

# DIWANIYAH RIVER HYDROLOGY AND ITS IMPACT ON THE ADEQUACY OF IRRIGATION FOR AGRICULTURE

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## ABSTRACT

*The study of rivers is one of the important Hydrology studies that is increasingly important with the increase in population and the Diwaniyah river is one of the rivers that did not study hydrological study and is passing through a dry area where temperatures rise and the research dealt with the problem which is the effect of the Hydrology characteristics of the Diwaniyah River on the adequacy of irrigation for agriculture and there were Justifications for studying the increase of the problem due to the entry of the river in a dry area and one of the most important conclusions of the research is the fluctuation of rain and high humidity in the region for these years and the lowest water revenue by (9,542,880) m<sup>3</sup>/year and the deficit during the dry season (-3470004) During the rainy season (-342000,14) m<sup>3</sup>.*

## INTRODUCTION

Water tables are one of the most important natural resources on which the localization and development of human civilization depends, and water remains the foundation of life, what The Almighty said in writing (and made water everything alive). The importance of water in desert and semi-desert areas is greatly increased, and its importance increases over time due to population growth and increased requirements for human development and food security, whose realization depends on the abundance of water for various activities such as agriculture and industry. That the hydrological study of water resources is one of the important studies focused on the international associations so came

## STUDY PROBLEM

- 1- What is the impact of the hydrological characteristics of the Diwaniyah River on agricultural development

- 2- Is the net water supply in the Diwaniyah River sufficient and amounts to a water deficit.

## HYPOTHESIS

- 1- The hydrology properties of the Diwaniyah River have important implications for agricultural development.
- 2- The net water in the Diwaniyah River is not constant, resulting in a water shortage in the study area.

## JUSTIFICATIONS FOR STUDY

The rationale for the study is that water is necessary for a human being, there is no life without water.

- 1- The existence of the hydrological studies of the Diwaniyah River as hydrology.
2. The importance of the river increases due to its entry into a dry area and the role of water in the characteristics of the hydrological

situation in various activities increases with an increase in population growth rates.

## STUDY LIMITS

The Diwanayah River is located in the province of Qadisiyah, which is located between the two viewing circles (18 17°31') and (24 24°32') to the north, two long lines (24 24 K 44) and (6 49 45° east), while geographically located in the middle of the Central Euphrates region, surrounded by five provinces, bordered by the north, the province of Babylon, and From the west and north-west of Najaf governorate, to the south by Muthanna governorate, to the south-east by DhiQar province, and to the northeast by Wasit province, see map (1)

### B- Temporal boundaries:

Climatic data: climatic data for a long climate cycle (31) years was adopted in the period (1986-2016) of the study area station (Diwanayah station) and agricultural statements for selected years

### Diwanayah River:

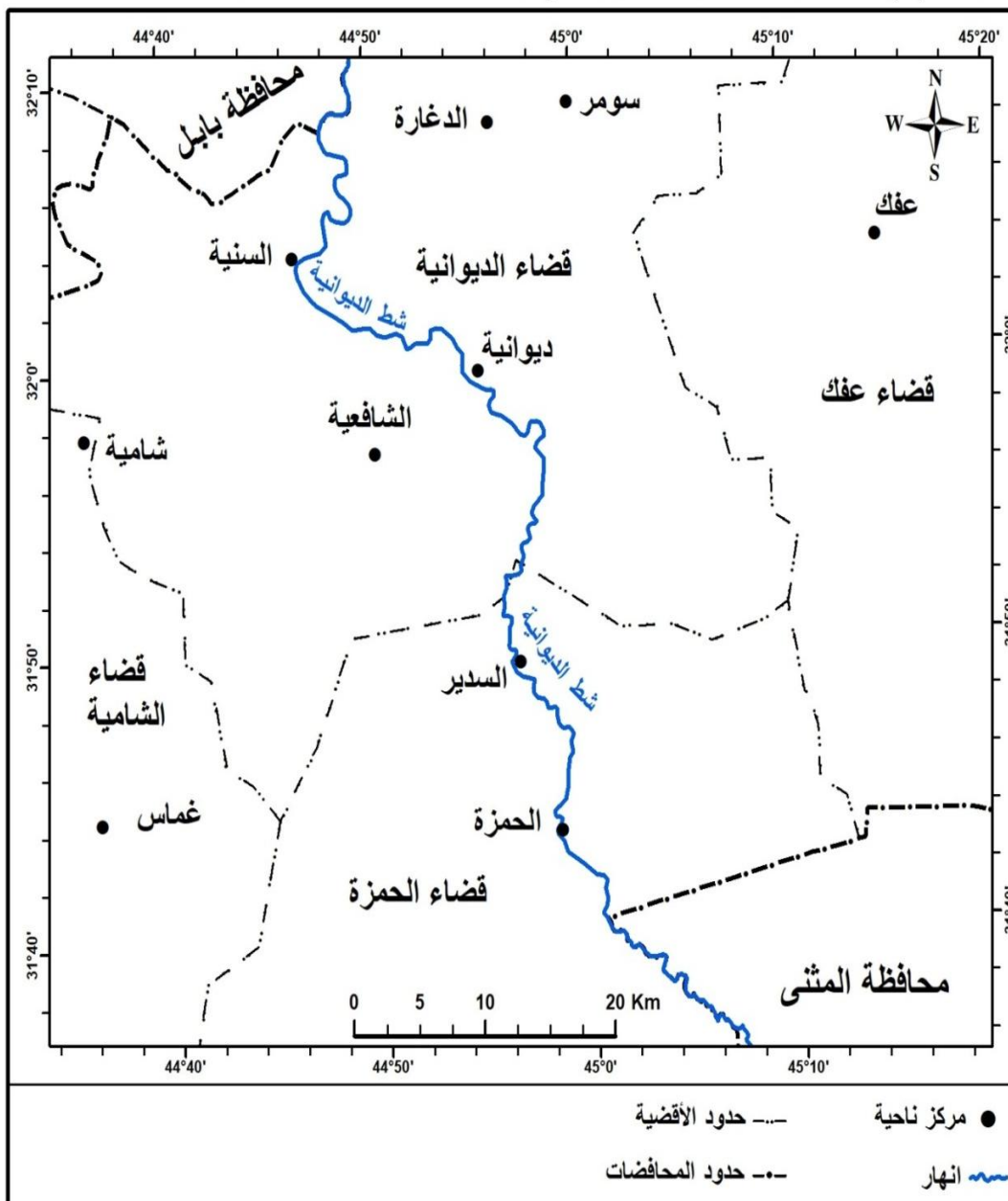
At the area of Sadr al-Dagara, then passes through the center of the province and the district of Al-Sadir and the center of Hamza district and continues in its direction towards the south until it enters the territory of Muthanna province at Imam Hamza district al-Rumaita within the administrative borders of Muthanna

province, see map (1), a dirt, unlined river controlled by two gates, and built a series of bridges because of its penetration of the city of Diwanayah from about half, and it is the longest waterway severing through the province from the north to the south. It has a length of 126 km, and its discharge capacity has reached 60 m<sup>3</sup>/th, which is an area estimated at 500,000 dunums, and from the table (1) It is clear that the rates of scoring in the Diwanayah River vary according to the months of the year as well as vary from year to year, and the rate of discharge takes a rise in the months (June, July, August, September, October and November) and these months were recorded the highest discharge rates in 2014 ( 63.71, 69.54, 66.73 68.12, 77.37, 83.14 m<sup>3</sup>, respectively, due to the high rates of scoring for the months mentioned due to the high temperatures that lead to the need for irrigation in these months, which requires greater water releases, and then decreases discharge in the remaining months (December, December, February and March Nissan and Mays) for the same year record (66.42, 51.33, 43.17, 54.38, 50.22, 48.51 m<sup>3</sup>/tha) respectively. In the study of the table (1) it is clear that the year 2015 recorded a significant decrease in discharge for the rest of the years (2012-2017) due to the lack of rainfall (rain and snow) which feeds the Euphrates River as well as increased water consumption, high temperatures and evaporation in the study area, as shown by the The same table that the discharge rates for 2017 were close to those of 2014 but were relatively lower than in October and November, with the highest rates (75.61, 80.35 m<sup>3</sup> respectively).

- (1) Ali Abdul Zahra Kazem al-Waili, Surface Water Resources and Its Impact on Agriculture in Al-Qadisiyah Governorate, Professor's Journal, No. 51, Faculty of Education - Ibn Rushd, University of Baghdad, 2004, p. 530.
- (2)

Map (1)

Extensions of the Diwaniyah River in Qadisiyah Province



Source: Ministry of Water Resources, Diwaniyah Water Resources Directorate, Employment Division, Unpublished Data, 2018.

Type of month	Discharge Rate Factor Model 207	Discharge M3/THA 2017	Type of month	Discharge Rate Factor Model 2016	Discharge M3/THA 2016	Type of month	Discharge Rate Factor Model 2015	Discharge M3/THA 2015	Type of month	Discharge rate factor model 2014	Discharge M3/THA 2014	Type of month	Discharge rate factor model 2013	Discharge M3/s 2013	Type of month	Discharge rate factor model 2012	Discharge M3/THA 2012	month	Chapter
Wet	1.12	67.54	Wet	1.14	65.33	Mode rate	0.89	33.41	Wet	1.10	68.12	Wet	1.11	67.88	wet	1.12	66.51	September	Fall
Wet	1.26	75.61	Wet	1.24	71.10	Wet	1.04	39.14	Wet	1.25	77.37	Wet	1.25	76.11	Wet	1.27	75.19	October	
Wet	1.33	80.35	Wet	1.29	74.22	Wet	1.15	43.26	Wet	1.34	83.14	Wet	1.35	82.15	Wet	1.37	81.10	November	
Wet	1.04	62.99	Wet	1.05	60.28	Wet	1.00	37.55	Wet	1.07	66.42	Wet	1.06	64.73	Wet	1.04	61.82	December	winter
Mode rate	0.83	49.86	Mode rate	0.83	47.54	Mode rate	0.88	31.32	Mod erate	0.82	51.33	Dry	0.01	50.27	Dry	0.68	49.11	January	
Dry	0.67	40.65	Dry	0.66	38.13	Mode rate	0.81	30.42	Dry	0.01	43.17	Dry	0.68	41.48	Dry	0.68	40.21	February	
Mode rate	0.87	52.50	Mode rate	0.90	51.49	Wet	1.04	39.14	Mod erate	0.87	54.38	Mode rate	0.87	53.23	Mod erate	0.86	51.13	April	Spring
Mode rate	0.80	48.41	Mode rate	0.84	48.21	Mode rate	0.94	35.37	Mod erate	0.81	50.22	Mode rate	0.81	49.20	Mod erate	0.80	47.22	March	
Dry	0.67	45.49	Dry	0.75	43.25	Mode rate	0.97	36.28	Dry	0.78	48.51	Wet	0.67	46.51	Dry	0.76	45.10	May	
Wet	1.01	60.70	Wet	1.02	58.66	Mode rate	0.92	34.61	Wet	1.02	63.71	Wet	1.02	62.19	Wet	1.00	59.15	June	Summer
Wet	1.14	68.78	Wet	1.14	65.67	Wet	1.18	44.12	Wet	1.12	69.54	Wet	1.12	68.11	Wet	1.14	67.24	July	
Wet	1.06	64.12	Wet	1.09	62.34	Wet	1.16	43.52	Wet	1.07	66.73	Wet	1.08	65.48	Wet	1.07	63.28	August	
-	-	60	-	-	57.18	-	-	37.35	-	-	61.88	-	-	60.61	-	-	58.92	Average	

**Table (1) monthly and annual rate of discharge, and model of discharge rate factor (\*) in the Diwaniyah River for the duration (2012-2017)**

Source: Researcher based on: Ministry of Water Resources, Directorate of Water Resources in Diwaniyah, GIS Division, Unpublished Data, 2018.

(\*) The discharge rate factor model: the result of the discharge factor for a year or a given month is the general discharge rate, so if the result of the equation is more than one, the year or month is wet, but if the result is less than one (0.80-0.99) the year or month is moderate, (0.79-below) so the year or month is dry, how much Apply the equation of the following coefficient  $k \leq (-Q)$  where k discharge factor model, Q discharge rate, -Q general discharge rate, see: KhuloudKazimKhalaf al-Jurani, The Hydrological Properties of the Tigris River in Maysan and Basra provinces, unpublished master's letter submitted to the Faculty of Education at Basra University, 2014, p. 1 07.

Table (2)

Annual rates for the highest and lowest level (m) of the Diwaniyah River for the duration (2012-2017)

Lowest level (m)	Highest level (M)	Year
1.44	2,86	2012
1.56	2.96	2013
1.62	2.98	2014
1.19	2.11	2015
1.48	2.53	2016
1.75	2.88	2017

Source: Ministry of Water Resources, Diwaniyah Water Resources Directorate, Employment Division, Unpublished Data, 2018.

Table 2 also found that in comparison between 2012 and 2017, the highest river level was (2.86) and the lowest level was 1.44 m in 2012, while in 2017 it was the highest level (2.88) and the lowest level (1.75) and this difference is evident in the highest ratio between the two years. This is due to the amount of rain and the increase in the amount of releases.

## Branching streams from the right side of the Diwaniyah River

A- The modern shafi'a table: - which branchats at the kilometer (35.82), which is length (32.2) km and with a discharge rate of (9.5) m<sup>3</sup>/th see table (15) and shape (14), the area it narrates is (88931) without, which is a non-earthly table Padded controlled by three gates in the chest with four pumps, as the dimensions of this regulator is six meters wide and five meters high see picture (3), and branch the small excavator shatt from the modern shafi'i table at kilometer (8.2) and its length (12.5) km and its actual discharge capacity (1.7)m<sup>3</sup>/th.

B- The old Shafi'i aye table: it branches at the kilometer (35.82) from the right bank of the Diwaniyah Shatt al-Diwaniyah and is 7.8 km long and has a drainage card of (0.4) m<sup>3</sup>/tha and narrates an area (4378) without it, controlled by a single gate, which is an unlined earthy table, see picture (4).

C- Um Abbasid table: The branch of this table is at the kilo (42.75) from the right bank of the Diwaniyah Shatt and has a length (6.0) km, while its drainage capacity has reached (2.1) m<sup>3</sup>/ tha and tells an area (5007) without, an unlined earthy table that controls the chest of one gate.

D - Ghanem Table: Branching from the right bank of the Diwaniyah River at 20.63 kilometers, with a length of (3.5) km at a discharge rate (1.3)m<sup>3</sup>/th and controlled by two gates, which is a dirt table, and irrigates an area (2285) dunum

E- The Schedule of the Shatt Diwaniyah\*: This table branched at the kilo (35.82), at the right of the Diwaniyah River with a relatively large length of (27) km, and its discharge rate (41.8) m<sup>3</sup>/tha, controlled by two electric radial gates 4 x 5 meters, a earthy table looking at the image (5), tells an area (6241) dunum

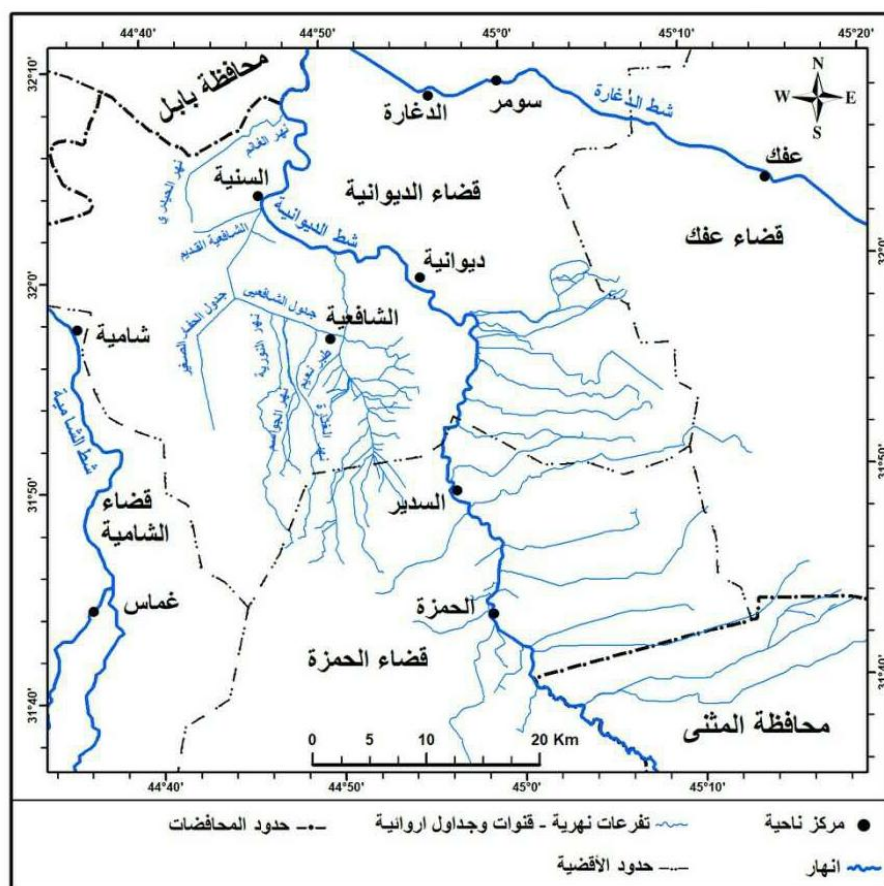
## Branching streams from the left side of the Diwaniyah River

A- The Nooria table: The Nooria table is branched from the modern shafi'i aye table at 12 kilometers, and is the easiest of the Diwaniyah River, with a length of (28) km and a discharge rate of (1.5 m<sup>3</sup>/th), controlled by two gates and an area estimated at about (7214) dunums.

B- Sherifia Table: The left of the Diwaniyah River is branched at a kilo (0.34) km, with a discharge rate of (2.97) m<sup>3</sup>/tha, controlled by two gates and four American-type pumps with a capacity of 1 m<sup>3</sup>/th and fast (6.6) rpm and the lifting (8) meters, a padded table, looking at the image (6), and narrating an area estimated at about (3594) without

As in map (2) and table (3)

Map (2) Diwaniyah River and streams branching from its right and left sides



Source: Ministry of Water Resources, Diwaniyah Water Resources Directorate, Employment Division, Unpublished Data, 2018

Table (3) Diwaniyah River and its branches

Type of lining	Discharge M3/S	Number of gates	Length KM	Fork	The location of the fork sleeve	The name of the table or the river or the beach	ت
earthy	60	-	126	-	Shatt Al-Hillah	Diwaniyah River	1
earthy	1.5	2	28	left	12	Nuriya schedule	A
earthy	9.5	3	32.2	right	35.82	The modern Shafi'i schedule	B
earthy	0.4	1	7.8	right	35.82	The old Shafi'i schedule	C
earthy	2.1	1	6	right	42.75	The schedule of Abbasid	D
padded	2.9	2	15.6	left	0.34	Sharifia schedule	E
earthy	41.8	2	27	Right	35.82	Schedule of Shat Diwaniya divert	F
earthy	1.3	2	3.5	right	20.63	Al-Ghanim schedule	G

Source: Ministry of Water Resources, Diwaniyah Water Resources Directorate, GIS Division, Unpublished Data, 2018.

From table (3) the physical characteristics of the Diwaniyah River show the high value (ph) in the Diwaniyah River in the third sample (9.2) while the lowest rates (7.1) were recorded in the third sample. The outstanding substances (T.SS) show the rise of the suspended substances in July to (94) mg/L and recorded a decrease in January to (69) due to the decrease in the water level in the river as well as the peak of the strip ing activity of the river, while the total dissolved salts (TDS) values were similar among all samples due to the salt balance in the water of the main source. In other terms, the river continuously increases in certain amounts of water throughout the year. As in table (4)

Table (4) Physical characteristics of the waters of the Diwaniyah River

Temp. C	Depth (cm)	Turbidity (*) (NTU)	E.C ds /m	T.D.S mg/ I	T.S.S mg/I	PH	Elements العنصر	The data			
Water temperature ° m	Water depth and light transmittance cm	Brownish (Akurah)	Electrical conductivity Mm / cm	Dissolved salts Mg / l	Suspended matter	PH	the month	Meridian s	Latitude	Location	the river
38	299	16.5	3.8	717	87	8.9	July	53°44'	0°32'	Sample 1	Diwaniyah River
17	203	4.6	1.2	706.2	69	8.1	As 2	53°44'	0°32'	Sample 1-1	
37	223	18.7	4.7	777.8	98	8.8	July	56°44'	52°31'	Sample 2	
18	134	5.5	1.18	711.2	73	7.1	As 2	56°44'	52°31'	Sample 2-2	
38	156	19.2	5.3	823.1	94	9.2	July	58°44'	44°31'	Sample 3	
17.5	105	6.7	1.2	805.3	77	8.3	As 2	58°44'	44°31'	Sample 3-3	

Table (5) Table of chemical properties of diwaniyah river water

K Mg/l	Na Mg/l	Mg Mg/l	Ca Mg/l	Hco3 Mg/l	No3 Mg/l	So4 Mg/l	Cl Mg/l	Element	The date			River
Potassium	Sodium	magnesium	Calcium	Bicarbonate	Nitrates	Sulfate	Chlorides	Month	Meridians	Display circles	Location	
14.22	423.29	178.13	277.19	202.18	9.09	760.32	725.21	September	44.53	32.0	Sample1	
7.41	131.38	119.28	169.38	129.41	3.1	554.51	588.14	April	44.53	32.0	Sample1-1	
15.34	425.31	179.24	279.41	208.33	10.03	773.24	741.33	September	44.56	31.52	Sample2	
7.88	133.42	121.29	173.15	133.28	3.3	559.12	595.53	April	44.56	31.52	Sample2-2	
16.36	426.18	182.62	281.17	211.27	11.4	775.62	748.61	September	44.58	31.44	Sample3	
8.11	135.36	124.71	176.44	136.16	3.6	561.31	601.27	April	44.58	31.44	Sample3-3	

Tab 5 showed that bicarbonate recorded its highest value (210.27) mg/l in the third sample of the river. The lowest (120.40) in the first sample in January was potassium, while potassium is rarely found in high concentrations in water due to the geochemical behavior involved in the synthesis of clay minerals during weathering operations. As shown by the table (5) high potassium values in July from January, the third sample in July recorded the highest values (17.36) mg/L and the lowest values in January in the first sample (6.40 mg/L). The most abundant and widespread calcium in the earth's crust is the Diwaniyah River with the highest values in the third sample in July by (280.1) and the lowest values in the first sample in January by (160.3) mg/L.

The main source of sodium ion in natural water is reflected in table 5 of the decrease in sodium values in January, which recorded its highest value in the third sample in July (420.1) mg/L and the lowest value in July in the first sample (130.3) mg/L due to high temperatures and increased evaporation.

**THE ADEQUACY OF IRRIGATION IN THE DIWANIYAH RIVER AND ITS IMPACT ON AGRICULTURE**

To calculate the adequacy of irrigation in rivers and schedules of the study area, the following mathematical equations were applied:

1. To calculate the adequacy of irrigation, the drainage (m<sup>3</sup>/tha) was converted for each river and schedule per day and on the days of the season (rainy or dry) divided by what the Ministry of Irrigation (currently the Ministry of Water Resources) allocated for each (4961) dunum for the dry season and 3/tha per (1144) dunum for the rainy season.
2. To calculate the deficit and flood, the adequacy of irrigation was subtracted from the area of the watering area and for the dry and rainy seasons.

The application of nasal equations (\*) shows that the higher the value of irrigation efficiency, the closer it is to the flood (relatively) because all the rivers and streams in the study area suffer from the deficit even though the rainy season is less than the dry season and although the region suffers from a deficit in the two seasons. According to the table (6) the adequacy of irrigation for the Diwaniyah River during the dry season was (2.60) m<sup>3</sup>, but in the rainy season it was (7.86) m<sup>3</sup>, and the deficit during the dry season (-347000.40) m<sup>3</sup> and during the rainy season (-342000.14) m<sup>3</sup>

Area of the water area	Deficit	Enough irrigation for the rainy season	Deficit	Enough irrigation for dry season	Discharge M <sup>3</sup> /S	The name of the table or the river or the beach	
350000.0	324000.14	7.86	347000.4	2.60	60	Diwaniyah River	1
7214.0	7213.18	0.19	- 7213.94	0.06	1.5		A
88931.0	88929.76	1.24	- 88930.59	0.41	9.5	Nuriya schedule	B
4378.0	4377.95	0.05	- 4377.83	0.017	0.4	The modern Shafi'i schedule	C
5007.0	5006.72	0.275	- 5006.9	0.091	2.1	The old Shafi'i schedule	D
35944.0	35943.72	0.38	- 35943.87	0.125	2.9	The schedule of Abbasid	E
6241.0	6253.52	5.48	- 6239.19	1.81	41.8	Sharifia schedule	F
2285.0	2284.83	0.17	- 2284.94	0.056	1.3	Schedule of Shat Diwaniya divert	G

**CONCLUSIONS**

1. Water revenue: In 2012 and 2014, the highest water revenue in all the rivers studied was the highest in 2014, with a record of 14,758,000,002 m<sup>3</sup>/year, while The years 2015, 2016 and 2017 accounted for the lowest water revenues due to fluctuating rainfall and high relative humidity, with 2015 recorded a water revenue of 9,542,880,000 m<sup>3</sup>/year.
2. Enough irrigation for the Diwaniyah River during the dry season (2.60) m<sup>3</sup>, but in the rainy season (7.86) m<sup>3</sup>, the deficit during the dry season
3. Most of the physical properties of the Diwaniyah River rise in July and decrease in January due to the low water level in the river as well as the peak of the river's zigzag activity.

**SOURCES**

- (1) Ali Abdul Zahra Kazem al-Waili, Surface Water Resources and Its Impact on Agriculture in Al-Qadisiyah Governorate, Professor's Journal, No. 51, Faculty of Education - Ibn Rushd, University of Baghdad, 2004, p. 530.
- (2) Ministry of Water Resources, Diwaniyah Water Resources Directorate, Employment Division, Unpublished Data, 2018.
- (3) Ministry of Water Resources, Directorate of Water Resources in Diwaniyah, GIS Division, Unpublished Data, 2018.
- (4) Ministry of Water Resources, Diwaniyah Water Resources Directorate, Employment Division, Unpublished Data, 2018
- (5) Ministry of Water Resources, Diwaniyah Water Resources Directorate, GIS Division, Unpublished Data, 2018