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Designing Maps Of The Quantitative Areal Distributions Of The Qualitative Characteristics Of Well Water In Najaf Al-Ashraf

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Abstract

Geographic studies have gained great importance, especially after the developments that have taken place in the field of modern technologies that have facilitated the process of preparing an integrated geographic database and clarifying it in the form of elaborate digital maps in terms of method, style, and output. This requires focusing on the method through which an integrated map can be prepared that is comprehensible to the reader. For this reason, the researcher focused To choose the method of spatial representation or color gradation of the quality characteristics of well water in Najaf Governorate, given that the latter falls within the dry and semi-arid climate according to the Köppen classification of climatic regions, which forces the use of well water in some human activities, especially in the rainy season.

This study included three axes. The first axis focused on the theoretical framework represented by the research problem, its hypothesis, and the research methodology. The second axis included the steps for preparing maps of the areal gradation of the qualitative characteristics of well water in the study area. While the third axis focused on digital maps of the qualitative characteristics of well water in the study area, as well as the results, recommendations, and sources of the study.

Quantitative maps are generally based on statistical or numerical data in their drawing. In the current study, the researcher relied on the field study. If seven samples of well water were collected and examined in the laboratory to create a geographic database, (12) maps were prepared using the (GIS) program.

Introduction-:

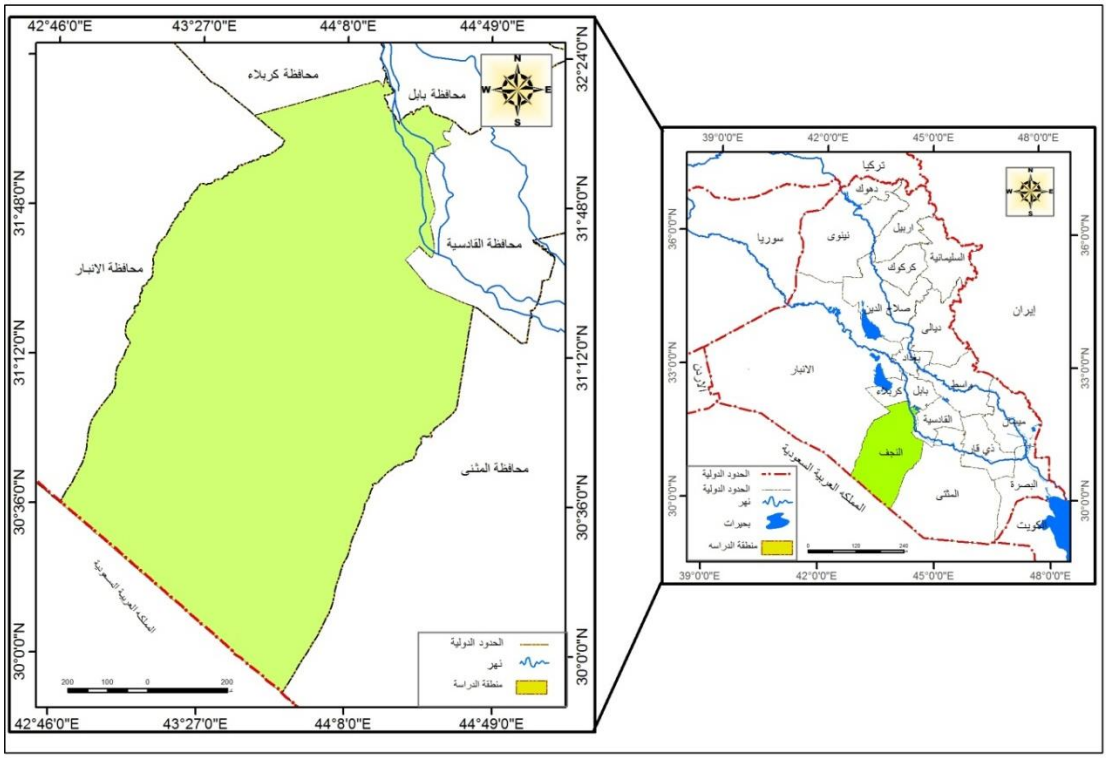
After the development that occurred in the various fields of science at the end of the twentieth century, the science of maps was not isolated from this rapid development, and the term digital maps produced by information systems programs appeared. Geographic (GIS), and despite this development in map design and production, it has not It eliminates traditional cartographic representation methods and methods, in order to design, produce, and output it in its final form to the user. .

1- Theoretical framework

1-1- The problem of the study:-
The research problem includes several questions, which are as follows:
1-1-1-Is it possible to prepare cadastral maps of the qualitative characteristics of wells in the study area in a way that achieves their representation?
1-1-2- Can the ARC MAP10.1.3 program environment complete data on the qualitative characteristics of selected wells in the study area?
1-2- Study opportunities:-
The search opportunity will be as follows:-
A - The method of representing cadastral maps of the qualitative characteristics of groundwater in the study area is the ideal method for preparing a map that is comprehensible to the reader.
B - Data on the qualitative characteristics of selected wells in the study area can be completed for the ARC MAP10 1.3 program environment. .

1-3- Objectives of the study:
The main purpose of the study lies in the following
1-3-1- Explain how to prepare and design quantitative maps in the ARC MAP10 1.3 program environment. To clarify the difference in the quantitative variation in the values of the concentrations of the specific characteristics of the wells in the study area.
1-3-2- Show the capabilities of the ARC MAP10 1.3 program. To supplement the study data through samples showing the concentrations of a number of wells.
1-4- Limitations of the study:-
The study area extends within the central Euphrates region of Iraq and is located between two latitudes (50 29 - 21 32 degrees) to the north, and two arcs of longitude (50 42 - 44 45 degrees) to the east. It is bordered by Babylon Governorate to the north, Karbala Governorate to the northwest, and Al-Anbar is bordered to the west, and to the south it is bordered by the Kingdom of Saudi Arabia, while it is bordered by Al-Muthanna Governorate to the southeast, and to the east it is bordered by Al-Qadisiyah Governorate, map (1).

Map (1) location of the study area of the governorate



Source: Republic of Iraq, General Authority for Survey, Administrative Map of Iraq, scale 1/100,000, 2020.

2-Steps for preparing cadastral maps.

Quantitative cadastral maps are a type of quantitative thematic maps. They are usually used for the purpose of representing data related to cadastral units, such as population maps that show the spatial distribution of the population, according to residential clusters or administrative units. However, in the current study, the point data was converted into cadastral maps after undergoing To a number of processing operations within the ARC MAP10 1.3 program environment. .

To produce a quantitative spatial distribution map, we arrange geographical phenomena or features into categories based on the values they represent, and then shade each category with appropriate shades and colors. The nature of shadows depends on the method of measuring the phenomenon used. If we use the nominal scale, then we do not use graduated colors, because the goal of this scale is the ability to distinguish phenomena from one another. If we use an ordinal scale or a relative scale, we must use a series of graduated colors or patterns. For example, we must use several shades of one color, with the lowest value represented by the lightest shade and the highest value represented by the darkest shade of the same color. The important thing in producing this type of map is the correct and appropriate choice of the classification system. In nominal and ordinal classification, we usually have a group of categories. In the case of relative scale data or categories, we must first arrange the views or features into categories. The classification project or system used has a significant impact on the impression the map leaves on the mind of its reader. Therefore, the data to be

represented on the map must be classified in a way that highlights the spatial differences present in the studied area, and reduces the possibility of confusion or misinterpretation of the map. It is also necessary to pay attention to the purpose of cadastral maps: is it to compare a group of maps or to make only one map? If the goal is to compare a group of maps, then the categories or classes must be tested in a systematic manner to ensure the possibility of comparison. Preparing cadastral maps for any study follows several steps, which are as follows.

2-1 Building a spatial database:

The database is a complex set of data and information about the geographical phenomenon that is to be represented in the form of tables that can be updated and modified, which can be accessed in a regular and easy manner inside a computer, and a geographic information systems program can deal with it easily and conveniently to transform that data into a miniature image that shows temporal and spatial variations in the form of a map or shapes and drawings[1]. Graphically, the geographical database is prepared through several stages, which are as follows.

2-1-1- Data collection stage:

The geographic database consists of two sets of data, the first of which is quantitative data, and this data is represented in the study of the current map, which serves as the backbone in any study. A set of base maps have been approved, including the administrative map of Iraq and the map of Najaf Governorate. The second type is descriptive data, which is With written data that is linked to spatial data, which is in the form of tables consisting of a number of seven rows representing well water samples in the study area and a number of columns representing the concentration values of the specific elements of well water in the study area.

2-1-2- Entering and tabulating spatial data:

At this stage, the data is converted from its usual form into a digital form that the computer can read and deal with ([2]) and it is either through a scanner to convert spatial data from paper maps to the digital form in (Vector) form. However, in the current study there is no argument for applying This step enables the researcher to obtain an administrative map of Iraq and a map of Najaf Governorate in vector format.

The computer keyboard was used to enter descriptive data into the database, which consists of information and data on the characteristics of atmospheric water at stations in the study area. All data were entered into the table, which consists of a number of rows and columns, in the EXCEL program and the ARC

MAP10 1.3 program. Thus, a descriptive database linked to the spatial elements was built, as each row is linked to one of the spatial elements.

2-1-3-The process of digital processing, data derivation and organization within the ARC MAP10 1.3 program. .
The treatment process consists of a number of sequential steps, which are as follows.

2-1-2-1- Correction of maps:
It is the first step in data processing operations, whether they are uncorrected satellite visuals or maps. Geometric correction (geographical reference) is important in finding precisely defined points on the map with known natural coordinates based on the location and reference of the map, as these known points are used as connecting points between nature and the map. In order for the map to become compatible in its correct place with nature ([3]), geometric correction was made to the maps of the study area, represented by the administrative maps of Iraq and the map of Najaf Governorate.

2-1-2-2- Deriving data: The process of deriving maps of the qualitative characteristics of well water goes through a number of steps in the program (1 ARC MAPV.10.3.) After performing the operations of linking the astronomical locations of the locations of the well samples with the values of their physical and chemical concentrations, the derivation stage comes. , and is represented by the following.
- Arc Map 10.3.1 ➔ Arc toolbox ➔ 3D Analyst Tools ➔ Raster Interpolation ➔ IDW.

Then the final stage is the process of cutting the layer of each element of the well water quality according to the dimensions of the study area

Arc Map.10.3 .1 ➔ Arc toolbox ➔ Raster ➔ Raster Processing Data ➔ Management Tools ➔ Clip

3-2-Designing digital maps for the study:
Designing the map is one of the basic steps to obtain a map that is recognizable to the reader. It includes coordinating and organizing the elements of the map, represented by the outer frame, the coordinates, the north direction, and the scale of the map, as well as the key to the map and the symbols it contains that explain the geographical phenomena within the map. Therefore, it must be chosen accurately and appropriately for its details and in appropriate colors ([4]This process depends on the method of coding, design, and conveying information from

the map designer to the cartographer ([5]), and therefore this must be explained in detail.

3-2-1- Symbols: The cartographer uses symbols to represent what he wants of geographical phenomena with symbols ([6]). No matter how different the shapes of these symbols are, they are divided into three sections representing: point symbols, which are used to show the locations and locations of geographical features, and linear symbols, which are used to represent the linear features that represent In nature, longitudinally, such as rivers and roads. Cadastral symbols are used to represent phenomena spread in the form of areas in nature. These symbols may be qualitative, indicating the type of phenomenon, quantitative, indicating the quantity of the phenomenon, or quantitative and qualitative, indicating both type and quantity. In preparing the study maps, geometric symbols were relied upon to indicate the nature[7]. To identify a certain phenomenon or specify specific locations, the Arc Map program provides a large set of symbols that can be modified according to what the study requires.

3-2-2- Color: Colors in cartography are an important factor in estimating the shape of geographical phenomena on the map to be drawn and determining their sizes, development, and dimensions. This is in addition to having a clear significance in explaining distances, densities, movements, and directions[8]. The current study relied on a group of colors that Provided by the Arc Map V10.3 software environment through the Symbology tool.

2-2-3- Line: The accuracy of the line is one of the important indicators in evaluating maps from a technical point of view. It is used for the purpose of clarifying the title and content of the map, as well as naming the places, geographical phenomena, and paragraphs included in the key. The cartographer can also direct attention to a number of its details. By choosing the style, size and location of the letters ([9]).

4-2- Exporting: It includes adding an aesthetic touch to the map through good design, the final output of the symbols and their positions, and the balanced design of the map's elements and spaces, the writing style and its size, in a way that makes all the elements of the map consistent. This stage affects the final appearance of the map and the extent of its perceptibility. Her visual.

3- Preparing color gradation maps of the qualitative characteristics of well water in the study area

Maps of the qualitative characteristics of well water in the study area were prepared using the cadastral pattern method and were represented using the method of specific regions, the method of demarcation lines, and the method of

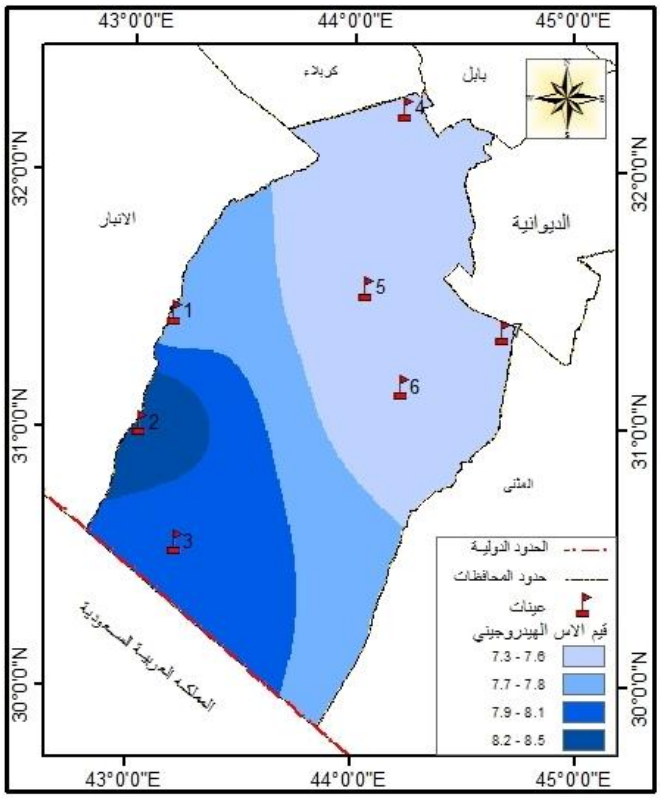
color gradation from light to dark. The dark color indicates the areas in which the values of the constituent element of well water increase, and it graduates to a lighter color to give the reader the impression of the scarcity of the constituent element. For well water, as can be seen from map (2), which represents the pH values in well water, which were represented using the areal pattern method and with a blue color gradient in four degrees according to the categories divided into element values, the light blue color took values ranging between (7.3 -7.6), while the color Dark is the highest value, which ranges between (8.2 - 8.5). As for map (3), which shows the electrical conductivity values of well water, I colored that map in shades of violet, so the lowest values were colored light, while the highest values were colored dark.

Table (2) Chemical characteristics of well water in Najaf Governorate

Nitrate (NO3-1) /mg/L	Chloride (Cl) /mg/L	Sulphate (-So4) /mg/L	Potassium (K+) /mg/L	Sodium (Na+1) /mg/L	Magnesium (Mg+2) / mg / liter	For Ca/mg/L	Dissolved Solids (T.D.S) /mg/L	Electrical conductivity (E.C) Micromos	pH	the sample
80	83	1082	211.87	212.03	120	311	2008	2999	7.7	1
91	779	2179.3	230.04	229.98	160	698.9	4497	4987	8.5	2
108	890.8	1170	211.2	275.03	229.9	244.9	5195	7487	7.9	3
70	94	1120	145.03	270.1	250	368	400	592	7.5	4
96	420.8	1501.01	202.03	110.09	100	410	350	731	7.4	5
89	255	170.2	260.1	130	105	109	973	999	7.4	6
15	127.9	90.05	190.04	80	236	100	250	385	7.3	7

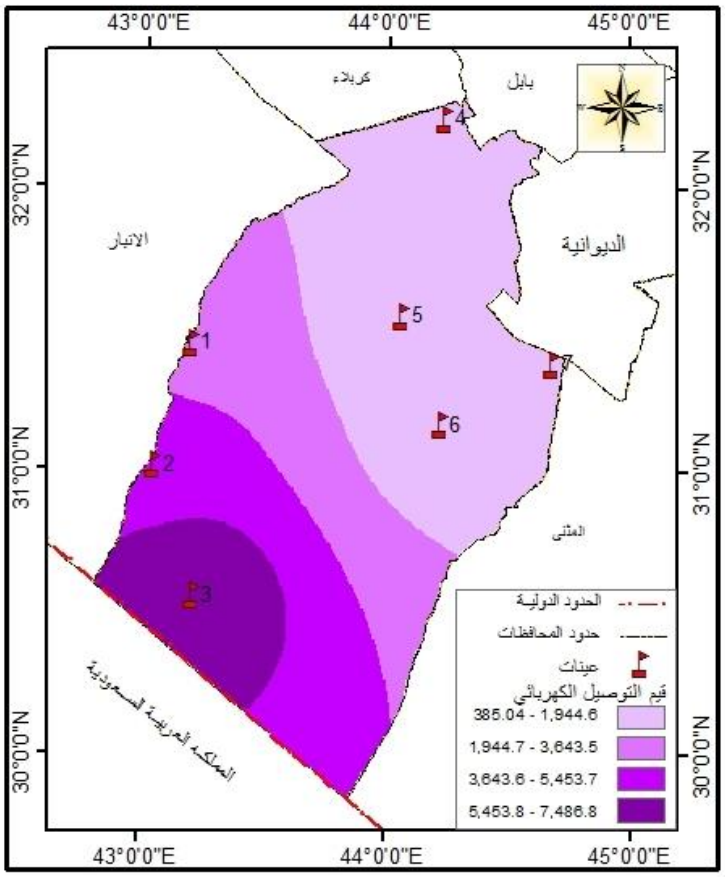
Source: Based on analyzes of the chemical laboratory in the Babylon Environment Directorate.

Map (2) pH concentration of well water in the study area



Source: Based on Table (1)

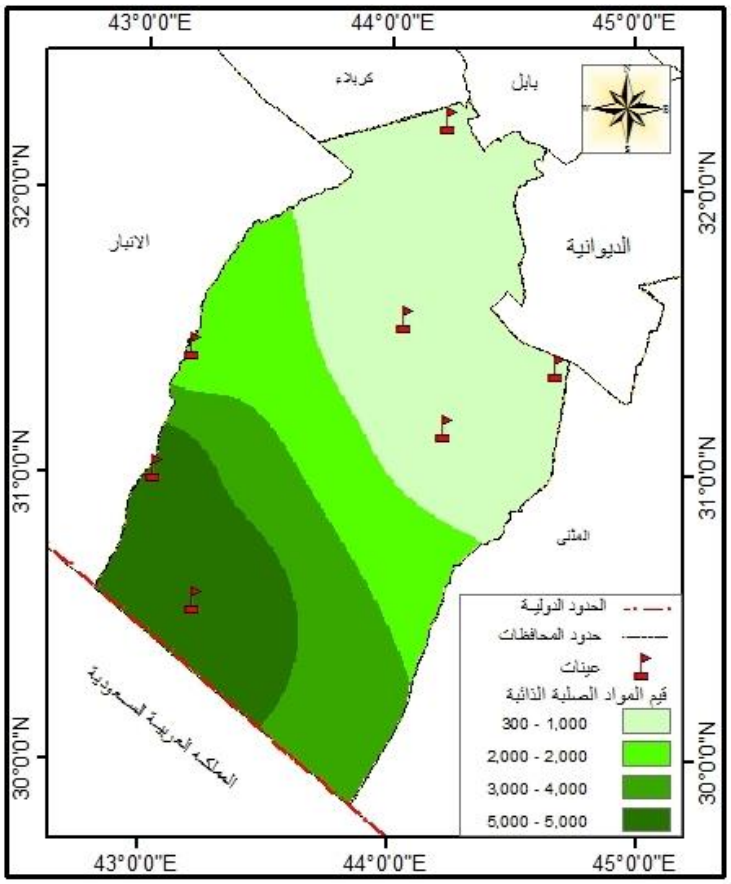
Map (3) electrical conductivity concentration (µM/cm) of well water in the study area



Source: Based on Table (1)

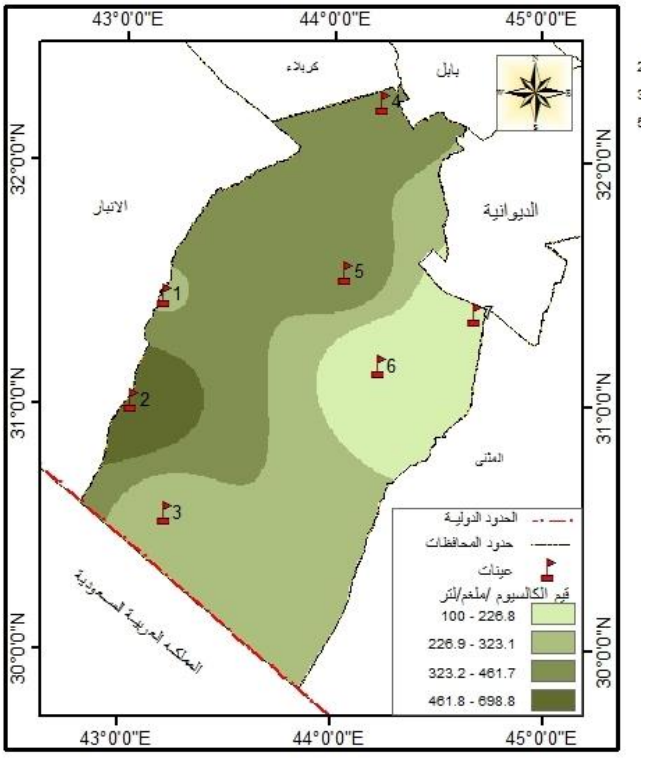
As can be seen from map (4), which shows the values of solid dissolved substances in well water, they are colored in bright green. The highest values are in a light color, which ranges between (300-1000 /mg/L), while the highest values are in dark green. This is in addition to map (5), which showed the calcium values in the well water of the study area, which was colored in shades of dark green. The highest values were in the light color, which ranged between (100 - 226.8 mg/L), while the highest values were in dark green, which ranged between (561.8 - 698.8/mg/L). As for map (6), which showed the values of magnesium in the well water of the study area, with a pink color gradient and four degrees according to the categories divided into the values of the element, the light blue color took values ranging between (100-139.4 /mg/L), while the dark color represented the highest values that It ranges between (201.3-250 /mg/L), as can be seen from map (7) which shows the sodium values in well water. It was colored pink, so the highest values took on a light color, which ranged between (80-148.83 /mg/L), while the highest Values in dark green ranged between (230.68-275.03 mg/L).

Map (4) concentration of dissolved solids in well water in the study area



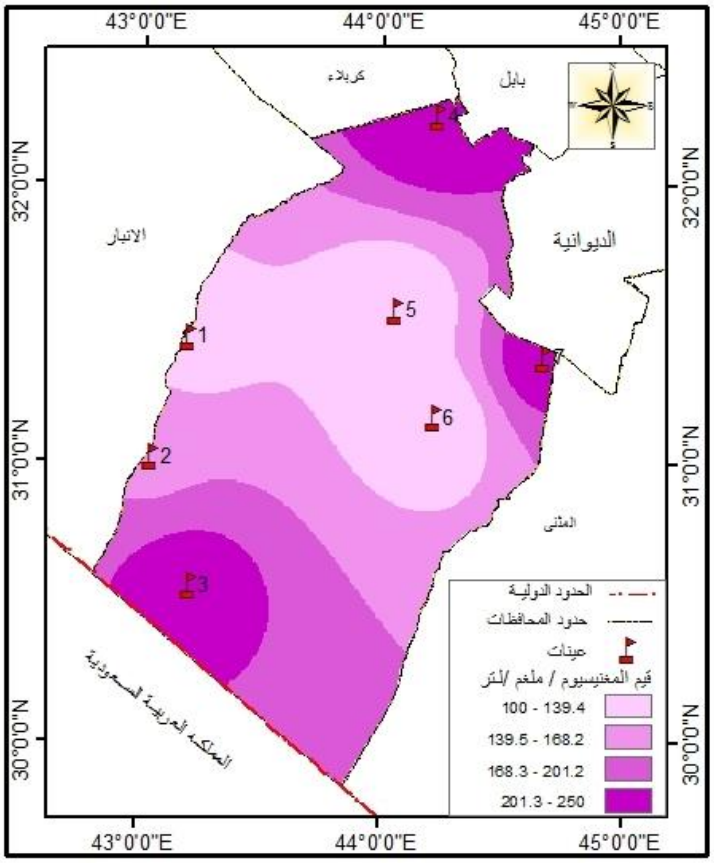
Source: Based on Table (1)

Map (5): Calcium concentration (mg/L) of well water in the study area



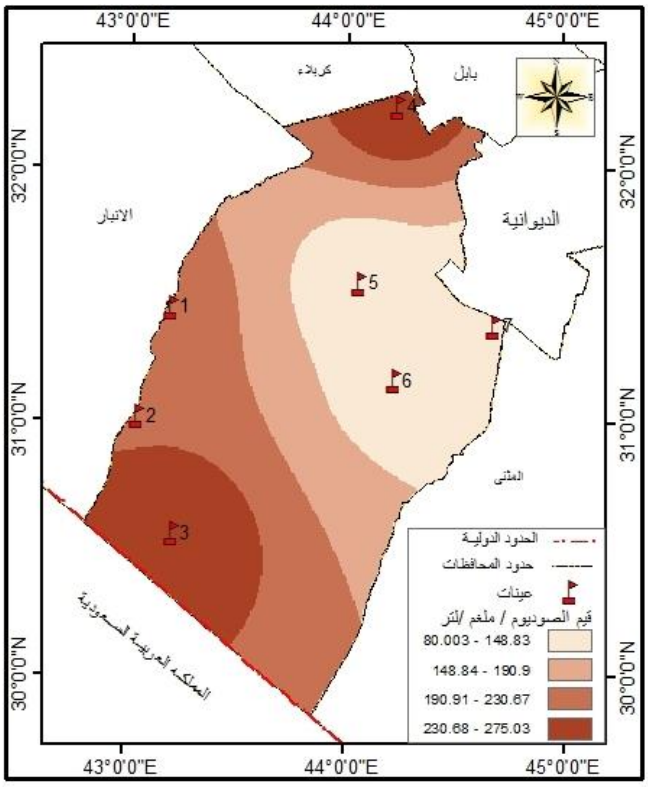
Source: Based on Table (1)

Map (6): Magnesium concentration (mg/L) of well water in the study area



Source: Based on Table (1)

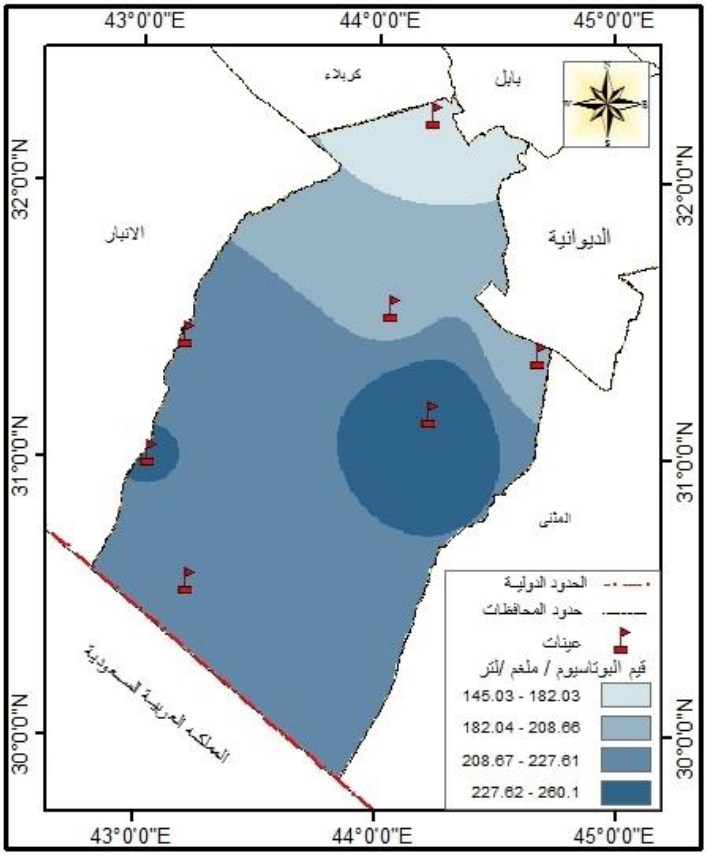
Map (7) sodium concentration (mg/L) of well water in the study area



Source: Based on Table (1)

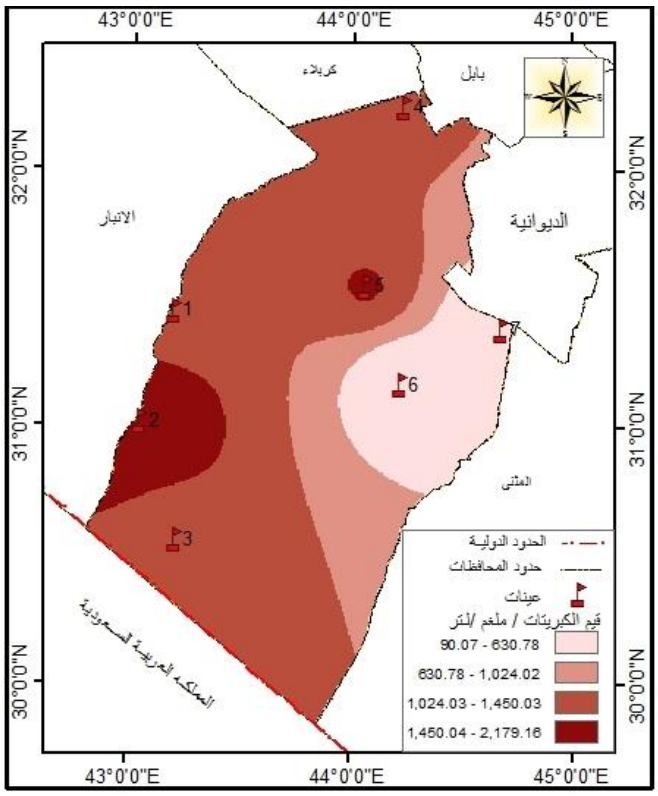
This is in addition to map (8), which showed values of potassium in the well water of the study area, which was colored in shades of dark blue. The highest values were in light color, which ranged between (145.03 - 182.03 /mg/L), while the highest values were in dark green, which ranged between (227.62 -260.1 /mg/L. As for map (9), which showed the values of sulphate in the well water of the study area, which was colored in shades of dark brown, the highest values were in the light color, which ranged between (90.07 -630.78 /mg/L), while the highest The values in dark green ranged between (1450.04 - 2167.16 /mg/L), as can be seen from map (10), which shows the values of chloride in well water. It was colored in bright green, so the highest values were in the light color, which ranged between (83.05 -276.27 /mg/). litres), while the highest values in dark green ranged between (659.56-890.78 mg/litre). This is in addition to map (11), which showed the values of nitrate in the well water of the study area, which was colored in shades of dark blue. The highest values were in the light color, which ranged between (20-50 mg/L), while the highest values were in the dark color, which ranged between (100/mg/L(

Map (8): Potassium concentration (mg/L) of well water in the study area



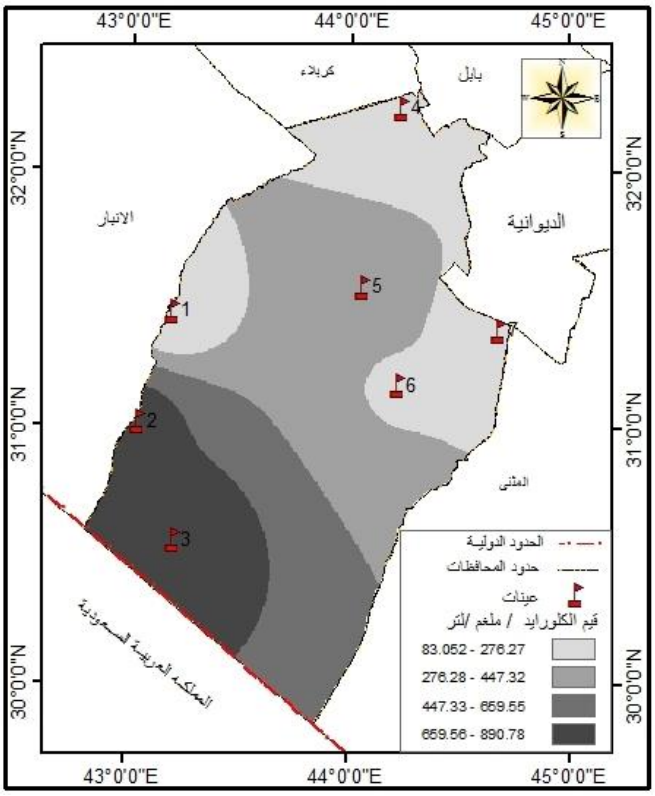
Source: Based on Table (1)

Map (9) sulfate concentration (mg/L) of well water in the study area



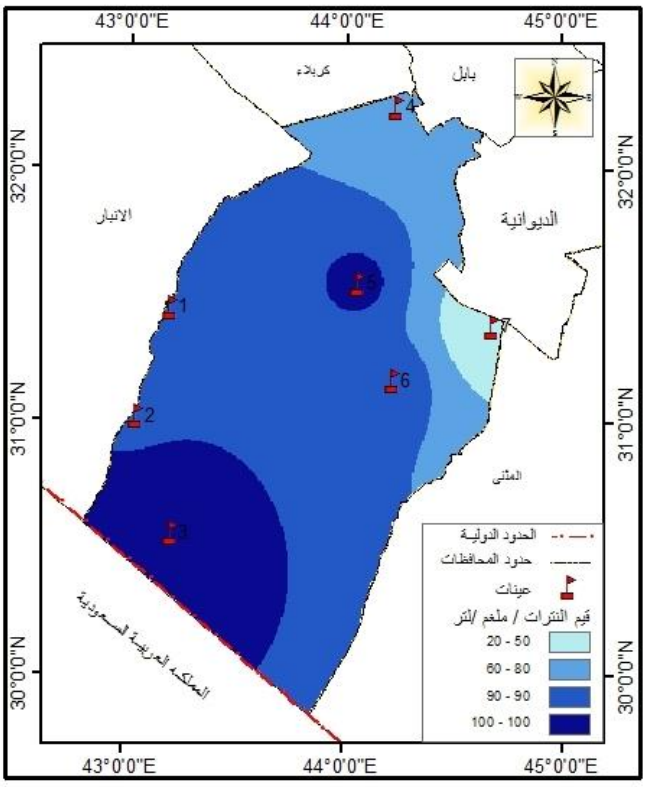
Source: Based on Table (1)

Map (10) of chloride concentration (mg/L) of well water in the study area



Source: Based on Table (1)

Map (11): Nitrate concentration (mg/L) of well water in the study area



Source: Based on Table (1)

Conclusions

-1The necessity of emphasizing the study of traditional cartographic representation methods and their means, because it is the basis for representing digital maps while enhancing some statistical methods.

-2The study found that the method of representing the values of the concentrations of well water characteristics using cadastral symbols is the best method through which the values of well water concentrations in the study area can be completed through derivation processes in the (ARC MAP10 1.3) program.

Recommendations

-1Preparing maps that show the variation in the concentration values of the qualitative characteristics of Alaba's water, by building an integrated geographical information base.

-2Establishing laboratories for geographic information systems within universities to develop the capabilities and skills of students in mapping.

-3Encouraging students to undertake cartographic studies that are concerned with maps of water resources in general and maps of groundwater in particular.

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