkey. The highest point in Iraq is located at the Iran-Iraqi border and it is 3607 m above sea level while the lowest point is at Arabian Gulf and it is at sea level (0 m)

Mountains in North Iraq

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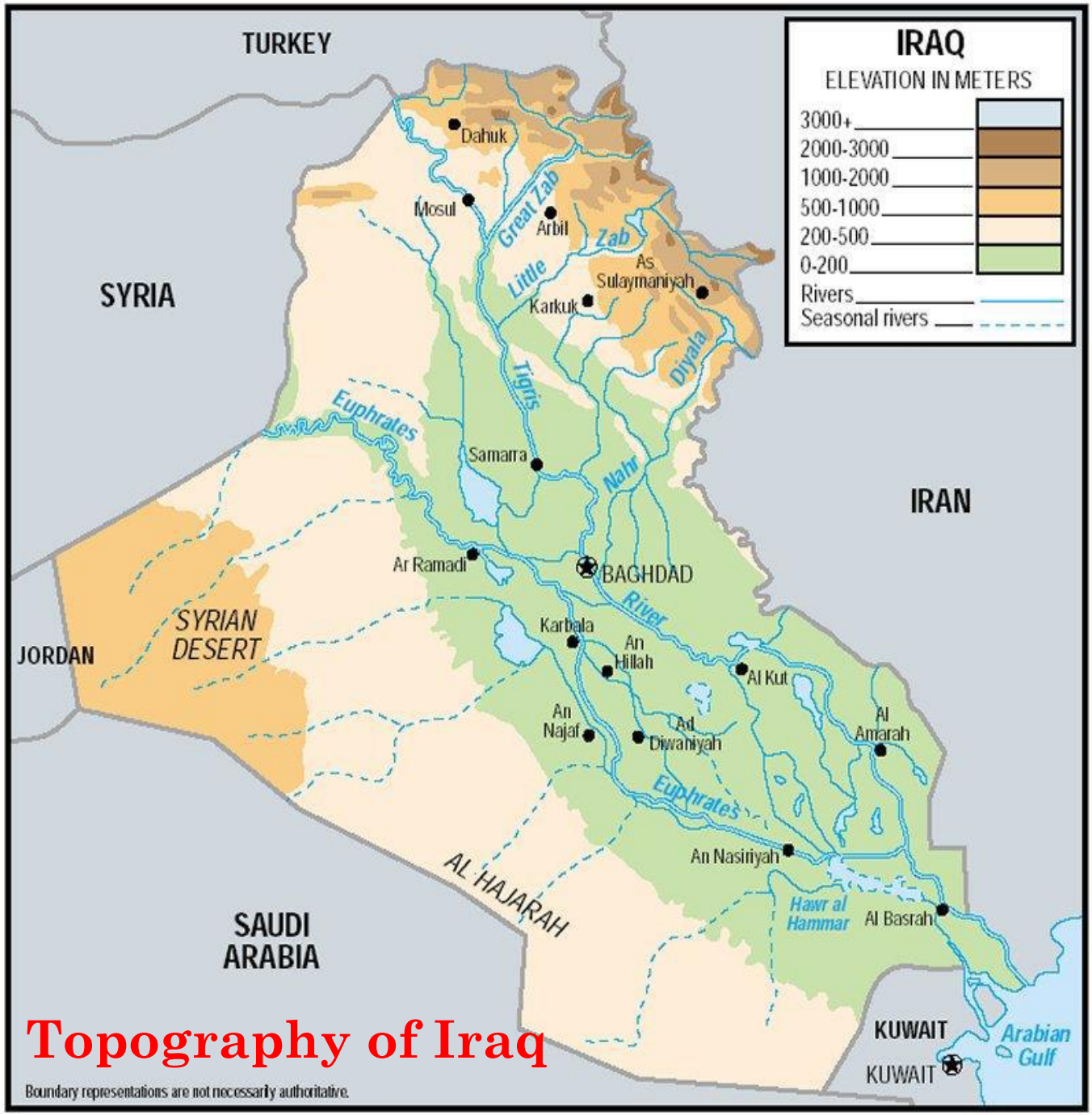
Shatt Al-Arab Near Gulf



North

Topography of Iraq

Water Resources in Iraq

Surface Water Resources

- The main sources of surface water resources are rivers Tigris and Euphrates and together they constitute about **98%** of Iraq surface water
- Both rivers (Tigris' and Euphrates') are transboundary rivers, originating in Turkey passing through Syria before entering Iraq
- The Euphrates flows about 1,160 km and the Tigris flows about 1,300 km within the national boundary of Iraq
- Rivers Tigris and Euphrates confluences together and form one large river called Shatt al-Arab which is discharging into Arabia Gulf. Shatt al-Arab is used for navigation where ships and boats can sail to Gulf and then to Arabian Sea or Indian Ocean

Table 1: Information on Rivers Tigris and Euphrates

River	Length (km)	Length in Iraq (km)	Total Catchment Area (km^2)	Catchment Area inside Iraq (km^2)	Total Annual Flow (BCM)	Annual Flow in Iraq (BCM)
Tigris	1,718	1,300 (76%)	235,000	122,200 (52%)	80-84.2	6.8 (8.3%)
Euphrates	2,940	1,160 (39%)	444,000	177,600 (40%)		

River Tigris Tributaries

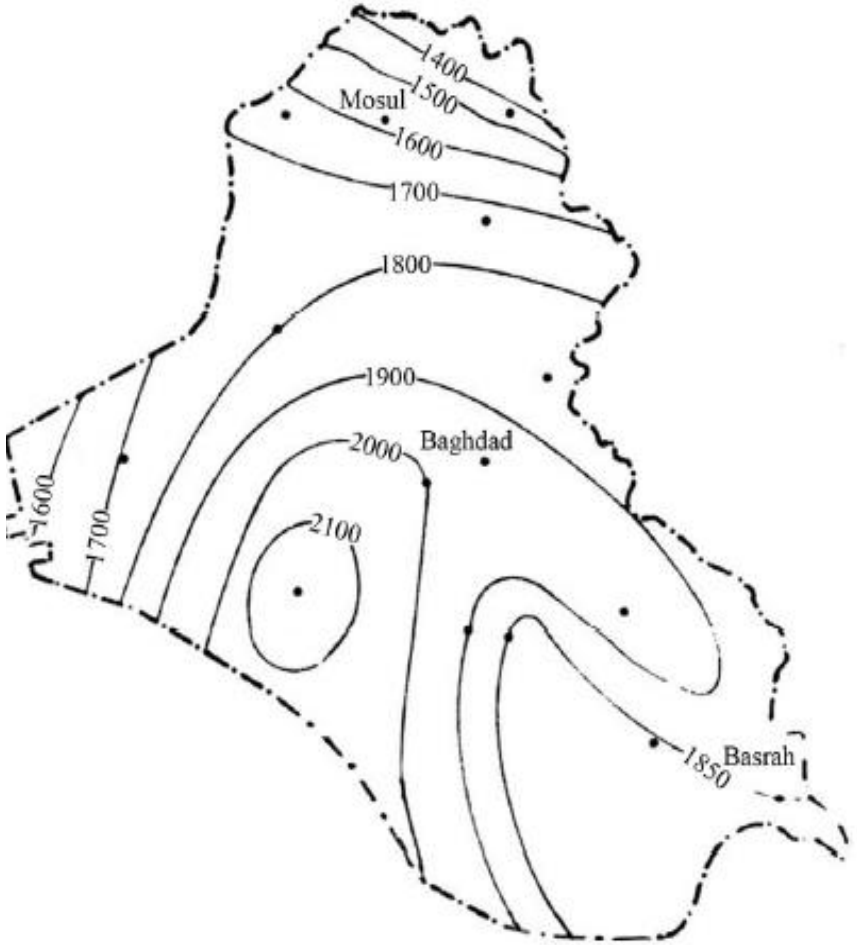
- upper Zab (originate from Turkey)
- lower Zab (originate from Iran)
- Dialay river (originate from Iran)
- Al-Udhaim River (located entirely in Iraq)
- Al-Tib River (originate from Iran)
- Dewarege River (originate from Iran)
- Al-Shehabi River (originate from Iran)
- Karkah River (located entirely in Iran and)

River Euphrates Tributaries

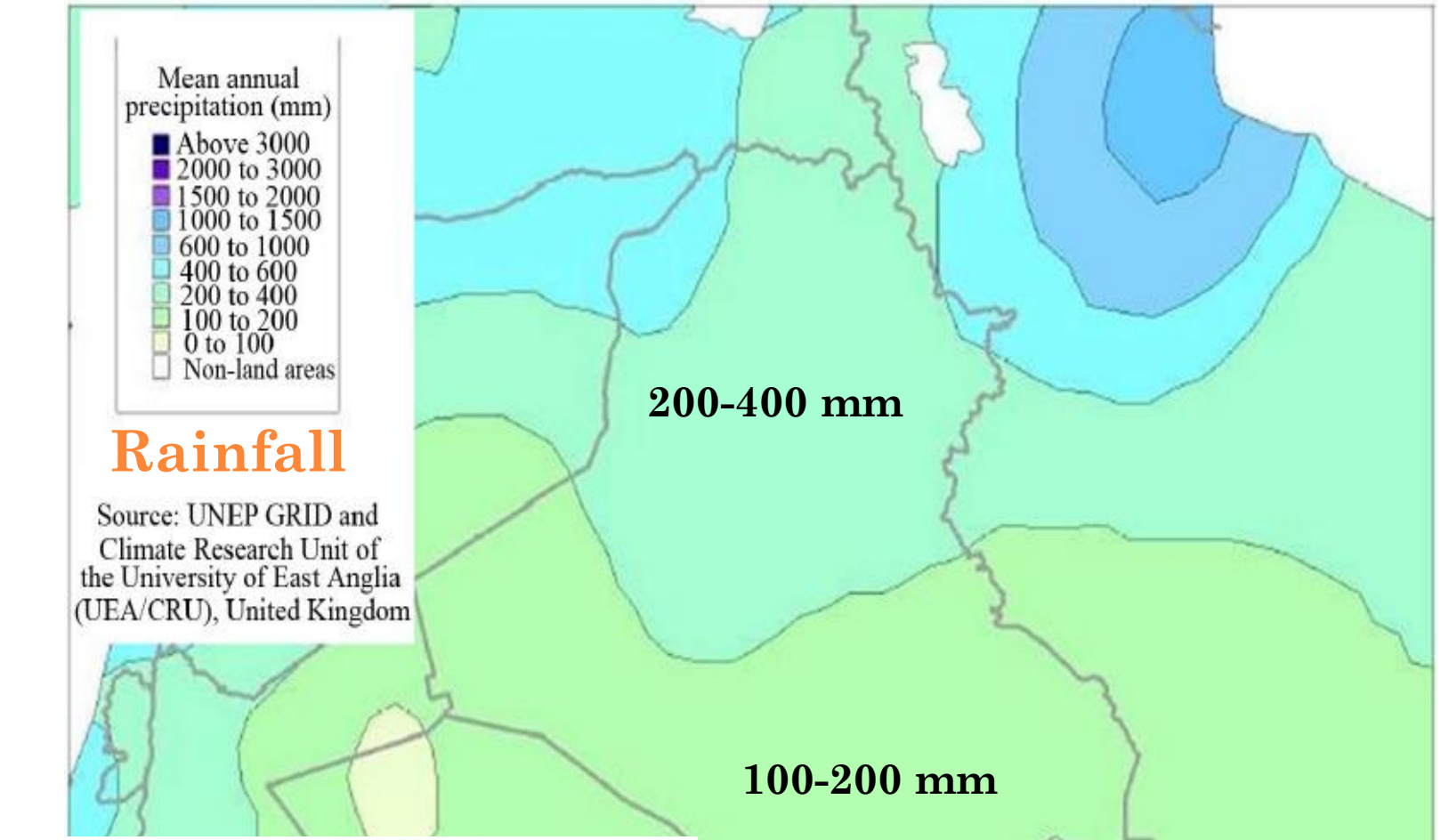
- All the tributaries of the river are outside Iraq

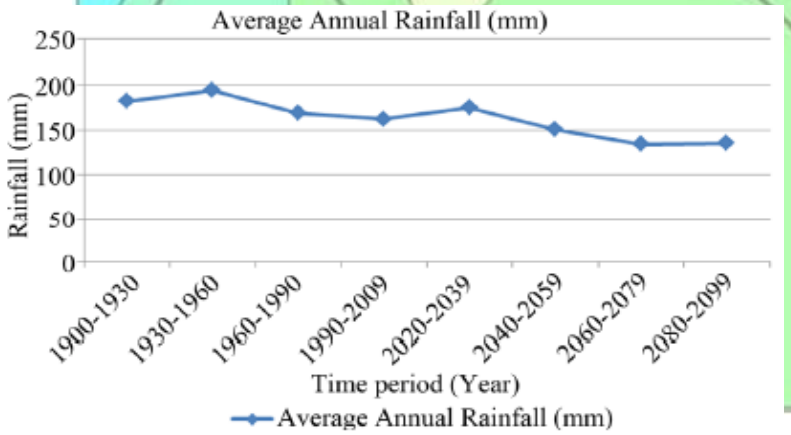
HYDROLOGY

Weather Zones



Evaporation


Mean annual precipitation (mm)
Above 3000
2000 to 3000
1500 to 2000
1000 to 1500
600 to 1000
400 to 600
200 to 400
100 to 200
0 to 100
Non-land areas
Rainfall
Source: UNEP GRID and Climate Research Unit of the University of East Anglia (UEA/CRU), United Kingdom
200-400 mm
100-200 mm
N
W
E
S
0
100
200
Kilometres


Average Annual Rainfall (mm)
Rainfall (mm)
250
200
150
100
50
0
1900-1930
1930-1960
1960-1990
1990-2009
2020-2039
2040-2059
2060-2079
2080-2099
Time period (Year)
Average Annual Rainfall (mm)

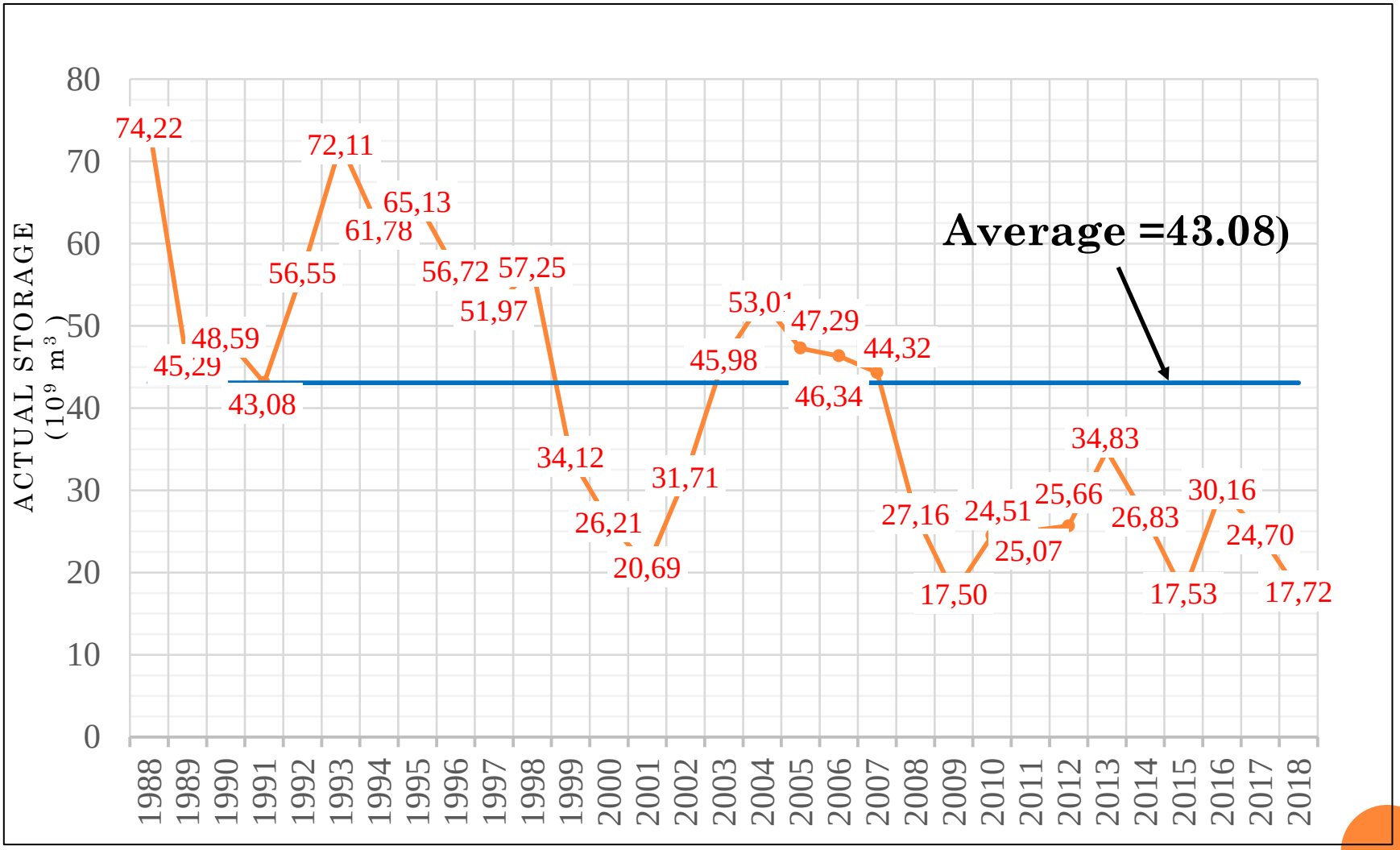
Reservoirs Storage Capacity

Dam Name	Year of Const.	Reservoir Capacity (m^3)	Basin	Remarks
Dokan	1959	6.8×10^9	Tigris	Constructed on Lower Zab River
Darbandikhan	1961	2.8×10^9	Tigris	Constructed on Diyala River
Hemrin	1981	2.4×10^9	Tigris	Constructed on Diyala River
Mosul	1986	11.11×10^9	Tigris	Constructed on River Tigris
Dohuk	1988	0.475×10^9	Tigris	Constructed on River Robardo
Al-Udhaim	1999	1.5×10^9	Tigris	Constructed on Al-Udaim River
Haditha	1986	8.28×10^9	Euphr	Constructed on Euphrates River

Total Storage Capacity in the Reservoirs= 33.36×10^9 m^3

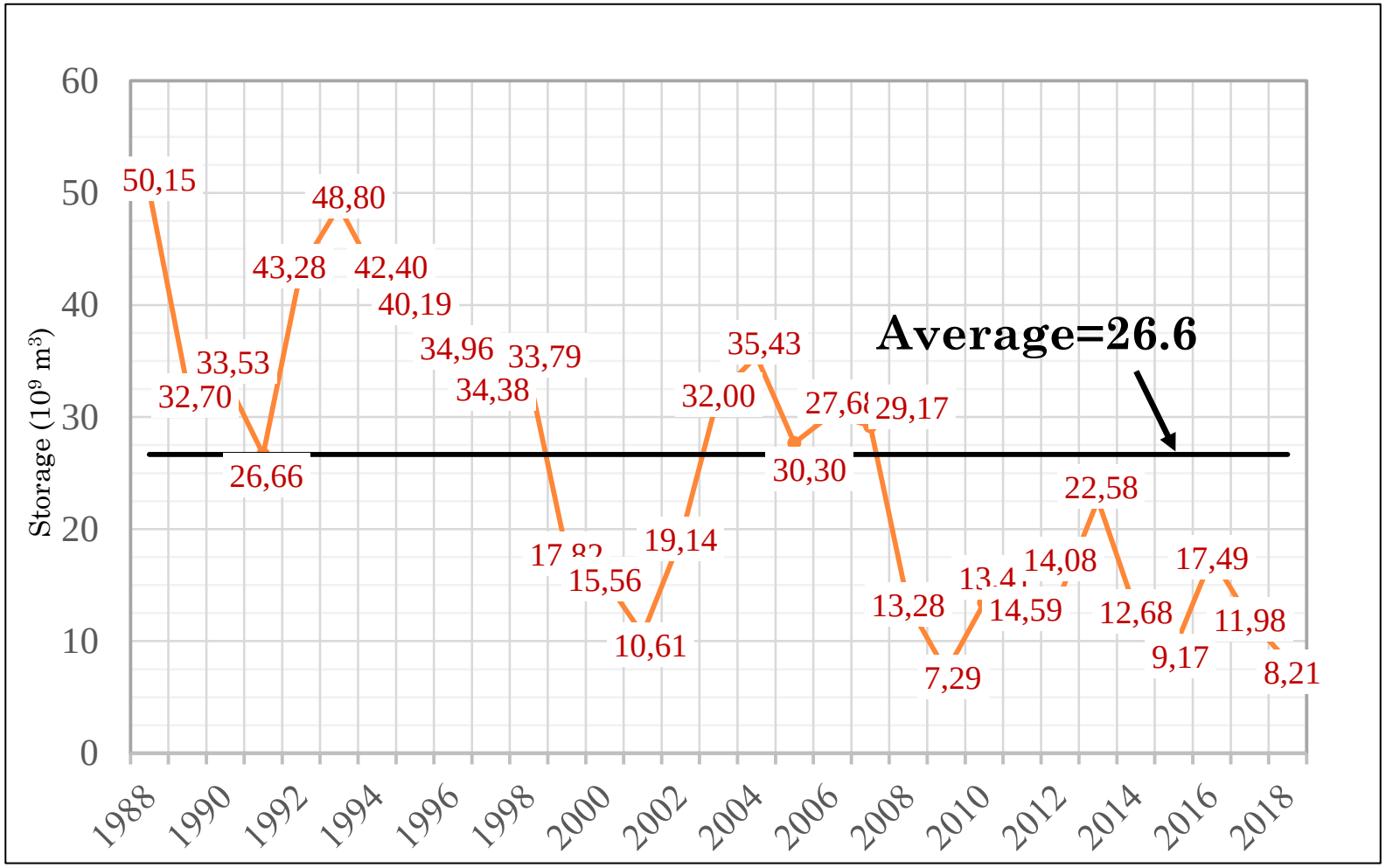
Hydropower Generation

No.	Dam or Barrage	Install capacity (MW)
1	Dokan dam	400
2	Darbandikhan dam	240
3	Total Hydropower generated by Mosul Dam	1010
4	Haditha dam	660
5	Al-Udhaim Dam	40
6	Samaraa Barrage	84
7	Hemrin dam	50
8	Al-Hindiyah barrage	15
9	Shatt Al-Kuffa Barrage	6
Total Install capacity in MW		**2505**

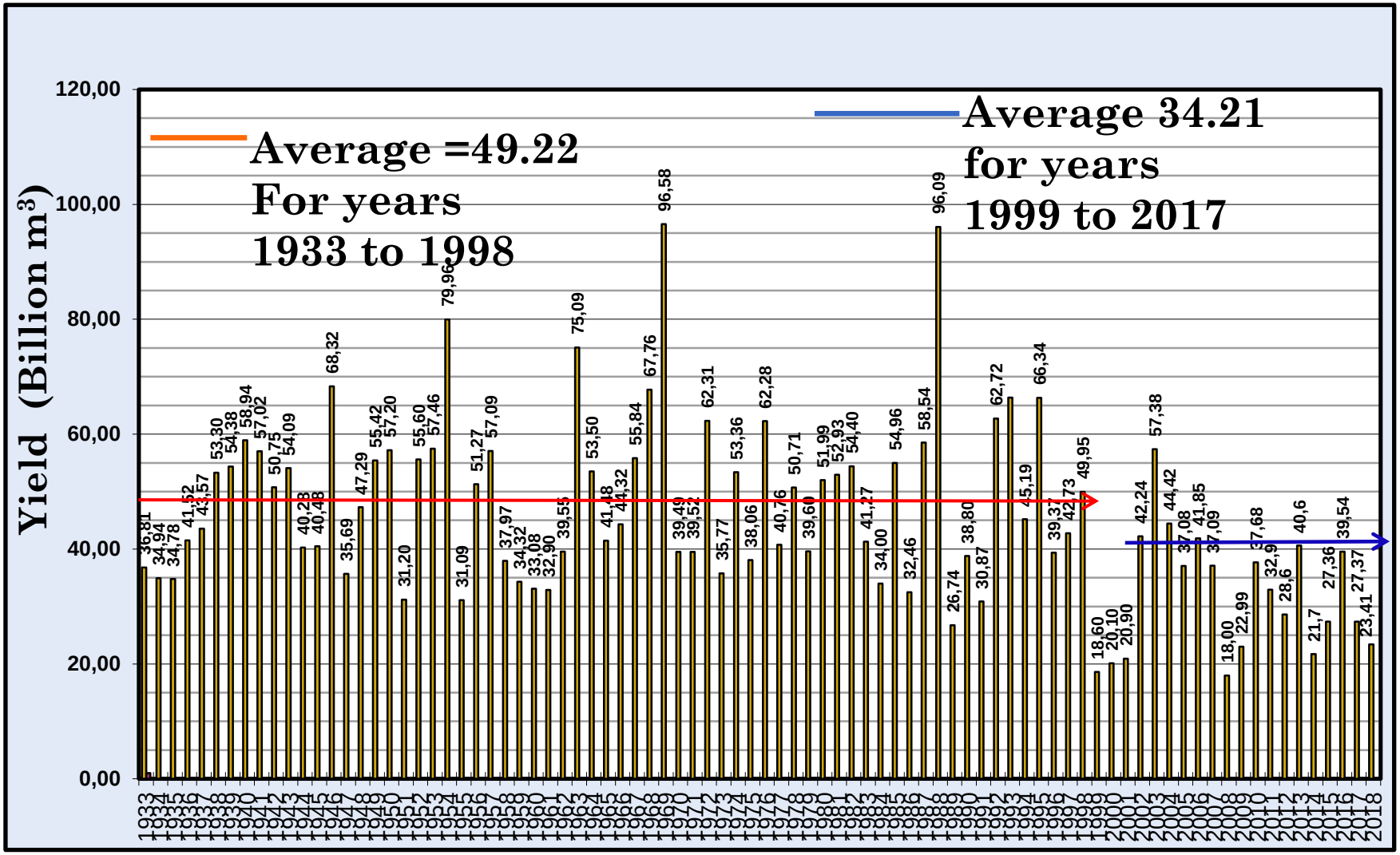


Year

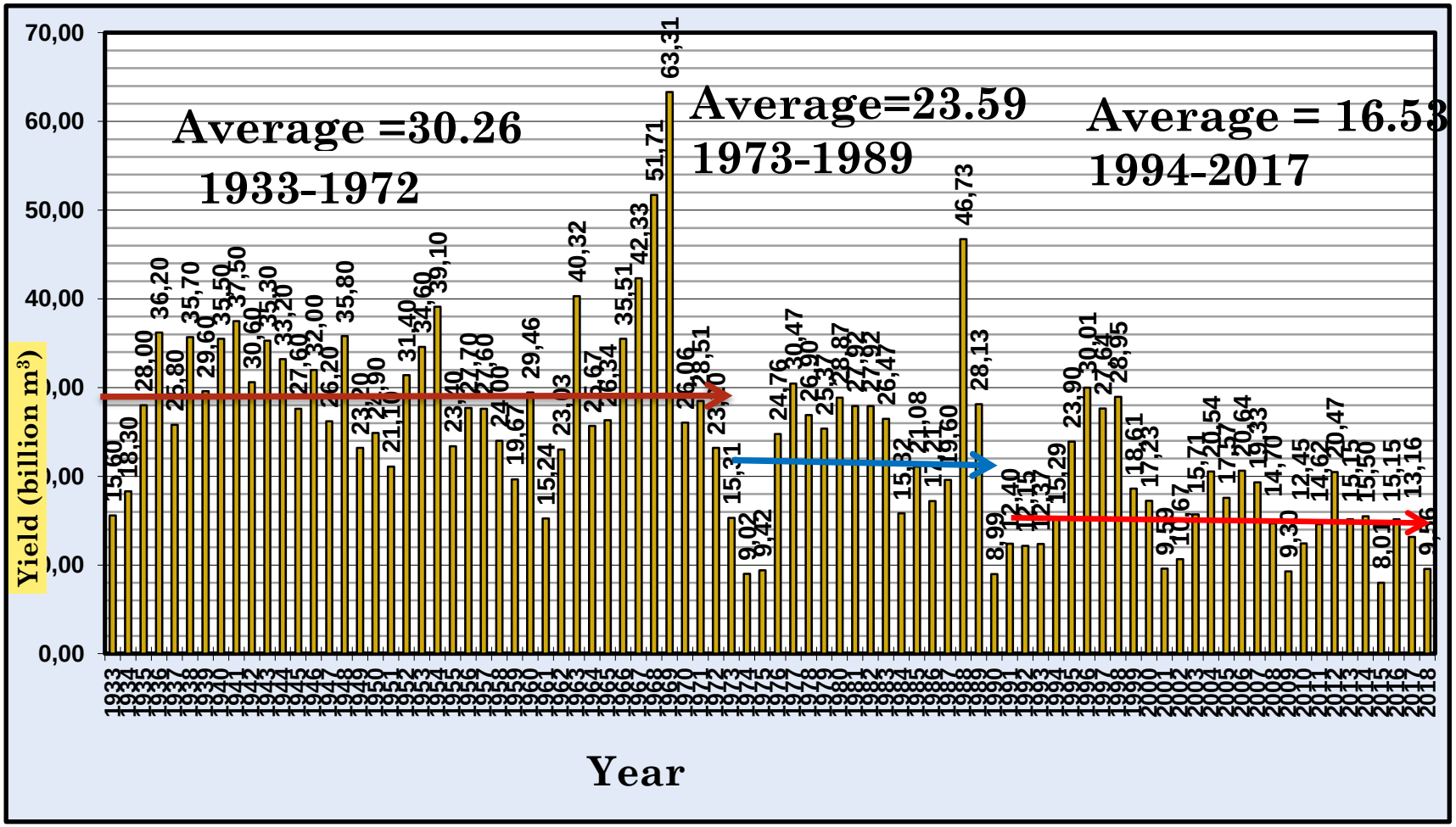
Live Storage in Reservoirs and lakes up to 1st June



Live Storage in Reservoirs and Lakes up to 1st November



Annual Yield of River Tigris at Upstream



Yield of River Euphrates at Upstream

Groundwater Resources

- The groundwater meets 2% to 9% of the total demand on water resources in Iraq.
- Iraq is divided into ten groundwater zones
- Thousands of wells were excavated in different parts of Iraq for various purposes, especially for agricultural purposes.
- The total number of wells excavated up to 1990 reached 8752 of which 1200 are for agricultural purposes and all of these wells were excavated by the government. The number of wells excavated by the private sector reached 400 wells only.
- The total amount of ground water exploited per year is about 1.2×10^9 m^3.

HOW TO SUSTAINABLY MANAGE WATER RESOURCES IN IRAQ?

- Rehabilitation of Mosul dam in order to increase storage level from 319 to 330 m amsl
- Rehabilitation of agricultural drainage networks and to link it with the evaporation ponds in order to use the drainage water for replenishing the storage in marchlands at South of Iraq (when the salinity of the drainage water is below 4000 ppm), irrigating green belts and supplying the oil industry with water (applying reuse concept)
- Supplying the marchland at the South with 5.7 x 10^9 m^3 during the wet years and 3.7 x 10^9 m^3 during the dry years in order to maintain the ecological balance in them

- To overcome the water shortage by implementing an effective sustainable management including the usage of 5.25×10^9 m^3 of groundwater recharge
- To use modern efficient irrigation systems (with efficiency more than 60%) to replace the low efficiency traditional irrigation systems (with high losses, high seepage and about 30% efficiency)
- Achieving the required reforms in the legislations that give more control on water resources usage
- To limit the number of licenses given for fisheries in order to control water demand and reuse water
- Use desalination plants operated by renewable energy at the Southern part Iraq where the salinity of water is higher than the recommended limits

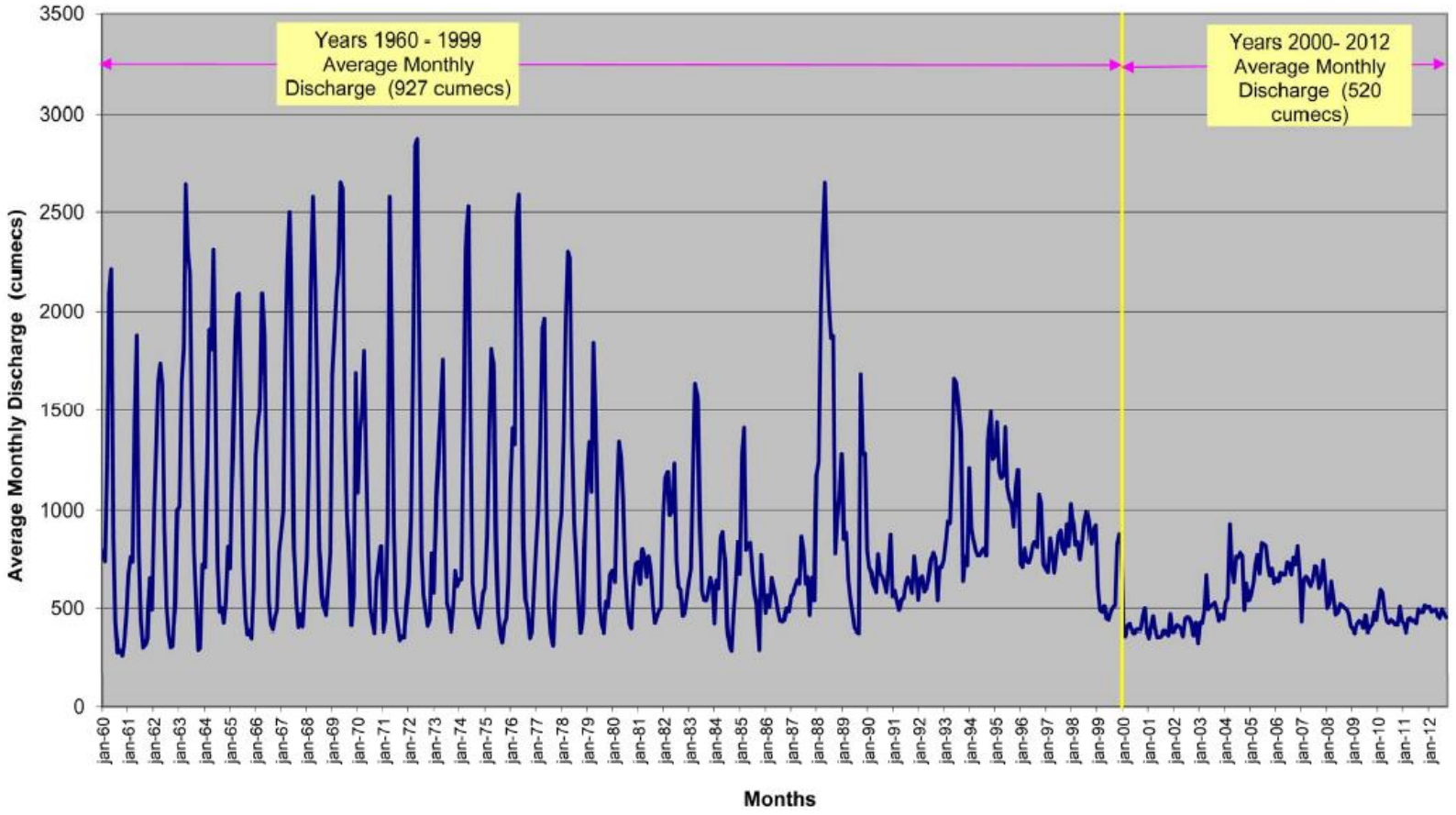
The Challenges Facing the Water Resources Management in Iraq

1. The construction of big storage projects by Turkish government on trans-boundary rivers. For river Tigris, dams such as Ileso and Jzara dams will cause

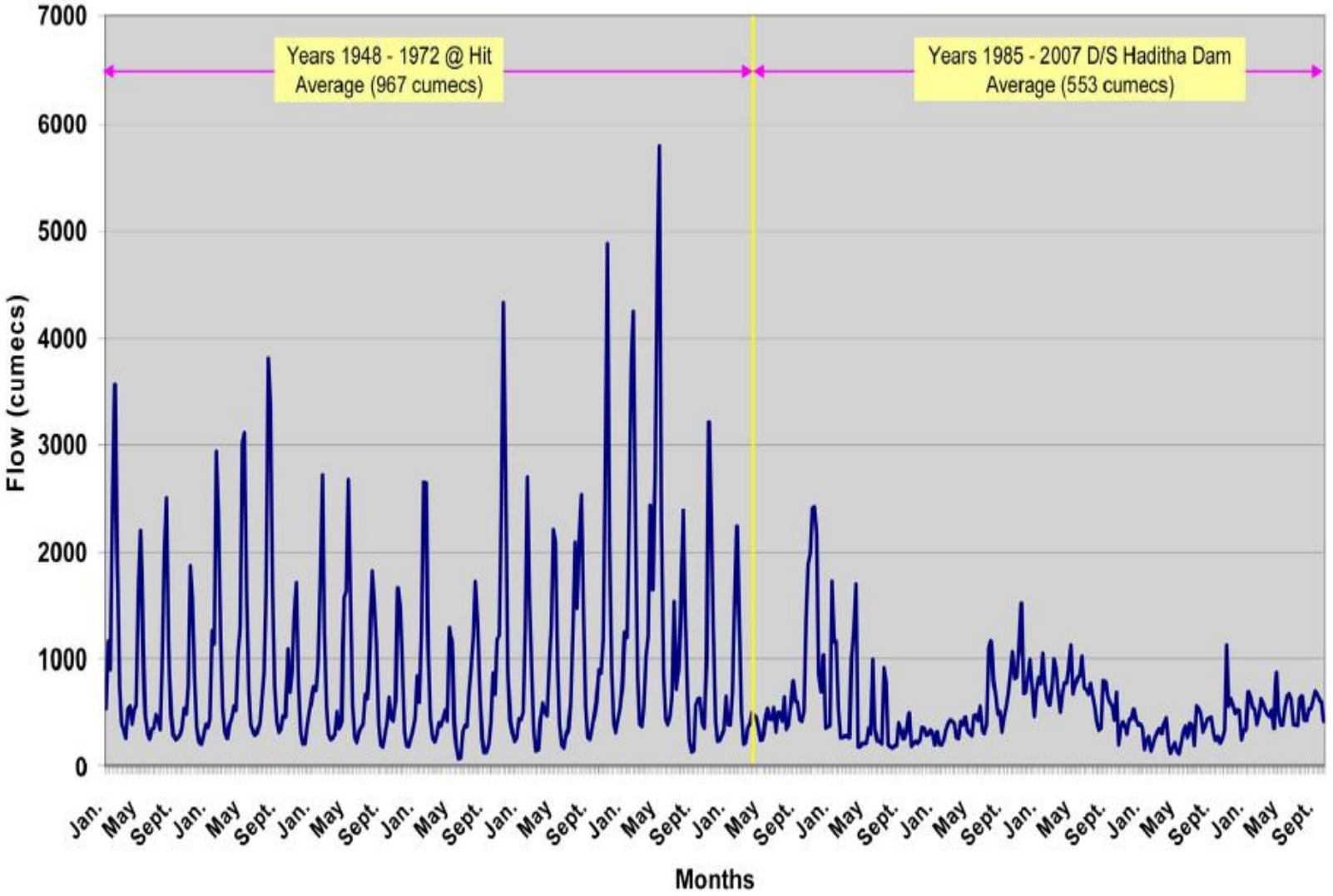
   i. Decreasing the annual water volume by 9.7 x 10^9 m^3 which forms about 47% from the annual water volume before constructing these dams. These dams will store a water volume of 15.5 x 10^9 m^3. The effects of the Turkish dams filling is significantly reduce water levels in the river Tigris at Mosul, Baghdad, and in the marshlands at South Iraq, raising fears of drought which would affect the water supply for various purposes.

Constructed Dams and Dams under construction on rivers Tigris, Euphrates and rivers discharging to them outside and inside Iraq

ii. Deteriorating water quality in rivers Tigris and Euphrates particularly after filling the Ileso and Jazra dams beside low flow will cause reduction in hydropower generation



Flow in River Tigris at upstream and downstream for years 1960-2012



Flow in River Euphrates at upstream and downstream for years 1948-2007

2. The need for building a large desalination plant in southern Iraq. The project will supply population of 400,000 persons in the city of Basra with drinking water as well as supplying oil fields with water. Completion was originally expected to be in April 2017 but it is delayed due to economical restrictions. Upon completion of the desalination plant, it will be the largest facility of its kind in Iraq, and it is capable of supplying 199,000 m^3/day of potable water

3. To reuse the irrigation return to meet part of the water demand. Also, the treated water can be used for oil wells re-injection, creating green belts to combat desertification and augmenting the water available for the Mesopotamian Marshlands of southern Iraq.

4. Resuming a dialogue with riparian countries to achieve an equitable distribution of the transboundary water resources according to UN Convention on the Law of the Non-navigational Uses of International Watercourse. The equitable distribution of the flow in rivers Tigris and Euphrates will have detrimental impact on water supply in Iraq.
5. Public awareness program is vital since it will help in reducing water losses and value water. This will reduce the demand on water.

Conclusions

After reviewing the problems of water resources management in Iraq, the following conclusions can be highlighted

1. Regional cooperation and coordination

In Iraq, 60.8% of the surface water resources are trans-boundary and originating from neighbouring countries where the downstream basin of the transboundary rivers (Tigris and Euphrates) are located in Iraq. This makes the rivers to be vulnerable to inflow control from upstream. The basins of these transboundary rivers are require cooperation among riparian countries in order to equally shared the water in the rivers basins and comply with international treaties namely the UN Convention on the Law of the Non-navigational Uses of International Watercourse. Indeed, unilateral hydraulic projects in Turkey and Iran display no consideration for downstream users in Iraq.

Due to river damming and increased withdrawals at upstream, Euphrates and Tigris inflow have significantly decreased in less than a decade, and this downward trend is expected to worsen upon the completion of damming projects that are currently under construction and filling. Resuming a dialogue with riparian countries to achieve an equitable distribution of water resources is very important to the future of water resources in Iraq.

2. Public awareness program

The government should focus on awareness programs in schools, universities, communities and media in which the peoples should learn how to conserve the water as a natural resource and wisely use it. This is because large volumes of water are wasted by users deliberately or inadvertently.

3.The new management practices and legislation

The management of water resources in Iraq is supply driven type. However, the climate change and population growth has clear impact on the availability of surface water. New management practices such as reuse, sustainable and efficient use, and increase water tariff to value water by the public.

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Thank You