Spatial and non-spatial analysis of wells in Al-kifl district and water assessment using Geographic information Systems for the year 2023.

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Abstract:

This study was conducted in (Al-Kafil district) for the purpose of determining the appropriateness of the groundwater, Which is considered a "no" source in those areas for human use where (18) wells "Engraved" were chosen to design a database for it and (17) Bares "from them to take Samples and for three chapters, and the specific water tests were conducted at the Babylon Environment Directorate Laboratory on 1/1/2022 until 10/12/2022 such as (EC, PH, T.D.S, T.H, SO4, No3, NA, MG, CA) In addition to determining the Concentrations of ions on all models taken from the water of these wells, indicators And characteristics that depend on evaluation purposes and knowledge of the extent Of the water suitable for uses for civil uses were identified, and the area of the study Area reached (150km2)The results showed that the concentrations of some of the Studied characteristics fall Within the permitted, while the concentrations of other Characteristics exceeded the Limits of the required specifications, in general the water OF some wells is acceptable For human use and others need treatment at the present Time and all wells are valid for Agriculture As a result of High salinity and sulfate due to their proximity to sewage water and because they are Within the classification of residential.

Keywords:Spatial Data, Standard Deviation , Coefficient of Variation ,Mean Center, Standard Distance

The search problem

Obtaining a modern DEM map of Babylon governorate, designing a database of wells in ALKafil district and assigning their locations in the field, as well as the difficulty of taking water models from wells where there are no stationary water pumps, which makes us come to the site more than once to the mobile pumps are installed by farmers for irrigation purpose

Introduction

There are two ways to pollute water, the first of which is through contamination of groundwater with surface pollutants or due to seepage and percolation from the surface of the soil, as happens when groundwater is polluted with pesticides, fertilizers, or waste residues [6] or with sewage water. The most important factors of groundwater contamination are gravity and the solubility of chemical compounds as well. The porosity of the soil or due to the movement of water down its natural filtration process. The need for this study arose as a result of the scarcity of water to which the study area was exposed and the lack of surface water represented by Shatt al-Hilla and the Kifl River as a result of the decline in the level of the two rivers, which caused the water not to rise to the main and subsidiary streams and rivers. Branching off from the two rivers. The study aims to determine the potential contamination with a number of chemical elements such as (EC, T.D.S, T.H, PH, SO4, NO3, Mg) and in a study [4], this study dealt with the quality of groundwater in the center of the city of Hilla and the amount of contamination with

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elements Home and find out whether this water is suitable for human use, as the study showed that the origin of this water is atmospheric, as well as a study [1], where in this study a qualitative survey was conducted of 13 wells from the wells of the city of Al-Kadhimiya, and 4 areas were chosen on the Tigris River, and an increase in the values of turbidity, hardness, calcium, and magnesium was found. And chlorides, sulfates, and evidence of pollution (colform), which made it unsuitable for drinking. As for irrigation, some of it is suitable for plants that tolerate moderate salinity and chloride. Through laboratory tests of the water of the Tigris River, it was found that the water is not suitable for drinking and can be used for irrigation. Also, a study conducted by Al-Furat Company to study and design irrigation projects [4] for the city of Hilla included a study of the main reasons for the rise in the level of groundwater. This study showed that one of the most important reasons for the rise in the level of groundwater in the city of Hilla is the rise in the level of the Shatt al-Hilla relative to the groundwater levels in Throughout the city, the absence of means of drainage for water remaining deep within the soil from its various sources, the absence of means of drainage for water remaining deep within the soil from its various sources, and the inability of the subsurface runoff system to drain it naturally..

Research objective:-

The research aims to identify the reality of the spatial and non-spatial distribution of Wells, assess their water in the study area, analyze their distribution trends and the pattern of their spread through Geographic Information Systems Technology and support decision makers with future plans and maps to reduce the problem

Research sources:-

The research was based on a group of sources, the most important of which is the field detection of wells in the sponsorship area, the design of a database for 18 drilled wells, taking samples of well water and examining them in the laboratory of the Babylon Environment Directorate, as well as relying on the Dem digital elevation model for the province of Babylon from the (United States Geological Survey, USGS)

Materials and Methods

Field work:

1-A field survey was conducted for (18 wells) from the wells of the region of Kifle, and water samples were collected from (17 wells) dug and used for civil purposes, and (4 areas) were chosen, some of which are close to the Kifl River surrounding that area, which are others are relatively far away in order to compare the results statistically and spatially with the results of the the Al-Kifl River. The depths of these wells range between (9-24 meters). Samples were taken after operating the well for a sufficient period of time. This is in order to obtain typical samples, and as in the map (1) distribution of wells according to regions and for each groundwater reservoir.

2-A form was prepared for each well, including information (the name of the well owner, the type of pump used, the well's coordinates, pumping speed, the region, the type of water, and the type of water use for domestic or agricultural purposes, and the productivity of each well). The form is filled out in the field with information, and then the information is collected. The data is included in the tables that were designed in the GIS program in order to project points on the maps of Babylon Governorate regarding groundwater locations.

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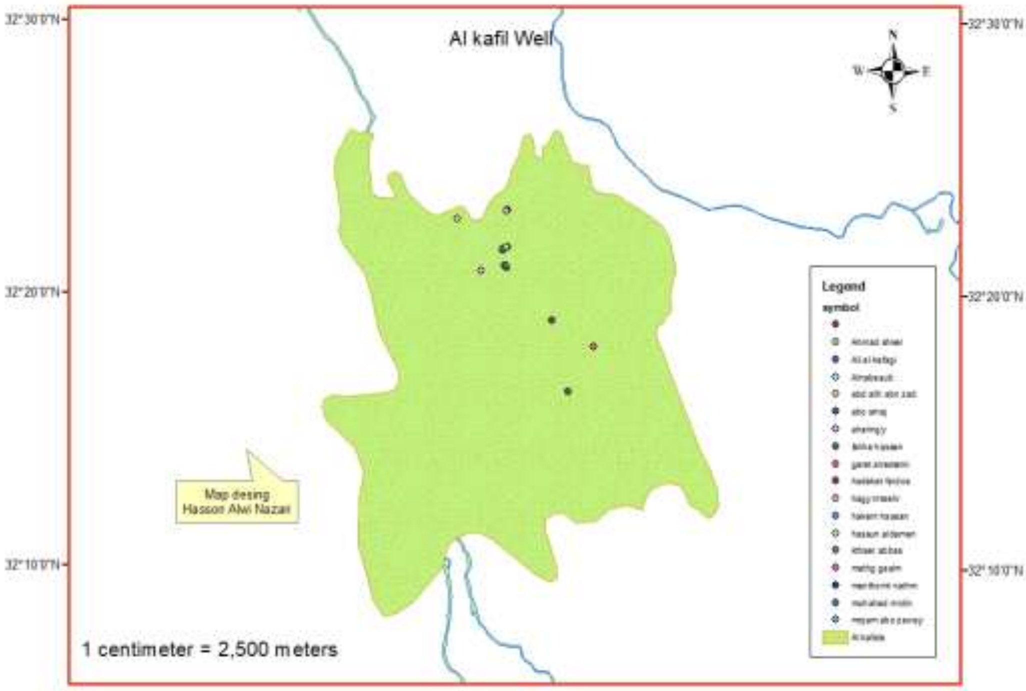
3- The study also included Classification wells according to the size of each well, the depth of each well, its age, the area that each well waters, as well as the nature of the lands adjacent to each well, for example (residential, agricultural, residential + agricultural) in order to know and compare the concentrations of the chemical elements of these wells.”

According to the regions, it was revealed through the results of tests of the chemical elements of well water that the wells that fall within the residential classification have a high percentage of salts, as well as sulphates, nitrates, and the rest of the chemical elements in varying proportions. The reason for this is due to the seepage of sewage water into groundwater tanks and its arrival to the groundwater-bearing layers. And mixing with this water, which leads to it containing high percentages of these elements outside the environmental determinants of standardization and quality control, as in the Nile region, where well water contains high percentages of sulphates, as well as the areas where wells are dug near sewage storage facilities. As for the wells that are drilled in agricultural areas and fall within the agricultural classification, the percentage of sulphates and nitrates is low and within the permissible limits locally and globally because they are free of sewage pollutants, and all the water present in the groundwater tanks of the groundwater-bearing aquifers is free of pollutants unless a human hand extends to it. As in the picture (1) drawing a model of a a well used for agriculture in the Kifl region, used for agriculture and Hamasani as in Table (1) K means electric pump, G means kerosene pump

Map (1)



represents the distribution of wells in Al Kifile

Laboratory work:

Laboratory tests were conducted in our directorate’s laboratory to evaluate the quality

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of water according to the characteristics studied for human use, based on the Iraqi Standard (I.Q.A.), the Iraqi Standard (417), the second update, the Iraqi Standard No. 25 of 2018 1967, the International Standard (W.H.O.), and the Asian Standard. The function has been measured. Acidity using a PH meter, an electrical conductivity meter, measuring the concentration of calcium, magnesium, and hardness using an EDTA solution, sodium using a flame photometer, sulfates using thermal visible light, and chlorides using a scavenging method using silver nitrate, in addition to measuring turbidity using an Orbeco Hellige Turbidity Meter.

Working within the GIS program:

Preparing an integrated database that includes tables within the program for 17 wells, according to the geographical location of each well, the area of the cultivated area, and the size of the well, comparing it with the tests of the Al-Kifl Rivers, and preparing maps for each area to be a scientific reference in the future in the event of surface water scarcity, as in the table. (1) The data was analyzed statistically using the arithmetic mean, standard deviation, and dispersion coefficient, and the results were matched with the results of the tests of the Al-Kifl Rivers, and the well number was adopted in all tables of test results.

Also, within the GIS10.4 p program from the Toolbox according to the following Steps ArcGis10.4-Toolbox-spatial Analyst Tools-Interpolation-(Krigin, Trend, splin)

spatial and non-spatial analysis of wells in the study area was carried out in order to determine the locations of Wells where water is suitable for irrigation and domestic uses and to build water pools in the future in case of water scarcity, and all chemical elements were identified on maps using the GIS program

Table No. (1) Wells database in Kifel Governorate for the year 2022 AD

Moving water level	Constwater level	Region	volume Pump	Cultivated area	Well size	y	x	Depth meter	Name of the owner of the well	Well Number
6.5 m	2mtr	Al , Kifl	1 Inch K	Feed Station	8 Ing	32.3852	44.4006	11	Ali Al , Khafaji	1
6.5 m	2mtr	Al , Kifl	3 Inch K	Feeding water	8 Ing	32.3531	44.3991	12	prophet Ayoub	2
6 m	2mtr	Al , Kifl	4 Inch G	4 Dunam	8 Inch	32.3637	44.4007	11	Ahmed Shaker	3
6.5 m	2mtr	Al , Kifl	4 Inch G	4 Dunam	8 Inch	32.3628	44.004	9	Hamed Hussein	4
6.5 m	2mtr	Al , Kifl	4 Inch G	3 Dunam	8 Inch	32.3611	44.3975	12	Faleh Rashid	5
6.5 m	2mtr	Al , Kifl	2 Inch G	2 Dunam	8 Inch	32.3616	44.3974	8	Khudair Abbas	6
6 m	2mtr	Al , Kifl	2 Inch K	1 Dunam	8 Inch	32.3182	44.4339	12	faradise Garden	7
6 m	2mtr	Al , Kifl	4 Inch G	4 Dunam	8 Inch	32.350	44.4005	11	Kazim Charter	8
6 m	2mtr	Al , Kifl	1 Inch K	Feed Station	4 Inch	32.385	44.4003	12	Nazim System	9
6.5 m	2mtr	Al , Kifl	4 Inch	4 Dunam	8 Inch	32.3845	44.400	12	Hajji Mutashar	10

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			G							
6.5 m	2mtr	Al , Kifl	2 Inch K	Feeding the	8 Inch	32.2146	44.2427	24	Abu Zawaya	11
6.5 m	2mtr	Al , Kifl	1 Inch K	Home use	4 Inch	32.3514	44.3997	11	Muhammad	12
6.5 m	2mtr	Al , Kifl	3 Inch G	4 Dunam	8 Inch	32.3628	44.4004	10	Hussein Aldman	13
6.5 m	2mtr	Al , Kifl	4 Inch G	4 Dunam	8 Inch	32.3485	44.381	12	Rarangea 3	14
6.5 m	2mtr	Al , Kifl	2 Inch K	Feeding	4 Inch	32.3796	44.3636	9	Abdullah bin	15
6.5 m	2mtr	Al , Kifl	4 Inch G	4 Dunam	8 Inch	32.2748	44.4469	12	Abu Smaij 2	16
6.5 m	2mtr	Al , Kifl	4 Inch G	4 Dunam	8 Inch	32.3023	44.4649	10	Al Rustumiya	17
6.5 m	2mtr	Al , Kifl	3 Inch G	3 Dunam	8 Inch	32.523	44.3225	12	Mahmoud Falih	18

Result and Discussion

The results of all laboratory tests performed are shown in Tables (2)and(3)

Table (2) Concentration Rate of well water properties in Alkafil district

EC ppm	T.D.S ppm	CL ppm	SO4 ppm	Mg ppm	T.H ppm	Ca ppm	Na ppm	NO3 ppm	PH	depth meter	Number well
1643	1103	226.7	416.2	73.3	585	109.2	126.5	4.2	7.4	11	1
1805	1224	216.9	601.9	82.8	663	129.8	133.8	4.3	7.1	12	2
2016	1374	197.2	330.8	73.6	487.5	70.2	260.2	4.18	7.8	11	3
2661	1795	276.1	445	.128	780	93.6	299.8	4.22	7.3	9	4
3850	2700	601.4	571	41.4	273	39	544.6	4.61	7.5	12	5
2932	2054	395.4	387.4	115	643.5	62.4	362.5	5.11	7.2	8	6
3740	2613	423.9	94.4	174	1209	174.8	365.9	4.32	6.9	12	7
2249	1447	374.6	465.8	62.1	721.5	78	268	3.35	7	11	8
1408	890	335.2	312	69	468	85.8	160	3.31	7.3	12	9
1231	775	207.1	380.5	45.1	370	76.4	2010	4.3	7.3	12	10
1759	1134	187.3	260.2	59.8	487.5	85.8	256.2	4.9	7.6	24	11
1159	732	167.6	312.1	59.8	429.5	78	85.3	4.7	7.8	11	12
2661	1795	276.1	445.6	128	780	93.6	299.8	4.2	7.3	10	13
2430	1805	479	418	111	620	194	210	5.6	7.7	12	14
1939	1450	180	312	21	670	37	247	3.5	7.4	9	15
1608	1184	241	550	87	720	128	132	8	7.2	12	16
1814	1460	38	308	21	570	38	247	3.8	7.4	10	17

Table (3) results of the Kafl River tests

EC	TDS	CL	SO4	Na	T.H	Mg	Ca	NO3	PH	The area	Model name
1131	706.3	141.9	213	74.2	351.1	23	101	5	7	Kafl	Kafl River

For the purpose of determining the qualities of well water, chemical elements were approved and compared with the Iraqi standard specifications (m .S.P) and who specifications

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(W.H.O) the specifications of the European region for drinking water and the specifications of Central Asia shown in Tables (4)and(5)

Table (4) Iraqi standard specifications (M.S.P) World Health Organization specifications (W.H.O) the specifications of the European region for drinking water

mg/l	Iraqi standard	W.H.O		European comma	
		acceptable	maximum	acceptable	maximum
CL	200	200	600	25	200
Mg	50	-	150	30	50
No3	20	6	11	-	-
So4	200	200	400	25	250
T.D.S	1500	500	1500	-	1500
T.H	500	100	500	-	-
Ca	200	-	-	-	-

(Abdul Sattar Aziz Jamil, Rafiq Ahmed Khalifa, Salah al-Din Yassin Jassim, Linda Shaul Andreus, study and analysis of the qualitative characteristics of the water of some wells in the Daquq region and the extent of its suitability for civil uses, 2009)

Table (5): Middle Asia class specifications

Characteristics water	Ion concentration mg/l						
	T.D.S	Na	Ca	Mg	Cl	So4	T.H
good	1500	600	600	75	150	400	30
acceptable	2000	800	700	100	250	500	45
allowed	2500	900	800	125	300	700	60
inappropriate	3000	1000	900	150	350	800	80

Temperature

Temperature affects the activity of Aquatic Biology, bacteria, determining the properties of water and all results within standard limits

The temperature of the tested well water ranged (22-26) and the temperature of the Kafl River (25-31) within the study area

Hydrogen ion concentration (PH)

English: The hydrogen ion concentration values of the tested well water ranged between (6.9-7.8) and these values can be considered within the limits suitable for different uses, as shown in Figure (1)

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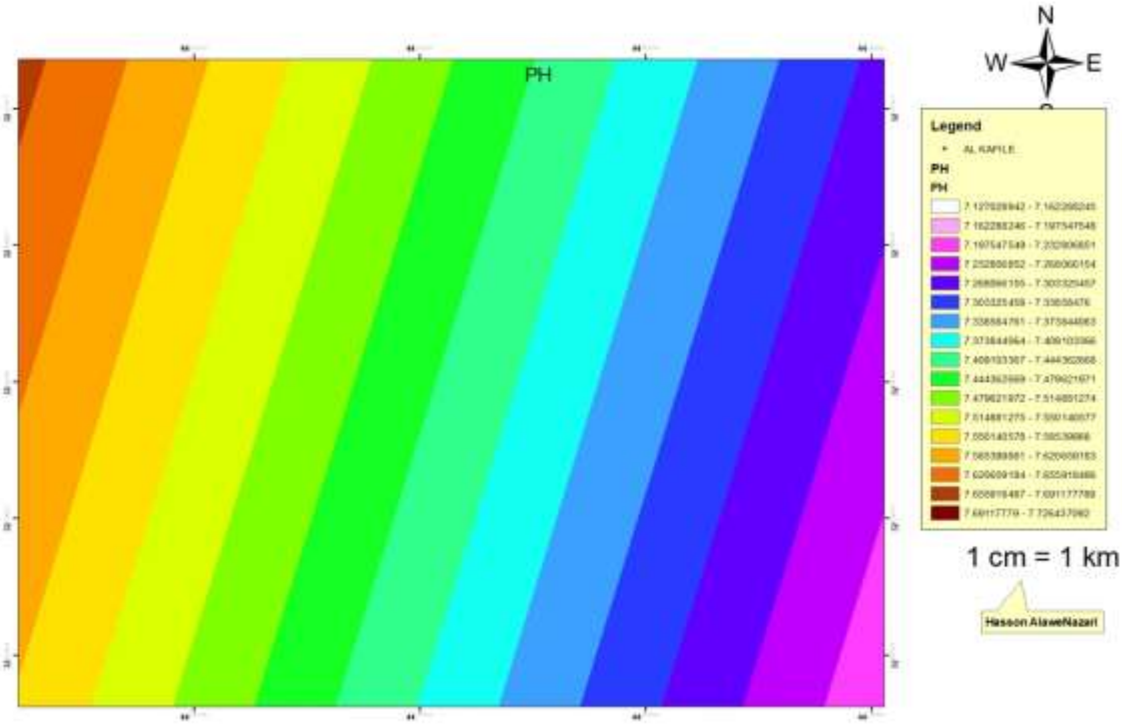

Figure (1) results of hydrogen ion tests and their comparison with the Iraqi standard

Dissolved Solids (T.D.S):

The concentrations of dissolved solids for the examined wells ranged (775-2700). When comparing these results with the specifications in Table (4), a percentage of (42%) of the wells falls within the permissible Iraqi and international specifications (1500) mg/L and (71%) within the Asian standard (2500) mg/L as in Table (5) and outside the standard the citizen well, Hakim Hussein Al-Daman 1795mg\L, Falih Rashid 2700mg\L, , and Al-Firdaws Garden 2613mg\L. These wells need a treatment unit for the purpose of using them for irrigation.

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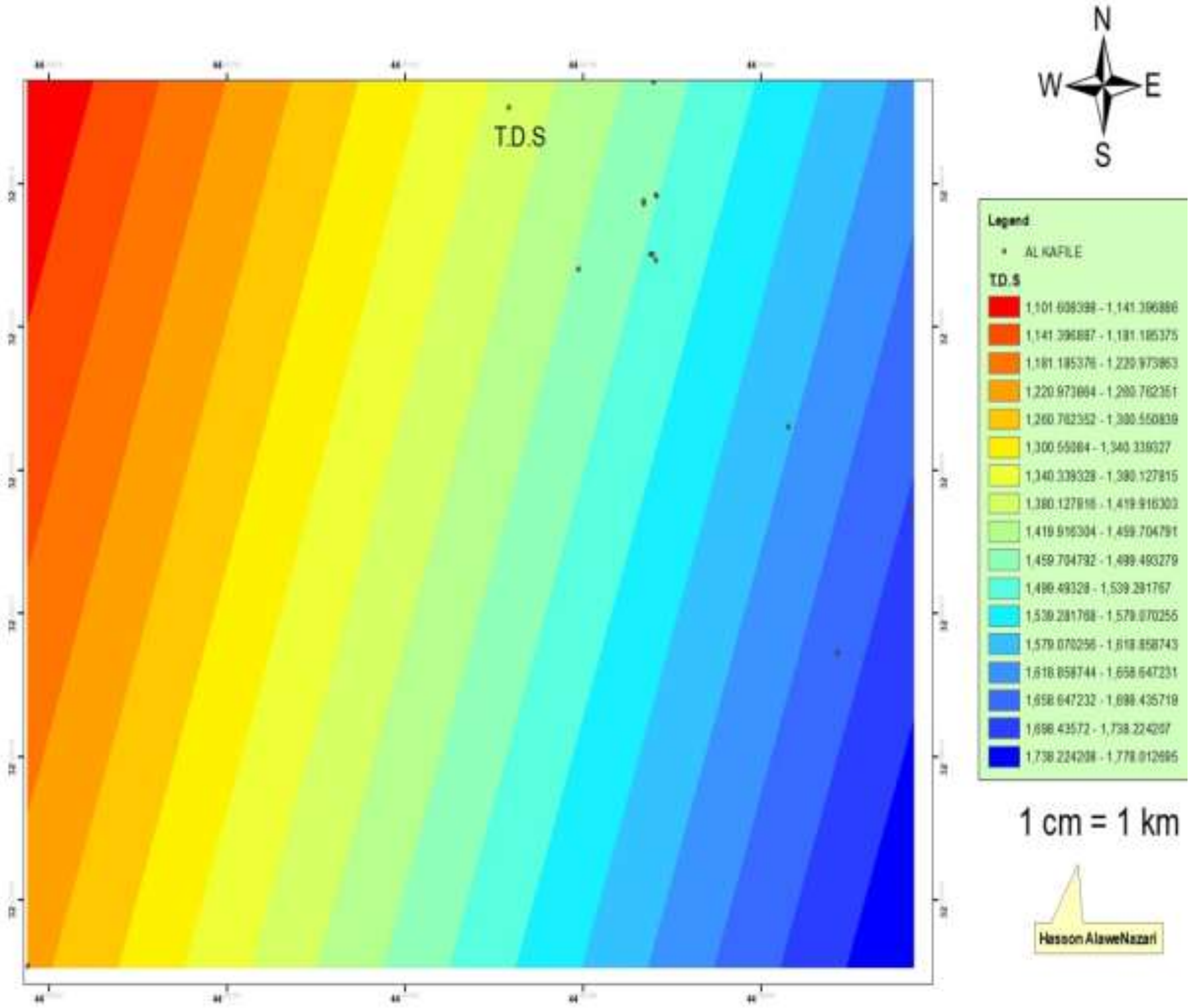

Figure (2) results of tests of total dissolved solids for well water and comparing them with Iraqi standard specifications

Total Hardness (T.H)

The total hardness of groundwater varies greatly depending on the geology of the area. The hardness is attributed to the abundance of divalent ions of the elements, especially calcium and magnesium, which are found largely in groundwater. The presence of hardness makes the water conducive to soap, as excess hardness in the water causes soap precipitation and prevents foam from occurring. The good one.

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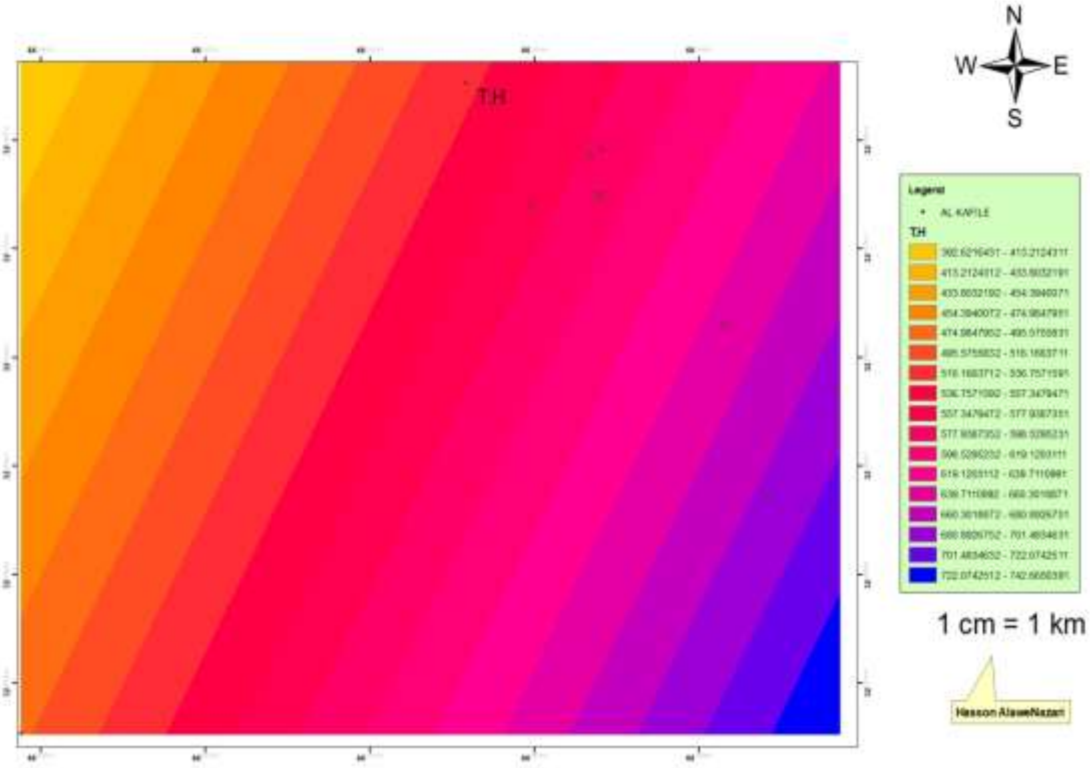
(28%) conforms to the Iraqi and international standards, outside the standard: Ali Al-Khafaji, 585 mg/liter, the Prophet Ayoub Complex, 624 mg/liter, Hakim Hussein Al-Daman, 780 mg/liter, Khudair Abbas, 643 mg/liter, Al-Firdaws Garden, 1209 mg/liter, and all the wells that It falls outside the Iraqi standard (500) mg/L. It requires a treatment unit to be used as water for domestic purposes, and all of it is suitable for agriculture. As for the Al-Kifl Rivers, they meet Iraqi and international specifications, as shown in the figure below.



Form (3) the results of the tests of the total hardness of the Wells and their comparison with the Iraqi standard

Magnesium Mg:

Gypsum and dolomite rocks are considered the primary source for the presence of magnesium ions in groundwater. When analyzing the results of the models examined, it was found that the concentration of magnesium ions is as follows: (85%) within the Iraqi and international specifications (150) mg/l and outside the specifications Al-Firdaws Garden 174.8mg/L, as for the Al-Kifl rivers, they fall within the Iraqi and international standards

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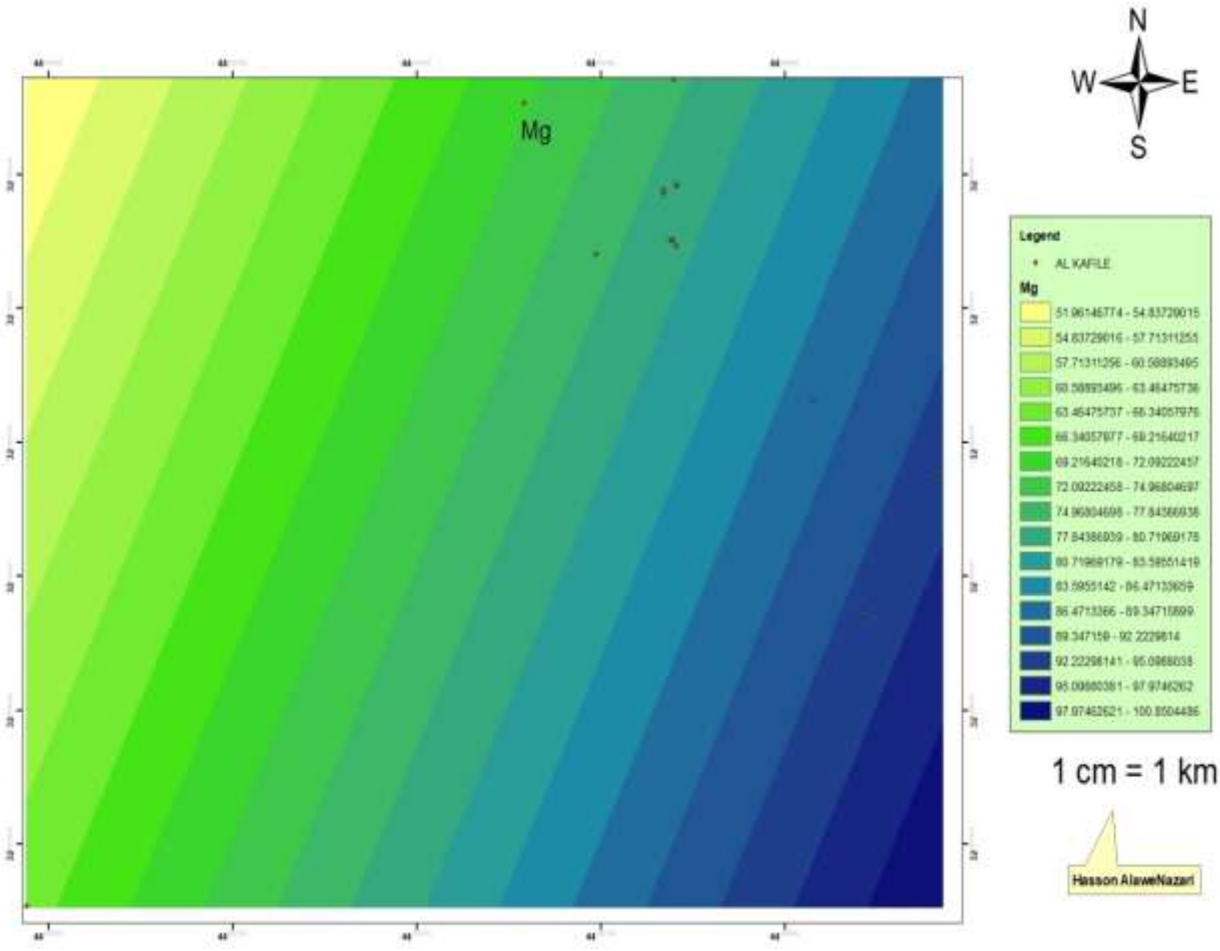

Figure (4) results of magnesium tests for Wells and their comparison with the Iraqi standard

Calcium CA:

Calcium is found in the water according to the geological structure of the region, as it is found in dolomite, gypsum and amestone rocks. The results of the tested models indicated that the concentration of calcium ions ranged between (39-303), and when comparing the results with the Iraqi standard specifications, (96%) conforms to the specifications for all tables Al-Kifl District and 100% conforming to the Asian specifications, except for the Al-Fayhaa Garden well (303), which is outside the specification. Below are the graphs that show the comparison between the wells' water and the water of the Kifl Rivers.

When comparing the annual average of well water test results with Table (4) and Table (5) for the Al-Kifl area, we find that it conforms to Iraqi and international specifications, except for Al-Firdaws Garden. As for the, Al-Kifl conforms to Iraqi and international specifications, as in the figure below for the results of calcium tests.

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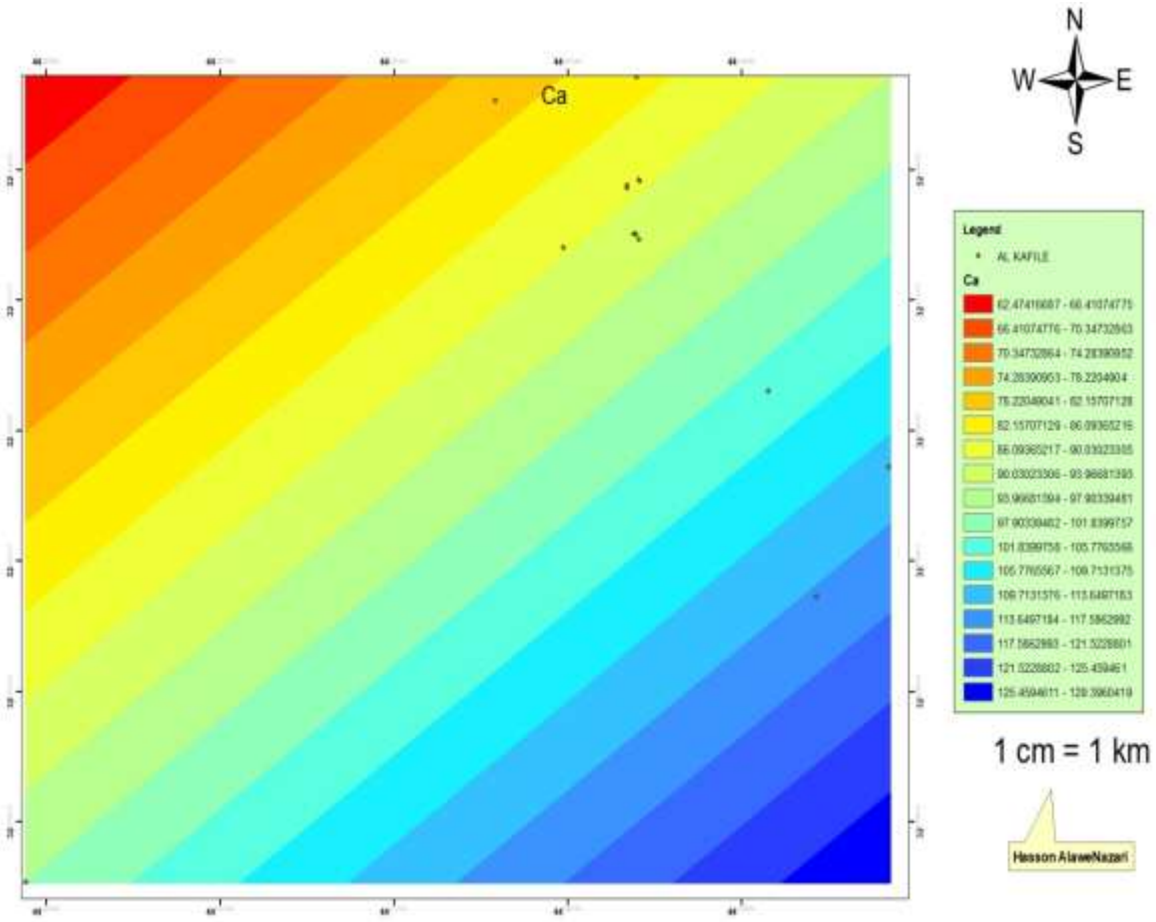

Figure(5) results of calcium tests for Wells and their comparison with the Iraqi standard

Nitrates N03:

The presence of nitrate salts in drinking water indicates ancient contamination of the water with organic materials, as nitrates are produced from the oxidation of nitrite salts in the examined wells. Below are the charts for these areas and their comparison with the waters of the Kifle River.

The maximum limit for the results of nitrate tests (annual rate) was 8 mg/Land the minimum was (3.3 mg/L). Table (2). When comparing the results with Table (4), the Iraqi and international standards, and Table (5), the Asian standard, we find that the results are It conforms to Iraqi and international specifications. As for the Al-Kifl River, it conforms to the specifications, does not conform to the specifications, as shown in the figure, due to the large number of violations of the river's water by the people, represented by sewage and throwing organic materials and food waste into the river, which caused an increase in the percentage of NO3 ions

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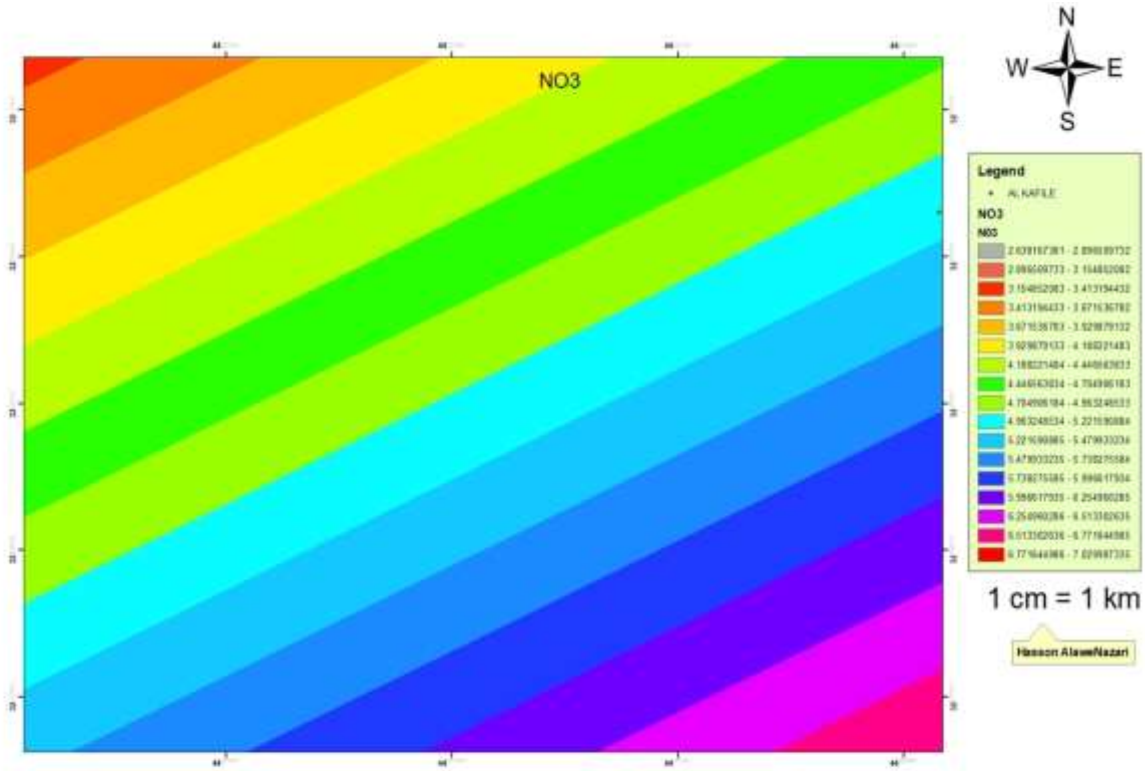

Form (6) the results of nitrate tests for Wells and comparing them with the Iraqi standard and the Asian standard

Sodium Na:

The percentage of sodium concentration in water is of great importance, as its increase in water causes poisoning of aquatic organisms, and when the water contains a large amount of it, it is considered unsuitable for drinking and irrigation. As follows, the sodium concentrations for each study area and comparing the results with the results of the Kifl River.

The maximum limit for sodium test results (annual average) was (544) mg/L and the minimum was (85.3) mg/L, Table (2). When comparing the test results with Table (4), the Iraqi standard, and Table (5), it is 44%. It conforms to the Iraqi standard and 100% conforms to the Asian standard. As for the Kifl River, all results conform to the specifications as shown below

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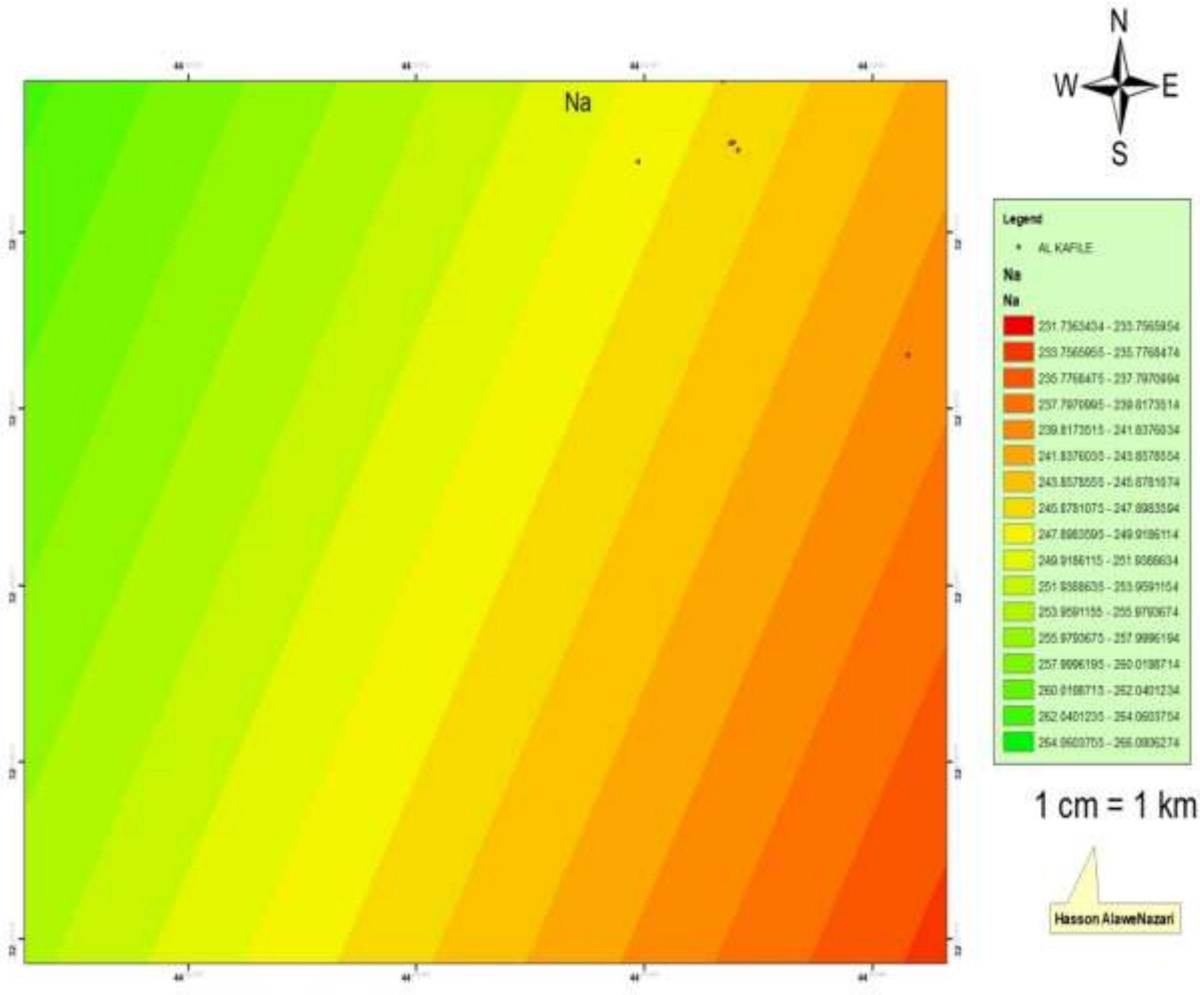

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Figure (7) results of sodium tests for Wells and comparing them with the Iraqi standard and the Asian standard

Chloride Cl:

The presence of chloride salts in high percentages in drinking water may indicate water contamination with animal and human waste, especially in the case of an increase in their percentage in water, other materials, and neighboring lands. The percentages of chloride salts usually range more in groundwater than in surface water, and increasing its concentration in water causes a salty taste to it. Comparing the results of the tests for chloride ion concentration with the Iraqi and international specifications, Table (4) and Table (5), the Asian specifications. The results of the regional tests and the results of the tests on the Kifl River are as follows:

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80% within the Iraqi and international specifications (600) mg/L and outside the specifications of Citizen Faleh Rashid’s well 601 and 70% conforms to Asian specifications. Below are the charts for these tests and their comparison with the results of the tests on the the Kifl River

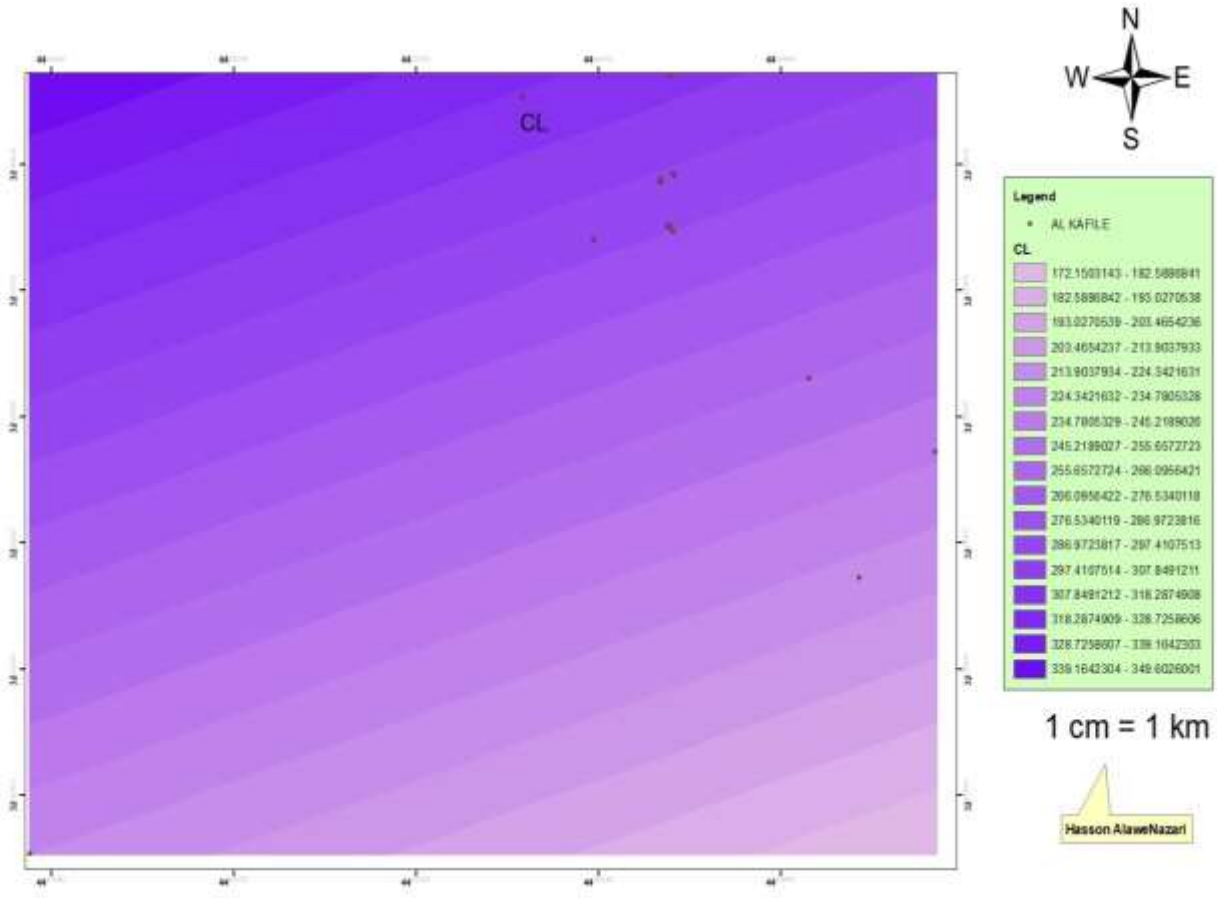

Figure (8) the results of chloride tests for Wells and their comparison with the Iraqi and Asian standards

SO4: Kabratate

Increasing the concencentration of sulfate ions drinking water exposes individuals to the risk of diarrhea .the resulte indicate that the water contains the following concentration of sulfate ions. All results fall within Iraqi and Asian specifications. Table (2), where the maximum limit for sulfate reached (600) mg/L and the minimum (94) mg/L. As for the Al-Kifl rivers, they conform to all specifications at the present time, as in the figure below.

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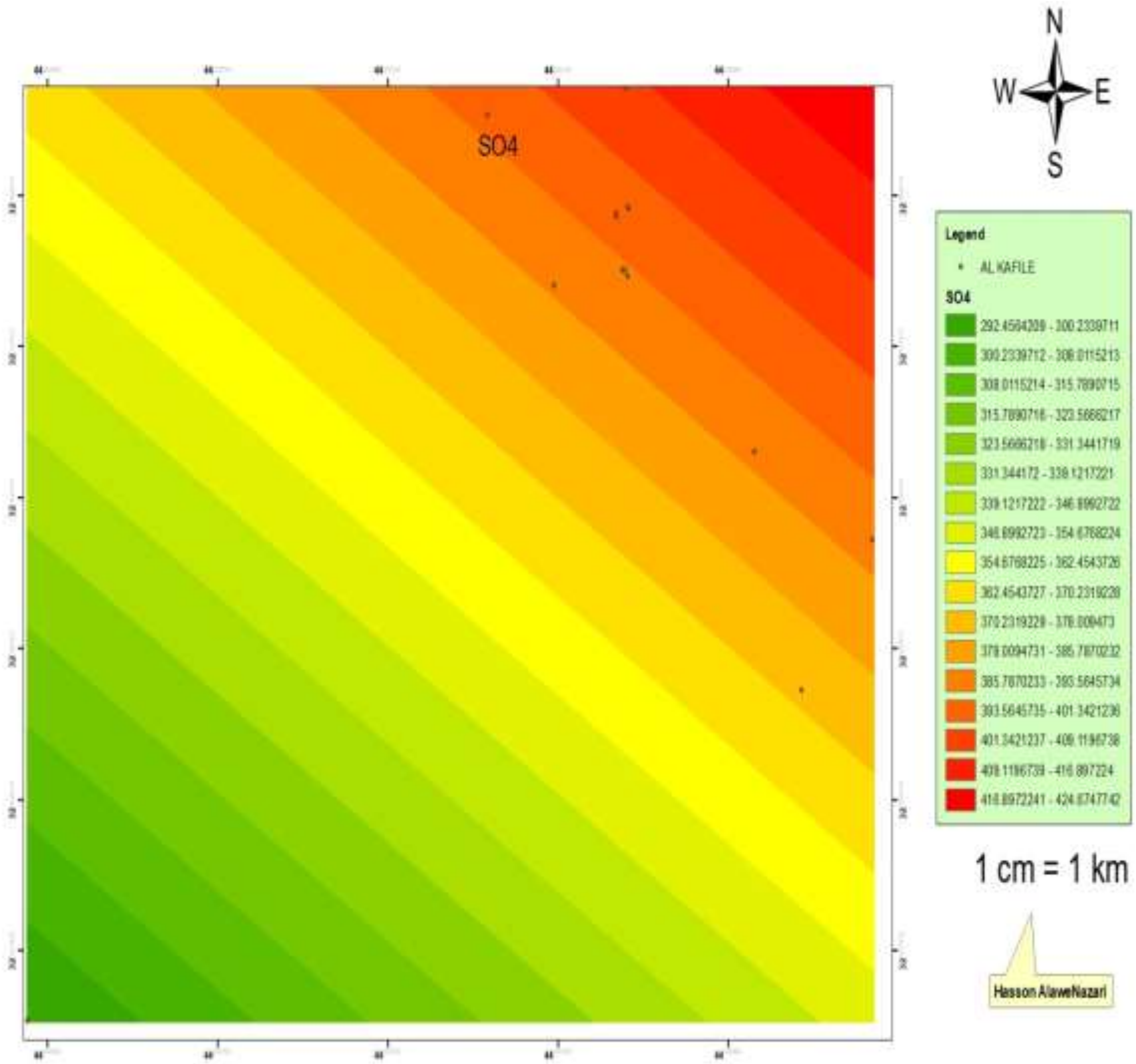

Figure (9) sulfate results for Wells and their comparison with the Iraqi standard tests

Electrical conductivity: - EC

Electrical conductivity expresses the percentage of total salts dissolved in water , its height indicates a high percentage of salts in water , as the more salts in water, the higher its electrical conductivity and the increase in salts, either due to natural action, such as the nature of water and groundwater, or dissolved and dropped by rainwater from elements, or by industrial action, such as sewage or industrial discharge on natural water bodies.the electrical conductivity of water depends on the set of dissolved solids such as water temperature, ion concentration, ion valence.

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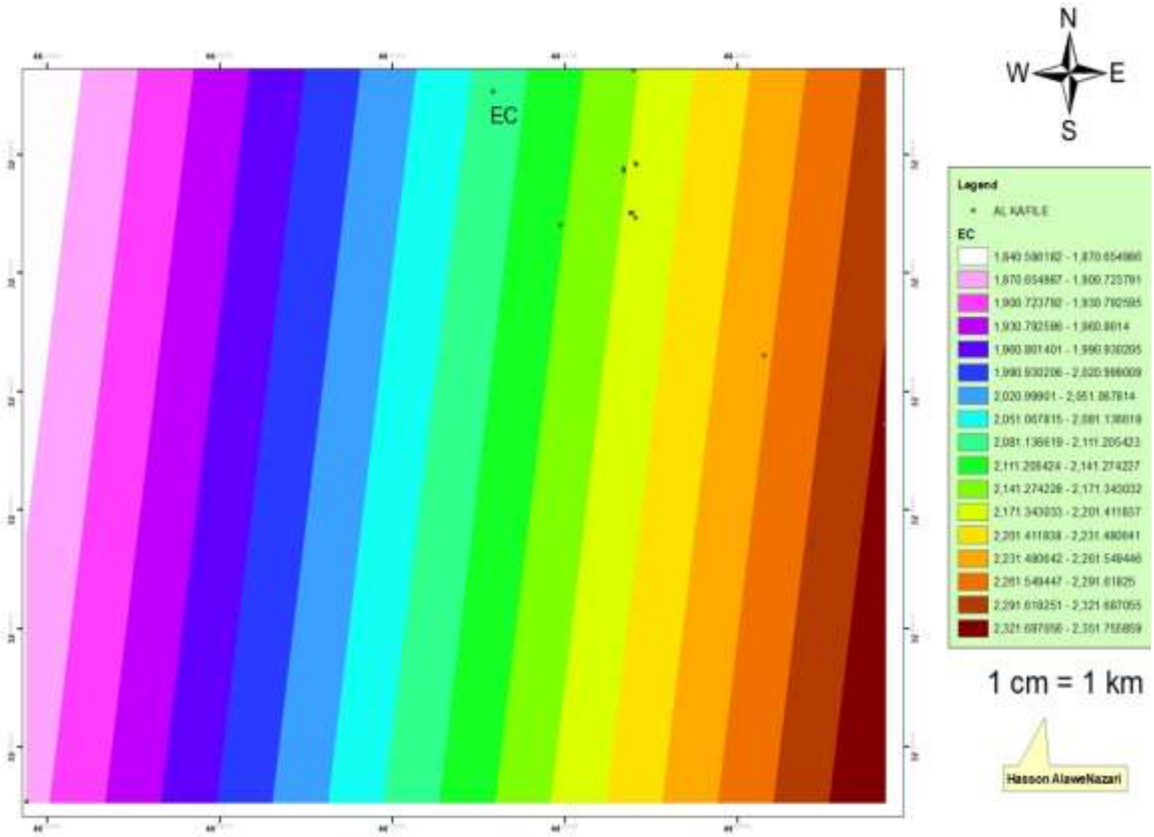

Figure (10) the results of electrical conductivity tests and their comparison with the Iraqi standard

Non-spatial analysis of data

To display and summarize a large set of non-spatial data (metadata), several types of graphs can be developed, such as the frequency distribution, the histogram and the Polygon, but on the other hand, these data can be summarized and described digitally by calculating some indicators or calculation coefficients that give a good picture of the characteristics of these data to automate the description of a set of [9]

First , the central tendency, and secondly, the extent of dispersion or spread of these data, it in any set of values means the spacing between its vocabulary, the disparity or the difference between them, and the dispersion is small if the disparity between the circuit values is small, i.e. when the values are close to each other, and the dispersion is large when the values are far from each other or the amount of spread of data or values

1-Arithmetic mean the arithmetic mean or arithmetic mean is one of the best and most widely used measures of centralism, which is the average of a set of numbers or is the product of dividing the set of these values by their number, and its most important features all the original values enter into the calculation of the average, easy to calculate and understand, and the most common [9]

2-Standard deviation the standard deviation solves the units of the variometer, since the standard deviation is only the square root of the variance value, and therefore the value of the units of the standard deviation will be the same as the units of the original set of numbers

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3-Coefficient of difference the coefficient of difference is used when comparing the extent of dispersion in the data of two different sets of non-spatial data, especially in the case of the difference of the two types of the same data and the difference of their units, the comparison is made by ridding the standard deviation from the effect of the difference by dividing it

For the purpose of comparing the accuracy of the results (precision) for the water of the wells and the water of the Kifl River, the measures of "mean" were chosen: the arithmetic mean, the standard deviation, the measures of central tendency, and the dispersion coefficient. The lower the value of the dispersion coefficient, the closer we are to the true values (observed value), which are defined by a value. (1) (Ghaida Yassin Al-Kindi 2009), where sample readings were taken for each region and for three seasons, as in Tables (2) Al-Kifl,

indicate the lack of dispersion in all well water, as the values range in the Kifl area (0.48-0.31),

Al-Kifl River. This confirms that the study area is free of pollution with chemical element ions, as well as the Al-Kifl River. For the purpose of accuracy of the results, the (Arc GIS) program was used to calculate the statistical operations for each element of the study area, as in the statistical tables below. For each study area.

When observing the table values of the coefficient of difference in the table (2), we find that all the tests of the chemical elements of the wells of the study area are low, that is, all values are less than one, and this indicates that the values are clustered around their rate and not dispersed, that is, all values are real values

Table (6) Mathematical statistics (Kifl district, water wells

		Al-Kifl area				Sample
C.V	SD	mean	sum	max	min	
0.35	767	2170	36905	3850	1159	Ec
0.46	132	283.7	4823	601.4	83	Cl
0.36	554	1502	25536	2700	732.4	Tds
0.31	121	388.8	6610	601	94.4	So4
0.24	1.08	4.5	72	8	3.31	No3
0.03	0.24	7.3	125	7.7	6.9	Ph
0.48	39	79.6	1354	174.8	21	Mg
0.45	42	92	1573	194	37	Ca
0.44	111	249.9	1998	544	85	Na

SD= standard deviation ,Mean=mean center, C.V= Coefficient of difference

Analysis of the spatial characteristics of the distribution of wells in the study area

The analysis studies in geography are based on two principles, namely distribution and relationships, and through the use of some well-known metrics that determine [9] The characteristics of the distribution of the geographical phenomenon and its spatial trends in terms of clustering and dispersion around a certain value, so I have used certain codes to show the characteristics of the spatial distribution of the distribution of wells in the sponsorship area in terms of their clustering and concentration around a certain point and the nature of their dispersion around the center and the direction of this dispersion and its patterns according to the measurements of the spatial center and the standard distance within the environment of ARC GIS 10.4, the most important of these relationships can be found

1-Mean Center

Mean Center:- this tool shows that the spatial center of the distribution of wells in the Kafl are

a is

located in the north-eastern part of the Kafl center, and this is attributed to the great attractiveness of these areas as a result of the presence of components and the success of drilling wells in these areas, represented by the presence of many rivers and streams, which feed from the (4) suitable for agriculture and domestic uses, some of which are used for drinking and watering animals, the map shows (2) the spatial distribution center of these wells

Table (8) shows the characteristics of the arithmetic mean

OBJECTID	Shape *	XCoord	YCoord
1	Point	44.39794	32.347098

This tool is located in the Tool Box program within the geographical distribution measurement group of the total spatial statistics tools according to the following steps

Arc Tool Boox – Spatial Statistics Tods - Measuring Geoghraphic Distribution – mean center

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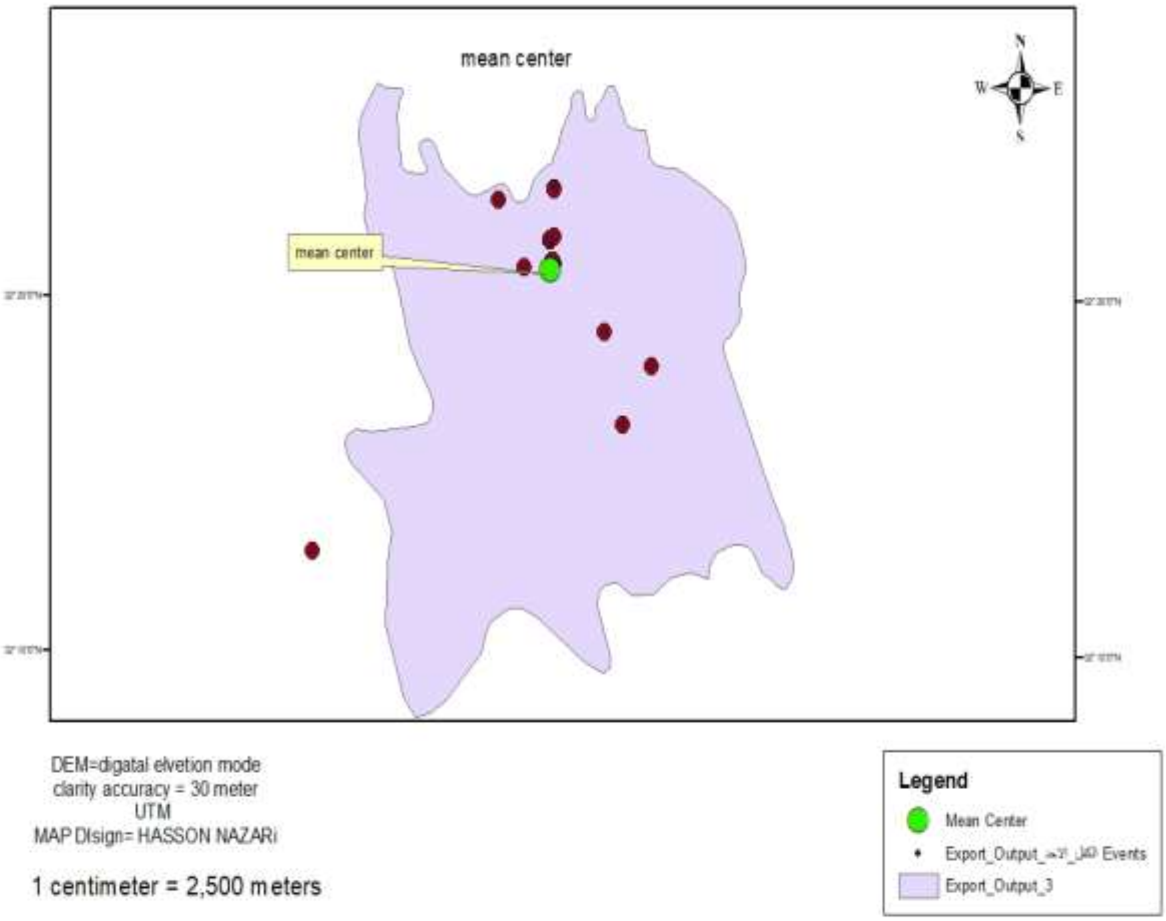

Map (2) represents Mean Center of wells in Al Kifile

2-Standard Distance

This tool is located in the Arc toolbox toolbox program within the geographical distribution measurement group of the spatial statistics toolkit using the ArcGis10.4 program according to the following steps

Arc Tool Box – Spatial Statistics Tools – measuring Geographic Distribution – standard distance

This tool determines the degree and direction of the dispersion of points around the spatial center, as the distance between the points from the spatial center is determined, and to find out the extent of dispersion, it is possible to take advantage of the moderate distribution probabilities to show the concentration of 88% of the points around the center as in the map(2) the larger the value of the standard distance from the average center, the greater the variance and dispersion of the elements of the phenomenon are represented graphically on the map by drawing a circle with its average center

The analysis of the standard distance was used to calculate the extent to which the distances between the well sites in the sponsorship area differ from the average distance, and through the analysis it was found that the percentage of the number of wells located within the circle whose radius of the standard distance of the value (0.065501), as in the table, it achieves a

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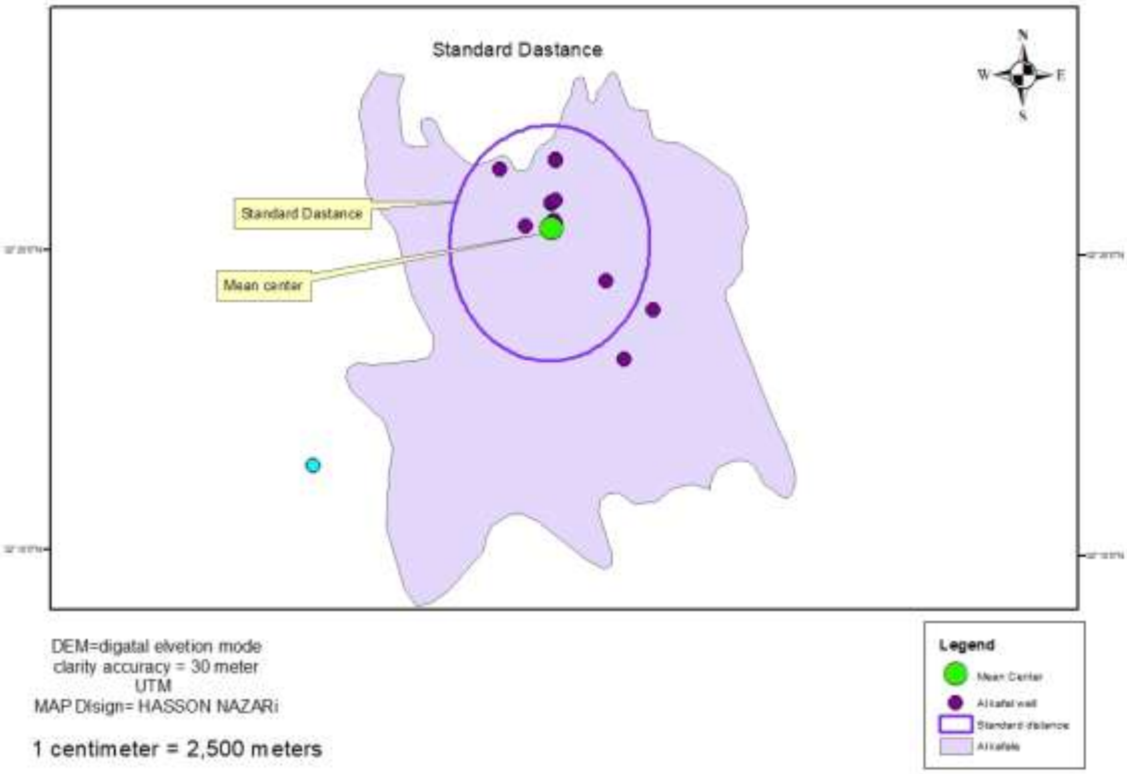
ratio closer to the normal distribution, and the standard distance is related in a direct relationship with the dispersion of the distribution of points, so that the larger the value of the standard distance from the average center, the greater the variance and dispersion of the elements of the phenomenon, and vice versa, the larger the standard distance, the greater the dispersion of the distribution, and the smaller the standard distance, the greater the concentration of points around the arithmetic mean



pattern Table (9) shows the standard deviation point distribution

OBJECTID	Shape *	CenterX	CenterY	StdDist	Shape_Leng	Shape_Area
1	Polygon	44.39653	32.338887	0.065501	0.411804	0.013473

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Map (3) represents Standard Distance of wells in Al Kifile

-Standard Deviation Ellips 3

The direction of distribution on the map was determined using the ArcGis10.4 program according to the following steps

Arc Tool Box – Spatial Statistics Tools – measuring Geoghriphic – Directionl Distribution Ellips

This scale determines the direction of dispersion of the elements of the studied phenomenon in an oval shape opposite the standard distance by determining the dimensions of the two Axes (x,y) from the spatial average separately using this property, the direction of spatial distribution is determined by point phenomena within the area of the area, which is an important issue in geography to determine the axes of distribution of the phenomenon and Babylon so that the value of the rotation of the direction of distribution of Wells (38.5379) reached a degree from the north direction

Table (10) characteristics of the direction of spatial distribution

OBJECTID	Shape *	Shape_Length	Shape_Area	CenterX	CenterY	XStdDist	YStdDist	Rotation
1	Polygon	0.345746	0.009314	44.39794	32.347098	0.048572	0.06107	38.537918

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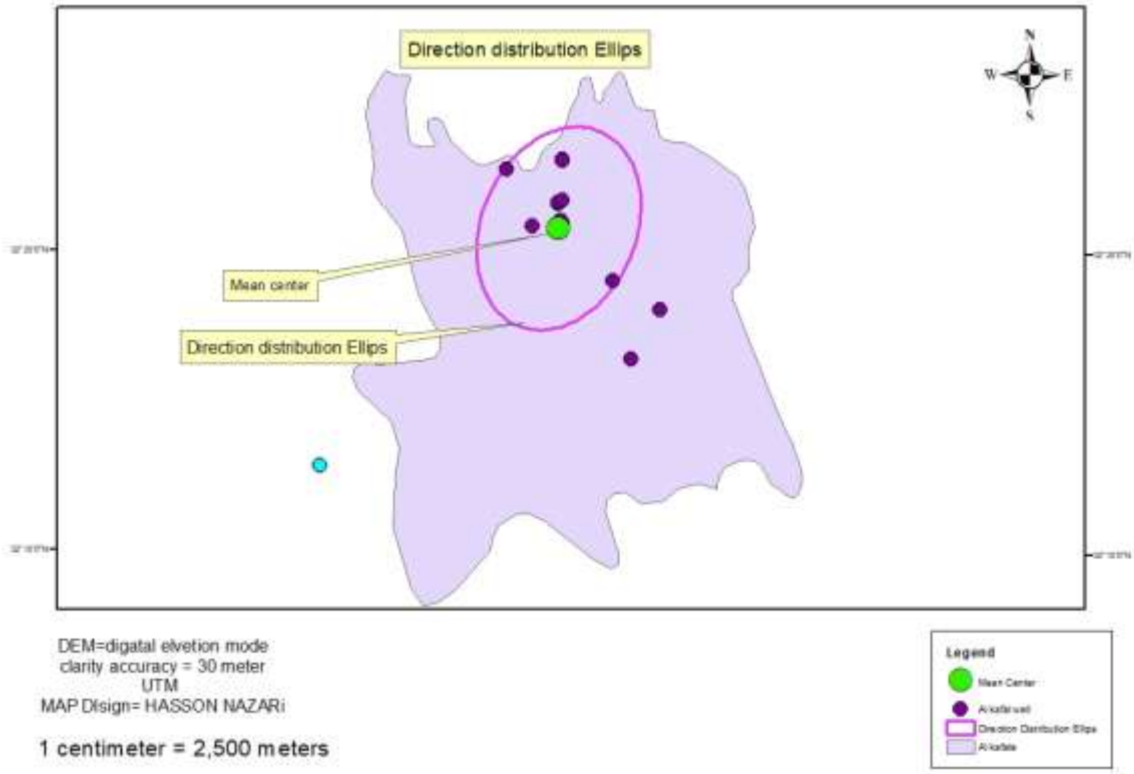

Map (4) represents Standard Deviation Ellips of wells in Al Kifile

4 -Average Nearest Neighbor

This scale determines the direction of dispersion of the elements of the studied phenomenon in an oval shape opposite the standard distance by determining the dimensions of the two Axes (x,y) from the spatial average separately using this property, the direction of spatial distribution is determined by point phenomena within the area of the area, which is an important issue in geography to determine the axes of distribution of the phenomenon and Babylon so that the value of the rotation of the direction of distribution of Wells (38.5379) reached a degree from the north direction

The Neighborhood Link can be extracted by the ArcGis10.4 program from the Arc Tool Box application by following the following steps -:

Arc Tool box – Spatial statistic Tools – Analyzing patatterns Nearest Neighbor

This scale determines the direction of dispersion of the elements of the studied phenomenon in an oval shape opposite the standard distance by determining the dimensions of the two Axes (x,y) from the spatial average separately using this property, the direction of spatial distribution is determined by point phenomena within the area of the area, which is an important issue in geography to determine the axes of distribution of the phenomenon and Babylon so that the value of the rotation of the direction of distribution of Wells (38) reached a degree from the north direction

The Neighborhood Link can be extracted by the ArcGis10.4 program from the Arc Tool

Box application by following the following steps

To find out the pattern on which the distribution of phenomena is located according to the neighborhood relation, the results of the analysis show us the program that shows outputs for the forms of point distribution patterns that range from the scattered pattern diverging irregularly and its result is approaching the figure (2.15) to the convergent clustered pattern as in Table (11) values of the nearest neighbor directory

Distribution pattern	The value of the statistical coefficient
Pool	0.00 - 0.09
:Cluster convergence	0.1 – 0.49
Random convergent	0.50 – 0.99
Random	1.00 – 1.19
Divergent	1.20 – 2.15

Figure (3) shows the distribution levels ranging from 0.01,0.10 on the right side and (-0.01,-0.10) on the left side and also contains the z values that accompany the confidence levels for the nearest neighbor analysis, it turns out that its value reached (0.05), which means that the presumption of neighborhood relevance took the pattern convergent irregular clustering because it approaches the numbers (0) and (0.09), and it turned out that figure(4), which reinforces this result by drawing a square around this pattern, and on this basis, the spatial distribution of wells in the study area, and through the analysis of this and the figure itself, shows us the following

1-The distribution pattern of the Wells is clustered as in the figure below defined by the square

2-Wells gather in this area as a result of the presence of several streams, including the Prophet Ayyub's Creek, the hamsaniya Creek and the Abu Zawaya Creek. it is scientifically known that groundwater reservoirs are fed by rivers and rain, so these wells are sweet and suitable for irrigation and domestic uses

3-Through the field inspection of this area, we found that many peasants use these wells for drinking purposes with the presence of home treatment units installed in the database

4-The combined distribution pattern drains the groundwater reservoir water because the wells are close, so they affect each other, which leads to a lack of water in Wells where the pump volume is less than the other and the water level in them is lower

5-In order to maintain the sustainability of groundwater in each water reservoir for the longest period, the amounts of groundwater for each reservoir must be calculated, measuring the length and width of each reservoir, the size and design of a database in order to benefit from each drop of water for each reservoir, as well as the age of the reservoir, and in light of this, the volume of the pump is calculated for each well and oblige the farmer to cultivate a specific area and a specific type of agricultural crops, especially agricultural crops that consume small amounts of water

6-The state must intervene and use groundwater experts and prepare maps and good planning and stay away from the clustered wells because they consume large amounts of groundwater and the distance between one well and another is at least 500 meters so that the wells do not affect each othe

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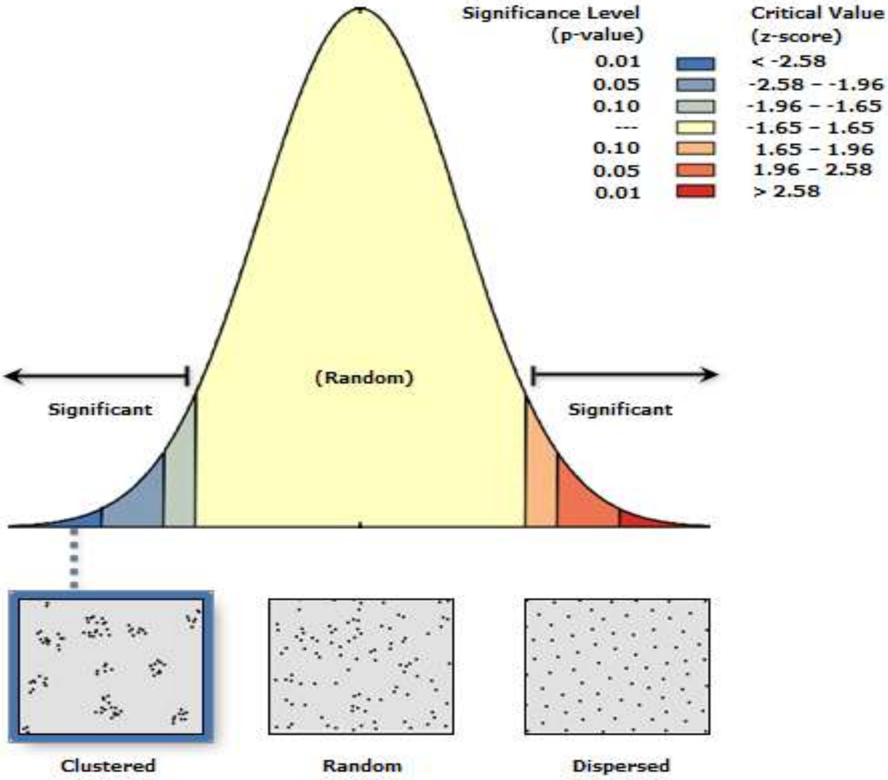

Map (5) represents Average Nearest Neighbor of wells in Al Kifile

Conclusions

1- Through the use of the non-spatial analysis of the measures of centrality, the arithmetic mean and the standard deviation, it was found that the results of the tests of the chemical elements of the wells in the study area match the results of the tests of the wells of the nearby areas because they are located within the groundwater reservoir of the same area and according to the length and width of the groundwater reservoir and its relationship with the groundwater reservoirs adjacent to the reservoir.

2- Geographic Information Systems techniques have shown their efficiency in extracting various statistical coefficients and thus reaching the final pattern of the distribution of wells in the study area, where the neighborhood relationship showed the final result of the distribution, which is a clustered distribution, which causes the depletion of large quantities of water for Wells without economic feasibility .

3- The random pattern is one of the most difficult patterns of distribution to the government, as it is expensive in terms of delivering services to it, as well as high transportation costs and time, as well as an indication of the absence of government planning

Recommendations

1-Focusing on the redistribution of wells in the sponsorship area and getting rid of the accumulated pattern

2-Support the peasants through comprehensive rural development, this enhances the improvement of the living situation of the population, support food security, drilling government wells with organized planning, consulting groundwater experts and designing a database for all wells using geographic information systems and modern technologies

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