

LIMITING WATER RESOURCES FOR AGRICULTURAL USES IN RANIA DISTRICT, SULAIMANI GOVERNORATE

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ABSTRACT

This study was conducted during 19th August, 2018 to 12th February, 2019 in Rania district, Sulaimani governorate to classify the water of 24 springs, 25 wells and 3 rivers for agricultural purpose. The results indicated that all the studied water had good or excellent class for irrigation depending on global systems of irrigation. On the other hand, depending on USDA classification (1954) the water of (44, 5, 2 and 1) locations had (C₂S₁, C₃S₁, C₄S₁ and C₄S₂) classes for irrigation purpose respectively. While the waters of 49 and 3 locations had excellent and very satisfactory class for livestock and poultry uses respectively. Depending on dissolved oxygen (DO mg l⁻¹) value most of the studied water were suitable for fish culture, except the water of two locations were not suitable for all fish species due to low values of dissolved oxygen in these two locations which were 5.20 and 6.30 mg oxygen per ml water.

KEYWORDS: Water classes, Agricultural uses, Dissolved Oxygen.

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INTRODUCTION

Water quality is of essential and significant importance because of its role to human health, aquatic life, ecological integrity and sustainable economic growth. Indeed, without good quality, water sustainable development and environmentally sound management of water resources will be meaningless.

Also, poor irrigation water quality has negative effects on crop productivity, crop product quality, and public health of consumers and farmers who come in direct contact with the irrigation water. The impact of water quality is measured the effect of the irrigation water on soil characteristics and crops (Etteieb *et al.*, 2017).//////The Water quality of any specific area or specific source can be assessed using water quality of any specific area or specific source can be assessed using physical, chemical and biological parameters. The values of these parameters are responsible in limiting the water quality for agricultural uses (Ayers and Westcot, 1985) Water resources in Kurdistan region are including surface water such as streams, rivers, lakes, groundwater like wells and springs and its crucial to determine the classes of all these water sources to be clear that the main water fit to use

in a specific purpose like irrigation, human drinking, livestock and poultry watering.

Quality of irrigation water depends on or determined by its chemical composition and the conditions of use. All the waters, surface or sub-surface, contain soluble salts which increases the concentration of the soil solution upon irrigation (Husain *et al.*, 2010). Ayers and Westcot (1985) indicated that water quality depends on physical, chemical and biological characteristics which influence its suitability for a specific use.

All the mentioned investigations have been done depending on several global and local classifications which included different systems of water classifications such as (Richards's classification, 1954) (Deneen classification, 1954) (Wilcox classification, 1955) (Ayers and Westcot classification, 1985).

GROUNDWATER CLASSIFICATION FOR AGRICULTURAL USES:

There are numerous systems for irrigation water classification such as:

1- Richards's classification (1954).

Richards (1954) classified irrigation water into 16 classes depending on electrical conductivity and sodium adsorption ratio (EC and SAR) as shown in table (1).

Table (1): USDA water classes.

EC =C dS m ⁻¹	SAR =S			
	C1S1	C1S2	C1S3	C1S4
	C2S1	C2S2	C2S3	C2S4
	C3S1	C3S2	C3S3	C3S4
	C4S1	C4S2	C4S3	C4S4

2- Deneen classification (1954).

The irrigation water was classified depending on salinity potential (SP) and soil permeability to three classes as reported by Deneen in the table (2).

Table (2): water classes depending on SP.

Water quality	Salinity potential (SP) = (Cl ⁻¹ + ½ SO ₄ ²⁻) mmole _c l ⁻¹		
	Permeability		
	Low	Medium	High
Good	< 7	< 5	< 3
Moderate	7-15	5-10	3-5

3- Wilcox classification (1955):

Depending on residual Sodium Carbonate (RSC) = CO₃²⁻ + HCO₃⁻ - (Ca⁺² + Mg) (mmole_c l⁻¹), Wilcox (1955) classified the irrigation water into three classes table (3).

Table (3): Water classes depending on RSC.

Water class	RSC
1-Probably safe	<1.25
2- Marginal	1.25-2.5
3- Unsuitable	>2.5

4-Todd classification (1966):

Todd (1966) classified irrigation water based on (TDS), chloride and sodium percent as shown in (4).

Table (4): Water classes depending on TDS, Cl, and Na%.

Parameter	Suitable	Moderate	Doubtful
TDS(ppm)	700	2000	>2000
Cl(ppm)	150	500	>500
Na%	60	60-75	>75

5-Ayers and Westcot classification (1985) :

Depended on EC, SAR other properties as shown in table (5) the irrigation water was classified into three classes according to (Ayers and Westcot, 1985).

Table (5): Ayers and Westcot classification (1985).

Potential irrigation Problem	Unit	Degree of restriction use		
		None	Slight to Moderate	severe
Salinity EC_{iw} at 25° C	dS m ⁻¹	< 0.7	0.7-3.0	>3.0
Infiltration		> 0.7	0.7-0.2	< 0.2
SAR	0-3			
	3-6	> 1.2	1.2-0-0.3	< 0.3
	6-12	> 1.9	1.9-0.5	< 0.5
	12-20	($mmole_c l^{-1}$) ^{1/2} > 2.9	2.9-1.3	< 1.3
	20-40	> 5	5.0-2.9	< 2.9
Sodium toxicity (SAR) Surface irrigation		< 3	3-9	> 9
Sprinkler irrigation		< 3	>3	
Chloride (Cl)	Surface irrigation	$mmole_c l^{-1}$ < 4	4-10	> 10
	Sprinkler Irrigation	$mmole_c l^{-1}$ < 3	>3	
Boron (B)	mg l ⁻¹	< 0.7	0.7-3.0	> 3.0
Miscellaneous Effects				
Nitrogen (NO ₃ – N)	mg l ⁻¹	< 5.0	5.0-30	> 30.0
Bicarbonate (HCO ₃)	$mmole_c l^{-1}$	< 1.5	1.5-8.5	> 8.3
pH.		Normal Range 6.5-8.4		

6-Don classification (1995):

Don (1995) classified irrigation water depending up on total salt content (TDS), EC, SAR, Na% and pH to five classes as follow:

Table (6): Water classification depending on EC, TDS, Na%, SAR, and pH.

Water Quality	EC (dS m ⁻¹)	TDS (ppm)	Na%	SAR	pH
Excellent	0.25	175	20	3	6.5
Good	0.25-0.75	175-525	20-4-0	3-5	6.5-6.8
Permissible	0.75-2.0	525-1400	40-60	5-10	6.8-7.0
Doubtful	2.0-3.0	1400-2100	60-80	10-15	7.0-8.0
Unsuitable	>3.0	>2100	>80	>15	>8.0

Water classification for animal use:

The water quality for livestock was classified by Altoviski (1962) as recorded in the table below:

Table (7): Water quality guide for the livestock uses or Altoviski classification.

Parameters (ppm)	Very good	Good	Permissible	Can be used	Maximum limit
Ca ⁺²	350	700	800	900	1000
Na ⁺	800	1500	2000	2500	4000
Mg ⁺²	150	350	500	600	700
SO ₄ ⁻²	1000	2500	3000	4000	6000
Cl ⁻	900	2000	3000	4000	6000
TDS	3000	5000	7000	10000	15000

Water quality guide for livestock and poultry uses was classified by Ayers and Westcott (1985

Table (8): classification of water for animal uses (Ayers and Westcot,1985).

Water (EC) dS m ⁻¹	Rating or classes	Using
<1.5	Excellent	Usable for all classes of livestock and poultry
1.5-5.0	Very Satisfactory	Usable for all classes of livestock and poultry. May cause temporary diarrhea in livestock not accustomed to such water; watery droppings in poultry.
5.0-8.0	Satisfactory for Livestock	May cause temporary diarrhea or be refused at first by animals not accustomed to such water.
	Unfit for Poultry	Often causes watery faeces, increased mortality and decreased growth, especially in turkeys.
8.0-11.0	Limited Use for Livestock	Usable with reasonable safety for dairy and beef cattle, sheep, swine and horses. Avoid use for pregnant or lactating animals
	Unfit for Poultry	Not acceptable for poultry.
11.0-16.0	Very Limited Use	Unfit for poultry and probably unfit for swine. Considerable risk in using for pregnant or lactating cows, horses or sheep, or for the young of these species. In general, use should be avoided although older ruminants, horses, poultry and swine may subsist on waters such as these under certain conditions.
>16.0	Not Recommended	Risks with such highly saline water are so great that it cannot be recommended for use under any conditions.

The water quality for livestock was classified as mentioned by Ayers and Westcot (1985), which referred to upper limit of heavy metals and other ions as shown in table (9):

Table (9): Guidelines for livestock.

Parameter	Upper Limit (mg l ⁻¹)
Cd	0.05
F	2.00
Fe	Not needed
Pb	0.10
Mn	0.05
NO ₃	100
NO ₂	10
Zn	24

Many studies have been done at different locations in Kurdistan region on water quality which included both of surface water and ground water by Esmail, 1986 ,Dohuki ,1997 , Mam Rasul 2000, Khwakarim et al., 2010, Esmail and Salih, 2014, Rajab, 2015, Bapir and Ali, 2016 and Albarwary et al., 2018). Also numerous studies have been done in Iraq by Alhashimi and Mustafa 2012 and Alamar, 2015.

since there are little or no studies in Rania district about different water resources and their uses for different purpose for this reason this

study was selected to classify the water of different resources (rivers ,springs and wells) for irrigation ,livestock and poultry uses and fishing culture.

MATERIALS AND METHODS

The study was conducted in Rania district, Sulaimani, Iraqi Kurdistan region, which included 52 water sources (25 wells, 24 springs, and 3 rivers) ,the GPS reading of the studied locations were recorded in table (10).

Table (10): GPS reading for selected locations.

Samples	Location	Elevation (m)	N	E
1-River	Zey bchuk	589	36°12'51.00"	44°59'23.20"
2-River	Hizop	526	36°10'18.80"	44°41'12.40"
3-River	Shawre river	768	36°21'16.90"	44°46'37.00"
Springs				
4-Spring	Qula-Rania	594	36°15'24.80"	44°53'09.00"
5-Spring	Ganaw-Qurago	527	36°12'24.06"	44°56'16.30"
6-Spring	Qulga-chwarqurna	533	36°12'02.50"	44°52'49.70"
7-Spring	Darmanaw-qamtaran	516	36°10'28.80"	44°41'17.30"
8-Spring	Qula-kanymaran	545	36°12'26.80"	44°43'34.30"
9-Spring	Sarwchawa-sarwchawa	537	36°16'32.40"	44°45'19.80"
10-Spring	Kak hamza-plingan	500	36°23'31.80"	44°46'04.50"
11-Spring	Pira mlot	927	36°23'40.20"	44°46'33.30"
12-Spring	Qalat	1015	36°23'45.30"	44°47'17.30"
13-Spring	Dalwka	1080	36°23'48.30"	44°49'19.40"
14-Spring	Demam	954	36°23'47.40"	44°46'49.10"
15-Spring	Mamand axa-kawbin	890	36°24'21.00"	44°45'06.00"
16-Spring	Srushk-kawbin	900	36°22'56.80"	44°45'28.00"
17-Spring	Sarwchawa-Gulan	1124	36°23'35.00"	44°42'51.40"
18-Spring	Mamxalan	831	36°23'42.70"	44°42'28.20"
19-Spring	Sardke-daraban	824	36°22'21.80"	44°45'43.50"
20-Spring	Zurkan-dere	633	36°16'16.00"	44°48'07.20"
21-Spring	Sarukany-dere	853	36°21'20.10"	44°46'38.10"
22-Spring	Sarwchawa-qalasaiday sarw	961	36°20'27.30"	44°46'51.90"
23-Spring	Sarwchawa-nore	1005	36°20'48.60"	44°45'29.00"
24-Spring	Tawe-mirabag	660	36°20'58.20"	44°46'05.60"
25-Spring	Sarashkawtan	1065	36°16'50.90"	44°48'56.90"
26-Spring	Kany bnaw	800	36°20'11.20"	44°47'26.70"
27-Spring	Luse spring-topawa	542	36°12'33.20"	44°46'40.10"
Wells				
28-Well	Qurago	519	36°13'09.50"	44°56'46.40"
29-Well	Boskin 1	513	36°13'28.00"	44°55'22.60"
30-Well	Boskin 2	529	36°13'24.70"	44°54'47.20"
31-Well	Chwarqurna	535	36°11'03.40"	44°50'42.60"
32-Well	Hizop 1	552	36°10'28.40"	44°41'17.90"
33-Well	Hizop 2	564	36°10'29.20"	44°41'19.00"
34- Well	Klaw sur	554	36°10'01.10"	44°42'19.50"
35-Well	Qamtaran	549	36°10'01.50"	44°44'41.40"
36-Well	Kany maran	533	36°10'58.60"	44°44'38.20"
37-Well	Qaraniaxa	536	36°10'59.30"	44°44'29.20"
38-Well	Plingan	522	36°12'15.80"	44°45'56.70"
39-Well	Kolin 1	550	36°13'31.00"	44°51'34.00"
40-Well	Kolin 2	533	36°13'25.00"	44°50'30.00"

41-Well	Garmkadal	617	36°12'22.00"	44°46'06.00"
42-Well	Shkarta	634	36°20'39.40"	44°42'30.90"
43-Well	Naqolan	604	36°15'48.70"	44°46'16.30"
44-Well	Hajiawa	584	36°15'00.00"	44°46'44.20"
45-Well	Rania	637	36°15'58.80"	44°50'40.50"
46-Well	Sarkapkan	649	36°15'57.60"	44°50'09.50"
47-Well	Rezena	715	36°18'07.50"	44°48'59.70"
48-Well	Pashkotal	718	36°18'56.20"	44°48'05.30"
49-Well	Nore	821	36°21'05.70"	44°46'09.60"
50-Well	Daraban	846	36°22'05.05"	44°45'34.09"
51-Well	Grjan 1	543	36°12'24.90"	44°46'46.80"
52-Well	Grjan 2	549	36°12'33.30"	44°46'40.20"

WATER SAMPLING:

Water samples were collected three times from 19th August 2018 to 12th January 2019 and in 1000 ml disposable polyethylene

The main water analysis included EC, pH, concentration of Ca^{2+} , Mg^{2+} , Na^+ , K^+ , Zn^{2+} , Pb , Cd^{2+} , Mn^{2+} , Fe^{2+} , HCO_3^- , CO_3^{2-} , Cl^- , SO_4^{2-} , PO_4^{3-} and dissolved oxygen, which were determined according to APHA(1989) the range and the mean of the results were shown in table (11), While the mean concentration of them during t

The results of water analyses were classified for agricultural uses depending on some global systems of water classification.

RESULTS AND DISCUSSION

Classification of water for irrigation purpose: The studied waters were classified according to some classifications as follow:

Richards (1954) classification (USDA classification):

Depending on USDA classification the water of (44, 5, 2 and 1) locations had (C_2S_1 , C_3S_1 , C_4S_1 and C_4S_2) classes for irrigation purpose respectively. It means 84.62, 9.62, 3.84 and 1.92 % of the studied waters had (C_2S_1 , C_3S_1 , C_4S_1 and C_4S_2) class for irrigation (table ,11). These results indicated that the water of 49 locations were suitable for irrigation and the water of 1spring (Ganaw- Qurago spring) and 2 wells (Qurago and Pashkatol) were not good for irrigation due to high EC value more than 2.25 dSm^{-1} and moderate SAR value which ranged from 10 to 18.

Table (11): shows the chemical properties of the studied water resources in Rania district.

Water Properties	River			Spring			Well		
	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean
pH	7.88	7.94	7.91	6.88	7.55	7.26	6.75	7.55	7.22
Do (mg l ⁻¹)	8.01	8.2	8.14	4.85	8.46	7.56	6.95	8.38	7.71
EC (dSm ⁻¹)	0.49	1.45	0.90	0.43	3.83	0.86	0.44	2.46	0.75
Mg	0.86	3.5	2.31	1.02	7.93	2.41	0.92	3.49	1.84
Ca	2.24	4.96	3.45	2.05	20.64	5.21	2.27	10.55	4.43
Na	0.35	12.41	4.74	0.12	27.47	1.47	0.19	16.95	1.44
K	0.07	0.42	0.21	0.03	3.55	0.23	0.04	0.72	0.12
HCO ₃	3.24	16.19	9.08	2.16	44.83	7.90	2.85	24.12	6.48
CO ₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO ₄	1.08	2.00	1.43	0.73	3.2	1.23	0.69	2.08	1.07
Cl	0.03	0.18	0.08	0.01	0.84	0.07	0.03	0.28	0.081
PO ₄ (mg l ⁻¹)	0.00	5.81	2.90	0.00	6.22	1.43	0.00	4.67	1.2
SP	0.29	0.68	0.43	0.40	1.64	0.38	0.23	0.79	0.35
RSC	1.69	13.32	6.2	0.62	35.94	4.09	0.72	19.62	3.22

TDS(mg l ⁻¹)	313.60	864	555.73	272	2320	546.27	278.4	1571.2	476.67
SAR	0.24	10.36	4.08	0.12	12.95	0.79	0.18	11.3	1.02
Na%	4.00	67.00	34.00	1.00	56.00	7.00	4.00	64.00	12.00
Pb	mg l ⁻¹	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd
Zn		Nd	0.001	0.0006	Nd	0.002	0.007	Nd	0.0004
Mn		Nd	0.001	0.0006	Nd	0.002	0.007	Nd	0.0004
Cd		Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd
NO ₃ ⁻		5	30	20	4	21	16	6	16
								16	10

Doneen classification (1954):

This classification depends on salinity potential (sp) and according to this parameter and the results in table (11) all the studied water have good class for high, moderate, and low permeable soils since the value of salinity potential was very low $\leq 1.64 \text{ mmol}_c \text{ l}^{-1}$.

Wilcox Classification (1954):

The water for 8 locations number (6, 7, 17, 23, 31, 41, 42 and 52) have probably safe class because the value of residual sodium carbonate (RSC) of them was below 1.25 mmol_c^{-1} . whereas the water for locations number (1, 4, 9, 11, 13, 14, 15, 16, 22, 24, 25, 26, 35, 37, 39, 40, 43, 44, 45, 48 and 49) were located within marginal class since the residual sodium carbonate (RSC) value of them was ranged between $(1.25-2.5) \text{ mmol}_c^{-1}$ and the remain locations (2, 3, 5, 8, 10, 12, 18, 19, 20, 21, 27, 28, 29, 30, 32, 33, 34, 36, 38, 46, 47, 50 and 51) had unsuitable class because value of RSC for them were more than $2.50 \text{ mmol}_c \text{ l}^{-1}$, (table ,11).

Ayers and Westcot (1985) classification:

Depending on EC value the studied waters for the locations (1, 4, 6, 7, 8, 9, 11, 13, 14, 15, 16, 17, 20, 22, 23, 24, 25, 26, 31, 34, 35, 37, 39, 40, 41, 42, 43, 44, 45, 46, 47, 49, 51 and 52) were classified as non-saline water, or suitable for irrigation, while the water for locations number (2, 3, 10, 12, 18, 19, 21, 27, 28, 29, 30, 32, 33, 36, 38, 48 and 50) were located within slight to moderate class and only water for location number (5) had sever class since its EC value was more than 3 dS m^{-1} . On the other hand depending on SAR value water for locations number 2 and 28 have slight to moderate degree of restriction for irrigation use, because SAR value of them was located between (3-9), whereas sample number (5) have sever restriction of use since its SAR value was more than 9, and all other water samples have no restriction use for irrigation.

Depending on HCO₃ concentration the water samples of most locations had slight to moderate restriction use since the value of bicarbonate were ranged between $(1.5-8.5) \text{ mmol}_c \text{ l}^{-1}$ except the water for locations number (2, 5, 12, 18, 28, 32 and 33) had moderate to severe restriction of use for irrigation because the value of HCO₃ was more than $8.5 \text{ mmol}_c \text{ l}^{-1}$ (Ayers and Westcot, 1985).

Don classification (1995):

Don (1995) classified irrigation water depending up on, EC, TDS, SAR, Na% and pH to five classes as follow: According to Don (1995) classification. depending on EC values, the irrigation water for locations (1, 4, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 20, 22, 23, 24, 25, 26, 30, 31, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 51 and 52) had good class because the EC values were between $(0.25 - 0.75) \text{ dS m}^{-1}$, however water for locations (2, 3, 18, 19, 21, 27, 29, 32, 33, 36 and 50) had Permissible class, since their EC were more than 0.75 dS m^{-1} and less than 2 dS m^{-1} , and water for locations (12 and 28) had a doubtful class because EC value was ranged between $(2 \text{ to } 3) \text{ dS m}^{-1}$, while sample number 5 located within unsuitable class for irrigation because EC value of this water was more than 3 dS m^{-1} .

Depending on total soluble salts the studied waters have different classes, water samples for locations (1, 3, 4, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 20, 22, 23, 24, 25, 26, 29, 30, 31, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 51 and 52) have good class for irrigation, since the TDS of these samples was located between $(175-525) \text{ ppm}$, while the water for locations (2, 18, 19, 21, 27, 32, 33, 36 and 50) were located within permissible class because the TDS value of them was ranged (from 525 to 1400) ppm, the samples number (12 and 28) were located within doubtful class, since the TDS value was ranged between $(1400-2100) \text{ ppm}$, while the water for location number (5) had unsuitable

class due to high TDS value (more than 2100)ppm.

Relying on sodium percentage water samples of (3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51 and 52) had excellent class because Na% value was less than 20%, sample numbers (1, 32, 33 and 34) had good class since Na% was ranged from (20-40)%, the water for location (5) has permissible class since the Na% was located between (40-60)%, and the water sample for locations (2 and 28) were located within doubtful class due to high sodium % value (60-80)%.

Classification of water for animal uses:

Depending on Ayers and Westcot (1985) the studied water for most of locations were excellent for poultry and livestock uses since their EC value was less than 1.50 dS m⁻¹, except the water of Qurago-Ganaw spring and Qurago well which were very satisfactory for poultry and livestock uses because the EC value of them was between 1.50 to 5.0 dS m⁻¹. It means the water for all the studied locations were suitable for poultry and livestock uses or watering.

The water of the studied location were suitable for livestock uses depending on concentration of calcium, sodium, magnesium, Sulfate, chloride and total dissolved salts according to Altoviski (1962) classification, since their values were less than (300, 800, 150, 1000, 900 and 3000) ppm respectively as shown in table (11).

According to Ayers and Westcot (1985) the water of the studied locations were suitable for livestock uses since the concentration of the studied heavy metals and nitrate were very low in comparing with allowable concentration of them as shown in table (11). Since the concentration of the studied heavy metals and NO₃⁻ were very low in comparing with the allowable values by Ayers and Westcot (1985) as recorded in table (9).

Depending on Francis-Floyd (2003) most of the studied waters were suitable for fish culture since the dissolved oxygen of them was between (4.5 – more than 8) mg l⁻¹ which was suitable for most fish species. On the other hand the water for one spring (location number 12 or Daloka spring) and one well (location number 28 or Qurago well) were not suitable for fish culture since the TDS of them was more than 1000ppm

or the EC value of them is more than 1.60dS m⁻¹.

CONCLUSION

It appears from this investigation that the water of most of the studied locations (rivers, springs and wells) were suitable for irrigation, poultry, livestock uses in addition to fish culture.

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Appendix (1): The mean of some physiochemical properties of the studied water resources in Rania district during the hydrological year.

Sample NO.	pH	EC $dS m^{-1}$	DO $mg L^{-1}$	Mg ⁺²	Ca ⁺²	Na ⁺	K ⁺	HCO ₃ ⁻	Cl ⁻	SO ₄ ⁻²	CO ₃ ⁻²
1	7.84	0.51	8.01	0.87	2.24	1.45	0.07	3.25	0.04	1.21	0.00
2	7.89	1.40	8.23	2.58	3.17	12.40	0.41	16.19	0.18	2.00	0.00
3	7.83	0.77	8.38	3.50	4.96	0.35	0.14	7.81	0.02	1.08	0.00
4	7.33	0.62	8.20	1.50	3.11	0.20	0.04	3.58	0.02	1.11	0.00
5	7.26	3.61	5.07	4.67	13.24	27.45	3.53	44.87	0.80	3.19	0.00
6	7.53	0.59	7.97	1.68	3.04	0.30	0.08	3.48	0.04	1.33	0.00
7	7.41	0.52	8.32	1.03	2.59	0.28	0.07	2.88	0.06	0.93	0.00
8	7.36	0.80	8.00	1.50	4.54	1.21	0.16	5.70	0.13	1.27	0.00
9	7.34	0.69	8.34	1.75	4.46	0.31	0.06	5.10	0.04	1.35	0.00
10	7.31	0.76	7.50	2.40	4.56	0.20	0.06	6.09	0.05	0.96	0.00
11	7.40	0.70	8.33	2.24	3.95	0.19	0.05	5.20	0.04	1.16	0.00
12	7.13	2.36	6.34	7.94	20.65	0.37	0.20	26.90	0.04	2.03	0.00
13	7.51	0.64	8.38	2.27	3.35	0.18	0.05	4.53	0.06	1.25	0.00
14	7.36	0.67	7.55	2.40	4.01	0.22	0.09	5.34	0.05	1.14	0.00
15	7.53	0.64	8.56	2.22	3.48	0.14	0.05	4.95	0.02	0.89	0.00
16	7.49	0.60	8.40	2.24	3.54	0.17	0.05	4.54	0.03	1.24	0.00
17	7.57	0.44	8.47	1.04	2.05	0.12	0.04	2.17	0.03	1.01	0.00
18	7.13	1.50	6.24	5.31	11.78	0.51	0.16	16.23	0.05	1.41	0.00
19	7.28	0.95	6.87	3.22	5.53	0.57	0.22	8.52	0.07	0.91	0.00
20	7.34	0.71	8.35	2.49	4.82	0.21	0.10	6.48	0.04	1.03	0.00
21	7.25	0.85	7.32	2.61	5.73	0.24	0.10	7.42	0.04	1.19	0.00

22	7.57	0.63	8.37	1.72	3.29	0.17	0.04	4.38	0.05	0.75	0.00
23	7.59	0.52	8.25	1.11	2.23	0.15	0.04	2.32	0.04	1.01	0.00
24	7.54	0.61	8.07	1.55	3.48	0.21	0.04	3.88	0.03	1.18	0.00
25	7.51	0.57	8.39	1.46	2.74	0.17	0.04	3.60	0.04	0.73	0.00
26	7.49	0.56	8.27	1.47	3.12	0.23	0.05	3.55	0.05	1.10	0.00
27	7.31	0.90	7.93	2.25	5.97	1.51	0.10	8.22	0.17	1.23	0.00
28	7.23	2.44	7.81	2.55	6.43	16.94	0.71	24.11	0.26	2.07	0.00
29	7.33	0.87	8.14	2.02	5.24	1.44	0.10	7.23	0.13	1.09	0.00
30	7.40	0.80	8.25	1.98	4.69	0.98	0.14	6.42	0.12	1.07	0.00
31	7.60	0.49	8.45	1.49	2.29	0.25	0.09	2.87	0.05	0.99	0.00
32	7.03	1.33	7.29	1.09	10.56	3.50	0.09	12.88	0.29	1.14	0.00
33	7.1	1.17	7.38	1.37	7.41	3.01	0.09	10.37	0.23	1.03	0.00
34	7.40	0.66	8.44	1.67	3.53	1.38	0.16	5.23	0.10	1.15	0.00
35	7.52	0.51	8.04	1.02	3.23	0.25	0.05	3.49	0.05	0.91	0.00
36	7.16	1.14	6.97	1.95	5.08	1.54	0.13	7.33	0.23	1.03	0.00
37	7.28	0.74	7.68	2.07	4.25	0.40	0.07	5.50	0.07	1.11	0.00
37	7.33	0.80	7.81	2.56	5.09	0.56	0.20	7.21	0.05	1.05	0.00
39	7.49	0.53	7.48	1.11	2.85	0.24	0.08	3.27	0.05	0.89	0.00
40	7.44	0.49	7.98	1.34	3.07	0.39	0.05	3.64	0.04	1.08	0.00
41	7.58	0.49	7.58	1.23	2.82	0.19	0.06	2.97	0.04	0.98	0.00
42	7.47	0.46	8.08	0.92	3.12	0.21	0.04	2.91	0.03	1.04	0.00
43	7.33	0.63	8.06	1.54	3.95	0.24	0.06	4.32	0.06	1.21	0.00
44	7.47	0.56	8.09	1.64	3.07	0.23	0.05	4.03	0.04	0.84	0.00
45	7.43	0.64	8.21	2.02	4.09	0.28	0.09	5.18	0.06	1.13	0.00
46	7.38	0.61	8.00	1.85	3.88	0.80	0.07	5.56	0.05	0.80	0.00
47	7.36	0.71	8.11	2.30	4.67	0.35	0.10	6.11	0.06	1.10	0.00
48	7.32	0.77	8.01	2.88	3.54	0.35	0.12	5.68	0.06	1.07	0.00
49	7.28	0.71	8.08	2.09	4.30	0.43	0.10	5.57	0.08	1.15	0.00
50	7.21	0.95	7.59	3.49	4.36	1.20	0.23	8.44	0.09	0.69	0.00
51	7.54	0.73	8.16	2.13	5.12	0.39	0.07	6.33	0.06	1.14	0.00
52	7.34	0.67	8.28	2.03	4.67	0.39	0.07	5.97	0.05	1.03	0.00
RLSD _{.001}	0.11	0.23	1.02	0.67	1.85	0.44	0.05	2.30	0.06	0.39	N.S

دیاری کردنی هه ندی سه رچاوهی ئاو بو به کارهییانی کشتوکالی له رانیه \ پارێزگای سلیمانی

پوخته

ئەم توێژینە وەهێه له ماوهی نیوان 19 \ 8 \ 2018 تا 12 \ 2 \ 2019 له رانیه \ سلیمانی ئەنجام درا به مه بهستی پۆلین کردنی ئاوی 25 بیرو و 24 کانی و 3 رووبار بوو به کارهێنایی کشتوکالی. ئەنجامه کان ئه وه یان دهرخست که وا ئاوه کان له جووری باش یان باشتترین بوون به پێی پێوه ره جیهانیه کان، به لام به پێی پێوه ری ئه مریکی ئاوی شوینی ژماره (44، 5، 2 و 1) له جووری (C4S2، C4S1، C2S1، C2S1) بوون یه ک به دوا ی یه ک. له هه مان کاتدا ئاوی شوینی ژماره (49 و 3) باشتترین و قبول کراو بوون بوو ئاژه لا و په له وه ره به پێی رێژه ی ئوکسجینی تاوه له ئاودا سه ره جم ئاوه کان گونجاو بوو به خێوکردنی ماسی جگه له ئاوی 2 شوین که وا نه گونجاو بوون له بهر ئه وه ی بری ئوکسجینی تاوه له ناویاندا 5.20 و 6.30 ملگم لتر-1 ئا و بوو.

تحديد صلاحية بعض مصادر المياه للاستخدامات الزراعية في المنطقة رانية \ محافظة السليمانية.

الخلاصة

اجريت هذه الدراسة في الفترة الواقعة بين 19\8\2018-2019\2\12 في قضاء رانية \ محافظة السليمانية لتصنيف المياه (24) عين و (25) بئراً و (3) نهراً للاغراض الزراعية. دلت النتائج الى انه جميع المياه المدروسة جيدة او ممتازة للرى استنادا الى بعض التصنيف العالمية. أما استنادا الى التصنيف الامريكي فان مياة (44، 5، 2، و 1) موقعا لهم صنف (C2S1، C3S1، C4S1، C4S2) على التوالي. في نفس الوقت مياة (3، 49) موقعا صنفت تحت صنف ممتاز و مقتنع للحيوانات و الدواجن على التوالي. اما مياة جميع المواقع صالحة للتربية الاسماك باستثناء مياة موقعين كانت غير صالحة بسبب قلة تركيز الاوكسجين الذائبة فى المياه (5.20، 6.30) ملغم لتر¹ على التوالي.