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ENVIRONMENTAL ASSESSMENT OF SHUT ALKUFA IN IRAQ

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Abstract

The drainage network is inefficiency and low availability of drained water from agricultural lands and is not associated with a major network organization. The study area has high temperature, which causes an increase in evaporation whether the water on the surface of the soil or water to the drainages. This causes an increase in saline in the water. The drainage of the waters located on the Shatt al-Abbasiyah pours at the Qaddhus or to the main drainage and then to Hor Ibn Nahjam. In the waters of the drainage, there are many aquatic plants, whether on the banks such as reeds or in the waters of the drainage, such as shamplan or Nile flower. Some farmers irrigate agricultural crops through drainage water. The increase of most elements and chemical compounds in the water of the drainage network is higher than the permissible limits for irrigation according to international standards. Some of the water of the drainages is within the permissible limits, especially in January, which can be used to irrigate some high salinity crops while taking care of good soil drainage.

Key words : Kufa river, land clearing, soil drainage, aquatic plants.

Introduction

The process of drainage of agricultural land (Land clearing) is of great importance in removing excess water from the plant and soil, whether above or below the soil surface. Excessive water has an impact on soil depth. Drainage is of great importance as it helps to rid the soil of salts and excess water. It also regulates the soil moisture and improve the conditions of ventilation and increase the proportion of oxygen under the root area and also to wash the soil. The drainage network is variable in winter and summer due to high temperatures, evaporation and accumulation of salts on large areas of the soil, which requires attention to drainage network to ensure its efficiency. As for the winter, due to the fluctuation of rainfall, which is not reliable in soil washing, which requires the establishment of an integrated drainage network. The drainage reduces the level of water and salts on the soil surface. As well as it leads to increased oxygen down the root area. The sedimentary plain in Najaf province is characterized by the existence of a drainage network covering the agricultural land in this province. The drainage network in the study area is influenced by several factors, including the effect of liquid waste from industrial activity from the Kufa plant of Pepsi, whose liquid waste ends up in a watercourse, causing pollution by chemical elements and compounds that lead to pollution of the Euphrates River. The drainage network in the study area also suffers from the excess of waste water, as well as the solid waste, which helps to contaminate the network of elements and chemical and biological compounds, which are reflected in the pollution of the Euphrates River. Drainage in the study area is incomplete or inefficient. The al-drainage network in Najaf is an open, undeveloped and inefficient network, most of which end in the Euphrates River in Kufa and Abbasiyah.

The problem of the study was a set of questions :

1. What is the nature of the drainage network in the study area?
2. Is there a difference in the specific characteristics of the drainage network in the study area?

The hypothesis of research is a preliminary solution to the problems between things and causes or is the interpretation of phenomena studied.

On this basis the researcher put the following hypothesis :

1. The geographical distribution of the drain network in the study area varies according to the factors affecting it.
2. There is a difference in the specific characteristics

of drainage and the nature of the factors affecting it.

The study aims at detecting the nature of the drainage network through the study of geographical extension and studying the specific characteristics of some drainage water in order to develop the solutions and proposals that develop the drainage network.

Study area

The province of Najaf occupies the southwestern part of Iraq, extending between longitudes (44' 45"") (50' 42") east and latitude (21' 32") (50' 29") north (fig. 1). It is bordered to the north by the provinces of Babel and Karbala and to the east is bordered by Qadisiyah and Muthanna. As for the west, it is bordered by the province of Anbar. The study area in the coastal plain is about 1400 km^2, or 5% of the governorate area of 28824 km^2 (DUP, 2015). While the western plateau occupies 95% of the area of the province, so the drainage network extends within the province of the sedimentary plain of the province (fig. 1). So the study was limited to the region of the sedimentary plain, especially the Kufa river. While the western plateau region is free of it due to spatial variation in the soil characteristics of both regions (Faisal, 2009).

The geographical extension of the drainage network in the study area

Kufa river drainages

The drainage is located along the Kufa river after branching and until it leaves Qadisiyah. The main drainages are 53, which are distributed according to districts and sub-districts as shown in Figs. (2, 3) and Table 1 (DUP, 2015). The number of drainages in the district of Kufa were 4 (western, tourist, northern and southern) lengths (28, 13, 12, 10) km, respectively and the area of 27640 dunums.

The center of the district of Al-Manathira has reached about 6 drainages. The longest of these drains is the Ayashi and the shortest of them is the Kchkehl. All the drainages on the Shatt al-Kufa pour directly into it. As for the sub-drainages, it is poured into the branch of the Shatt al-Kufa, which causes the salinity to increase. These branches are used to irrigate the crops and some farmers also irrigate their land from the drainages, which increases their salinity concentration.

Specific characteristics of the water of some areas of the study area

The large drainage was chosen within the Shatt al-Kufa and by the districts with 6 drainages :

Um Ni'eijah (the drainage of Bani Hassan) : This drainage extends within the Haidariyah area and is poured

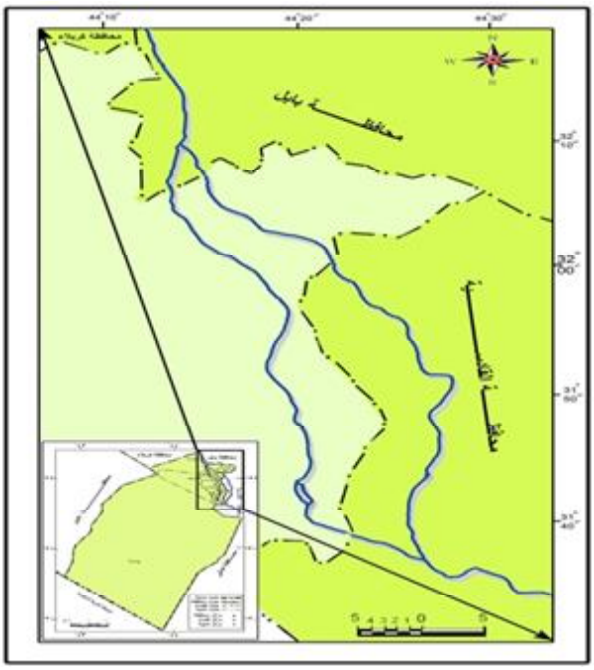

Fig. 1 : Iraq administrative map with study area in Najaf Governorate (GES, 2016).

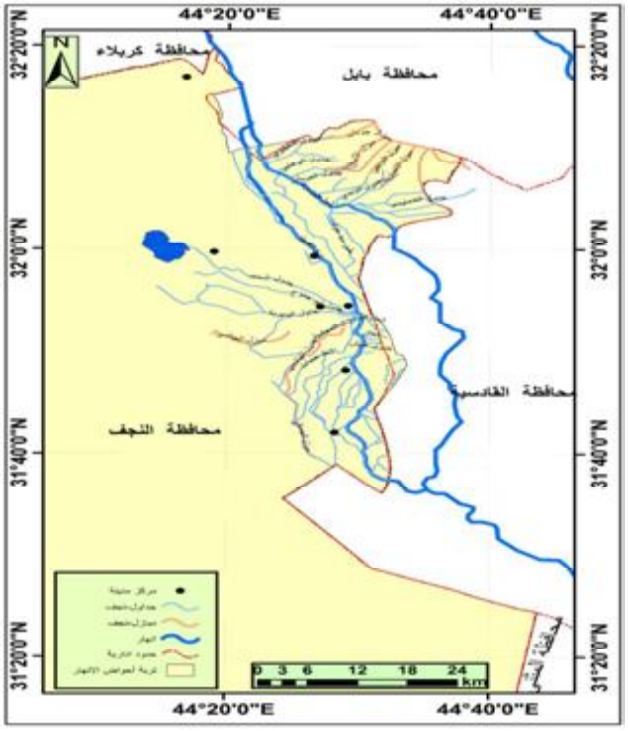

Fig. 2 : Drainage network in the study area (Ministry of Water Resources, Najaf Governorate, 2016).

into the Shut Kufa. The values of PH ranging between 8 and 8.2 (Table 2), according to the standard of the Islamic Educational, Cultural and Scientific Organization (ISEcl) (table 3). This water is suitable for irrigation. The electrical conductivity concentrations EC ranged from 9.1 to 10.6 dS/m and according to the ISEcl standard, this water is

Table 1. Lengths and the Euphrates River drainage conjugations before branching and the Shatt Kufa drainage (MWR, 2016).

Location	Drainage	Length (km)	Flow m^3/s	Method	Land area (dunum)
Haidariyah area	Um Naeja	28	5	Normal	35000
Kufa district center	Alhafar	28	20	Normal	27640
	Sahihi	13	10	Normal	
	Shamali	12	15	Pump	
	Janhobi	10	15	Normal	
Manathara District Center	Kchkehl	3	2	Normal	47300
	Khsav	10,4	10	Normal	
	Ayashi	12	5	Normal	
	Almshab	10	4	Normal	
	Sayed Ali	8	0,5	Normal	
	Alberhecat and Althoaar	10	0,5	Normal	
	Ahadjamah	5	0,5	Normal	
Mashkhab	Umm Harijh	5	10	Normal	38056
	Abu Khashneh	16	12	Normal	
	Fahtlh Alaumuma	9	7	Normal	
	Abu Nawat	6	2	Normal	
	Shahlaka	4	1	Normal	
	Mhishrk Hor Naim	5	3	Normal	
	Umm Arif	2	2	Normal	
	Hussain	4	1,5	Normal	
Qadisiyah	Khsav	24	30	Normal	46591
	Alabboudh	5	2	Normal	
	Sahnawi	4	1,5	Normal	
	Aljharh Alchehrqeah	9,4	20	Normal	
	Aljharh Algherbeah	9,25	25	Normal	
	Alhamamih	2,1	4	Normal	
	Umm Alhbt Alchehrqeah	6,5	3	Normal	
	Allahuah Alchehrqeah	4,8	2	Normal	
	Joyha	2,6	1	Normal	
	Ksad	4	1	Normal	
	Sayed Nour Al Omoumi	3,5	4	Normal	
	Tahbala	5,25	3	Normal	
	Alhaimar	2,75	2	Normal	
	Alohimr Alchehrqa	0,8	1	Normal	
	Jahmah	0,85	2	Normal	
	Mahatouh	3,1	0,7	Normal	
	Almnfean	4,2	1	Normal	

Table 1 continued....

Table 1 continued...

	Al Qadisiyah Al Jadid	9,4	4	Normal	
	Aum Skhrh	6	3	Normal	
	Nekara - Sabti	1,125	1		
	Al-Nahili	7	0,5		
	Allekes	2,5	0,5		
	Fihrt	2,7	0,5		
	Nishiyeh al-Hadithi	2,5	2		
	Tarmin	1,175	0,7		
	Hasret	3	0,5		
	Alrhvia	4	3		
	Al-Ghashim	2,5	2		
	Al-Alwa (Tabara)	4	1		
	Jahladiya (Sayed Hussein)	2,7	0,7		
	Um Bahrdeh Gharbiya	2,7	0,5		
	Alngeshah	1,9	0,5		
	Dub	1,5	2		
	Aum Behrdah Alchehrqeah	1,75	3		

higher than the permissible limit for irrigation. According to the US National Advisory Committee for Irrigation Water (table 4), this water is not suitable for irrigation. They cannot be used to irrigate agricultural crops even when the well-drained soil is available. The concentration of total soluble salts (TDS) was higher than the permissible limits for irrigation, whereas the concentration of sodium (Na) was significantly higher than the permissible limits for irrigation according to the ISEcl standard, while the magnesium concentration was higher than the ISEcl). Ca concentration was significantly higher than the ISEcl standard. The concentration of potassium (k) according to the ISEcl standard in January is allowed for irrigation and is not allowed in July. The concentration of SO_4 is higher than the ISEcl limit. While the concentration of chlorides CL is higher than the permissible limits for irrigation according to the standard (ISEcl) and according to the classification (Scafield) (table 5) for irrigation water, these concentrations are allowed for irrigation if used. As for nitrate No3 and according to the standard (ISEcl) this water is suitable for irrigation. As for the total intrusive T. H according to standard (Todd) (1980) (table 6) classification of this water is very difficult. It is noted that all the elements and vehicles rise in July compared to the month of January and this is due to high temperatures and evaporation, as well as the cultivation of summer crops topped by the crop (Shahlab).

Al-Hafar drainage

This drainage is one of the tallest drainages in the district of Kufa, which runs southward and flows to the Shatt A-Kufa. Table 2 shows that pH values according to ISEcl (table 3) are considered to be permissible for irrigation. The concentration of (Ec) in water according to the standard (ISEcl) is not allowed for irrigation. According to the American Advisory Committee standard (table 4), it cannot be used to irrigate crops even when the well-drained soil is available. While (T.D.S) according to ISEcl standard, water is allowed for irrigation in January and is not allowed for irrigation in July. The Na concentration according to the ISEcl standard is considered unsuitable for irrigation. The concentration of Mg according to the ISEcl standard is considered unsuitable for irrigation. The concentration of Ca according to the ISEcl standard is not suitable for irrigation and the concentration of K according to the ISEcl standard is not suitable for irrigation. The concentration of Hco3 according to the ISEcl standard is considered unsuitable for irrigation. While the concentration of So4 (ISEcl) is not suitable for irrigation. The concentration of Cl (ISEcl) is not suitable for irrigation and according to the classification (Scafield) (table 5) for irrigation water is good water for irrigation in January. In July, water is doubtful. No3, according to ISEcl, is suitable for irrigation in January and is not suitable for irrigation in July. As for (T.H) according to (Todd) (1980) (table 6) are classified

Fig. 3 : **a**. Aljbsa drainage; **b**. Aljharh Algherbeah drainage.

Fig. 4 : Water of Bani Hassan drainage in agricultural land.

Table 2 : The chemical properties of some of the water of the Kufa water in the study area.

Element	Um Ni'eijah		Alhafar		Aljhbsh		Um Khishneah		Khsv		Qadisiyah Aljhdid	
	January	July	January	July	January	July	January	July	January	July	January	July
pH	8	8.2	7.9	8.3	7.6	7.9	7.7	8	7.7	7.9	7.6	8
EC dS/m	9.1	10.6	7.6	9.7	8.7	10.1	6.9	7.5	10	11.3	6	7.2
T.D.S mg/L	2600	3230	1850	2150	2350	2400	1995	2330	2486	3477	2399	3245
Na mg/L	270	310	350	378	287	267	377.1	389.5	277	354	300	387
Mg mg/L	77	85.3	120	144.3	85	103	87	110	74	120	101	124
Ca mg/L	370	410	385	445	401	470	320	395	285	344	303	377
K mg/L	7.5	8.3	11	14.3	9.1	14.7	10.1	15.2	7.9	11.3	10.5	14.3
HCO_3 mg/L	7.8	11.7	12	14.2	8.5	12.5	9.7	12.4	9.1	10.8	7.8	9.91
SO_4 mg/L	470	499	320	388	290	340	370	447	385	388	290	364
CL mg/L	350	377	370	473	444	490	477	510	473	503	370	401
NO_3 mg/L	4.5	5.7	6.2	11	8.3	9.5	13.2	14.5	6.1	8.7	7.8	9.2
T.H mg/L	810	930	120	146	580	670	787	997	499	540	330	450

Table 3 : Validity of water for irrigation according to the ISESCO standard (ISEcl) (1997).

Symbol	Unit	Minimum	Maximum
EC	dS/m	0	3
T. D. S	mg/L	0	2000
Ca^{+2}	mg/L	0	20
Mg^{+2}	mg/L	0	50
Na^{+1}	mg/L	0	40
HCO_3^{-1}	mg/L	0	10
Cl^{-1}	mg/L	0	300
SO_4^{-2}	mg/L	0	200
NO_3^{-1}	mg/L	0	10
K^{+1}	mg/L	0	2
PH	mg/L	6	8.5

The values of pH and No3 according to ISEcl (table 3) are allowed for irrigation. EC, Mg, T.D.S, Na, K, SO_4, HCO_3 and Ca (ISEcl) are not allowed for irrigation. As for the concentration of Cl (ISEcl) is not suitable for irrigation and according to the classification (Scafield) (table 5) for irrigation water is questionable water. While total (T.H) according to Todd (1980) (table 6) classified this water as very hard. The elements and compound for the water of the drainage are increased in July compared with January and are not allowed for irrigation except pH and NO_3.

Um Khashniyeh drainage

It is considered one of the main drainages in the district of Mashkhab and ends in the Qadisiyah district at the Jahara Gharbiya. The values of pH and Hco3 according to ISEcl (table 3) are allowed for irrigation. EC, Mg, Na, K, SO_4, Cl, NO_3 and Ca according to (ISEcl) are not allowed for irrigation. As for the concentration of (ISEcl) is not suitable for irrigation and according to the classification (Scafield) (table 5) for irrigation water is questionable water. The concentration of T.D.S according to ISEcl is permitted for irrigation in January and is not allowed for irrigation in July. While total (T.H) according to Todd (1980) (table 6) classified this water as very hard. The elements and compound for the water of the drainage are are not allowed for irrigation.

Table 4 : Water categories according to their validity for different agricultural uses according to the standard of the American National Advisory Committee (1968).

Salinity (dS/m)	Validity	Agricultural use
0.75	Valid for irrigation of all agricultural crops in all types of soils	Cultivation of all agricultural crops
0.75-1.5	Are suitable for irrigating some crops that are relatively saline in well-drained soils	Valid for growing wheat, barley, rice, maize, tomatoes, vegetables, pomegranates and olives
1.5-3	Suitable to irrigate the crops in the condition of taking care of the soil and its good drainage	Suitable for growing cotton, palm, beets and others
3- 7.5	Can be used to irrigate some crops while taking care of soil drainage	Valid for palm growing
More than 7.5	They cannot be used to irrigate crops even when soil with good drainage is available.	.....

Table 5 : The permissible limits for chlorides (CL^{-1}) by Scafield of irrigation water (Abdel, 1983).

Water classes	CL^{-1} mg/L
Less than 142	Excellent
142-250	Good
250-425	Permissible
425-710	Troubled
More than 710	Unsuitable

as relatively hard water. All elements rise in July and goes down in January. Most of the elements and compound are not allowed for irrigation, especially in July and some were allowed for irrigation in January. This is due to the drainage of agricultural land, which is grown rice crop in the hot season as well as high temperatures and extreme evaporation during the summer.

Al-Jhabasah drainage

It is one of the main drainage and pours into it two sub-sections within the district of al-Manathara. The end of this bastion in the Khasaf, which also turn in Qadisiyah.

Table 6 : Classification of water hardness (Todd, 1980).

Description water case	T.H mg/L
Soft Water	0-75
Relatively Hard Water	75-150
Hard Water	150-300
Very Hard Water	More than 300

Al-Khasaf drainage

It is one of the tallest drainages in the Mashkhab district and within the Qadisiyah area. In this bastard hurt a group of sub-branch and then pour into Qadisiyah. The values of pH and NO_3 according to ISEcl (1997) (table 3) are allowed for irrigation. EC, Mg, Na, K, SO_4, Cl, T.D.S. and Ca according to (ISEcl) are not allowed for irrigation. As for the concentration of (ISEcl) is not suitable for irrigation and according to the classification (Scafield) (table 5) for irrigation water is questionable water. While total (T.H) according to Todd (1980) (table 6) classified this water as very hard. The concentration of HCO_3 according to (ISEcl) is valid for irrigation in January and is not suitable for irrigation in July. Cl is not suitable for irrigation and according to Scafield (table 5) for irrigation water, this water is questionable. All elements and compound rise in the summer. Some elements were within the permissible limits, but the concentration of saline elements was observed to be significant and noticeable.

Qadisiyah drainage

This drainage is one of the secondary mabazal in the area of Qadisiyah, its water is discharged in the direction of Baha'i, one of the Euphrates River. The values of pH and NO_3 according to ISEcl (table 3) are allowed for irrigation. EC, Mg, Na, K, So4, Cl, T.D.S, HCO_3 and Ca according to (ISEcl) are not allowed for irrigation. As for the concentration of (ISEcl) is not suitable for irrigation and according to the classification (Scafield) (table 5) for irrigation water is questionable water. While total (T.H) according to Todd (1980) (table 6) classified this water as very hard. All elements rise in July compared to January. There are some elements and compounds are within the limits allowed for irrigation. Which indicates that the use of fertilizers is few. While saline elements are high, but can be used to irrigate crops that have the potential to tolerate high salinity. Some farmers use this water to irrigate the crops and with an interview with a farmer, the water was scarce during the hot season (fig. 4). But this method is wrong, which leads to the increase of soil salts, which is reflected on agricultural production and over time the soil becomes high salinity without plant.

Results and Discussion

The drainage network is characterized by its inefficiency and low availability of drained water from agricultural fields and is not associated with a major network organization. The study area is characterized by high temperature, which causes an increase in evaporation whether the water on the surface of the soil or water to the drainages. This causes an increase in saline elements in the water of the drainage network. The drainage of the water on the Shut Kufa pours to the Shut of Kufa. While the drainage of the waters located on the Shatt al-Abbasiyah pours at the Qaddhus or to the main drainage and then to Hor Ibn Nahjam. In the waters of the drainage, there are many aquatic plants, whether on the banks such as reeds or in the waters of the drainage, such as shamplan or Nile flower. Some farmers irrigate agricultural crops through drainage water. The increase of most elements and chemical compounds in the water of the drainage network is higher than the permissible limits for irrigation according to international standards. Some of the water of the drainages is within the permissible limits, especially in January, which can be used to irrigate some high salinity crops while taking care of good soil drainage.

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