



**PERFORMING CARTOGRAPHY BY USING GIS TO SHOW THE
NATURAL SIGNIFICANT IN SAYDSADIQ DISTRICT**

Bilal Fatah AMIN

MASTER'S THESIS

Department of SOIL SCIENCE PLANT NUTRITION

Supervisor: Prof. Dr. Alaaddin YUKSEL, Dr. Fuad KHALID

2017

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**REPUBLIC OF TURKEY
BİNGÖL UNIVERSITY
INSTITUTE OF SCIENCE**

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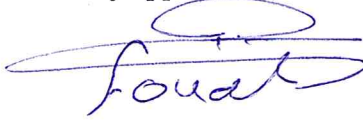
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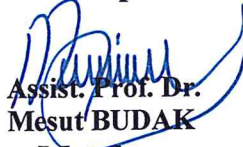
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PREFACE

-Thanks and praise to Allah that gave me energy, ability and patient to continue studying and conducting this research.

-Thanks to both supervisors (Prof. Dr. Alaaddin Yuksel) and (Dr. Fuad Khalid Saed) that took charge supervision of this research who faithfully and loyally with their notes and observes enriched the research.

-Thanks are also been sent to all those distinguished persons whom supported me during my studying and particularly in maters' stage.

-Finally I thank anyone who even by a word assisted me.

Dedecation

-My beloved parents may Allah protect them.

-Dedicated to those who serve Saydsadiq district and are trying to make it one of the nice cities in Kurdistan.

-To any geographer who bears the science in mind and became a seeker.

Bilal Fatah AMIN

Bingol 2017

CONTENT

PREFACE.....	ii
CONTENTS.....	iii
LIST OF FIGURES.....	iv
LIST OF TABLES.....	v
ÖZET.....	vi
ABSTRACT.....	vii
1. INTRODUCTION.....	1
2. LITERATURE REVIEW.....	6
3. MATERIAL AND METHOD.....	10
2.1. Studied Area.....	10
2.2. The Research Method.....	12
2.3. The Research Plan.....	13
2.4. The Data Methods.....	14
4. RESULTS AND DISCUSSION.....	15
4.1. Illustrating Cartographical Features of Geology and Topography.....	15
4.1.1. Cartography Science and Geographical Information System.....	15
4.1.2. Map Illustration of Geological Formation.....	20
4.1.3. Map Topography Illustration by GIS.....	28

4.2. Cartographic Representing of Climate, Soil and Natural Plant by Using GIS.....	43
4.2.1. Climate.....	44
4.2.2. Soil Types and The Difficulties In The Inspected Area.....	61
4.2.2.1. Soil Types.....	61
4.2.2.2. Soil Classification.....	62
4.2.2.3. The Soil Problems in the Researched Area.....	67
4.2.2.4. Some Physical Feature of the Researched Area's Land.....	68
4.2.3. The Forest and Natural Vegetation.....	75
4.3. Hydrological Cartography of Saydsadiq District by GIS.....	86
4.3.1. Hydrology Specialty of Saydsadiq.....	87
4.3.1.1. Down Pouring.....	87
4.3.1.2. Ground Water.....	90
4.3.1.3. Underground Water.....	101
5. CONCLUSION AND RECOMMENDATION.....	137
5.1. Conclusion.....	137
5.2. Recommendation.....	140
REFERENCES.....	142
APPENDICES.....	153

LIST OF FIGURES

Figure 3.1.	Sayydsadiq from iraq in the world.....	12
Figure 4.1.	World map by Ptolemy.....	17
Figure 4.2.	Geological Formation of Saydsadiq.....	29
Figure 4.3.	Saydsadiq Topograph.....	36
Figure 4.4.	Saydsadiq Slope Degree	39
Figure 4.5	Saydsadiq Directions.....	40
Figure 4.6.	Earth Shade in Saydsadiq.....	42
Figure 4.7	Contours line of Saydsadiq.....	43
Figure 4.8	Avarage temperature months between 2003-2016.....	50
Figure 4.9.	Avarage high and low temperature months between 2003-2016	51
Figure 4.10.	Temperature map.....	51
Figure 4.11.	Relatively Moist according to months, years and season.....	57
Figure 4.12.	Figuer avarage temperature, moist ratio and wind speed.....	60
Figure 4.13.	Avarage ratio moist homutide in months.....	60
Figure 4.14.	Soil components and their relation with the four layers.....	62
Figure 4.15.	Thin stony soil Gellara Village- Srwchk sub-district.....	63
Figure 4.16.	Castanee Soil.....	65
Figure 4.17.	Saydsadiq Soil Classification based on Burneg Classification.....	66
Figure 4.18.	Taken soil sample from one of the places of Saydsadiq district.....	70
Figure 4.19	Soil Aample Area in Saiduadiq.....	73
Figure 4.20.	Hydrogen ions of Saydsadiq samples.....	73
Figure 4.21.	Sand formation of Saydsadiq.....	74
Figure 4.22.	Clay formation samples in Saydsadiq.....	74

Figure 4.23.	Silt formation samples in Saydsadiq.....	75
Figure 4.24.	Vegetation in the researched area.....	76
Figure 4.25.	Olive trees in Said Sadiq Mountain.....	78
Figure 4.26.	Natural Forest in Sirochik Province.....	81
Figure 4.27.	The Forests near Valleys and River Banks.....	82
Figure 4.28.	Seasonal Grassland.....	84
Figure 4.29.	Chaqan Stream in Saydsadiq.....	92
Figure 4.30.	Everlasting rivers in Saydsadiq.....	92
Figure 4.31	Qelebo Dam.....	95
Figure 4.32.	Water resources.....	97
Figure 4.33.	Hasar stream.....	100
Figure 4.34.	The collected samples locations in Saydsadiq.....	110
Figure 4.35.	Location and graphic lines of (pH).....	111
Figure 4.36.	Location and graphic lines of (TDS).....	114
Figure 4.37.	Location and graphic lines of (TH).....	116
Figure 4.38.	Location and graphic lines of (Cl).....	118
Figure 4.39.	Location and graphic lines of (Ca).....	119
Figure 4.40.	Location and graphic lines of (Turbidity).....	121
Figure 4.41.	Location and graphic lines of (SO ₄).....	121
Figure 4.42.	Location and graphic lines of (Alkalinity).....	122
Figure 4.43.	Location and graphic lines of Mg.....	123
Figure 4.44.	graphic lines of (Na).....	124
Figure 4.45.	Location and graphic lines of (NO ₃).....	126
Figure 4.46.	Location and graphic lines of (K).....	128
Figure 4.47.	Geographical location for the springs and the yield in.....	132
Figure 4.48.	Spring's water sample.....	136

LIST OF TABLES

Table 4.1.	Vertical formation of Saydsadiq Geolog.....	27
Table 4.2.	The geological area of Saydsadiq	28
Table 4.3.	Some Hills and mountains of Saydsadiq.....	37
Table 4.4.	Slope Classification.....	39
Table 4.5.	The average of monthly, seasonal, and yearly.....	46
Table 4.6.	The length of theoretical day and the sun-beam projection angle.....	47
Table 4.7.	The overall monthly, seasonal, and yearly of temperature degrees.....	49
Table 4.8.	Monthly seasonal and yearly temperature average of air and soil.....	50
Table 4.9.	The average rain monthly, seasonal and yearly (milligram).....	54
Table 4.10.	Wind direction average monthly and yearly.....	56
Table 4.11.	Wind speed average monthly, seasonal, and yearly.....	56
Table 4.12.	Relative moist average monthly, seasonal and yearly.....	59
Table 4.13.	Monthly, season alandy early evaporation average.....	59
Table 4.14.	Acid and alkaline of soil.....	70
Table 4.15.	The types of soil cells according to pellets' sizes and percentages....	71
Table 4.16.	Physical features and PH of 16 soil samples with their	72
Table 4.17.	Place Area Artificial forest types, and elevation above sea level....	78
Table 4.18.	General forest and Grassland in Said Sadiq province.....	83
Table 4.19.	World Health Organization, year 2006, for potable water.....	112
Table 4.20.	Iraqi Standard for year 1996, for potable water.....	112
Table 4.21.	Water drinking suitability standards for Animals.....	112
Table 4.22.	Water classification based on TDS.....	113
Table 4.23.	Classifying water by hardness.....	116

SAİDSADIQ BÖLGESİNDEKİ DOĞAL ÖZELLİKLERİ GÖSTERDİKLERİ İÇİN GLS VE KARTOĞRAFİK VERİLERİN KULLANIMI

ÖZET

Harita doğa ve insanlık olgusunun diyagramatik coğrafi temsidir. Haritacılık biliminde ArcGIS programları kullanılarak yeni bilgilerle her zaman güncelleme yapılabilir. Süleymaniye ilinin 52 km güneyindeki Saydayadiq ilçesinin doğal coğrafyasını incelemek amacıyla GPS ve teknolojileri kullanılmıştır. Süleymaniye bölgesi büyük bir coğrafi konumdadır. Süleymaniye coğrafi olarak 35,13,0 – 35,40,30 – 45,57,30-45,35,30 koordinatlarında yer almaktadır. Merkezî yükselti 1710 m, Kuzeyde Sharbazher bölgesi, güneydoğuda Penjwen bölgesi vardır. İlçenin komşuları güneydoğudaki Halabya valiliği, güneyinde Darbanikhan Gölü, güneybatıda Warmawa bölgesi ve batıda Sulemaniah'dır. Bu ilçenin alanı 705 km² dir. İdari olarak, iki alt bölgeye ve 92 köye ayrılmıştır. Kolosh Formasyonunun jeolojisini ve nehirler,çeşitli sedimentleri bir araya getirerek bölgenin geniş bir yelpazesini bu alanlar (% 62) oluşturmaktadır. Araştırma alanının yüksekliği kuzeyde 2154 m ve güneyde 444 m dir. Orta kısım yüksekliği ise 1710 m dir. En yüksek ekvator çizgisi 2100 m, en düşük 500 m ve eğim ise 22,8° dir. Arazi oluşumu çoğunlukla ince bir kayalık tabaka olmakla birlikte, Sharazur ovasi bir catena toprağıdır. Toprağın fiziksel özellikleri alınan örneklerde bazı sorunlar yaşamaktadır, ancak yine de kimyasal ve tarım uygulamaları ile çözülebilir. Dağların zincirleri arasında yeryüzü olgusunun jeomorfolojisinin eksiksiz bir birimi olan bazı düzlükler, tepeler ve vadiler vardır. Son onbeş yıldaki ortalama yağış miktarı 523,3 mm 'dir. Alanın rüzgarına nispeten göreceli olarak yaz aylarında kuzeyden geliyor. En fazla buharlaşma miktarı iklim değişikliği, nem ve benzeri koşullara rağmen 403 mm ile Temmuz ayıdır. Bir başka kartoğrafik özellik, bölgenin sıcak bir hava ve düşük sıcaklığa sahip olmasıyla karakterize olan dokuz ay boyunca güneş ışığıdır. Sonuç olarak gelişen teknoloji kullanılarak, bölgede meydana gelen yağış miktarı genellikle ortalamanın altında olduğu, sis ve dolu yağış olaylarının meydana geldiği tespit edilmiştir.

Anahtar kelimeler: Critical, GIS, Natural source, Cartography.

PERFORMING CARTOGRAPHY BY USING GIS TO SHOW THE NATURAL SIGNIFICANT IN SAYDSADIQ DISTRICT

ABSTRACT

Map is a diagrammatic geographical representation of natural and philanthropy phenomenon. Cartography science is always updatable with new information by using ARC GIS program. this study, Several technology reasons with GPS to investigating the natural geography of Saydsadiq which is one of the districts of Sulaymaniah governorate in the south with 52 km. Sulaymaniah Governorate is in the east of Iraqi Kurdistan Region that has a great geographical position. Suleymaniye is located geographically 35.13.0 - 35.40.30 - 45.57.30-45.35.30 coordinates. The central elevation is 1710 m. There is Sharbazher district in the north and Penjwen district in southeast. The district neighbors are Halabja governorate in southeast, Darbanikhan Lake in south, Warmawa district in southwest, and Sulemaniah in west. The area of this district is 705 km². Administratively, it is divided into two sub-district and 92 villages. We are going to discuss about Saydsadiq age of medieval geology that consists of Ballambo, Garra, Komitan, and Tanjero mountains' formation. Its new age of geology involves with Kolosh formation and forth age sediments like rivers, steep rivers, and various sediments all together complete a wide range of the district's formation which is 62% of the area. The research locates in north of 2154 m height and 444 m in the south. The central part's height is 1710 m. The land formation is mostly a thin rocky layer but Sharazur plain part is a catena soil. The physical features of soil have got some problems in the taken examples but still it can be solved through chemical and farming practices. There are some plains, hills, and valleys between the chains of mountains which complete a unit of geomorphology of earth phenomenon. The average pouring in the last fifteen years is 523.3 m. What is relative to the wind of the area is coming from north in summer. The largest amount of evaporation is on July which is 403m despite of climate change and humidity and etc. Another cartographical feature is the sunlight during nine months of a year which is a good characteristic of the area with having a warm weather and a low ratio of humidity in the air. Finally, we have pouring feature which generally the days of raining is below average also less thunders, foggy, and hailing that all happens as a result of using developed technology.

Keywords: Critical, GIS, Natural source, Cartography.

1. INTRODUCTION

Cartography after parting from geography is regarded as the newest science in the new modern science. In terms of topic and different investigation doctrine from geography, this science's aim is accumulationg, analyzing and putting up special information on various multi side of earth and implementing it with appropriate map scaling which makes its manifestation more clear (Mustafa 2000).

Specialists of this science from the beginning could not be draughtsman of a special area. Which means they were inactivate in showing the spectacles with their map scaling and specific plotted projection because this was the duty of surveying engineer. But now by means of new devices, equipment and technics can abolish this way and the specialists in the field of mapping can be draughtsman in applying and choosing the kind of originate and scale in the way that is better for demonstrating the phenomenon.

In fact we need to consider a general definition for this topic because most of the scientists know that the factor of geographic topics success is the usage of map, like (Briston James) who says "the most important participant of geography in terms of scientific for human beings comes from the consequence of using maps which partition, differentiation, comparison and displaying the ways of distribution are demonstrated by maps (Alxair 2002). And those which are in the context of concept and philosophy of geography means to achieve it, so from this perspective map is the reason of world of understanding and skips verbal utterances obstacle as well lots of languages and classes are trying to get and deliver the issues through maps (Said 2014).

Map is measured as a geographic reason and instrument, which is used in analyzing the distribution of the natural phenomenon, humanism and diverse clarifications. When arranging and designing maps are relying on the way of proper cartography representin

Using various instruments its significant increases, mainly using modern technics just like geographic information technology.

With protecting and sticking to the premise likewise the genera rules of mapping. When choosing an appropriate way for representing the unlike phenomenon, it will have impact on quick understanding and divulging the knowledge in the map. What faces the geographers is paying attention to comprehending and knowing the main rules of map science and its role in indicating the ways of proper cartography representing of arranging, setting up and producing maps by applying using cartography IT in setting up maps (Kadr 2013).

It is clear that geography science as a part of the humanities sciences nowadays invades plenty of space in the intellectual centers and along with the other sciences paces and is in progressive renovation. Certainly natural behalf is stared as the main astray and an important tip in geographical science. Natural geography as a core branch of geography science examines the natural phenomenon on earth this part in geography analyzes and measures the manner of diffusion of the natural forms. From this aspect the importance of this research will clarified that is working with maps for showing up and scientifically being familiar with the topics and problems that are available in an area are much better than by describing, writing and numbers. It is much more better than description, writing and numberings. Despite that the modern technology makes our research to reach to the practical researches.

makes the academic field more active with (ARC GIS 10.3) which is depending on the programs of geographic knowledge system that are the programs of many other technological reasons the most important one is the Internet (many kinds of digital files) and GPS device for examining the geography nature of Saydsadiq district.

The Predicaments of The Research

Briefly it is having dilemma in the natural sides in Saydsadiq district and not arranging them to general interests, regardless of lacking the usage of technological reasons for screening the manners of these natural sides so this research comes to show the natural sides via cartographic depiction using many factors and modern technological regards.

The Research Goal

We recommended showing the main goal of the research in some points:

1. The main goal of writing this research is to make it a resource, for filling the gap of insufficient topic about the explored district in the district's library and the region in general. Also getting benefit from those scientific researches that are presented to the universities of Kurdistan Region and Iraq like a research or thesis on this perspective of the other areas in the last years.
2. Using modern geography technics for constructing specific map theme's by any natural phenomenon (geology, geomorphology, topography, climate, natural plant, and hydrology), with obedient of the basis, general principles of mapping science and writing research on viewing any of these occurrences.
3. The scholar's aim is to make an information bank of geography for the district by natural phenomenon perspective.
4. Choosing ideal formula that can be depended on by cartography illustration for any natural phenomenon.

The Research Question

We can make these questions principle as a support of reaching our goals:

How can we select a suitable way for displaying the natural phenomenon in the studied area just like (geology, topography, climate, hydrology and natural plant) and those ways which are used for this purpose ?

Does the geographic information system technic (GSI) have a significant in its usage in the natural specialties in Saedsadiq district?

Can we create an information numeral agency particular to the research in Saedsadiq district using advanced technological factors?

Can we create a special atlas for the natural attributes in Saedsadq district by using (Arc GIS 10.3) program?

Is there a relationship between surface temperature and land cover and vegetation built up area?

To what extent urbanization surface temperature affected during the period studying?

Research's Hypothesis

Hypothesizing is an earlier solution and a primary answer for the predicaments that helps the researcher to step to a right direction towards the research's goal. In addition hypothesis reaches the scholar to a correct goal. Researcher believed to collect the research's hypothesis in these points:

1. In presenting the natural sides the natural abilities will appear, we hypothesize that depicting Saed sadq will cause to show the different in the displayed phenomenon in Saed sadq district.
2. If we assume that selecting those ways are suitable for portraying natural specialties that are shown up on map this makes it easier for understanding and perception of information in the map as well displaying the unlike position between the different areas in Saed Sadiq district. We assume that map representation of the natural specialties is causing explanation of the variable quantitative and quality of natural parties.

The reason of selecting Saed Sadq for examination

This research is new and examining the natural geography in a scientific and academic center by using nowadays modern devices like(GIS) in this district is not being done. Despite the fact that the district is a part of Sharazwr and Shrazwr is a wide plain also its land is fertile regarding agricultural capacity, it is regarded as an important plain for agriculture in Iraq. In addition not paying attention to Saedsadq district is another reason that I wanted from this way show up by cartographic representation of the natural behalves that can be get advantage from administrative sides by my presentations.

The Difficulties of The Research

For sure no research is far from having various difficulties, so from the beginning of conducting this research till finishing it, I faced some difficulties which directly effects the quality of conducting and the result of the research. Examining a subject and activity like this was not an easy work, rather it faced many problems and difficulties I will show some of them:

1. There are lots of references on geography nowadays, but most of them are repetition and written in general. So one cannot depend on them for such a research, natural geographical research. Researches on scientific studies and references are hardly seen about Kurdistan region natural subjects in general and the examined area in particular. Similarly most of the lexicons are odd in Kurdish language and we do not have a center to translate these terms.
2. Not having skilled people who are specialist in (GIS) program for helping me when its needed, this makes lots of obstacles for me when there were a difficulty in the program and work this turns out to not having specialized cadres in the educational center, universities and institutes to teach those topics in good practical way that I myself during all my bachelor study did not study any practical activities on this program by our professors.
3. When visiting the governmental offices to gain data and information apart of the relevant parties with having various pleas does not help me while for achieving them lots of time and effort needed.
4. Not having weather station in Saydsadiq district so the researcher obliged to depend on the weather station of Halabja. For this reason there is insufficiency in the real depiction of the place's climate.

2. LITERATURE REVIEW

This research under the title of (Performing Cartography by Using GIS to Show the Natural Significant in Saydsadiq district) will become the third research about cartography in Kurdistan Region. The first one is (Illustration of Cartographical natural Features of Ranya District by using GIS and RS programs) which was a research that given to the university of Sulemani-College of Social Science in 2013. Second one is (Illustration of Cartographical Natural Features of Kalar district by Using GIS and RS programs) it is also a master thesis to the University of Sulemani college of Social Science in 2015. Those researches are mostly focused on RS program while I am depending on ARC GIS10.3 program with GPS Corporation. Also there are various distinction in natural and geographical zones.

Punch (2012) *The Use of Geographical Information Systems (GIS) for Spatial Planning and Environmental Management in India: Critical Considerations*. GIS is a computer tool used to collect, store, process and display the spatial information referred to. They are used to support decision-making in a wide variety of contexts, including spatial planning and environmental management. The use of GIS is used in a research program for environmental management of the Com River in Chennai and support for participatory processes of environmental and health management in slums to demonstrate appropriate applications of GIS in India.

Albites (2008) *Relationships between Cartography, Geographic Information Systems and Analytical Data for Mexican Spatial Data (EDEMEX)*. This study identifies the relationships between the development of cartography and GIS and Mexico SDI (EDEMEX) at the National Institute of Statistics, Geography and Informatics (INEGI) of Mexico. The National Geographic Information System defines the national geographic information system, which defines its principles and concepts. The first part of the 1990s witnessed a change in the digital format,

which provides for general progress, use and mapping in the context of the national geographic information system. The Institute launched the National Spatial Data Infrastructure Development Initiative, including relevant tools and standards, intensive use of modern information and communication technologies, resolution of access and distribution issues, National Geographic production according to Nges in the context of Adamax.

Anderson (2015) Cartography approves visual exploration of violent crime patterns in space and timing: user performance is the basis of comparison of the method. This study has provided an empirical comparison between animation and animation of temporal spatial phenomena in their application to knowledge extraction tasks based on the basic enterprise map to answer the following research questions: 1) Are animated maps provide increased possibility of accuracy in task completion Basic knowledge extraction across time series maps Fixed, or vice versa? 2) Do mobile maps provide an increase in efficiency in accomplishing basic knowledge extraction tasks through fixed time series maps, or vice versa? and 3) How user preferences align or do not match accuracy and efficiency measurements Independent sample results t- Tests indicate statistically significant differences between static maps and animation in terms of task accuracy and finish time. User preferences for links with task accuracy and end time were checked by calculating the correlation coefficient between the product at Pearson. The results indicate that there is no significant correlation between performance measures and user preference.

Bronden (2007) used GIS to analyze public library performance metrics. This exploratory study analyzed the spatial distribution of selected measures of the 2003 Public Library Statistics for Ontario, Canada, using GIS (Geographic Information System). The data consist of performance indicators covering broad categories of public information, personnel, groups, service transactions and expenditures. The specific key ratios that were normalized for the population served among 303 public libraries in Ontario were examined in the dataset in an attempt to determine spatial patterns and regional variations. Analyzes were also carried out after the classification of public libraries into periods based on the size of the population served. An additional objective of this study was to assess the usefulness of using GIS to analyze public library performance metrics. The results showed that for some performance measures there were differences in values measured at the regional level as well as among the population groups that were provided, and visual data for measuring library performance was

a powerful technique for detecting statistical patterns. Accordingly, GIS has the ability to detect hidden dimensions within library performance measurement data and can be used effectively to analyze and better understand library standards in seeking to clarify the value and relevance of public libraries.

Belka and Vozenilek (2016) imaged the cartography concept of the image map. Image maps have become very popular and frequently produced cartographical outputs during recent years. However, the unambiguous terminology, definitions, content and appearance specification have not been broadly researched. The authors understand the image map as a special map depicting geographic space in a particular cartographic projection and map scale, where its content consists of two basic components - image and symbol components. Image component is represented by remote sensing image (s), while symbol component is represented by cartographic symbols. Additionally, an image map has to have three essential attributes: cartographical projection, map scale and symbol component by means of map language.

Terab and Simo (2012) used Mapping-oriented 3D design visualization of geospatial information - overview and techniques. In the economy, society and personal life based on the map, spatial and interactive spatial perception becomes a natural component of an increasing number of applications and systems. However, the perception of 3D spatial information raises the question of how information can be represented effectively. Significant research has been undertaken in technology-oriented trends in cartography and computer graphics. Here, the unrealistic presentation represents a promising category of photography - located between the two fields - that offers a large number of degrees for vector-oriented optical imaging of the complex two-dimensional and three-dimensional spatial information of a particular application context. To the State. This research revisits the principles of the schematic design of three-dimensional spatial geography and provides a broad three-dimensional model that corresponds to the general and interactive conceptual pipeline. Based on this model, we propose non-light rendering techniques for an interactive mapping of key feature types, such as terrain, water, and buildings. particular, it incorporates the concept of novel blogging to seamlessly complement the realistic representation and mapping of 3D features. Our work concludes by discussing open challenges in this area of research, including topics such as user interaction and evaluation.

Dostal and Penaz (2011) converted the thematic mapping field to Java interfaces and layers. Stouty deals with the transformation of experiential experimental science, knowledge-defined knowledge of the scope of the thematic mapping, to categories of Java language interfaces. The reason for this transformation is the transfer of meta-knowledge from the thematic mapping area in the form of program code in the Java programming language. The resulting program code containing adverts from interfaces and layers will also be used to create a software application for a dynamic interactive support system to create thematic maps. The next pilot project of this knowledge system is aimed at users without knowing the necessary maps, allowing them to create and deliver interactive thematic maps.

The purpose of this tool is to prevent users from deviating from current map rules and avoiding serious errors in resulting maps. Knowledge science facilitates knowledge Properly designed smart mapping application prepared, where mapping knowledge is used based on automatic switching to program code in Java language. The generated program code contains data on the basic concepts and structure of thematic mapping in categories that correspond to the source structures described in ontology. The symbol also contains a description of the vertical and horizontal relationships between the declared layers and also the interface to reach these layers and relationships. Automatic switching of ontology flag in Java code is not completely lossless.

Karacas and Fedman (2012) studied a cartographic fade to black: mapping the destruction of urban Japan during world War in the study d use e practical and rhetorical e of maps created by the United States government during World War II as related to the development and implementation Of aerial bombing policies against Japan. In particular, our aim is to show how, in the planning and prosecution of air raids on urban Japan. We also address the mobilization of American geographers in the war effort, the re-configuration of America's spatial intelligence community during World War II, and the ways in which they were constructed in the context of total war

3. MATERIAL AND RESEARCH METHODOLOGY

3.1. Study area

The studied area is in Iraq, this country is one of the countries in Asia continent. Locates in south west of Asia and east of Arab homeland, Turkey borders its north, Iran is on the east side. Each of Syria, Jordan and Saudi Arabia are on the west. Kuwait and Arabian Gulf are in its south that its astronomic position is in parallel latitude of (29 05 20) north, and on meridians latitude of (38 42 00) to 48 45 00 of east (Using – (ARC Gis) 2017 by the Researcher and Iraq MAP).

Iraq has a significant position in new world, because it has important geographical position looks on the east part of Middle East area. As well it located in a bridge on earth which connects the three continents (Asia, Europe and Africa), as shown (in figure 3.1).

Iraq area is (438,320 sq) that is (84000 km²) of Kurdistan land, after First World War according to Lozan agreement in (24/7/1923) welded with Iraq by the allies.

Kurdistan region includes the whole governorates of (Hawler, Sulaimani, Kirkuk and Duhok). The ancient researches are all agreed that the Hamrin heights comprise the border between Iraq and Kurdistan region.

It is true that till now there is conflict on the geographic border of this part of Kurdistan, but according to the references this border starts in Iraq middle from south east of Badra town in Wast governorate to the north it goes towards north of oil bridge from west of Mandali. Besides the Hamrin heights goes till Fatha.side by side with Tigris river goes up, and from north of Mosel to south west twists towards Hazar town direction, then towards west direction with Iraqi-Syrian border From north of Baaj town. Iraq Kurdistan Region is(84000²km) which is more than 18% of Iraq total planimetric (See Figure 3.1).

That part of Kurdistan which is named by south of Kurdistan in Literature and called Kurdistan region by law and constitution. It is admitted as a federalism region by new Iraq constitution. Our studied area position in this Kurdistan region is (Saydsadiq district) that in one of the districts in Sulimani governorate. It is located in north east of Iraq and Kurdistan also south east of Sulaimani. Its north is Sharbazher and its north east is Penjwen district. From its south east it is conterminous with Halabja governorate, its south is Darbandikhan Lake and its south west is Warmawa district. Its west is Sulaimani governorate. (Look at figure 3.1).

Sharazwr area is in the utmost of south east of mountain area, between Sirwan brook and small tributary. Saedsadq district is a part of Sharazwr plain, the area of this district is 705 km², regarding to administration it consist of two sub districts (Said Sadiq center sub district) and Srwchk or Barznja district. Number of its villages are (92 villages). This district often so called by Sharazwr's heart or Sharazwr capital, because this district is the center of (Penjwen, Sharbazher and Sharzwr) districts. Its astronomical position it means its position by parallel latitude and Meridians latitude, Saidsadq district locates in (35.13.0- 35.40.30) parallel latitude of north of earth, and meridians latitude(45.35.30-45.57.30) east of earth globe (See Figur 3.1).

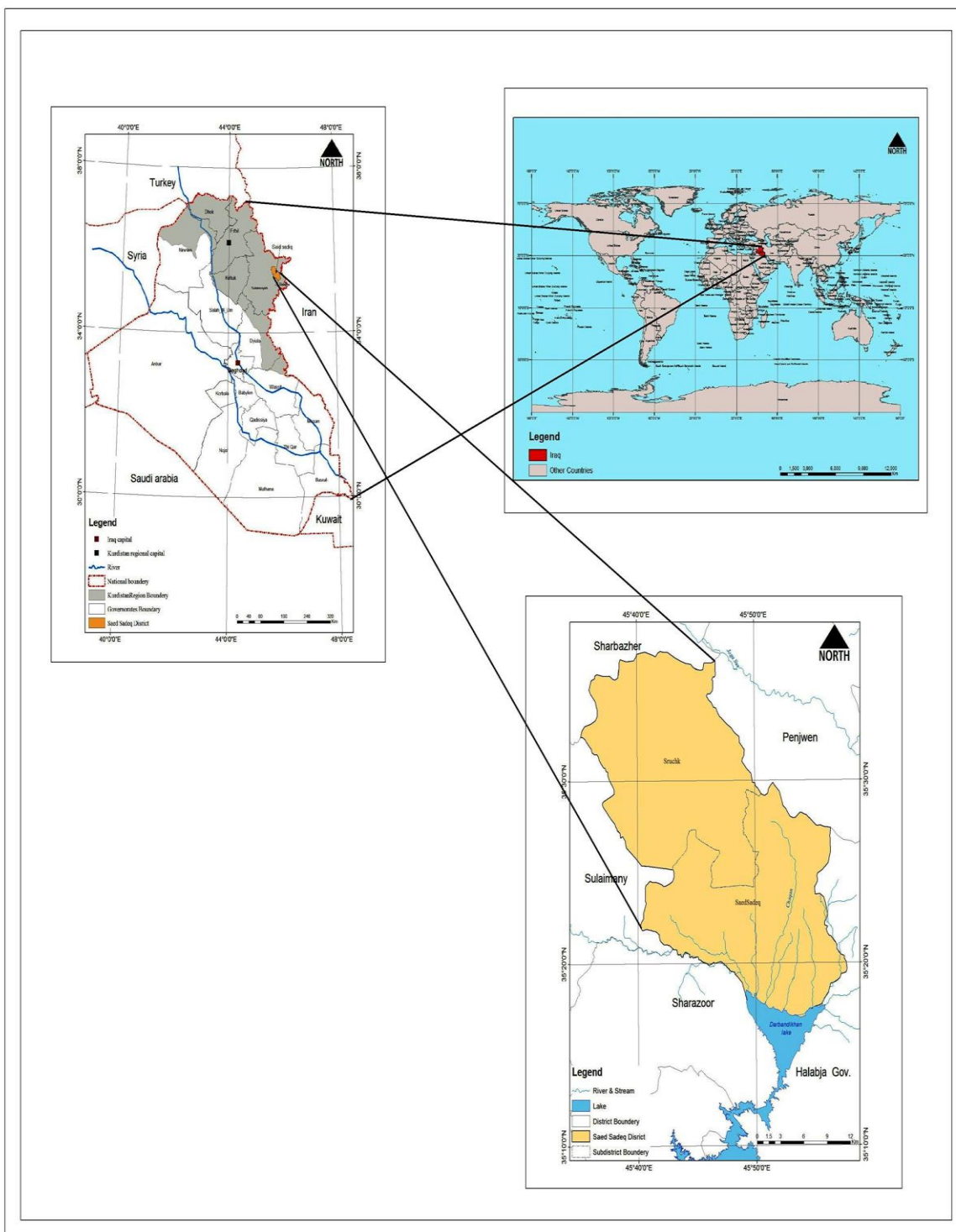


Figure 3.1. Saydsadiq from iraq in the world

3.2. The Researches Method

Any scientific research needs to have a method to become scientifically, and to remain within an academic frame. The research relies on a practical scientific method which counts on modern science and technology on the basis of obtaining references for showing attributive side and examined area. For this reason many various geography resources and GIS are being used apart from lots of various digital maps with the aim of making more clarification of the phenomenon and displaying the occurrences on several maps and cartographic figures. Also collecting special data on the topic by depending on official references, the universal organizations and using many factors to create a digital database for the district aside from direct visiting of the researcher to the different parts of the examined area in purpose of seeing and comparing the geographical phenomenon, also combining and analyzing them to the other knowledge.

3.3. The Research Plan

By means of reaching a precise scientific goal the research is divided into a preface, three parts, and we completed it by a conclusion, delegation and an outline, and the parts are:

The First part: with the title of cartographic representation of the geological and topographic specialties in Saedsadq district using (GIS). In this part at the beginning we briefly talked about an introduction to both the two terms (cartography and GIS) and we presented their essential in map natural attributes depiction. Then we marked the importance, manner of division and manifested quantity of natural specialties in each of the geological topography by map depiction. The goal of this part is to indicate the ages and geological component of the area.

Second part: Cartographic representation of climate, soil and natural plant using GIS. the beginning of the part starts with preface and indicating the climate features, and the theories screening in the field of practical climate that are applied on the area. In addition to indicating and speaking about that geographical factors that influence the area's climate such as the geographical outstanding of the area and its relief on sea level. Then showing up the area's soil, in terms of type and manner of specialties and the area's soil

structure via receiving (16) samples of the area's soil for the purpose of knowing its structure and indicating the physicality of the district' soil and then cartographic depiction is done for it. In this part also we talked about natural plant of the studies area, its attributes, creating natural plant veil map for both dry season and wet season via sky photo data (Landsat). The aim of this part is for creating and preparing the maps of the natural capacities of Saidsadq district, with analyzing the natural climate attributes and the types of soil and natural plant and the difference of distribution from a place to place in the studied area, in a way that each area is having its own attribute and characteristics that is unlike from a place to place.

Third part and Final part are for cartographic hydrology of Saedsadq district representation using GIS, there is a precise and scientific effort on the area's hydrology for both water resources and its types such as surface water and groundwater and indicating brooks and the rivers stirrup on maps. Furthermore evaluation of suitability competence of ground water of the studied area by taking (52) samples of well's and spring's water in the different areas of the district. Laboratory analyzing is being done for groundwater chemical phylum, for showing the capacity usage of various human activities. For this evaluation we depended on both measurements of (WHO) and Iraqi organization for signifying the level of having the chemical phylum in the district's groundwater. And then depiction of the result of these phylum on map and their distribution and indication in the area. As well astronomic depiction of the wells and their relief on sea level, their depth and level of stability and variability also the well's water foods are indicated. Moreover the astronomic position of springs, the area of the marshes and their products are being clarified and the kinds of canyons and the water direction of ground water is indicated.

3.4. The Data Methods

in this research lots of parts of the advanced programs are being used that are used in modern earth science and geography science especially those programs that are related to the researches topic such as (Arc GIS10.3, Global Mapper, Geomatic, Surfer Disimaldegry, and Rock works).

4. RESULTS AND DISCUSSION

4.1. Illustrating Cartographical Features of Geology and Topography of Saydsadiq District by GIS

In anticipation of illustrating cartography of any matters, the reasons and the ways of accomplishing that work must be demonstrated. Here we have achieved through map science and technique of systematical programs of geography science with cooperation of some other technological reasons as it has been mentioned in the preface of GPS and various sky files which will be covered in these programs. This is demonstrating the common expressions of this thesis then we are going to clarify the related information to Saydsadiq district to the reader to be more understandable. Therefore we have distributed the thesis into some subjects which is the first one clarifies the cartographical science and geographical information system. The second and third ones are going to illustrate geological and topographical features of Saydsadiq through cartography and geographical information system by the last available version of ARC GIS10.3 program.

4.1.1. Cartography Science and Geographical Information System

Nowadays map science becomes an independent science that does not belong only to geography science because map utilizing has become of a particular matter in most of the subjects to signify their aspects, but there is not any manifestation in geography without map illustration. So we are going to explain the expressions, definitions, and the terms of this science. This term derived from two Greek words, *Rpacpw* means drawing and *Chart* means cart or sheet. That means drawing on sheets or carts with the passing of time it became of Cartography which is used to map drawing (Said 2017).

The German geographer Max Eckert has defined cartography and said that cartography is a mixture of science and art (Abdul Karim 1996) On the other hand (I.C.A), International

Cartographical Association, proved multilingual definition for technical terms which was got a broader definition and quoted, “ Cartography is art, science, and technology to derive map and exploration as a scientific document or an art work. This union attained that cartography as a definition is different from map which is art, science and technology to a scientific certification or an art work (AbdulKarim 1996).

As a result one can say that cartography is all of that arty ways and scientific reasons which are taken by a cartographer to make the matter more understandable to the reader.

Cartography got aged as old as human beings on earth, but a science of cartography it is not as long as ago which is relevant to the nations and old civilizations like Babylonia, Egyptians, Chinese, Greece, and Romanian. In that age cartography was operated for the sake of trading, military, and tax. The oldest map that has been found is a Babylonia map which was drawing on clay that dates back to 4500bc. That is a broaden map that had been got from Jarsur city which is located in 300m north of Babylon City (Sathya 1997). But as a science and its usage in geography and diverting into geographical researches it dates back to the first usage of this terms and being a part of science that the first person explored geography term was Eratosthenes (Suhaune 2002). He was able to approximately measure earth perimeter which was a map design matter. Then his book was published under the name of Ptolemy, geography (Al-Sandry 2002). that concentrated on map and map design as a result had a tremendous impact on geography and its development. Until that time no one could design maps like Ptolemy did (Look Figure 4.1). Preston James added, “The most significant participation of geography in scientific ways is mapping that caused of distributions, differences, comparisons, and demonstrating all of the complexions” (Alkhir 2002). The German geographer Max Echert has defined cartography and said that cartography is a mixture of science and art (Abdul Karim 1996) On the other hand (I.C.A), International Cartographical Association, proved multilingual definition for technical terms which was got a broader definition and quoted, “ Cartography is art, science, and technology to derive map and exploration as a scientific document or an art work. This union attained that cartography as a definition is different from map which is art, science and technology to a scientific certification or an art work (AbdulKarim 1996).

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Figure 4.1. World map by Ptolemy

In the Middle Ages geography had stuck especially in European countries that had a bad influential on geography science and cartography. Even it cannot be seen any changes in map design compare to the last ages because in Middle Age church overcame society and they only focus on spreading Christianity among people through maps. What was common in geography on that age was so mismatched with other ages. They had designed maps in rectangular shape while in Romanian and Greek times they designed circular shape (AbuRazi 1998). At the same time in Islamic territories map design stepped very well because of some theoretical reasons that made the authority cares about geography to fulfill its management. As we see that the translational movements of translating geographical matters from European languages to Arabic language got starting. This complexity made some geographers that actually they wrote historical and social matters beside of geography, to be announced because of their curiosity of mapping in their writings, like Khwarizmi, Masudi, and Hawq al-Idris that had got a great cartography movement in their writings (Sathya 1997).

Renaissance Age is the age of a tremendous progress of geographical matters especially map, it became the topic of the researches because maps led to carve maps and paved the ground to the cartography. Phramay Map was designed in 1477s is counted as the separator between middle ages and the followed ages because it included most of the characteristics of the various maps with less changes (AbuRazi 1998). The facial of these age's maps are changeable in one researches to another that is because of arising that geographical movement for discovering various purposes. So we can perceive lots of cartography schools around the world and more especially in European countries, at the late of seventeenth and eighteenth century mapping got an amazing step toward in geographical experimentations. For instance, London's maps that was published by France J. Rock between 1734 to 1762s held lots of information and data with accuracy in art work compare to previous maps (AbuRazi 1998). Therefore cartography went on to illustrate geographical matters related to industrial revolution and arising verities of technology became an instrument to push cartography toward a better future.

Generally in twenty century and more especially in the late of the age, there was a wide usage of maps because of increasing information in the fields. The researchers believed that these data in need with gathering, separating, and saving; in order to fulfil these three

steps they had to have a system to acknowledging the real and dependable data then utilizing them particularly those that had a relevancy with archaeology; thus, they could have a plan to take another step forward.

The plan needed a developed system and lots of effort to achieve. As a result in 1964 a system was found in Canada that called Geographical Information System, (GIS), which was a dependable system to the geographical cases in the way of exploring and prudence of the obtained data then digitalizing the data or changing to numeral data that might be easier to be shown on maps and etc (Al-Dalimy 2006). Geographical Information System was one of those systems that geography science and even other science got advantageous of it because its usage is easy and also timekeeping. GIS has a good accuracy and adaptable with new information. It can hold lots of information and maps together with predicting the coming events. All of these features that GIS holds enriched geography subjectively and theoretically (Al-Zaidy 2007).

The system's scientific and abbreviation term is "GIS" that consists of:

- 1. System:** it refers to computer technology and relevant programs.
- 2. Information:** it refers to those data that structure the system with managing and organizing it.
- 3. Geography:** It is shown as place in this system that refers to earth and that real world which express the information (Al-Duikate 2007).

As a definition, this is the best proved definition for GIS.

GIS is a completed system that its process includes everything from the gathering, evaluation and processing of source data then saving and resolving the obtained information which depends on axes (X,Y) that tied the places together on earth (Said 2008). Also this system's definition holds much enough relevant things and articles that made it more broaden like, (equipment, program, information, experts and their practical works.) Precisely this system has the capacity of fulfilling three different works:

1. Position exploring widely.
2. Establishing geographical center.
3. Map designing.

GIS is mostly used in the first point, position and exploring widely, but the third one is highly used by organizations and map broadcasting foundations and anyone might use establishing geographical center (Al-Duikate 2008).

In this thesis we are going to use GIS to illustrate cartography.

4.1.2. Map Illustration of Geological Formation

In preparation for geological formation we have to cover about Tectonic System of Kurdistan Iraqi Region that is the same system which is used in Saydsadiq district. Tectonic System of Kurdistan Iraqi Region is a complexed system that vertical and horizontal movements are interlocked. Some long and interrupted system in eastern north and western south direction are influenced Kurdistan Region. Thereafter we have the same impact in north and south with east and west. Those reasons made Tectonic System of Kurdistan structure (Surdashy 199).

In 1958 the famous geologist Dunnington distributed Kurdistan geology into thrust zone, folded zone and unfolded zone. In 1958 Botton separated folded zone depend on geomorphological facets and used high and low folded terms (Al-Rashidy 2005).

In 1987 Iraq had been got a new geological system by Budy and Jassim that divided Iraqi tectonic system to stable shelf, unstable shelf and geosynclinals unit (Surdashy 1999). According to tectonic system formation Kurdistan divided into two parts:

A-Geosyncline

Geosyncline swamps (20) grew at the late of Jurassic era and early of Cretaceous era. The significance of the place belongs to its complexity and convolution that includes African,

Arabic, and Iranian plates. The most influential construction movements of the mountains that impacted the area were (Loramide, Austrian) in Cretaceous era and (Pyrenean, strain) in Triassic period (Siab et al. 1982).

B. Undulate Unstable Area

Undulate unstable area is between geosyncline swamp and undulate stable area. It has been called undulate unstable area because it is part of African undulate plate that taken a part of African crust movements in middle age. The sedimentary rocks deepen down to (8-14km) the sediment crust was so thick. The column of the layers were not interrupted and separated by Mallas sediment (Buday 1987).

Mallas are sediments in the ditches and shallows that come together by the continuous movements of mountains. A high ratio of quartz is abundant in these sediment rocks with round and pure molecular; the same of the sediments of the red layers in Swiss and Farsi that consist of conglomerate. According to Buddy classification in 1987 Saydsadiq district located in semi-mountainous of high folded zone and in the undulate unstable area at the level of Iraqi Kurdistan Region of topography.

Many and various natural phenomena on earth are counted as natural geographical basis. (Amin 1985). Kurdistan Region mainly was part of the Gndualand continent in Paleozoic century which was like a large pool covered by water; this pool's water was belongs to the Tishtsh sea. (Jasim and Alamre 1987). At that time several layers of calcareous slate rocks and mallases had subsided that came by the floods from north and western north that comes above the plains (Khasback 1973).The age of geology (Ayocin 35 million years ago) had a tremendous stage of the area's formation. In that period, a great technical movement had its stress on the sandy layers (tish) that caused of curvy mountains. This movement was called "Alby"; the tectonic movements easily can be noticed at the range of curvy mountains on eastern of Turkey and western of Iran. This tectonic movement had less influence on the north of Iraq and Kurdistan region (Khasback 1972).

Geological Formation of Saydsadiq

In Saydsadiq land numbers of formations have appeared; they have much distinctions in the case of age, formation, and distribution. The geological age of the area dates back to the second geological periods of Jurassic century till the end of fourth geological period. Formation instances of (Ballambo, Gara, Comitan, Pillasy, Sicanin, Sarky, Tanjaro, and Shirash) mountains that belongs to second period with new sediment formation that includes old sea sediments and the sediments of those rivers that consists of sand and sedimentary rocks which covered Sharazur plain. Also we have some new sediment that belongs to the fourth period. That widely formatted the area's plain and Sharazurs'. For instant, (various sediment and the flood rivers sediment) th geological formations were illustrated. In case of a better understanding of geological formation of the area we are going to explain from early to late periods.

Medieval formations (second)

This period includes several geological formations; their sunken ages date back to medieval geological period, more particularly to Cretaceous age. The components are:

1. Ballambo Formation

This formation sets up the widest area of Saydsadiq components which is (341, 58 Km²) especially in the north and Serochik sub-district. In way that ranged at the end of Garra Mountain and then widely stretch. A small part of its formation goes along northeast at the other side of Garra Mountain that Gwezakwere Village stays in the same geological formation. Thereafter, the formation goes along west and east of south. In the east we have Chinaray Bask and Syanzar villages and in the west we have Kazhaw, Mayawa, and Garmadara villages. Lastly, ranges in the south toward the valleys and hills above Bnajut, Kani Spika, and Main Doll villages. Finally, this component blends with the flood river components at the slopes and valleys of the area, as it was shown in figure 4.2.

Ballambo formation dates back to the High Jurassic age and Low Cretaceous age, its thickness is approximately (700 m) and the formation consists of two layers: Lower Ballambo: The age of this form dates back to the Low Cretaceous age, in way that in its

layers you can find out blue Jerry, red Marrilly, and black Shells rock layers. The deeps is nearly (300 m) (Budy 1980).

Higher Ballambo: This one backs to high Cretaceous age, which consists of Limestone and Klobojerny rock layers with (700m) depth. This layer appears in the mountainous layers. This formation fills with rocky, radiolarian, and ammonite slopes. The capacity of these layers is weak to hold water but at the time of having fissure it causes of boosting underground water up (Muhammad 2009).

2. Garra Mountain Formation

The age of this form dates back to the Medieval and Early Jurassic age. The form consists of thin slates like (Calcareous Jerry and Shelly Calcareous) with (20-300) m thickness (Budy 1980). This form in Saydsadiq located in the north beyond Sarochik sub-district. That formatted a range of mountains like Kazhaw, Shoke, Basik, Hundren, and Kani Golik. Garra formation area that formed Saydsadiq geology is (84, 65 km²).

3. Comitan Formation

This form consists of a tiny layer of Jerry, Marril, and Swan rocks with a layer of solid limestone that formed with iron oxide (Fe₂O₃) which is a filtered formation (Al-Jabary 2014). the age of this form dates back to Higher Cretaceous that was formatted from thin, solid, grey layers of limestone. Its thickness is 110 m (Al-Jbury 1991). It has a tremendous ability of holding underground water (Muhammad 2014). this form with (20, 92 km²) area takes a large part of Saydsadiq geological structure which ranges at the west of the area.

4. Jurcs and Pillas Formation

Jurcs formation consists of red muddy rocks and sandy, shell, and salt rocks but Pillas formation consists of white dolomite limestone in the beneath and chalky limestone from above with a layer of Marley Calcareous. Jurcs formation has a layer that does not percolate while Pillas formation is cleft and comes beneath of Jurcs formation (Al-

Rashidy 2005). the thickness is around 100-200 m (Siyab et al. 1982). Jurcs and Pillas formation come between Ballambo formation and rivers sediment in the east of Saydsadiq. The area is approximately (41, 60 km²) Kewles, Perhero, and Jwala villages stay in this form.

5. Cicanian and Sarky Formation

This form is cleft and reduces groundwater in the contrary underground water is recharging. The bottom part consists of dolomite rocks and the top parts consist of Jerry dolomite rocks. It has a dark grey color with 100 m (Aziz 2007). Correspondingly Sarky formation is the same of Cicanian which is cleft with 200 m thickness. The bottom part is a soft tiny calcareous limestone with Swan rock that is 122 m, The higher part that starts from thick medieval part consists of Jerry stone and involves with the grey layers with 118 m (Al-Niqash 1985). Cicanian and Sarky formation structured a small part of Saydsadiq area which is around (11, 86 km²). It locates between Pillas form in the east of the studying area near Ashktan village. Slightly appears in the north of Saydsadiq.

6. Tanjaro and Sherash Formation

Tanjaro formation is the sediment of Cretaceous age; there are numbers of curves in the plates and cracks as a result of earthquakes and ground movements. The stone layers are generally has a green color and in some places they are grey (Sabir 2006). As a result of solid formations in its layers it lost its cleft feature, also it takes a part of increasing transparent groundwater (Al-Jabary 2014).

a. Sheransh Formation: this form's age dates back to the top part of Cretaceous age while the bottom parts consist of thin limestone layers and Marely limestone. The higher ones made up of thin light blue Marely. Its thickness is changeable according to the sediment movements, but generally it is around 100-400 m (AbdulRahman 2008). It is not a proper layer to accumulate under groundwater because the layers formed with weak layers of stones (Muhammad 2009). The formation ranged in a parallel in the northwest of the district toward south till reaches the sediment that made up by the floods. The form

ended around Kanipanka village. The area of this form is not too long, it is around (27, 25 km²).

b. Fourth Period Formation

The age of this formation dates back to Pleistocene and Holocene which formed from rivers sediment, sand, and mud. The sediment of this formation is the newest form of Al-sulaymaniah geological formation, We can see the form beneath the mountains, valleys, and plains of Saydsadiq district, It covered a large part of Saydsadiq area (Surdashi 1999). that made steep rivers and tidy plains (Al-Manmi 2008). These sediments were made by conveying from the high place toward the plains and valleys. This conveys happens because of the earth gravity and portable water by floods therefor the sediment has Excellency in saving water (Al-Akrad 1972).

The sediment of this area has formatted a third of Iraqi land. That happens because of climate changes and its distinctions from one place to another. They were gathered with the passing of time by erosion especially in the mountainous places (Budy 1980). This form is counted as a good water container. It has its significance in Iraq after calcareous formations (Al-Akrad 1972). The fourth period sediment area is about (179, 9 km²), all of the sediment of this form located in southeast and west of Saydsadiq district. When we look at the figure 4.2. we can perceive that this form divided into two part.

1. Various Formations

The history of various formations dates back to Pleistocene (Siab et al. 1982). this sediment can be found in steep and wavy plains, also it has various kinds and it is changeable according to the sources and distances. Generally, it was formed by sand, mud, and iron, a mixture of the all, Local Stones, broken rocks and soft ones. The thickness is changeable and usually it is not less than 1m But in some areas the thickness can be (1-10 m) (Amin 2015). especially the agricultural plains (Al-Bany 2010).

This sediment has randomly gathered, the thickness of its layers is related to that age's topography. This kind of sediment located in south of Saydsadiq and in the center plains

of the district ranged to the east, south, and finally to the west which covered all the plains of Sharazur. As a result of the raining water and rivers the sediment slowly comes down to the flat lands. In that case the water threw its load at the after the mountainous places like those sediments that made by the floods when the rivers come out from steep curves. They have got various sizes which the tough stones and gibbers settle at the top. As far as we go away from mountainous places toward the plains the sediments are going to be smaller. It is worth mentioning that the formation has its significance in geographical divisions. If we look at geological part of figure 4.2. we can perceive that Saydsadiq center located on this formation; it shows the importance of this form for the area especially the agricultural plains that are already on this formations. The area is 80, 54 km² which formed all the plains in the south, southeast and southwest of Saydsadiq.

2. Steep Rivers Sediments

This sediment consists of split materials with distinguish sizes. The thickness is changing according to the area. These sediments have got many cracks that leak easily and this caused of saving underground water (Al-Mahin 1985). the age of this formation dates back to Pleistocene age which covered various places in Kurdistan particularly the low areas and shore plains of the rivers and seas. These sediments have mostly sunk by wind and water erosion. They include sand, mud, gibbers, and stones. The pellets are very small, they sank horizontally and this proves that they haven't got any earthquake or earth movements. It is difficult to know its thickness because they are changing from place to place (Al-Nabawy 2002). so it can be said that is around (0.5- 3 m) (Al-Tamimi 2007).

The rivers sediments are those ones which coming down from the top of the mountains and high places to the beneath and gathered upon one another. The main reason of their rolling is earth gravity and some various reasons like (sloppy, water movements, weather, the green lands, and earthquake.) so the sediments of the beneath of the mountains are developing through curved areas. Then the other matters at the sides coming across by the groundwater that leads to the center and takes a part of the steep river sediments (Majid 2015). The steep river sediments located beneath and side of the mountains between Ballambo formation in the mountainous places and various formations in the flat lands. We can find this formation in the soil of (Totaqaj, Barkawran, and Ushquba) villages that

ranged into two different ways which are southeast and Sharazur plain. In the west it ranged at the side of mountains and sloppy places with semi-mountainous and hills that includes (Kachaly, Paryaro, Maindoll, Kanispika, and Greza) villages. The area of this sediment in the Saydsadiq district equals to (95, 36 km²) Look at figure 4.2.

Table 4.1. vertical formation of Saydsadiq Geology

Thickness (m)	Rock Type	Formation	Age		Period
In 1 meter	Silt - Mud - Sand- Ozzing land	Flood land sediment	Holocen	New	Fourth
		Various Sediment			
3 - 0.5	Stone - Sand - Silt – Mud	Steep Rivers	Pleistocene		
200	Sandy rock, Silt Shelt, Marrel,	Tanjaro	High Crestaceous		Medieval
225	Light blue calcareous marrel	Shiransh			
110	Layery grey calcareous	Komitan			
700	Green marel with blue stone –black Shell	Ballambo	Low Crestaceous		
200-300	Thin flexible slate and sherly	Garra Mountain	High Jurassy		
300	Dolmity	Pillas			
100-200	Silt and blue Maly	Jurcs			
200	Flexible stone and Dolmity	Sarku	Low Jurassy		
180	Black and flexible Dolmity	Seknain			

Table 4.2. the geological area of Saydsadiq and its ratio according to the district area

Geological Formation	Area by Km ²	Area Ratio%
Garra Mountain	84.65	12
Recent alüvyal	80.54	11,4
River Terraces	95.36	13,5
Pilaspi	41.60	5,9
Tanjero Fn	27.25	3,9
Sehkanian Fn	13.63	2,0
Kometan Fn	20.92	3,0
Balanbu Fn	341.60	48, 4
Average	705, 55	% 100

4.1.3. Map Topography Illustration by GIS

When one is going to explain any nation's topography it consists of inner and outer factors. The mountains formation related to the rising and falling of earth plates. The plains were made by the spirals of earth plates that were going to fill by the rivers and valleys sediment. Kurdistan Topography is distinguishing from one place to another (Khasback 1973). Tracking down of the topography and earth plates in case of formation, geographical division, height, and its formation and influence are one of the basic works of natural geography science. Rising and falling of earth is a phenomenon that human being hadn't taken apart of it. It is a natural phenomenon that is changing according to tectonic movements, curves, earth cracking, erosion, subsiding, and rising and falling all of them has a great impact on various environments.

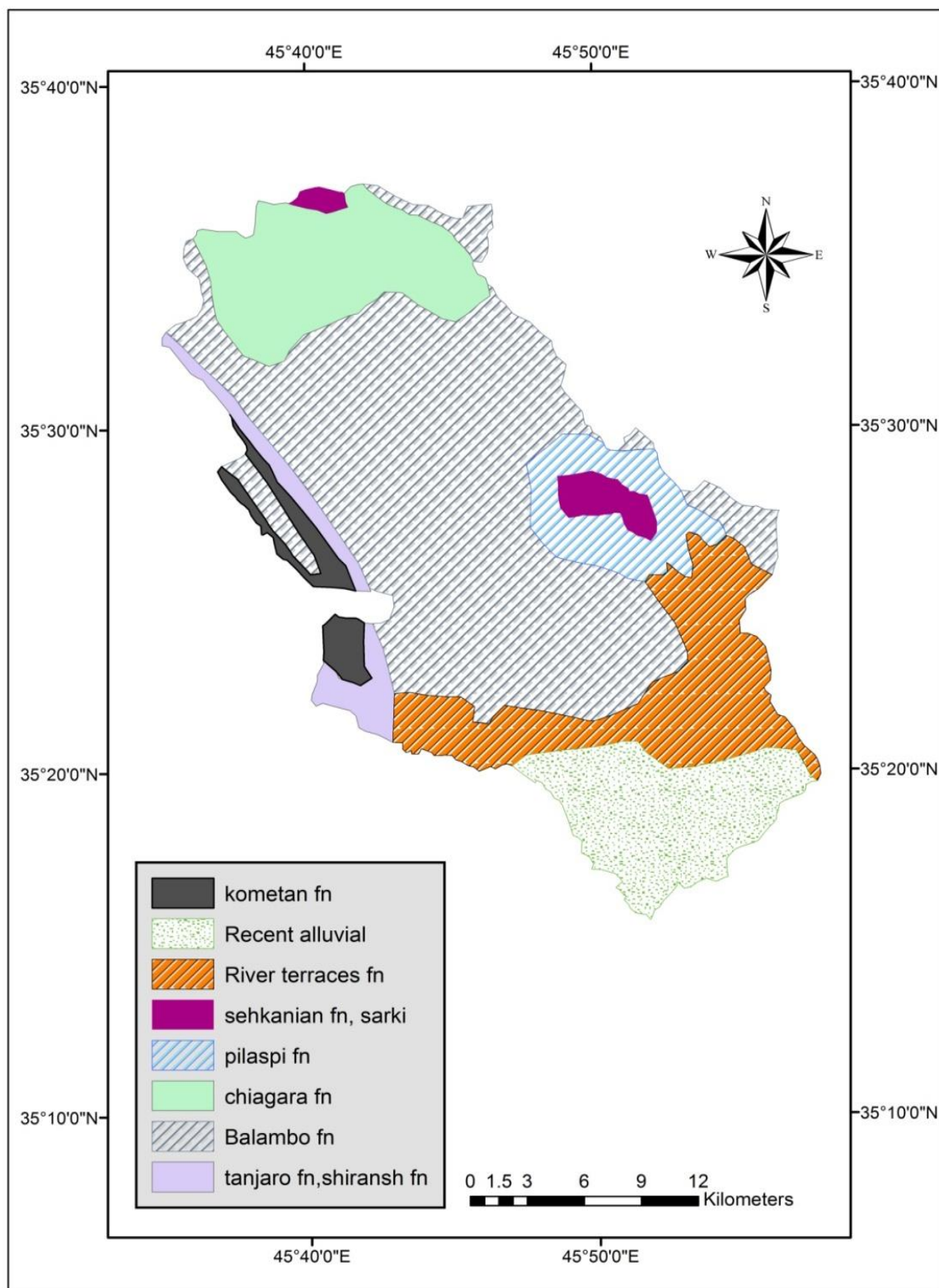


Figure 4.2. Geological Formation of Saydsadiq

The area of the research is shared between south, Sharazur plain and high mountains in the north. According to elevation, Saydsadiq located between the highest points which is (2157 m) from the top of Kazhra mountain in the north of Saydsadiq behind Sarochik sub-district. The lowest part is in the south of the district between Dolash village and Darbanikhan Lake which is (444 m). Until we go down toward south, southeast and north and northeast and northwest we face a great change in elevation. That elevation has a great impact on the area's climate change. See figure 4.3. The whole area of the district is (705 km²) that divided among four different topographical formations:

First/ Mountainous Area

Mountainous area is that topographical shapes that got a high local sloppiness (Hama 2008). This area has got a higher elevation than the other surrounding places. It can be identified by some distinct features like having apex with more than (1000 m) at that time can be called mountain. Also they have got enough sloppiness and various formations which arose because of various reasons. Generally, the mountainous places according to their complexity and height were divided into two parts.

A. High Mountain Areas

This area's mountains are high with (1500-3500) m (Omar 1999). Most of the mountains of the area have got a spiral and tough shape. They also got many cracks and huge refractions. Tectonically they come between (Myogeo and Sankline) in Balmir frame of Tanjaro (Budy 1980). Rain pouring and the area's sloppiness shape made weeping easier and fast. Their cascades are deep and sloppiness (Al-Salihy 1988) Their apexes got a thin layer of soil with having oak trees from beneath (Omar 1999).

The high mountainous area located in the north and northwest of the Sarochk sub-district. The mountains are high and steep mountains. The sides are sloppiness that made long deep valleys with long range. Despite of all we have got some rocky slates like calcareous ones that got weeping because of snow fall. So the peaks are treeless and wasteland. Examples of high mountains in the researching area like:

1. Korakazhaw Mountain: The highest mountain in Saydsadiq is Korakazhaw with 2100 m elevation. It is one of the huge mountains that located in north of Sarochk sub-district. In the east beneath we have Barqalla villages in the north it is opposite of Haji Mamand mountain. In the west there are Kani Goll and Handren villages. On the side of this mountain there are oak and terebinth trees.

2. Sarcook Mountain : Sarcook located in the end of a range of mountains in the north of Saydsadiq. It is one of the highest mountains of the area because of its sloppy and steep sides it cannot get any benefit. Terebinth tree and oak covered a large part of the mountain. The elevation of the mountain is more than 1800 m. In the east there are Gwezakwera village and beneath it ranged with Haji Mamand village, it looks over Sharbazher district.

3. Gorra Julaka Mountain : The elevation is 1600 m that located in the northeast of the researching area. Opposite of Sarcook Mountain and in the east of Gorra Jullaka there is Gweza Kwera village.

4. Qula Rash Mountain: It comes between Bioc and Chinaray Bask villages. There is Kotir Marra village in the south but in the north there is Gorra Julaka Mountain. The elevation of the mountain is 1500 m.

These mountains have been counted as the most important tourist centre in the area because of its climate and having various places like (caves, waterfalls, wild animals, pouring, spring water resources that mostly made by snow fall, and etc.) beside of these phenomenon there are various climate phenomenon like valley and mountain's breezing. These phenomenons are great reasons to extract tourists to the area particularly in those seasons that temperature got a high rate.

b. Low Mountains

These mountains are identified by its less reaction to the earth movements. Most of the spirals are simple despite the impact of weeping and falling apart (AL-Khatab 1998). They have got a parallel range in the northeast and southeast of Saydsadiq. There are

some sloppy spiral deep valleys between them. In contrary of the previous are this area is more flexible for accommodation and agriculture.

Simple Spiral Mountains The low mountains located between high mountains in the north of mountainous areas and south of Saydsadiq like Qawila Castle and Laklak Mountain. generally their elevation is 100-1500 m. Some of them have got numbers of places that used as accommodations by the population because of their suitability like Saydsadiq Mountain. Also we have Ashblax Mountain that ranged from Saydsadiq toward north of the district behind Kelakawa and Kachali villages then toward north again till Pary Hero and Ahmed Birna mountain opposite of Gullan village. In the west of this mountain there are Barde Rash, Main Doll, and Kani Spike villages. Most of the people have been farming because of the portability of the land for agriculture and farming; they use the mountains sides as a good farm.

C. Valleys

Generally, valley got a narrow and steep shape in both sides of the high surrounding place. It isn't a condition that the beneath part of the valleys is too deep to nearly around sea level. Some valleys have got thousand meters elevation. Some of them lower than that (Qadir 2013). The valleys have got a square shape between the range of the mountains that covered by a thick layer of soil (Hama 2008). These valleys widen at the end of the beneath of the mountains (Maaruf 2014). According to the Saydsadiq valleys we have some that distinguish the mountains that usually long narrow and deep valleys which haven't any agricultural usage. Sometimes there is some stream or rivers passing through these valleys. Also the valleys are the reasons beyond the geomorphological like caves, small water falls, springs, and falling large rocks on the side of the high places. In chapter three we generally talk about valleys with season streams. The valleys areas are counted as a part of the mountainous places because they have already coming between the mountains.

Second: Semi-Mountainous Zone

This zone has got 561-871 m elevation as it is counted as a bridge between hills and higher places. It means that you can find out the hill's features in this zone at the same time there is semi-mountainous scene (Muhammad 1986). The wars between Iran and Arabic countries slightly had its impact on the zone. This zone located between Sharazur plain in the south and mountainous places at the north of Saydsadiq. When we get nearer from south to north we will find ourselves among the high spiral mountains. The natural features of this area made the zone to be a good water container and less looser compare to other zones. Also the rivers, streams, and lakes are pouring to this zone. This feature enriches the zone with underground water. As a result of the various erosion from mountainous and semi-mountainous areas, the zone enriches with more organic matters that made fertile plains like Sharazur.

Third: Plain Zone

The plains are those lands which is flat and has got a lower elevation and lower than the hills also. These plains had been made by various reasons like erosion, subsiding and etc. they also know by their wide with less high places. They are the most significance zone in economical and settling (Ahmed 2013). the most important plains are:

A. Sharazur Plain

It is the widest plain in the mountainous zone which located in the south of the mountainous zones (Muhammad 2009). The average length is 45 km² with 10-25 km² width. The area is 675k² (Rashid 2011). the elevation is 450-600 m (Darwesh 2008) some of the scientists believe that Sharazur has got a concave shape while others believe it is a convex one that later on filled with the rivers materials. Most of the areas from Sharazur Zone have a good water filter system because of having imprecise; the filter is a developed one, at the same time the zone's land formation obtains a large amount of water in all of the three rainy seasons (autumn, winter, and spring). Also Sharazur plain has a fertile land that enrich with metallic organs because of gathering a large amount of

the rivers sediments that came from high places and mountains (Sand-silt-clay Gravel) (Ghafur 2012).

These plains were surrounded by Hawraman, Swren, Ballambo, and Nrwe mountains at the east and southeast. Barzinje and Goizha at the north and northwest. It links to the Sulemani plain in the west so some people believe that Sulemani plain is part of Sharazur plain. It has a significance role to Saydsadiq because it contains (38%) of the districts land (Al-Mawlewy 2008). After Darbandikhan dam some of the parts of the plain were covered by water in the south which is around 110, 000 donum (Reseacher 2017).

b. Zelim Plain

This plain has the second position after Sharazur. It located at the north of the district near of Sarochik sub-district. The area is 13 thousand donum the border of this plain is Morias village in the southeast and Mayawa village in the west and Zindane kometir in the east with Sarochik sub-district in the north of Saydsadiq and Kazhaw and Gellere in the northwest. The elevation is around 1000-1200 m (Reseacher 2017). so it locates in the rainy zones that the average rain yearly near (600 m) which made the plain to be appropriate for dry farming especially melon.

Fourth: Hills

The hills zone located beneath the mountains and departed areas. The hills don't have a right direction but they got various shapes. They are actually hills with all of the mountain's features. The differences with mountains are not formed in chain. (Maarf 2014). Saydsadiq district as a topographical place has got some hills that made up by erosion, subsiding, and gathering the matters. Like (Tasluje, Sharif, Tapa Rash, Seraw, and some other hills.) There were some historical hills that made up as a defense at the time of war like (Soilamish, Karem, Qainja, Naw girdan, and Qolabo hills).

Qolabo Hill: Qolabo hill is an ancient place that located in Saray Subhan Agha. It looks like a resting area. Also it has been known that the name (Qalabo) relates to the Islamic age. There is a graveyard which is known as (Ashaba Drezh). It is a resting and

dependable place of all Islamic wars and also it was a resting place at the time of Islamic age. Despite of all these hills used as a road of trading between Iraq and Iran.

In 1627s which equals to (1056 Kurdish year) the area was owned by King Subhan Suleman Sware Bilbas. King Swara had a brother, Bayazid, that may the valley which called Bayazid Agha is the same name (Ahmed 2001). Qolabo Hill is a sloppy hill with 520 m elevation with 20-50 m width at the top. In the late years after Kurdish uprising of 1991 when the soil had been taken to another area they found out some human sculptures with (45 kg) which was like a girl with one hand that made of Mafraq matter. Unfortunately, the sculpture has been sold lately and taken abroad (Darbaz 2009). Finally, we can identify the most importance features and formation of Saydsadiq soil according to the followings:

First: Saydsadiq land has got variety of distinction from one place to another in its elevation, formation, and etc. For instance, Sharazur is the lowest elevation with (500m) in the south of the district; this elevation rose up to (2200m) from the top of the highest mountains like Krakazhaw, Baraw, and Shoke in the north. Also Saydsadiq got a parallel shape from north and north east toward west and south.

Second: In the semi-mountainous zones there are many flexible areas which is influenced by the natural causes and made some passing water streams like Kewlese stream which now planning to construct Kewlese dam.

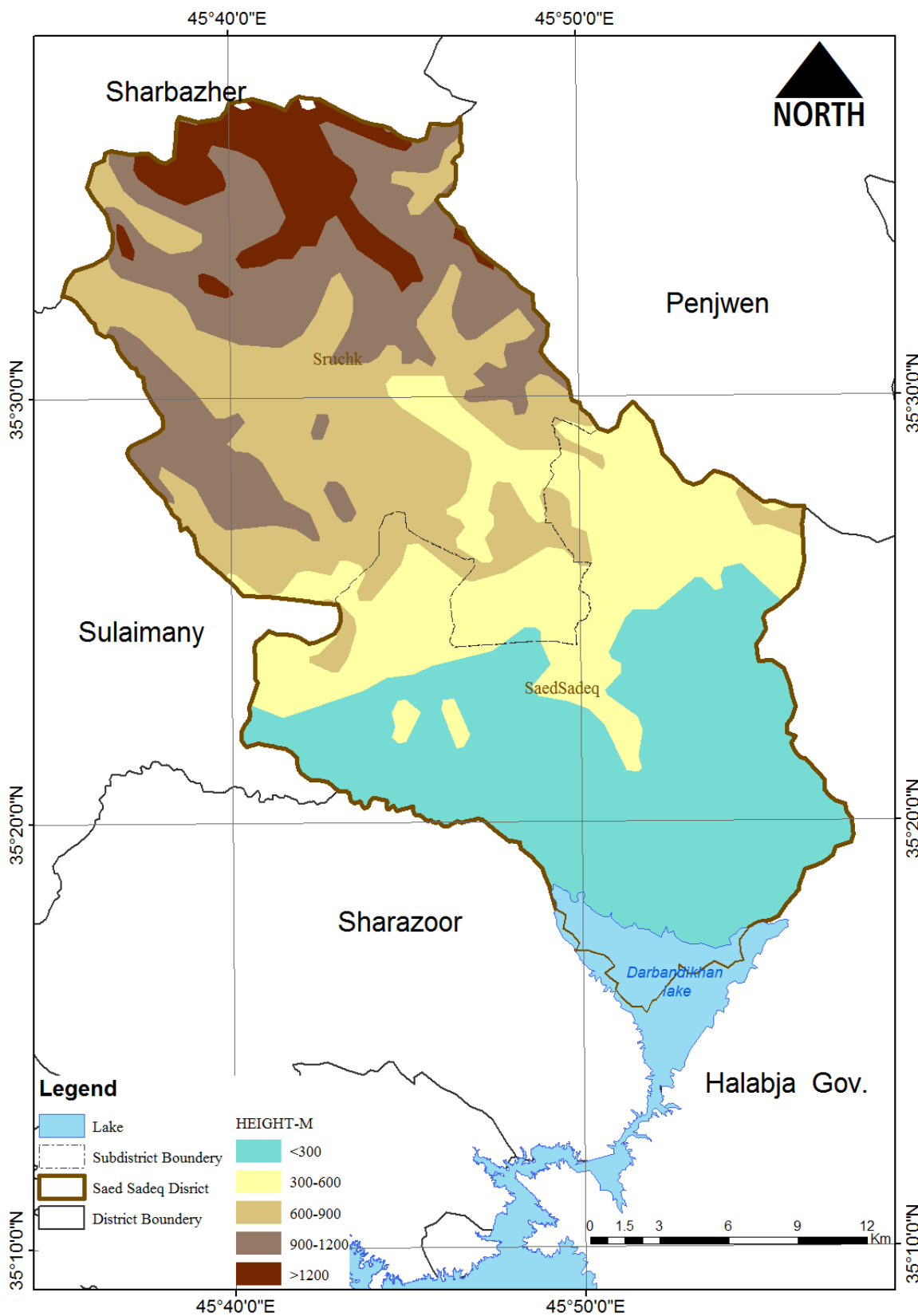


Figure 4.3. Saydsadiq Topograph

Table 4.3. Some Hills and Mountains of Saydsadiq

Latitude	Logitude	Hieght	Hills and Mountains	No
35.296102	45.85829	470	Soilemish Hill	1
35.339073°	45.756417°	505	Tami Kerem Hill	2
35.361609°	45.854448°	520	Qalabo Hill	3
35.20.356	45.53.503	522	Nawgrdan Hill	4
35.356641°	45.770473	570	Mwan Hill	5
35.42.747	45.22.711	575	Kani Panke Hill	6
35.356036°	45.878957°	626	Saydsadiq mountain	7
35.361609°	45.854448°	670	Ashblakh Mountain	8
35.434436°	45.732697°	1030	Shere Bre Mountain	9
35.423949°	45.714131°	1050	Hanjire Mountain	10
35.467565°	45.775989°	1050	Qauila Mountain	11
35.458314	45.718986°	1276	Morias Mountain	12
35.479633°	45.644649°	1435	Mayawa Mountain	13
35.542825°	45.784080°	1500	Zilzile Mountain	14
35.565011°	45.686232°	1650	Srochik Mountain	15
35.551782°	45.750535°	1690	Chinare Mountain	16
35.545537	45.654960°	1715	Gelere Mountain	17
35.565103°	45.73248	1740	Basik Mountain	18
35.613875°	45.720880°	1745	Haji Mamend Mountain	19
35.594288°	45.631033°	1912	Kani Gull Mountain	20
35.593314°	45.639963°	2000	Shoke Mountain	21
35.610561°	45.668298°	2071	Baraw Mountain	22
35.585260°	45.706916°	2150	Kazhaw Mountain	23

Despite all of what was covered, Saydsadiq has got some other topographical features that have a direct influence on the residents and their activities. So we are going to point out those features by ArcGIS10.3 with digital DEM. The features of DEM to solve the digital files of interpolate are:

Slope:

Slope means earth curve from equator or that curve which tied two different lines in the high zones. Sometimes they have the same level in the flat lands. Slope found out by degree, percent, or Relief ratio (Muhammad 2015). Dealing with slopes in any area has its significance because it influences on geomorphology and river valleys shapes with a great relation to the erosion matters. Also has its impact on human beings life, earth shape, and roads and water-courses (Palany 2003). It demonstrates earth ratio slope that helps different activities like constructing airport that needs (%1) slope. Railroad that needs (%2), (8%) slope is a good one to accommodation. The agricultural materials need (%15) (Muhammad 2009). If a slope equals to (%30) so it equals to (16.7) degrees or (300 m/s). If the slope ratio equals to (50%) so it is (26.6) degrees that equals to (500 m/s) (Amin 2014).

We can measure slope by two different ways: First is one which is common to the researchers of geomorphology; it is a grading ones. Second, it is a successful way to the engineers of roads, bridges, and irrigation. It measures through angles or high alternatives around (100 m) in length (Ali 2013). Also it illustrated Figuer.5. that the research area has mountain and plain topography. The slope is different form one place to another. ArcGIS10.3 is a proper program for this work in both of the ways, ratio and grading. The highest degree is (54.4-0) and the lowest is (3.4-0). It proves the topography of the area. As it can be seen in the map, that the accommodation area located in the flat and low zones. for knowing slope degree and type look Table 4. depending on (DEM30m) file and using (ArcGIS10.3) program by two ways: Degree and Percentage.

Table 4.3. Slope Classification

Slope type	Slope Degree
Erosion cliff	More than 45 ⁰
very steep	30-40
Steep	30-18
moderatly steep	10-5
Moderate	2-5
Level	Less than 2 ⁰

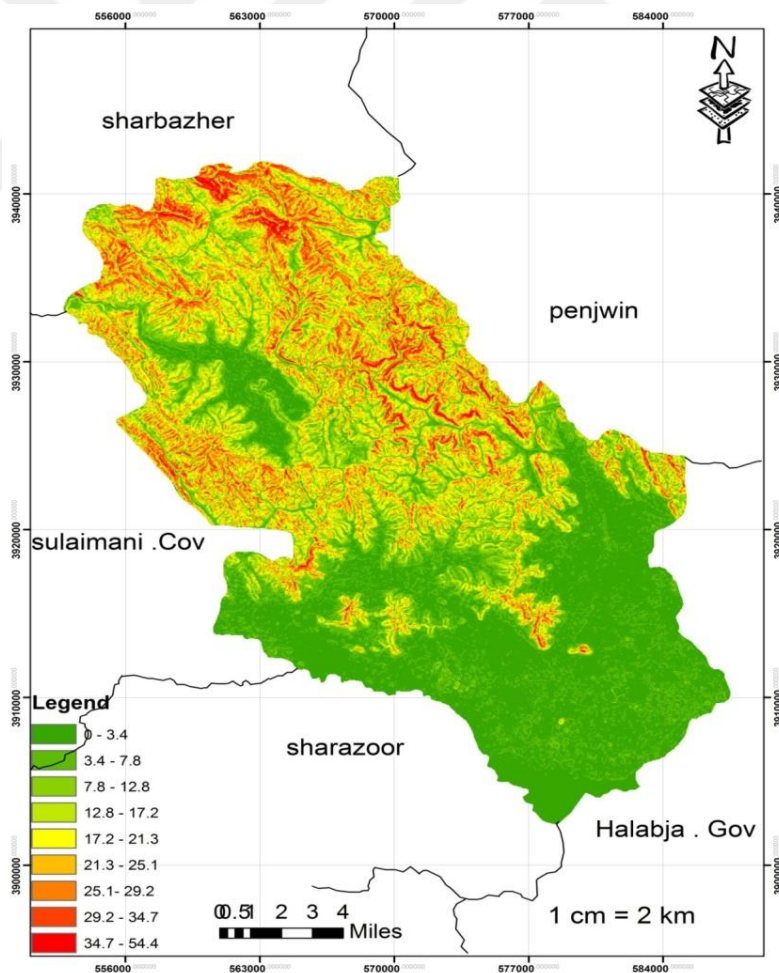


Figure 4.4. Saydsadiq Slope Degree

Aspects

When earth got a slope the sides may also got a distinction geographical directions (north, northeast, and etc.) As a result aspect means the most sloppy areas that leaning toward a direction whether it is north or northeast or others. This phenomenon measured by time's arrow direction; it gets starting from north with 0 degree till ends with a complete circle which is 360 degrees. In this zone number 1- means a flat land and then sloppy areas have important roles in the irrigation projects, dams, and pointing out the best zones of residency. It is as important as in geomorphology (Qadir 2013). If we closely look at figure 4.5. we can perceive that those parts that located in the south of Saydsadiq got (-1) degree. In the contrary, these degrees (240-290) located in the north and northeast. Then the south directions which are 337.5- 360 degrees that can be seen as small spots, each of them takes a part in Saydsadiq land formation.

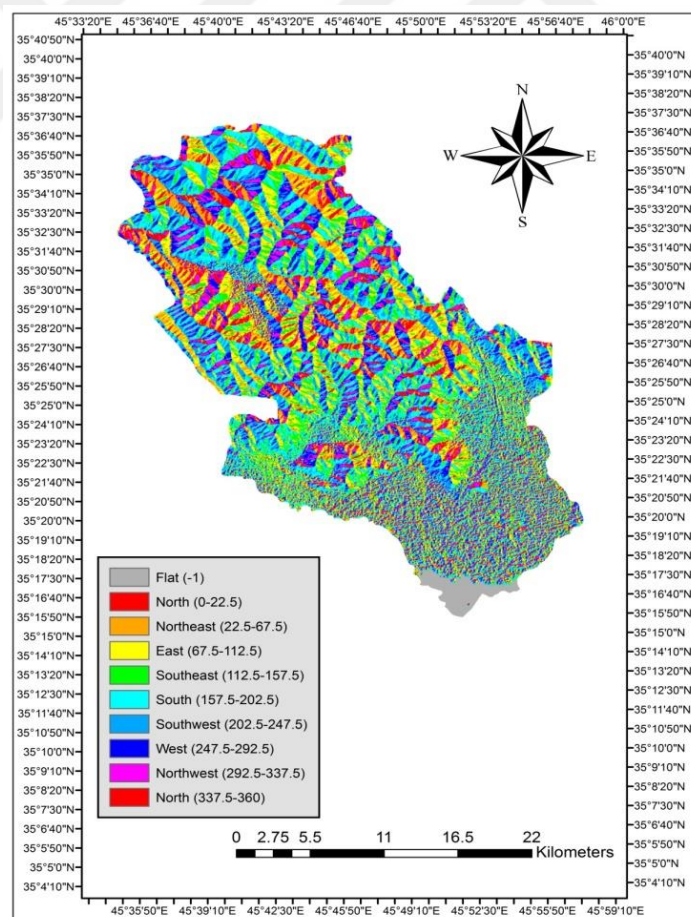


Figure 4.5. Saydsadiq Directions

Earth Shade

This feature has its influence on earth by having values or ray amount for each cell in (Raster) cells. In other words we can say it is sunlight on earth depending on the angles that hit the ground. The process of shading explains by putting down a ray on it or any other light resources on the Raster cells. The colors grading is found by (ArcGIS10.3) program. Light means the ray of sun and its angles between 0-180 degrees which starts from sunrise to sunset. For the sake of having a good result we will measure through time's arrow direction. The means of this process is measuring any cells from cell formations that each of them shows a various zone. Also highlighting these cells that involve another cell's shade. It is already useful for finding good resorts. So one can find out the artificial places which needs sunlight throughout the day (Muhammad 2015). For the sake of getting Hill shade of Saydsadiq through DEM file we got benefit from (Arc GIS) program. To recognize this features from various geographical zones. As it was illustrated in figure.7. Saydsadiq enriches with sunlight with having distinguishes in the parts of the area. There is an influence on sunlight in the north and northeast and northwest because of having enough amounts of high places compare to south and Sharazur zone which lasts long. So we can use the north and northwest to those things that need a little lesser of sunlight with opposite of the south.

Contours line

Contours line map is the most significant useful geographical maps which is part of the topography maps, relief features, and cultural features. It is a practical tool that directly can be depended despite of finding watershed (Qadir 2013). If we look at Figuer.8. we can find contours lines that Saydsadiq got a different earth shape, in a way that the south zone and Sharazur plain near of Darbandikhan lake have got an entire flat and levelled land with starting from (500) m contours line. It has been illustrated from the map that the line goes high toward north. The residency is located between 500-700 contours line. Generally, south is levelled and north and northeast are higher from 500 to 2100 from the top of Kazhaw mountain. It demonstrates 1600 m comparison between the higher zones. Contours line centre of Saydsadiq got 1300 m elevation.

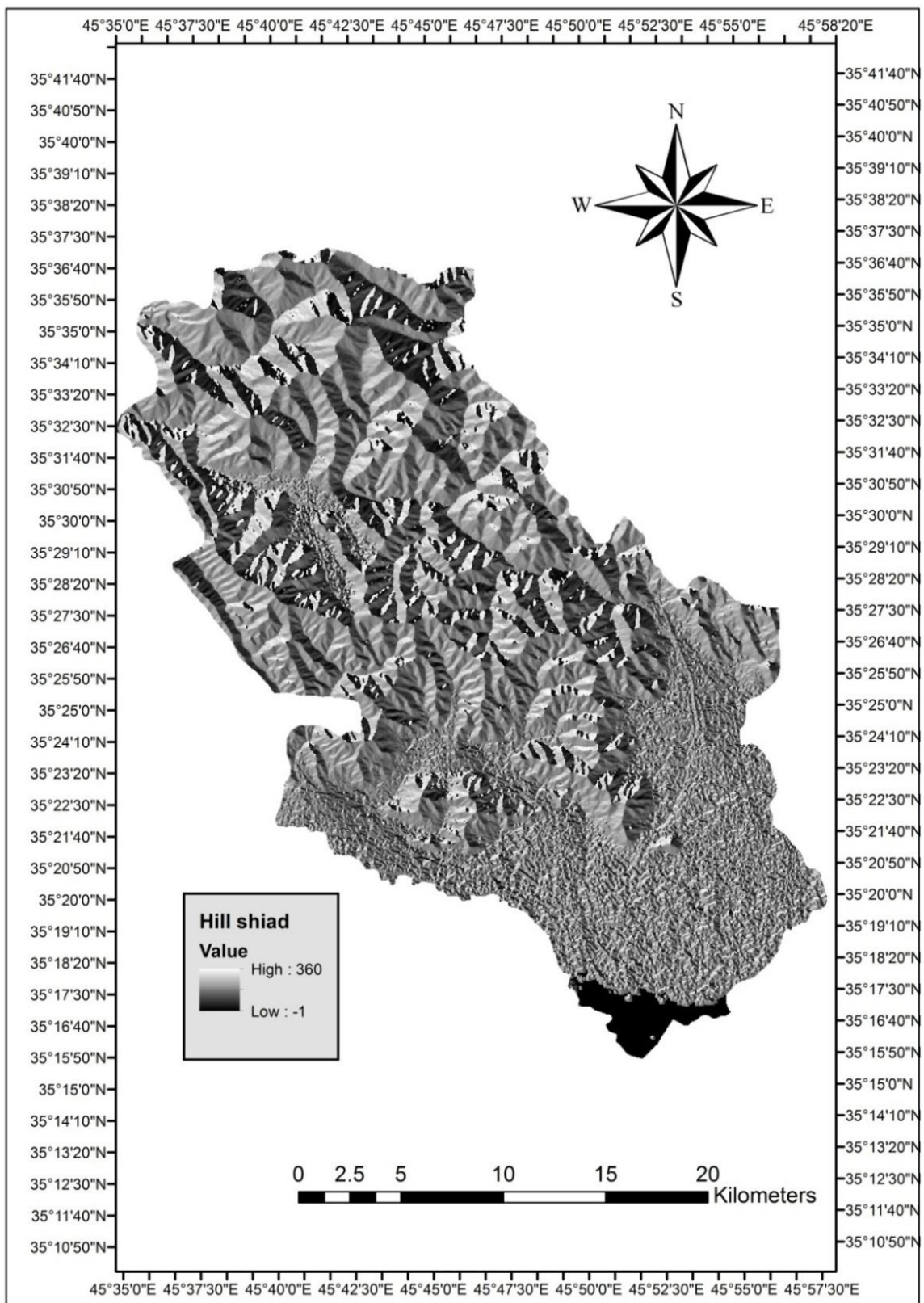


Figure 4.6. Earth Shade in Saydsadiq

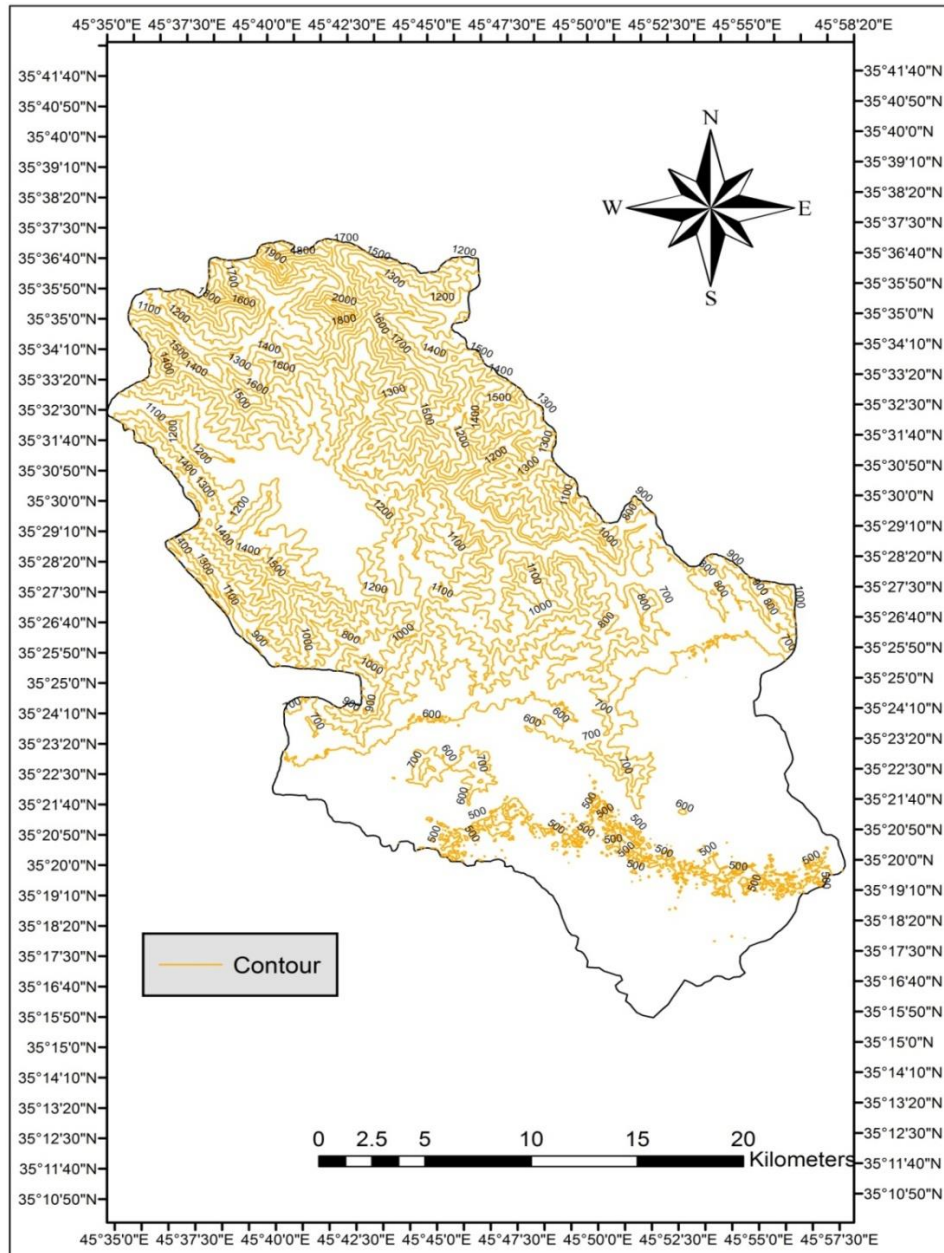


Figure 4.7. Contours line of Saydsadiq

4.2. Cartographic representing of Climate, soil and natural plant by using GIS

Soil is a geographic phenomenon, one of the important natural resources. It has a direct effect on the usage of agricultural lands. It is one of the essential financial resources, that's why it has a great role and has effect on national security, there is a direct relation between land and agriculture. And for this reason most of the scientists especially the

geographers took consideration into partition between land and other geographical phenomenon such as (bascule, climate genus, natural plants and agriculture).

Soil geography is a branch of geography and exploring on soil is an important part of natural geography. Soil is a source gets used and benefits by human beings. Meanwhile it is a part of environmental system, in this way we can represent and examine it like a ring for hanging together between soil and other environmental elements such as climate, rock and biosphere.

Soil is accounted as one of the natural sources that human activities depend on it, because all the various financial activities either its industrial, agricultural, trade or transformational activities, through soil we can conduct these activities.

In the past some of the geographers thought that exploring soil geography is special to compilation and geography distribution of soil.

But I think prespeaking on the reasons, physical and chemical structures and the arrangement of problems and solutions of soil, it is impossible to discuss about science of soil and soil geography in a scientific way. That's why in this part it has been paid attention to identify the physical features and attributes. Concisely discussed on cellulite and construction of soil, sour and alkaline dropping water passing. Through the file of DEM and Arc map 10.3 program the diagram cartography of physical attributes of Saydsadiq was showed and conducted.

4.2.1. Climate

The word climate is driven from 'Klima' a Greek word that means slope or proclivity (Naqishbandy 2007) . Climate is one of the main natural geographic that these cases take place in it (wind and changing of pressure, evaporating and down pouring, etc.) examining the component of natural geography without examining the climate and its species cannot be regarded as a proven serious scientific examination because climate is regarded as one of the most important natural factors that has a direct impact on above ground in terms of category and geographic distribution and plant or animal overly and

diverse of soil and agriculture and human activity throw over from a place to another one.

There is no doubt that (wind, heat and down pouring) are viewed as the most significant species of climate that has direct influence on the life of plants, animals and human beings and the financial activities in the area. So there is no need to talk about each kind of these accurately because Saydsadiq that is poor from data, thus for this reason it is being get used from Halabja meteorology station due to its being the closest station from the examining area. Despite that “Geostatic Analytic” representation could be done and the practical way “Arcmap10.3” using the program of map has being cleared some sorts of Saydsadiq climate for more clearance of the manner of the sorts.

Here we showed the characteristics of the district:

1. The duration of sun appearance

Sun is the main source of the energy used on earth. The dynamic causes of all the natural actions that happens in atmosphere. Climate and life are related to it (Rashid 2011). The amount of sun arrival into the earth ground measured by (Peranometer). This device measured the amount of sun that reaches to earth surface which includes(the direct sun-beam arrival from the sun and the indirect sun-beam arrival from atmosphere. (Naqishbandy 2007). By sun-beam projection we mean the number of hours sun-beam appeared on earth. It can be recorded by special devices, and it has great influence on the whole actions, that appear in the atmosphere such as the confusions in climate, wind, rain, reversion and changes in weather etc. There is a must to say that the amount of sun-beam that reaches sod is not the same in every time and place. This is because of the difference in the sun-beam projection, variety in night and day length, and the cleanliness of air, and the high and low of earth’s surface. The specialty sun-beam examinations in the area of the examination includes the following:

A. Sun-beam projection angle.

b. The length of beam duration (the length of the theoretical day).

c. The length of real sunrise duration.

The quantity of sun-beam

About the quantity of real sun-beam projection in the area will change according to month, season, and year. The sum average in spring reaches 7 hours, in March and April reaches [(6:12) (7) (8:12)] 1-2. The increase of real sun-beam duration projection especially in May is caused by the increase of sun-beam projection angle and the decreasing of cloud rate in the sky of the area. The most high level of sun-beam angle projection is in Summer which its average reaches (10:34) hours. In June, July and August the time of projection reaches (10:30)(10:24) (10:48) hours. The duration abundance of sun-beam projection in this season is caused by the vertical sun-beam on the tropic of cancer north hemisphere. Also the angle of sun-beam projection in this season increase over the area, especially in June as shown in table 5, the lowest rate of quirky angle of sun-beam projection in winter overall reaches (5:14) hours. On December, January and February is like following (5:30) (5:00) (5:12), and this is due to the difference of angle of sun-beam projection and the seemingly motion of sun-beam and the place of Saydsadiq astronomy, as well becoming far from the north hemisphere and becoming close to the south hemisphere of the sun in a way the sun-beam will become vertical on the tropic of Capricorn in this season.

Table 4.4. The average of monthly, seasonal, and yearly of real sun-beam projection duration (hour/minute) in Halabja weather station (2003-2015)

SPRING				SUMMER				AUTUMN				WINTER				YEAR AVER.
MAR	APR	MAY	AVER.	JUN	JUL	AUG	AVER.	SEP	OCT	NOV	AVER.	DEC	JAN	FEB	AVER.	
06:12	07:00	08:12	07:08	10:30	10:24	10:48	10:34	09:18	06:36	05:48	07:14	05:30	05:00	05:12	05:14	07:32

Table 4.5. The length of theoretical day and the sun-beam projection angle in Halabja weather station

MONTHS	Length of theoretical day(hour-minute)	Sun-beam projection angle
MARCH	11:46	52:21:04
APRIL	12:54	64:14:24
MAY	13:51	73:34:12
JUNE	14:19	77:52:48
JULY	14:06	75:57:36
AUGUST	13:17	68:01:12
SEPTEMBER	12:12	52:43:12
OCTOBER	11:04	45:00:30
NOVEMBER	10:07	35:50:24
DECEMBER	09:40	31:44:24
JANUARY	09:55	33:57:00
FEBRUARY	10:42	41:26:24
AVERAGE	11:59	54:24:36

2. Temperature

Temperature is one of the important phylum of climate, this phylum has a highly and important impact on the other phenomenon of life and earth, also affects the other phylum of climate (Shilshil 1987). The appearance of different phenomenon of climate is a result of temperature along with the other phylum; temperature is the degree sense of cold, heat and an energy that can be sensed through touching and measuring by temperature measurements. Thus so called by sensed energy, temperature is the measurement of the sensed energy that in it measuring of kinetic and the speed of the period molecule. The molecules in a hot period their speed is more as compare to a cold period (Ahmed 2011). The difference and the average of temperature will change according to the months of the four seasons. The highest average of temperature degree is recorded in July, the amount is 40,7 Celsius, due to the angle of sun-beam projection in summer that

becomes close in a way it is near to be vertical. The cloudless sky of the area and the increasing of the duration of day has enough impact on the up warding temperature in this season, meanwhile the lowest average of temperature is recorded in February which is 3,3 Celsius relegation of temperature in this month is caused by the asymmetry angle of sun-beam projection and diminish of the day time in this month, as well the area is subject to mass air of continent pole, which is a cold and dry air. Sometimes coming the mass air of sea pole reaches the area that has snow within from the North Pole areas. Temperature will change from a place to another one, the higher and lower places of earth is the main reason of this change. The high-lands have low temperature compare to the low-lands, in a way that for each 100 m of ascending from sea-level (0, 65 Celsius) temperature degree will decrease (Naqishbandy 2010).

In this way temperature of the mountain areas of Srwchk district are less than Sharazwr lowland and Srwchk district. The analyze of Table 4.7. shows this. The distribution and equal line average of yearly temperature in the examined district in south of Saydsadq starts by 22.33 Celsius and reaches 20.17 Celsius in the south parts of Saydsadq. this caused by the impact of high and lowness that as we go from south to north the area becomes higher in terms of topography . When talking about climate we need to refer to temperature degree of soil which is an important heat genus for plant and its value is not lesser than air temperature, which relies on it while pullulating and the other phases of growth (Al-Rawy 1990). the soil temperature can be measured in some deep point. In the depth (10 cm), (20 cm) and (50 cm), these depths are significant for pant growth in a way that in 10cm depth, is that depth that the plant pullulates. 20 cm depth is important of the plants' roots. (Ibrahim 2009). In Halabja weather station there is no 20 cm depth measurement, so we count on 20cm depth. In summer the more we go from the down of soil to the upper of soil the temperature will increase. But in winter oppositely the more we go to the top parts temperature will decrease (Rashid 2015). Soil temperature is higher in summer as compare to the other seasons. Which its average reaches (33.1) as shown in Table 4.8. Temperature of Jun, July, and August reach 31.5,34.0,32.0. The highness of temperature in this season produced by the length of sun-beam projection and the highness of air temperature that reaches 40.7 Celsius. In winter temperature average of soil reaches 9.5 Celsius that is lesser by (23.6 Celsius) compare to summer temperature. This is due to decreasing of sun-beam projection duration and air temperature.

Table 4.7. Monthly, seasonal and yearly temperature average of air and soil (Celsius)in Halabja Weather Station (2003-2015)

SEASON	SPRING				SUMMER				AUTUMN				WINTER				Yearly Average
MONTHS	Marc.	Apr.	May	Ave.	Junn.	July.	Aug.	Ave.	Sep.	Oct.	Nov.	Ave.	Dec.	Jan.	Feb.	Ave.	
MIN.	7.9	16.7	20	14.7	26.4	30.2	29.7	28.77	24.3	15.9	9.5	16.57	4.4	3.4	3.32	3.7	15.9
MAX.	17.5	24.5	31	24.4	37.7	40.7	40.7	39.70	35.7	29.9	18.1	27.90	13.35	11.5	13.8	12.9	26.22
AGE.	12.7	20.6	25	19.5	32	35.4	35.2	34.20	30	22.9	13.8	22.23	8.8	7.4	8.5	8.2	21
Average Soil Temp.	13.4	17.9	24	18.5	31.5	34	34	33.17	30.9	24.8	15.6	23.77	10.6	8.8	9.1	9.5	21.2

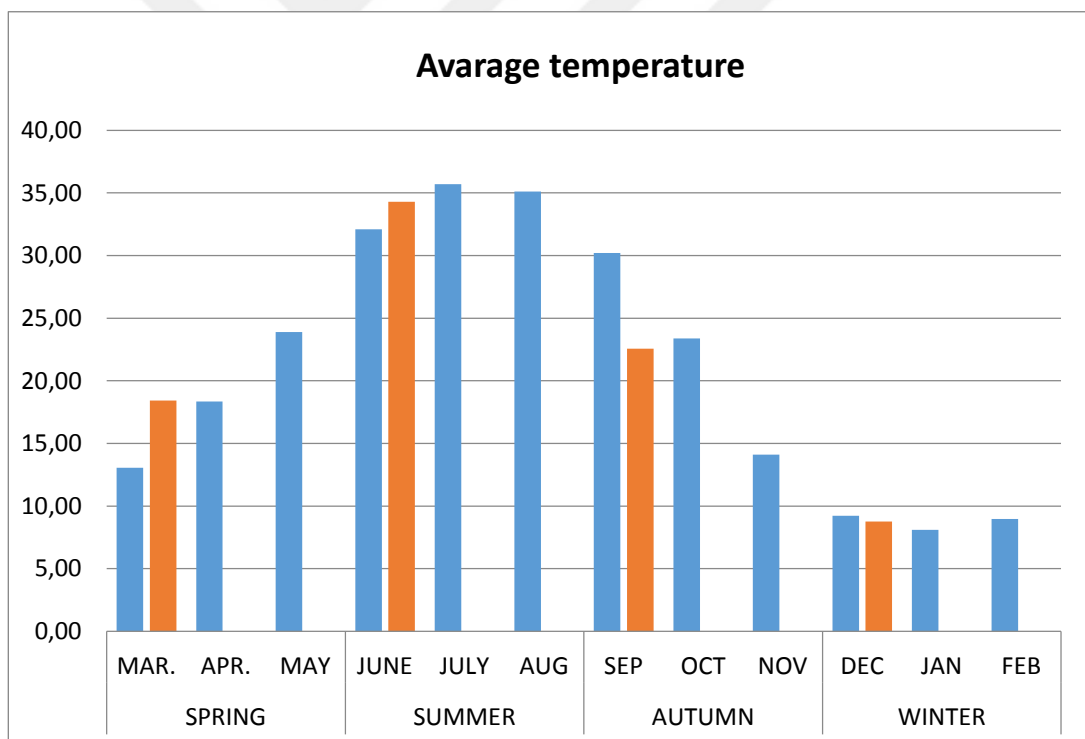


Figure 4.8. Avarage temperature months between 2003-2016

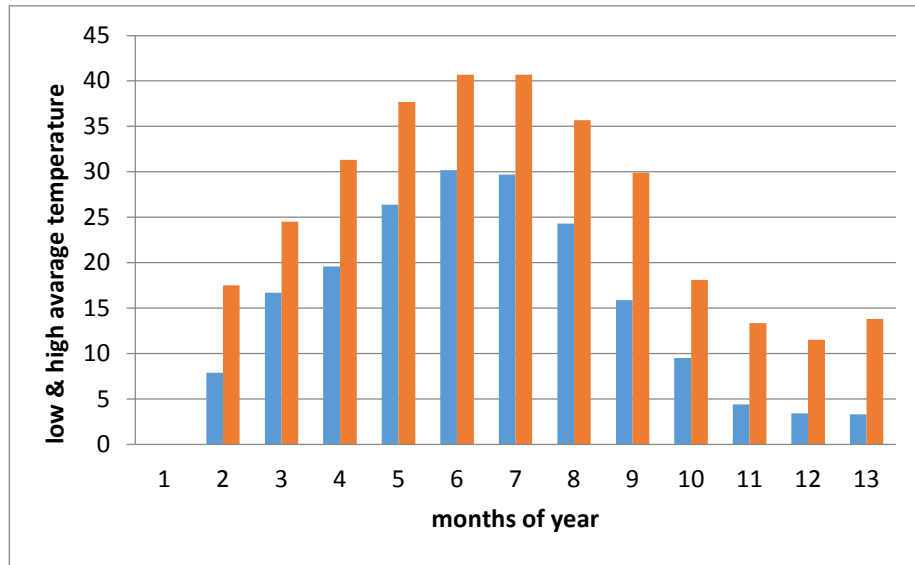


Figure 4.9. Average high and low temperature months between 2003-2016

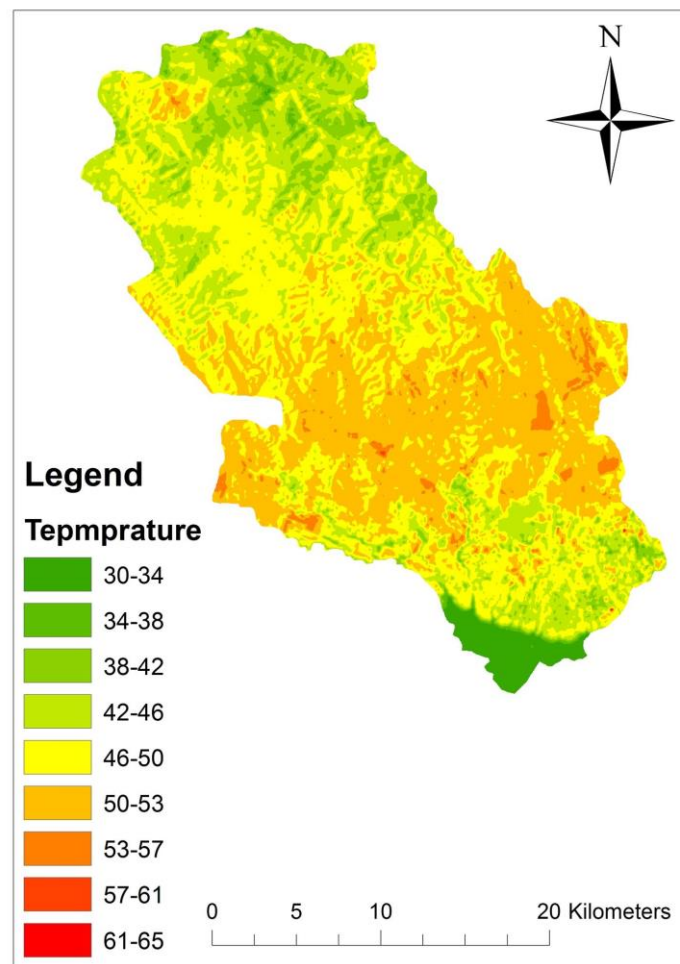


Figure 4.10. Temperature map

3. Rain

It is the most common falling down, it contains that falling down which reaches earth's surface in liquid. While the temperature of water vapor in the upper layers decreases into under the degree of dew (Talabany 2008). It is the falling down of tiny drops of water in the form of droplets, that diameter of each one reaches half milligram for a tiny drop, and 5 milligram for big drop. Raining is one of the important features of intensifying of water vapor in the air and then falling down in the form of droP (Ismail 2006).

Most of the rain that reaches the earth surface started with solid (ice), then when it falls down from the hot layers of troposphere it melts and reaches earth in gas (Imami 2011). The rain falls in there ways, it can be drizzle which its speed in an hour is lesser than 3 milligram, normal rain speed reaches between (3-7 milligram) in onehour (Hama 2007).

Shower rain speed in one hour is more than (7 milligram) (Khashab 1983). when Rain water falls into earth, not all of it falls into earth surface, it also takes part in creating the water of rivers and lakes. Another part of it remains concealed in underground (Al-Husny et al. 1973).

The geographical place of the district in terms of its being far and close to sea, astronomy place, and Topography of the region are reasons that influence the rate of rain falling and different rain falling from time to time and a place to another one. The rain that falls down in a district its source originates from coming of the low airs from the middle sea in the season of rain falling. From October real season of rain falling starts in this region, in these months a low atmosphere will create and in the middle and end of this month these atmospheres reach the region with the help of revers air (Sharif 2010).

Generally, in Kurdistan region and Saydsadiq, we have two seasons according to raining. Including dry season and raining season. Raining season are October and November in autumn, which October only contains five in one of raining that it is rate is too low yearly. But in November the situation will change, intermediary of rain will increase in the stations. This is due to temperature decreasing and growing of number of those Low atmospheres reach Kurdistan. This way raining of November contains the majority rain of autumn. Winter which includes December, January and March, rain in this season

compare to the months of autumn and spring, the intermediary of rain in this season reaches 33 days, December 10,5 days, January 11, February 11, so these days contain (43% -50%) of the average days of cloud and rain. Spring rain includes March, April, and May, known by falling for a short while, so it is revealed in major amount of raining during 15,30,60 minutes, that most of it is in winter. Despite that with each rain of this season thunder and lightning will happen. Sometimes there is also drizzle. Usually season of rain consists of 8 months in the region.

Dry season includes June, July , August and September. There is no rain in this season, rarely falls caused by absence of low airs from Mediterranean sea, level raising of thickening of temperature and descent of intermediary humidity relativity. About the degree of rain in the examined region we have to say that the degree of rain is unlike from a place to a place and a year to a year. that during 15 years between 2002-2016 the highest level of rain is recorded in 2006, which its degree is 769.6 milligram. And the lowest level of rain is recorded in 2008 which its degree is 316.7 milligram. The average of yearly raining is 522.6 milligram. The level of rain always changes according to season and the months, is not the same. In a way that the highest level of raining is in winter which reaches 268.3 milligram and then spring rain which its average of the three months can be second that is 145.2 milligram but raining in autumn is lesser and its degree reaches 109.1 milligram and in summer rain does not fall. This dissimilar in the rate and time of rain in the district means that Saydsadq is under the impact of dry climate as the rest of the other places.

4. Wind

Wind is the motion of air horizontally towards some specific directions with specific speed near earth surface. This is made by the result of two different pressures (Jawda 2004). It blows from high pressure district to low pressure district. Atmosphere pressure has main and direct role on air motion in terms of direction and speed (Amin 2011). Wind is called by the place it blows from. Wind factor is not account by a fixed factor. Thus it changes with the shift of earth's shape and the influence of friction action and time, because the wind speed in noon reaches its maximum level, due to raising up much amount of the air of the district by increasing temperature raises up to the upper layers of air, because of picking current at night the speed gradually reduces till dawn (Hadid et al. 1982).

Concerning the direction of wind in Saydsadq blows from different directions shown in Table10. Most of the wind that blows to the district is south wind a few of it is north direction wind. The direction of the winds blow to Saydsadq has their own special features and characteristics. For example north east wind is a cold, dry wind ,creates a cold and dry weather. South east wind (sharji) is a hot and humid wind which brings cloud and rain with itself, west wind is a dry wind that sometimes brings dust, and makes a hot, dry and dusty weather. Concerning the speed of wind in the district differs from a season to season, the top wind speed is in summer, that its average reaches(1.2 meter/minute).

Wind speed in June, July and August is 2.2, 1.2, 2)meter/minute. Abundant of wind speed in this season affiliate to the major different in temperature of the mountain areas thus it makes unlike pressures between them and coming air mass from the hot continent pole. The lowest wind speed average in winter is (2.3) meter/minute, the average wind speed in December, January and February is 2.3, 1.1, 1.2 meter/minute, its different with summer reaches 0.9 meter/minute. Reducing wind speed in this season caused by decreasing of temperature as well air mass comes to the district and temperature will reduce.

Table 4.9. Wind direction average monthly and yearly from Halabja weather station (2002-2005)

Months	N	NE	E	SE	S	SW	W	NW	Calm
MAR	0	4	2.4	1	44	8.8	21	6.4	6.4
APR	0	10	3.2	3.3	27	10	20	13.5	0
MAY	0	11	2	0	28	8.00	26.00	27,9	4
JUN	1.1	0	2.5	1.1	2.2	5.5	41	31.2	0
JULY	0	0	0	1	3.2	7.5	44	41	0
AUG	0	1.6	0	0	17.8	6.5	45.4	14.5	3.2
SEP	0	3.2	0	0	13	3.2	43.5	25.8	0
OCT	1	0	0	0	35	25	18	4.3	5.3
NOV	0	5	6.6	0	31	10	3.2	10	22
DEC	0	7	15	6.4	39	3.2	4.8	0	0
JAN	1	2.5	4.8	0	34	5,7	7.4	0	18
FEB	0	1	1.7	0	35	7	8	6	20
YEAR AVG.	1	5	4.7	2.5	25.8	8.3	23.50	18	11.2

Table 4.10. Wind speed average monthly, seasonal, and yearly form Halabja weather station (2003-2015)

SPRING				SUMMER				AUTUMN				WINTER				YEAR AVER.
MAR	APR	MAY	AVER.	JUN	JUL	AUG	AVER.	SEP	OCT	NOV	AVER.	DEC	JAN	FEB	AVER.	
1.7	1.9	1.8	1.8	2.2	2.1	2	2.1	2.3	1.8	1.3	1.8	1.3	1.1	1.2	1.2	1.7

5. Relatively Moist

It means having water in air in the shape of water vapor or thickening, water in the air is in these shapes (liquid, solid, and gas) (Sharif 1983). Humidity in the water vapor of atmosphere is almost evaluated by 0.001% of water from earth. The steadiness of water vapor in the air differs from a place to a place, between 0-4% we need to have 4 kilogram of water vapor for each 100 gram of air (Ghanm 2009).

Like a class from the other classes of climate moist in the air is important and has its major roles. Since it is the main reason to make up phenomenon of boosting up (cloud, rain, snow, and mist). In Saydsadiq district the highest average of relative moist is recorded in winter (January). Which its sum is (56,83 milligram), relative moist of June, July and August reaches 23.3, 28.7%, 28.9% the whole difference with winter reaches 27.9% milligram this is because of the different of temperature degree in these two seasons in general and absence of the low airs from Mediterranean sea, which eliminates raining and hardly rains. In addition growing of wind speed which has a dry wind, effects the reduction of relative moist, look at Table 4.12.

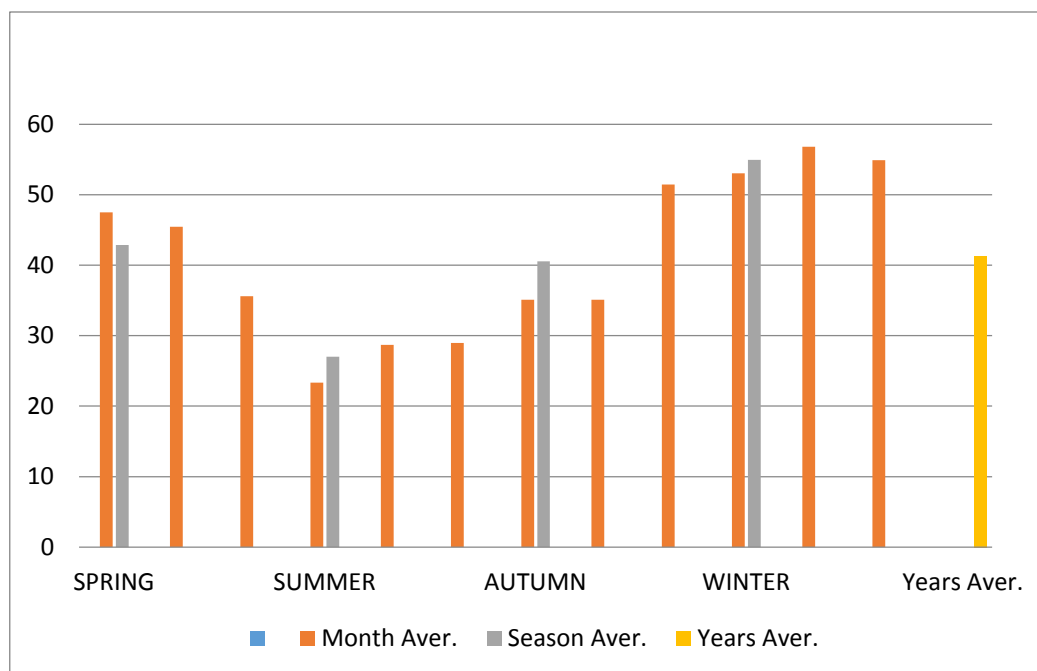


Figure 4.11. Relatively Moist according to months, years and season

6. Evaporation

Because of increasing temperature water vaporizes and raises to the upper layers of atmosphere, the amount differs by different temperature. If the missing water was on earth it is called evaporation, If it was from the surface of the plants it is called sweating, if it was from soil and plants together it is called evaporation (Al-Ahid 1423). Evaporation is one of the major climate classes. Since, it has a great influence on all of the types of pouring down. This process is a complicated occurrence, it is under the impact of some factors which most important includes (temperature, relative moist, wind speed, air pressure, cuticle) in a district that there was a clear different in temperature, atmosphere pressure, wind speed and amount of moist, there is no doubt for having different in amount of evaporating (bull-Aynain 1981).

The most rate of evaporation in Saydsadq is in summer which its average reaches 386.4 milligram. It is 49% of yearly evaporation Likewise the amount of evaporation in June, July and August reaches 371.7, 403.1, 384.1 Milligram. The most quantity of evaporation is in July, due to increasing temperature and wind speed which is a dry and hot wind. The wind in this season can contain lots of water evaporate, it causes increase of evaporation. In winter evaporation average is 49.9 milligram which is 6.4% by amount 43.2% lesser than summer, As the temperature degree reduces and real length day becomes short also wind speed reduces.

Table 4.11. relative moist average monthly, seasonal and yearly with (milligram,%) from Halabja Weather Station during (2003-2015)

YEAR	SPRING			SUMMER			AUTUMN			WINTER			Years Aver.
	Mar.	Apr.	MAY	JUNE	JULY	Aug.	Sept.	Oct.	Nov.	Des.	Jan.	Feb.	
2005	47.1	46.7	38.2	24.2	44.4	48.8	53	33.4	53.2	51.5	57.3	56.2	46.17
2006	46.8	62.1	47.6	25.6	55.8	49.8	55.6	48.8	57.9	54.3	68.9	63.7	53.08
2007	56.5	58.9	43.4	28.9	29.7	27.5	51.7	33.2	70	58	59.4	66.3	48.63
2008	42.5	32.7	27.1	22.8	43.5	46.9	57.7	40.8	47.3	43.4	54.7	53.5	42.74
2009	55.6	50.2	31.4	25.2	23.3	22.2	28.4	30.3	58.8	62.4	51.3	58.3	41.45
2010	50.4	51.3	37.4	24.8	20.5	20.4	23.2	30.2	31	46.9	55.3	58.7	37.51
2011	41.9	45	39.3	22.2	19.9	21.7	23.7	29.7	46	39.5	61	53	36.91
2012	43.5	37.1	37.4	20	19.2	19.8	21.9	32.1	49.5	55.5	54.2	44.1	36.19
2013	40.1	36.7	35.7	19.7	17.8	19.5	22.7	26.7	50.6	52.6	53.6	52.3	35.67
2014	48.7	40.8	27.9	22.4	21.6	21.9	24.9	40.5	49.7	64.7	50.7	44.1	38.16
2015	49.5	38.3	26.2	20.8	20	20.3	23.5	40.5	51.9	54.4	58.7	53.9	38.17
Month Aver.	47.51	45.44	35.60	23.33	28.70	28.98	35.12	35.11	51.45	53.02	56.83	54.92	
Season Aver.	42.85			27.00			40.56			54.92			
Years Aver.													41.33

Table 4.12. monthly, seasonal and yearly evaporation average from Halabja Weather Station(Milligram)

SPRING				SUMMER				AUTUMN				WINTER				YEAR AVER.
MAR	APR	MAY	AVER.	JUN	JUL	AUG	AVER.	SEP	OCT	NOV	AVER	DEC	JAN	FEB	AVER.	
111.5	147.7	237.1	165.4	371.7	403.1	384.1	386.4	278	174.2	75.4	176	49.9	47.7	52.5	49.9	107.6

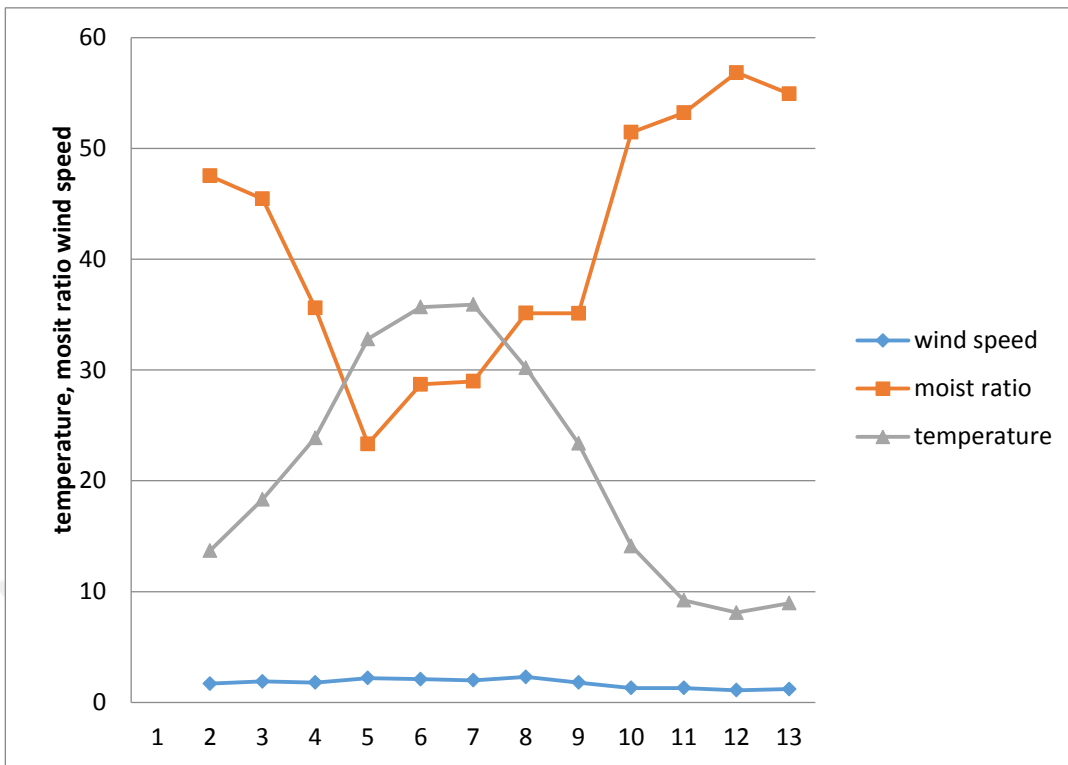


Figure 4.12. Figuer average temperature, moist ratio and wind speed

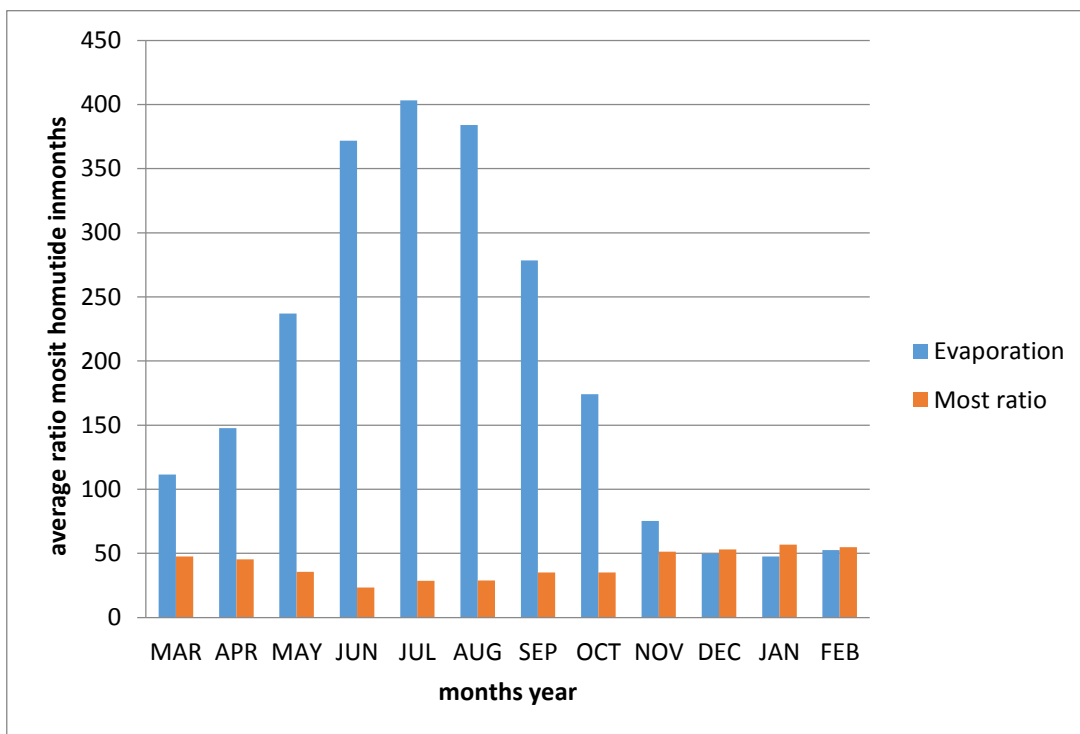


Figure 4.13. average ratio moist homutide

4.2.2. Soil types and the difficulties in the inspected area

4.2.2.1. Soil types

Several definitions are made for soil from several professions, following we have some definitions from some specializations:

In the field of geography soil is defined by a natural structure which is ahead for evolution consequently by the climate actions created from chemical, physical and animates interactions in the four main layers, which conclude high system on earth those layers are stone layer, atmosphere and Biosphere also hydrosphere which supply subsistence, food and air for all plants types and some of the animals. In scientific field soil that science which explores soil and its essential is called soil science. Soil is thin layer consists of metal resource, organs, water and air. It is a medium which plants grow and cultivate on it (Amin 2014). Biologically, it's defined as (a moldy thin layer covers earth surface; it's a mixture of iron, various types of rock and organs (Al-Shawahin 2005).

In here we can say that, soil is that structure which is the consequence of the four main layers (stone layer, atmosphere, biosphere, hydrosphere) that produces ecosystem and donates several features to the soil. Because of the different of the classes of each structure and their different interactions in each place in the world produces lots of soil types and will produce. The major influential structure in soil is origin stone which the soil creates from it. Those stones made from diverse geological periods. The geological centuries which happened to any district are unlike from a place to place. That's why the examine region according to the period stone structures passed by, it has various types of rocks and made kind of different soil.

The summary of the former lines can be shown by the follow Figuer 4.14. which makes the definition and the subject clearer. So a fertile soil is a soil which its components are good and has sufficient nutrition within also contains some water and keeps itself from extra water (Khasbak 1973).

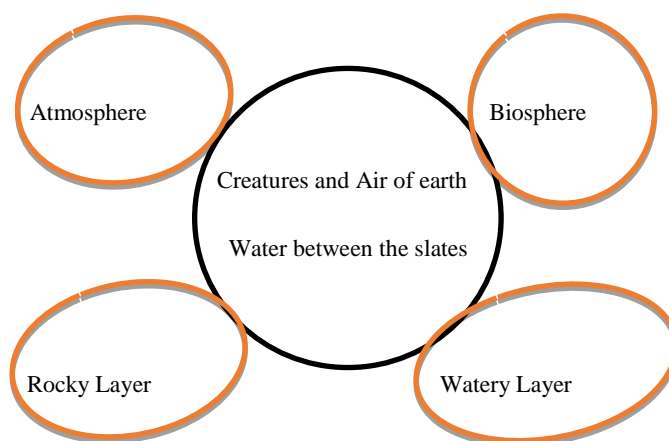


Figure 4.14. Soil components and their relation with the four layers.

One of the features of Sharazur plain soil is that, especially that part which located in the exploration district distinguished for being mostly high crispy, being crispy of the soil is a good helper to enter plenty of water. This is because the amount of falling water by raining in the district. As well the phenomenon of fission in the area which its depth is 1 meter, this helps water to accumulate in the stores (Abd-Alrahman 2008).

That's why for this feature many other characteristics of the examined area, it is one of the most fertile and best soils in the world for agriculture, due to its fertility and being loamy. The kind of the elements, metals and rocks in the soil of the examined district, has essentiality in the specification of the loamy of the soil and its fruitfulness with metals. That makes Sharazur soil to be to be one of the fertile ones (Muhammad 2008).

4.2.2.2. Soil Classification

By soil classification we mean the arrangement of some specified characteristics of soil in one unit, that the whole occurrences are the same in terms of characteristics and aspects. The aim of this arrangement of aspects is for showing the similarity and dissimilar points between the main groups of soil in one hand; on another hand for is a helper for analyzing and defining between the dissimilarities. This action supports us for an easy understanding and receiving precise information on the soil types and distinction with each other (Amin 2014).

Classification of soil is a complex problem that faces the geographical areas because of conflation of many factors such as water, air, plant, primary items, microscopic creatures and topography. By relying on (Burgh classification) Kurdistan region soil along with the examined area consists of these kinds:

1. Thin stony soil

It consists of a thin layer of soil that its edges are stones and rock fault (Siad 2009). It's an incomplete soil and its upper layer's texture is weak and gen B is rare, its depth is few basic period of gen C is coming directly after the upper gen (Amin 2008). It is a thin layer of soil which is still not changing to a complete soil (Qgafur 2012). Sometime they got a concave shape in the drought times of year (Ahmed 2010). The rate of organic substance is between 6.6- 9.9 % (Hussain 2010). so it isn't good and proper soil for agriculture. This soil consists off limestone and marline stone that dates back to the both of (eosin and myosin age) (FAO 2001). A bit of fault and soft mixture have covered the sloppy areas that mostly defend erosion. This soil highly covers the high and mountanuos zones. It locates in the north of Castanaee that ranged the largest part of the researched area which is 57% that is 474 km². (Look at figure 4.15).



Figure 4.15. Thin stony soil Gellara Village- Srwchk sub-district

2. Castanee Soil

The most average of the Sharazur formation was formed by this soil which is around 40% (Qaraman 1999). The soil color is dark brown which is soft and tiny (Qhafur 2012). It got with organic matters which rates 1-4% with %9 of calcareous. The soil has got enough potassium, calcium, and magnesium with alkaline organics all of these matters made the lower layer a little bit harder than the upper layers. Also the organic matters made the area to be one of the most fertile parts (Burigh 1960). It has several layers but the lower parts is softer and calcareous which is 20-30 cm deep. This soil type locates those areas that got 500-800 m rain yearly (Avesta 2012).

It is one of the most fertile lands of the area for wheat and barley. It is the second part according to the researched area. (Look at Figure 4.16. and figure 4.17). which is around 38.4% of the district's area nearly 283 km² yearly.

This soil located beneath the mountains and the plains that ranged in the south and southeast and southwest of the researched area; it means the center of Saydsadiq and the north of the district with some of the villages like Totaqach and Barkewan then ranges toward south and southeast till reaches Darbandikhan Lake. After that it ranges toward northwest till reaches beneath of the mountains and mixed with stone soil at Main Doll, agreze, and Kani Panka villages. We can say that the mountain which locates the center of the district is a Castanee soil. Yearly 114 thousand donum of this soil formation were covered by Darbandikhan Lake.



Figure 4.16. Castanee Soil

3. Mountain Soil

This soil formed 4.6 % of the area's soil that equals to 41 km². This soil is usually treeless because of erosion, wind, and cutting down the trees (Al-Hany 1972). Mostly it consists of broken rocks and calcareous Lysosols which have a high rate of nitrogen (Al-Khatib 1984). Generally, one can say that this area was mostly useless in agricultural ways because of that natural and human phenomenon that affects the soil in a continuous way throughout all of the seasons of the year (Hustid 1948). Also, most of the farmers of the area work unfairly with the soil because they do not have enough scientific information about the soil and its various types, besides the government does not pay attention to this dangerous phenomenon that faces the soil. Cracks, holes, and refractions help a faster dropping of water despite of treeless and sloppy which are two other main reasons for dropping. The area's formation is made of various kinds of stones and rocks. This soil is naturally drought because of its thinness and dropping fast that causes of holding a very few amount of water. The plants' leftovers slowly dissolve and blend to the solid

formations. This type of soil located at the high mountains in the north of the researched area. For instance Haji Mamenid and Kazhaw mountains.

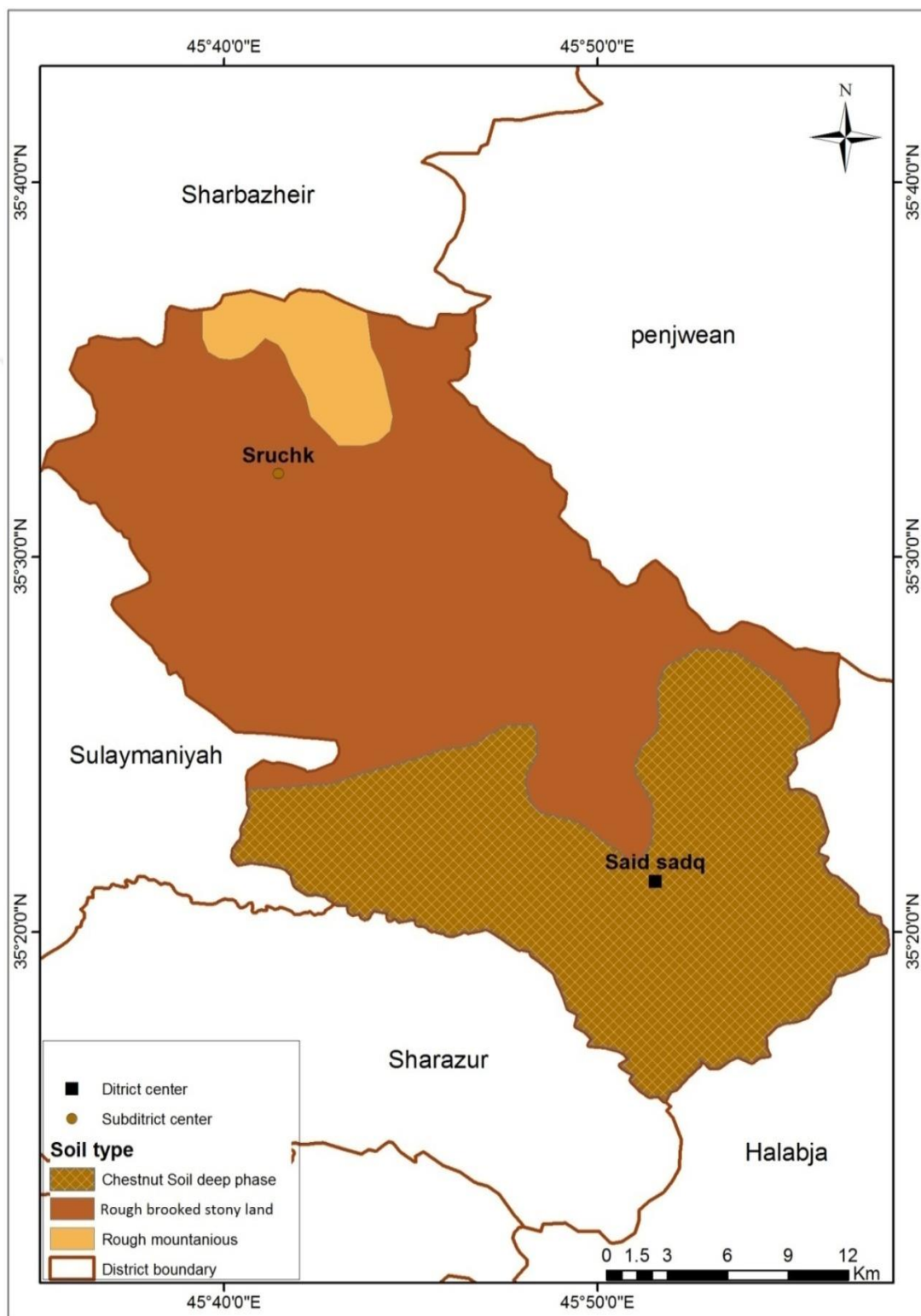


Figure 4.17. Saydsadiq Soil Classification based on Burneg Classification

4.2.2.3. The Soil Problems in the Researched Area

The soil has faced some various and fatal problems that some of them are natural and some of them are results of human activities.

First: Erosion

This problem mostly happens in the mountainous areas, it consists of the followings:

Forest distortion: This happens because of the human activities like cutting down the trees and burns the roots for various purposes.

Grazing Types: shepherds are grazing their sheep, goats, and cows without any attention to the various places and different types of grasses that lead the area to change from a green field to a desert.

Cultivation: cultivation must happen opposite of water direction but unfortunately the farmers do not follow this rule especially the farmers of from Greze and Kani Panke villages.

Water Erosion: this happens on the first layer of earth (A) which is an important layer that enriches with all needy substances (Alaidy 1986). This has a bad impact on the area's land especially the mountainous and hills near Kani Panke and Main Doll which are drought or treeless.

This phenomenon can be known by the following features:

1. A muddy and turbidity of the rainy water on earth.
2. Creating cliffs at the sides of the hills and streams.
3. Subsiding the muddy and oozing in the valleys and on the plains.
4. Blocking the waterways by mud, ooze, and sand.

5. Remaining the soils leftover on the grasses.

Wind Erosion

Wind erosion is another effective reason on the area's soil that causes of transporting the pellets of the land from one place to another. However the pellet of the area's soil is more than 1 mm with 60 so it is a good feature that prevent erosion. Despite it is geographical location of the district that has a concave shape.

Second: Less Production

When an area faces these problems it leads to be less fertile than the other. Fertile land is one that riches with the chemical and different netrins substance (Al-Mashhadany 1971). There are sever other reasons that have impacts on the soil productions like cultivation that most of the farmers of the area do not know how to cultivate in a scientific way while it is so important to cultivate their lands opposite of rain or water direction. Another one is planting the same yield for many times. So it makes the land to be less fertile one year after another.

Third: Agricultural Land Reduction

The population of the district and even the sub-districts and villages grow very fast. So these people need a wide range of land to be settled and used as accommodation. At that time we haven't equivalence between population and agricultural land. This phenomenon can be seen from the centre of the district because it had been constructed on the agricultural land then it grew and grow without any master plan for it.

4.2.2.4. Some Physical Feature of the Researched Area's Land

Anyone who tends to know about the features of a specific land he/she must endeavor to get information about some physical measurements and the relation between the soil and the surroundings like water, air, and climate (Al-Shahwain 2005). this affects the land's geomorphology. To know more about physical feature we have randomly got (16)

samples from various places that between 0-30 cm. We depended on the Arc Map10.3 program to analyze the samples. Look at Table 4.14. and the features are:

1. Hydrogen Number (pH)

Soil acid highlights the plant types on the area. Sometimes a high ration of alkaline, acid, or salt affects the lands fertile. Some atoms of the soil abolish to hydrogen hydroxyl ions. When hydrogen molecular are more than hydroxyls' at that time the molecular of water do not vanish at that time you can know that the land is acidy. pH number is used for measurement of acid and alkaline of soil. The ration is between (0-40) the medieval balance is 7. Any land has got more than 7 hydrogen number so it is an alkaline soil (Amin 2014). The best way for highlighting pH number in soil is washing. So, one can perceive that the humidity's soil is acidy. It gives more carbohydrate that is useful for several maters. The hydrogen ion of the researched area is between 7.88-7.3. After 7.59 degree it leads to be alkaline soil, the highest number that has got from the samples is number 16 which is 7.88. The lowest number that has been recorded is sample 7 that located in the Gelak village in the Sarochik sub-district which is 7.3. Look index Figure 4.20.

2. Soil Structure

The word cell is used for the pellet of the soil. When more consideration was given to the matter the word (Structure) is used for the formation of the soil. Soil structure means all how all of the cells were formed to obtain a real structure of the soil. If the soil is sandy, it will be called (Structure Tess). The atoms of the soil come together to structure the main parts and shown up as structured soil (Amin 2014). Soil cells have various types like (sandy, Stoney, sludge, and etc.) the pellets are between 1-0.5 mm they take a large part of cells formation which is equal to 39.1%. also the oozing pellet diameter size is around 0.002 – 0.5mm with 48.5% ratio. While mud diameter is less than 0,002 with %16.1 ratio (Qaraman 2004). Soil cell has distinction types as much as their size differences. They are divided into two group shapes. First one are those ones that have a straight or curvey pellet. The second type is compeletely different because they have got a scramled shape with angels and sharp endings that called (angular). These kind of pellets have been made because of their enduring against erosion and sweeping.



Figure 4.18. Taken soil sample from one of the places of Saydsadiq district

Table 4.13. The types of soil cells according to pellets' sizes and percentages

Hydrogen No.	Acid and alkaline degree
Less 4,5	Powerful acid
4,5-5	High acid
5,1-5,5	Much acid
5,6-6	Medieval acid
6.6-7,3	Balanced acid
7.4-8	Less salt
9,1-8	Medieval salt
9.1-10	Much salt
More then 10	Powerful salt

Table 4.15. Acid and alkaline of soil

Percentage	Sand Pellet Size	Cell Type
2.3	1-2	Roughest sand
6,7	0,5-1	Rough sand
8.2	0,5-0,25	Average sand
9,4	0.10--0.25	Small sand
12.5	0.5-0.10	Tiny sand
44,8	0,002-0,05	Ooze
16.1	Less than 0.002	Muddy

The most significance types of soil sells in the researched area that have been taken from the achieved samples:

1. Sand Structure (cells): The percentage of the sand structure in the researched area from the taken samples are between 33.25-3.6. The highest one is sample 12 in Sarochik district which is 33, 25 %. The amount of sand in this area related to its geographical place which is a mountainous area and between the valleys and rivers which is affected by erosion. The lowest rate is sample 15. But generally this structure locates in the northeast and west of Saydsadiq district.

2. Mud Structure: The percentage of the sand structure in the researched area from the taken samples is between 58-34%. The highest one is sample 3 in southwest of the district. The lowest one are samples 7 and 9 in the north of the researched area of the Sarochik district. But generally it located in the south and southeast of Saydsadiq.

3. Oozing Structure: The percentage of oozing structure in the researched area depends on the taken samples are between 54-24%. The highest one is sample 14 then 12 and 16 which locate in around Saydsadiq district. The lowest one is sample 13 in the north of the Sarochik district. But generally, it locates in the east and Saydsadiq centre.

Table 4.16. Physical features and PH of 16 soil samples with their astronomic position

No	Sample location	Y	X	Z	Sand	Silt	clay	PH	TEXTURE
1	Soilamish village	35.5675	45.835	494	5.13	42.81	52.6	7.6	silty clay
2	Qainaga	35.43722222	46.00055556	537	5.51	45.76	48.73	7.64	silty clay
3	Muwan village	35.340366	45.753388	501	4.2	38.45	58.35	7.7	Clay
4	Walasimt plant	35.65388889	46.10111111	641	22	38	39	7.55	Clay
5	Qadafarey village	35.4225	45.98027778	510	8.34	39.57	52.9	7.68	Clay
6	Greza village	35.46138889	45.83305556	570	8	51.37	40.64	7.84	silty clay
7	Gellara village	35.5825	45.66305556	1120	28.25	37.5	34.25	7.3	Clay
8	Kilakawa village	35.60444444	46.11166667	561	3.23	53.91	42.86	7.8	silty clay
9	Moryas moutain	35.48416667	45.97388889	1213	26.25	35	36	7.5	Clay
10	Mayawa village	35.605	45.75638889	1154	27	31.7	41.5	7.17	Clay
11	Dollash village	35.27912	45.896205	472	8.83	50.28	40.89	7.5	silty clay
12	Saidsadiq	35.43083333	45.99083333	557	8.52	51.23	40.25	7.66	silty clay
13	Srochk	35.665	45.79888889	1227	33.25	24.25	42.5	7.7	Clay
14	Kawlos village	35.7125	45.96527778	662	4.66	54.5	41.29	7.38	silty clay
15	Shanadarey	35.472	45.97111111	607	3.6	47.61	48.79	7.7	silty clay
16	Maw moutain	35.65111111	45.93138889	597	6.13	49.5	44.82	7.88	silty clay

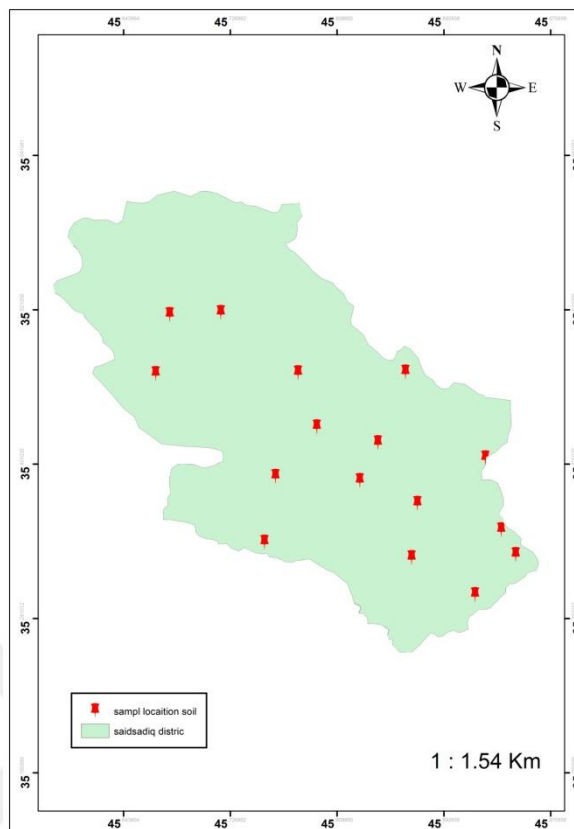


Figure 4.19. Soil sample area in Saydsadiq

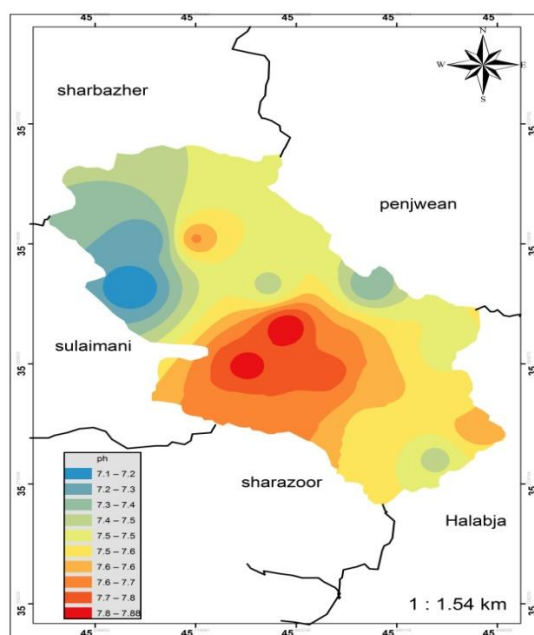


Figure 4.20. Hydrogen ions of Saydsadiq samples

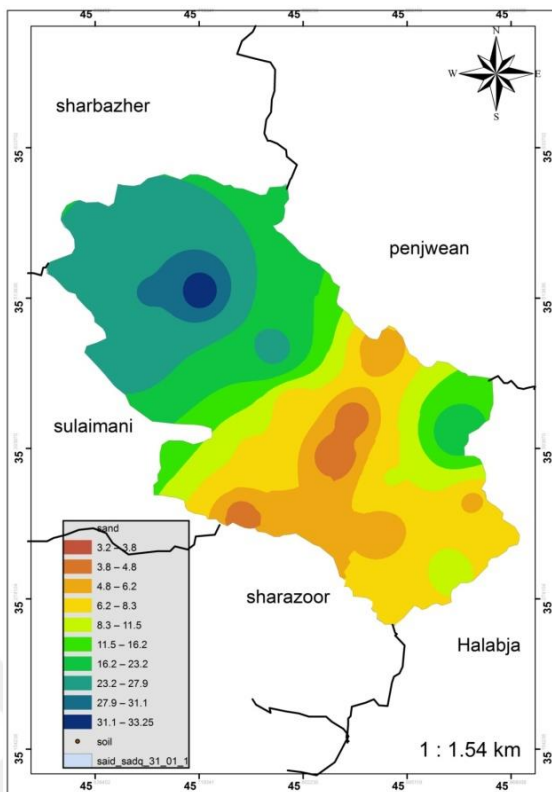


Figure 4.21. Sand formation of Saydsadiq

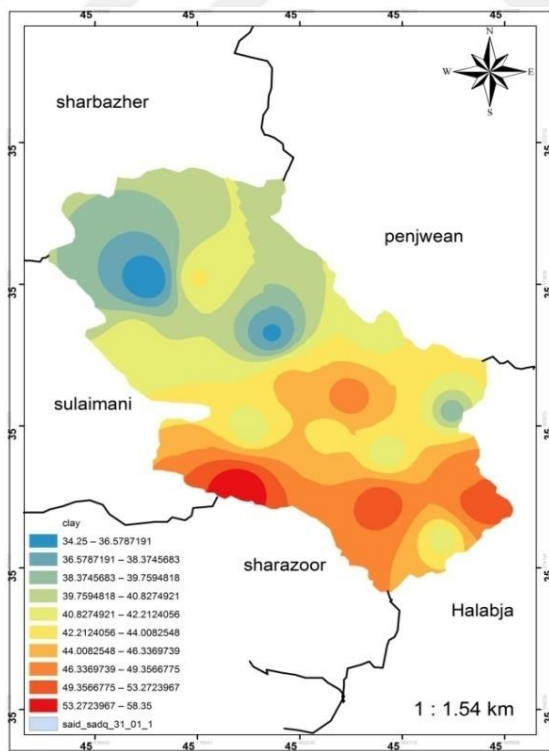


Figure 4.22. Clay formation samples in Saydsadiq

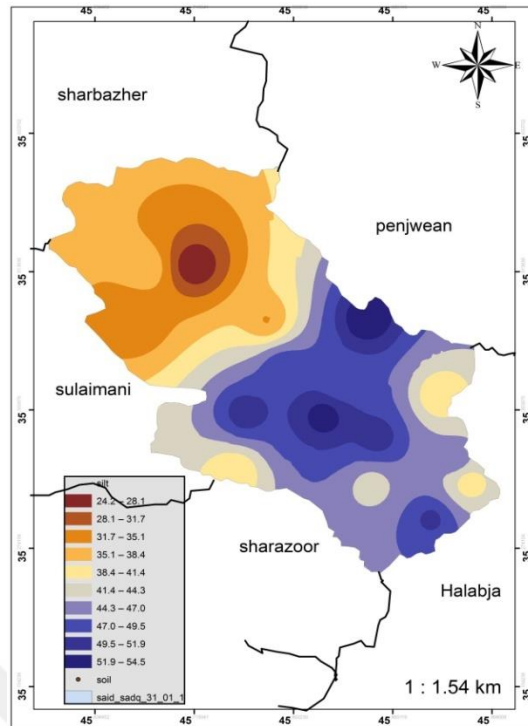


Figure 4.23. Silt formation samples in Saydsadiq

4.2.3. The forest and natural vegetation

Natural vegetation is generally those plants which grow in various places around the world without any human interact; it means that nature is the only reason behind their growing (Ahmed 2003). Despite it is natural resources the plants have many factors and influences on the air, soil, and topography of the area (Ghafur 2013). Natural phenomenon and wind, rain, soil, and etc. have got the priority of the influential factors on the natural plants. Also the layers of the ground have its own influence on the green lands. As a result there is a large variety between the various places in the researched area (Rashid 2011). As a matter of fact, human factors got their own participant in the influential fields that made distinctions between the types of the plants according to the hills, land, mountains, and valleys. Like (Belek, Qerem, and Bnawela) plants, but until we go up to the mountainous area the plants and trees change and mostly covered by (oak and terebinth trees) then we have (common medlar) tree. Natural plants area in the researched area is 27600 da that include the forest zones and steppes zones as it was shown in Figure 4.24.

Vegetation in the researched area

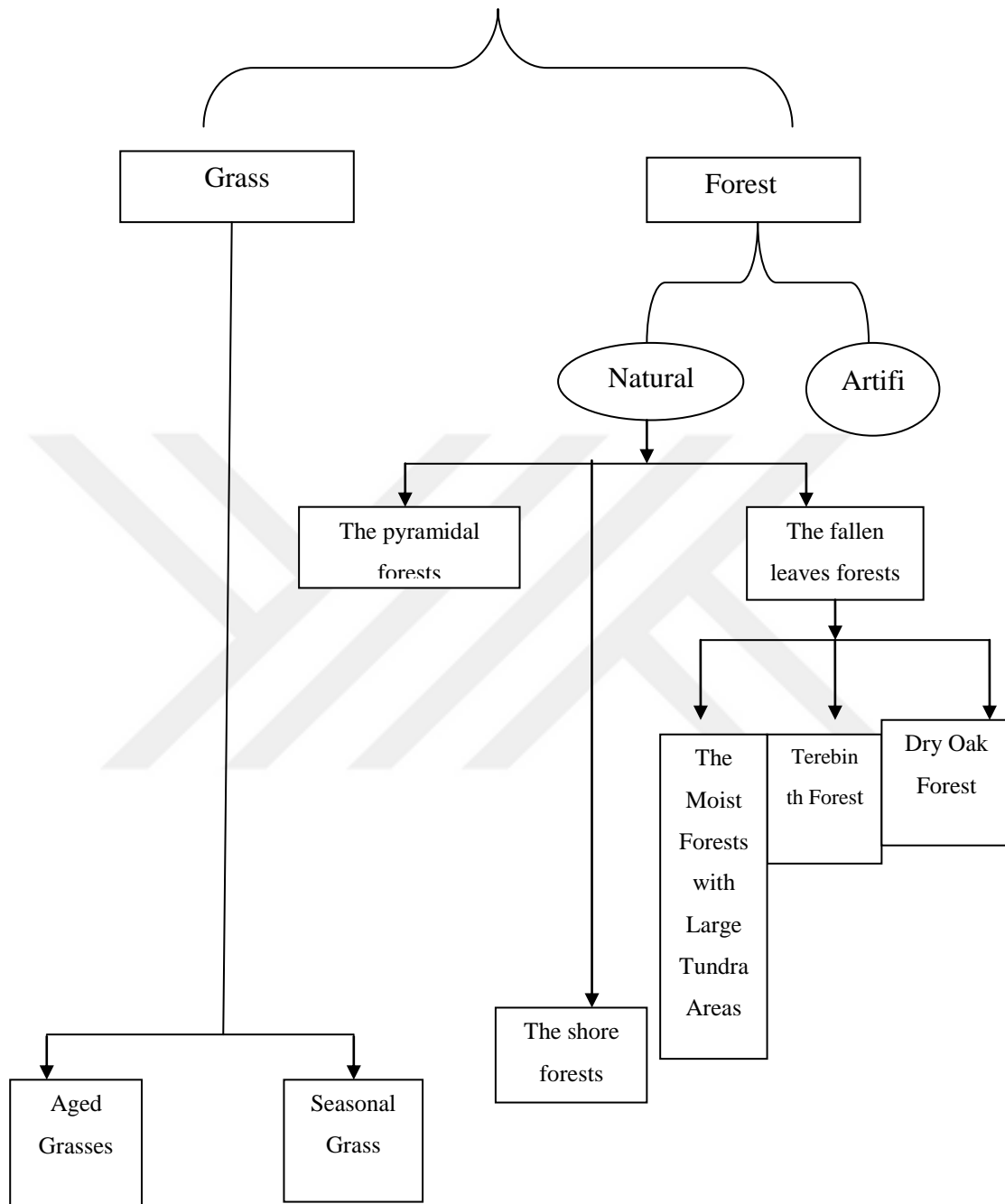


Figure 4.24. Vegetation in the researched area

First: The Forest Zones

Like all other parts of Iraqi Kurdistan Region, the forests in the area are made up of different classes and types of trees. The most common sort in the region is those trees which their leaves are fallen. Oak forest typically which occupies 85% of the forests' field. The densities of the forests depend on variety of factors. Among those factors, temperature, precipitation, moist wind direction. The factors can be more within the eastern part comparing to western and southwestern part and also comparing to distance areas. Often, their densities (forests) are less in areas close to cities, villages, and any other areas inhabited. That's because of cutting them and burning by the people. After 1991 the forest areas decreased due to deforestation and using them for burning. Despite this, there was no protection from the responsible organizations in which the situation that Iraq generally and Kurdistan specially had to pass (Rashid 2004). The forests in the province occupy larger areas in comparison to other types of natural forests. This is why the researched region is located in the forest trees of Mediterranean Sea climate. The trees grow there are adapted with the climate. It is more possible for forests rather than for grasses because rainy seasons are along with cold seasons. This type of climate is more appropriate to forests. The vegetation needs rain and warm climate even though the area is not lack of vegetation. The forest areas are about 200, 000 acres which is divided into natural and artificial forests.

The artificial forests

The artificial forests are all types of trees and plants which human being takes control of their planting and growing. They are planted along with the steep sides for making tourist areas, beautiful landscape, and besides to prevent erosion.

Planting the trees began after 1994 by the government and responsible organizations. Every year many acres of the plants and trees are planted in the province. The examples would be (Saydsadiq Forest Mountain, Sarawi Suban Axa, Berzinja, and Ashblax Mountain). The general area of artificial forest in the province is 836 acres. The trees are often pines, ivy, olive, almond, and oak.



Figure 4.25. Olive trees in Said Sadiq Mountain

Table 4.14. Place, Area, Artificial Forest Types, and Elevation above Sea Level

Place	Acres	Tree Type	Z	Y	X
Saraii Suhan Axa	140	Pine + Olive		45,82.15	35.37.317
Said Sadiq Mountain	59	Pine + Olive	529	45.52,511	35.21.21
Ashblax Mountain	67	Pine	596	45.51,46	35.21,478
Shahidan Forest	67	Pine	553	45.51,46	35.21.415
Greaza Forest	130	Olive + weeping willow	588	45.44.58	35,23.243
Berzinja Forest	100	Oak + Pine	1227	45.41,46	35.32,474
Total	563				

The Natural Forests

The natural forests in Kurdistan region and the researched area include trees and different plants. The most common types are the fallen leaves. This occupies 85% of the total natural forests. What remains is the (needle types) evergreen (AbduAllah 1971).

The trees' density related to variety of factors like, temperature, precipitation, moist wind direction. The density and the rock's hole don't allow rain water and snow. They plunge down deep into the soil. While the other types of rocks with fewer holes in them, they hold more water. This situation let the area with more plants growing.

Many of the natural forests lie within height areas 600 m – 2000 m. Precipitation along south, eastern area and plains is between 500 – 600 ml. It goes up to 750 ml within northern east. The lands covered with natural forests within Saydsadiq Province are estimated with 164,199 acres.

23,000 acres of this area were destroyed because of fire close to the following villages: (Basak, Berqela, Wendereane, Haji Mamand). The forest areas are contributed to the researched area unevenly. Srochik Province is where the largest part of the forests is located, which lies on the northern researched area. This contribution is because of climate, lots of precipitation, and far from population. The area is isolated which leads to no cutting neither burning.

The Natural Forests Are Divided Into Several Classes According To Their Elevation.

The classification of natural forests in the area

First: The Fallen Leaves Forests

The elevation of the fallen leaves forests measures from 500m – 1800m. The steep sides of these areas are helpful for carrying water and salt which leads to bitter soil to be formed and arrange possible environment to this kind of forest. The areas with this type of forest include Haji Mamand Mountains, Kazhaw, the mountains behind Berzinje, and Berqela which occupies many different trees and plants. The trees are mostly oak tree,

besides having different types like nut tree, catkin, terebinth, sumac, ivy, peach, nut tree, pea, wild apple, and etc.

The three different divisions of the fallen leaves forests according to elevation:

A) Dried Oak Forest: it lies in the low mountain areas, with elevation of 450 – 750 m (Talib 1999). It covers the low part of the mountain areas. Oak tree and terebinth are seen in this region. There are also other types of trees that grow here like thorn apple. Due to closeness to population, they are used widely. The widest part of oak tree in the province lies in the northern part of the research, close to Beekok village.

B) Oak Gall: These forests grow in the elevation of 750 – 1300 m which means they grow in the parts of low mountains. The suitable climate allows growing of oak tree and oak gall tree widely. When the elevation goes up into 1200m the oak tree will be substituted by oak gall tree. About precipitation it is (950 ml to 1200 ml. There are other types of trees as pine, oak gall, terebinth, thorn apple, juniper beside oak tree (Khasback 1972).

C) The Moist Forests with Large Tundra Areas: The moist forests are located in the high mountains with elevation of 1200m – 1800 m. This type ends with oak gall trees, oak gall forests in which oak tree replaces them. The precipitation average is between 1200 ml and 1350 ml terebinth, thorn apple, wild pea, juniper are common in this forest.



Figure 4.26. Natural Forest in Sirochik Province

Second: The Pyramidal Forests

They grow at the elevation of 600 m – 1200 m. The precipitation average is 400 ml annually (AbdulAshu et ai. 1985). Red soil covers the land. Pine trees do not rely on the land that is why they are able to grow on humid rocks, storks, and poor soil. Pine trees also have the ability to grow in the deep and fertile soil. Meanwhile the salted soil prevents growth. The pine trees are mixed with terebinth, juniper. They are estimated to have larger areas in the researched field. But because of random and illegal cutting, great damage happened to the area. This destruction causes erosion, and appearance of giant rocks. Many of the trees fell down into the rocks and situated there this is why it cannot be replaced with new trees (Hassan 1982).

3. The Forests near Valleys and River Banks

In this forest the willow tree is the most common types are white poplar, white birch, poplar, and nuts. The white birch trees are commonly used in building industry. This forest is near to the lakes, rivers, and valleys of the mountainous. They are grown at the elevation of 600 m – 1500 m above sea level. They are known for having great interest

with water. The area of this type of forest is 396 acres in the researched area in which trees like nuts, berry, ivy, and wild figs are commonly seen (Khalaf 1985).

The plains of the mountain areas such as Sharazur plain, a class of plants, vegetation, and steppes are seen which can be the relation of real steppes, mountain areas, and a type of mountain trees. These trees and plants are short old trees with rugged roots such as pistachio, oak, tall grass with the class of Shovan. A large part of the land faced cutting or they are terraced for agriculture after along years pulling them out of the ground.



Figure 4.27. The Forests near Valleys and River Banks

After explaining and divisions of the sorts of natural trees and their types in the area, the importance of these trees and plants are shown the points below.

1. The natural trees are reasons for better climate and arranging temperature somehow balanced. Because natural trees typically forests limit on the summer warm climate and cold winter climate. The trees also have effect on environment and they are reasons for better and suitable climate. They directly relate humans breathing.

2. The natural trees are also important sources for industry. Some trees are used for eating as oak and terebinth. Some of the grasses are used as grassland and hay such as berseem and alfalfa. Some of plants like (mushrooms, rhubarb, Kingr) are used for human's food. Even though some of the grasses are used in curing sicknesses and some are used for business purposes.

3. The natural trees are applicable for keeping the snow and delaying the melting of the piled mountain snow which causes increasing ground water continuously. Besides the forests help the water to go into core in which later causes increasing the ground water, lakes, and rivers. The most common ones are Shaxi Haji Mamand Forest, Basak, Berqela, and Kazhaw when for a long time snow is seen on their peaks.

4. The natural trees mostly forests make a green zone around cities and villages. They have enough impact on reducing dust and strong soiled winds.

5. The natural trees take a major role in stability and keeping the soil. In the mountainous and semi mountainous areas, they caused less erosion. This is why they have significant role in recurring soil, keeping balance of water soil as well as reducing erosion, and preventing erosion of rocks. All the facts cause the soil to be prevented and away from erosion. One of the most important points about natural trees is making the tourist areas. Since the natural trees effect on cool climate and give a beautiful figure to nature of the tourist resorts. Though the forest zones make a unit for many of the wild animals which attracts tourists. This is why the sightseers often like seeing the nature or hunting.

Table 4.15. General Forest and Grassland in Said Sadiq Province

Types of Trees	Areas with acres	%
Artificial Forests	830	0.3
Natural Forests	199000,164	72.1
Seasonal Grass, Humid Grass, and Hay	76000	27.5
Total	276000	100%

Second: Steppes Zones

Steppes grasses are known for density and they grow in areas with precipitation of 600 – 1000 ml. This type occupies the sides and cliffs of the researched area. The average of precipitation and soil type within the area is different. This different reflects the trees in the area. Even though the trees have been dominated by the grass but the more you go to the high lands (the direction to the north and eastern north) which they are above sea level, the steppes will be enlarged. The more going to the south and west, the trees will be closed to the desert types. Tropics in the rainy seasons typically middle of autumn and end of spring are rich in natural trees. While in spring it is poor and treeless. This is an indication of the seasonal trees (AbduAllah 1971).

The steppes grasses in the researched area have their own importance. They become grass fields for providing animals food. On the other hand they are used in economic and healthcare sections. Some are used for making medicines. Some are used in food sections. Beside all, they hinder erosion in the area. These grasses have been facing trouble, cutting, and fading away by the residents for agricultural purposes, specifically in the flat areas that allow agricultural machines easily (Khlaf 1959).

There are two types of steppes grasses

Permanent Grassland Plant (Old Grass): These grasses have ability of surviving in hot temperature, lack of available water. Because of their long roots which enable them to take food and their leaves are also able to hold enough water such as etc.

Seasonal Grasses: They include those types that grow by the end of winter and beginning of spring. The grasses get dry the hot temperature and end of rain. Which means their green season and dry season are alike. Mostly they are short trees with no stability and no offence of climate change. Due to their thin stem and short roots. The examples are Palpine, Kingir and Chawbaze.



Figure 4.28. Seasonal Grassland

The Problems That Face Natural Trees And Forests in the Researched Area Just like other parts of Kurdistan, Said Sadiq Province has faced many hardships within area change from time to time; some of the problems are shown below.

- 1. Random Grazing :** Random grazing means having lots of animals without any plan for graze them in a specific area and this has a bad effect on the grasses to be grown after they have been eaten.
- 2. Burning Forests:** It is one of the most dangerous disasters of the area that sometimes happen naturally and sometimes it is intentionally. Like burning (Saydsadiq orchard, Sarahy Subhan Agha, Basic and Qala natural forests).
- 3. Cutting Trees:** It is also one of the unplanned works by some of the farmers that has a dangerous impact on the forests that lead them to vanish and desert. Despite it is a bad environmental result.

4. Providing Agricultural Plains: The farmers of the mountainous areas have a small space to farm or to agriculture so they endeavor to cut the trees to provide a good and enough space for their activities.

4.3. Hydrological Cartography of Saydsadiq District by GIS

Water is a significance natural resource that has its strategic role in world widely and more especially in desert and semi-desert zones. It can't be easy to modify this fortune; it is enough to say that God said, "We made every living thing of water." so we have got that water is source of living.

Water is the most significance fortune on earth. Human being depends on ground and underground water. Its usage for an urban is 66m^3 per year and for a rural one is 33m^3 . (Jaff 2013). despite its importance for various daily activities, shortly on can say water is a source of life. So I do believe that this part is so important to take a part of my research to search the water resources and wells with their characteristics like the organic matters and chemical substances in it. Also I have covered about the usage degree in Iraq and World Health Organization to reveal the dirt substances and how much water of springs and wells are appropriate.

It is better to have a scientific knowledge about hydrology; it is a wide scientific term that includes all types of water on earth. The term had been taken from two different syllables, first, Hydro means water and second, logy means science. (Abu-Alsamurand Alkhatib 1999). This science deals with water mainly and then its resources, interactions with gases and biological environment. So one can say that hydrology is the science of ground water like, rivers, seas, and oceans with underground water like wells, resources, containers, and etc. We have covered about hydrology after achieving a enough information about the features of the area and having enough data about hydrology by getting benefit from topographical and geological features of the researching area.

We have known the elements of water through ArcMap 10.3 program by Geostatic Analyst after given the hydrological data of the area to the program by statistic equations of IDW. This process is analyzing all bits of the data with all the relevant matters. Then

we will discuss about all the water distributions and directions in various places by using cartography and special hydrologic resources. The area's hydrology means underground and ground water with pouring. First includes rivers, seas, streams, and lakes. Second it involves the various water resources. Pouring includes rain and snow mainly which are the main underground and ground water resources. As a result of developing various related fields to water resources there are many demanding on water. Saydsadiq district demanding on this fortune has been growing on both of quality and quantity ways. So, we are going to discuss all various sustenance of water in the area.

4.3.1. Hydrology Speciality of Sayydsadiq

4.3.1.1. Down Pouring

All of the ways of pouring from sky to earth is called down pouring. There some ways of pouring like raining, snowing, and hailing. The types of the pouring are depend on the temperature of water and air. If the temperature is above the frozen degree so it is rainy, but if it is below so it may be hailing or snowing (Khanm 2009). pouring in another word means downing small flakes, drops, and crystal hail-stones then it gets larger till the air cannot move it (Sharif 2011). pouring is a great element of climate. It is mostly in winter in the research zone (Salih 2010). also pouring is the main reason of water resources because it is an open plain area that has a great difference between plain zones (Sharazur) and mountainous zones in the north, northeast, and west of the district. The mountainous area is mostly snowy and the plains are rainy.

A. Rain

In part two in we covered about raining, its time, and its average in the research area, now we just talk about the significance of rain in some points:

Rain is the main and most important resource of ground and underground water in the area. The average yearly it is around 523.3 mm. so it causes of many springs, fountains, wells, and streams for instance, Balinteran stream and Saray Subhan Agha spring that are a dependable source by farmers to their farming.

That amount of rain which is pouring down at this zone is the main resource of drinking water that taken from springs, streams, and wells. Like Saray Subhan Agha spring and Hasar fountain are the two main resources of Saydsadiq drinking water. So any reducing may affect drinking water directly and gradually leads to vanish. It is the main resource of irrigation of agricultural products. According to the researches investigation 90% of the land of this district are dry farming like wheat and barley, it is an important product for the area especially wheat that we have 50580 tones in 2012.

Raining has the main role to natural plants that leads to a wonderful weather at this zone. Despite of these things this rain causes of reducing wind speed by the growing plants and having a clean area that has a great influence on tourism.

As a result of a good average of raining many natural plants grow particularly (Savana and Steps) that directly.

Raining has a tremendous role in creating streams, rivers, underground water and groundwater, erosion, and etc natural geographical and geological phenomenon.

b. Snow

Snow is a direct falling of snowflakes or icy flakes that have been getting directly from evaporation (Muhammad and Talabany 2005). when temperature is getting lower than all troposphere layers and ground temperature not more than three at that time snowing getting start. Snow has been made when air evaporation are freezing to glassy crystal rectangular. And we never have layers of snow (Imami 2009). Snow has a higher hydrologic than rain, because of that there is less evaporation than groundwater (Faris 2008). snow is already a great resource of underground and groundwater that subsiding between the cracks of earth (Dawd and Amin 1990). the most effective reason on snow is the thickness. That has got this thickness according to elevation and the moor opposition with north cold wind (Sharif 1999). We have got to snow at the range of mountains (Basic, Kazhaw, Haji Mamand mountains. It is a high ratio that near 900-1200 m elevation. In winter and more especially on January and February it gets higher and

higher with different types. The top and moor of mountains are covered by snow for more than two months.

On January and February the snow is different from other periods because it is thick and dense so it causes of providing 1 centimeter water more than others. So as long as we have layers of snows together we have the chance of flood. So we are going to discuss about the importance of snow in the research zone in some points:

1. Snow has tremendous impact on ground and underground water with the streams, rivers, seas, and lakes. In 2006 the area had got a high ratio of snow that boosted up underground water while in 2008 this rate got lower and had a great reduction on the water resources.
2. A great source of extracting visitors and tourists because of that wonderful scene.
3. A large amount of snow will be helpful to some birds and animals to catch their prey and getting food.

c. Hail

Hail is a small round icy component that reaches earth through spiral storm that taken from those clouds that look like a stack of layers. The air must be too cold and raise the drops for the frozen level. The process is from liquid to the solid because of too much frozen and melt the air cannot hold the substance so it falls down to earth (Ahmed 2011). At the end of this subject of pouring down we will cover about the features of pouring:

1. The elevation of the area that approximately 2000m like Barzian, Kazhaw, and Basic mountains this causes of poring a large amount of rain because mostly it is mountainous rain (Tutors 1998). as it was shown in chapter two the pouring yearly average of rain is (523 m).
2. The raining system of Saydsadiq is the same of the Mediterranean's. it means raining is in winter, spring, and autumn. A lower wind of Mediterranean has impact on this zone.

3. The average of raining days is 60 days. Hail at the same time equivalent to the cold wind and repeating in the spring.
4. The area has got all of the types of pouring like rain, hail, and snow that distributed among the various areas of the zone.
5. Those cold winds that come from Mediterranean is the great impact on pouring at the area which starts from September to May.

4.3.1.2. Ground Water

The ground water of a specific area is the result of the hydrologic and metrology effectiveness of the area. There are yearly, monthly, weekly, daily, and even hourly changes. We cannot reach an exact and accurate data of ground water because at that time we need to follow the reasons that leads us to the evaluation of the alternative and various reasons that made this result (Samur 1999).

So ground water is all of these waters that are on the ground and made up because of the pouring down of (rain and snow). The resources of the ground water are usually located in the mountainous areas while they are beneficial for the plains. So these resources are useful for the various daily activities and agricultural and farming acts of the area. Geomorphological feature of the valleys and rivers are known because they cannot take benefit from them as a result of depth of valleys and speed of the river's water. So only in Sharazur plain the farmers get benefit from the rivers by narrow streams and dynamos to the higher zones. Despite their reduction in summer that some of the streams are getting dry. The averages of movable ground water are not leveled. First it gets higher on February and gets lower on March. Then there are layer of snow that going to melt because of temperature until the end of May. The average has a great distinction between the rainy years and drought's. There are many streams in the research area that are beneficial for the variety of farmers' productions. Some of them are getting drought in summer. The followings are the most important stream:

A. Everlasting Streams

These streams waters have many resources not only snow and rain, but underground water is also takes a part of them (Ismail 2004). there water may raise and fall according to the seasons but underground water don't let them to get drought. Some of these streams have resourced from high areas and remain everlasting passage for water. The most important streams are:

1. Chaqan Stream

The sources of this stream come down from the east of the district like (Rasi, Jautan, Kolitan, and Dolla sur) streams. Choma Rasi stream and Kolitan with Jautan gather together and then with Dolla Sur come together above Jwala village and finally they form Chaqan, Then Basaky pouring to it that consists of many small streams and springs. After that Tutaqach and Waltsamat in the east pour to the stream. Eventually, there is another pouring which is Kani Zard in the left of the district. Look Figure 4.29. and Figure 4.30.

This stream distributes Saydsadiq bazaar into two parts that goes toward south till pours to Darbanikhan Lake. The length is 26 km and the width is 15-20m. it has a great significance for the district's formation because if we look back at history we will know that there were many accommodations at sides of this stream. Shanader, Haji Namiq, Taperash, and Kalurran villages have been built because of this water resource. Also it is a good resource for farming and agriculture at this district. Now at this time of summer the stream doesn't reach at the district because of its reduction and usages above the district by the farmers and gardeners.



Figure 4.29. Chaqan Stream in Saydsadiq

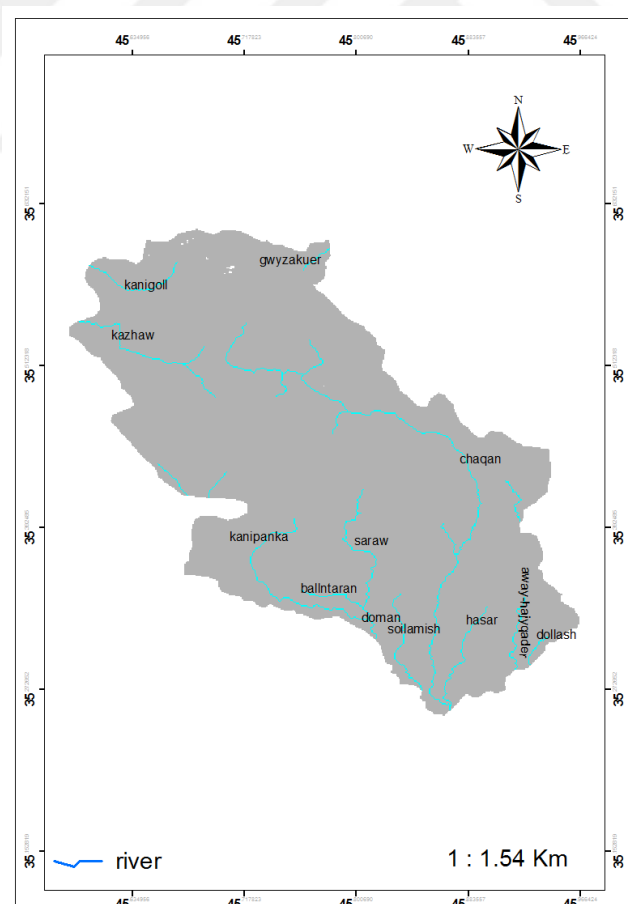


Figure 4.30. Everlasting rivers in Saydsadiq

2. Tanjaro Stream

This stream's resource locates of the west of Sulaymaniah. This stream is one of the parts of the Sirwan River. The waters in the Sulaymaniah zone at Azmar and Baranan mountains gather and pours to the Tanjaro (Khasnack 1973). As like as Chaqan it is a great resource of farming and irrigation. However it is not that large but when it reaches Sharazur plain it gets larger because of pouring several numbers of springs, streams, and snows of the Hawraman Mountains all together make the stream significance for the area. It is near of some villages (like Tapi Karem and Mwan) that they can get benefit from the stream for irrigation and farming. But the water is not proper for agriculture. Then it goes toward southeast till it pours to Darbandikhan Lake. The length is 19.7 km that passed through researched area.

3. Nawgirdan Stream

This stream located in the southwest of the researched area. It is one of the everlasting streams that sourced from Girdanaze Village. It longs to the south by (6 km) through Nawgirdan and Girdanaze villages then passes through Sharif plain till pours Darbandikhan Lake.

4. Sirwan River

This river's sources are from Kurdistan Region of Iran's mountains that distributed among three parts so as called (See Rwan means Three Rivers). One from west of Alwand mountain that called Gawrid, second from Lurstan area, and third from north of Sina governorate with 45 km (Rashid 2007). Sirwan gets in to Iraqi Kurdistan near of Lawan village. This river have ranged for 25 km between Iran and Iraq border. A dam has been made near Darbandikhan. In south of Darbandikhan between the range of Hamreen mountains some streams are pouring into this river (like Alwan, Dewana, and Narin). Also there is another dam that called Hamreen Dam. This river that has come from Hawraman Mountains of Iran Kurdistan then two streams pour into it. first one is Tanjaro that comes from Sulemaniah and second is Zalem which is from Ahme Awa. After leaving Hamreen Mountains it called Dyale River; it pours Dijla three kilometer at

the south of Baghdad (Alsahaf et al 1981). The length is (386 km) (Muhammad 2002). This river passes at the southeast of the researched area. It has a great role for the area and near villages. Now some of the water extract by pipping that used for agriculture and irrigation.

5. Haji Abdullah Stream

Haji Abdullah stream is one of the everlasting streams at the south of the researched area that sourced from Haji Abdullah spring. The length is (9.40 km) it leads toward south that filled with many streams and other springs water. It uses for irrigation in the (Berashke, Shatuwan, and Kelteke) villages.

6. Seraw Stream

This stream located in the Saray Sunhan Agha village in the west of Saydsadiq. It sourced from Saray Sunhan Agha spring. It has surrounded by a chain of mountains in the north. There are Saydsadiq district and Qilirgh village in the east. Main Doll village is in the west. This stream has a great role of irrigation and drinking water resource that piped to the district and provides water for Saraw, Ahblagh, and Shahidan quarters with Saray Sunhan Agha and Qilirgh villages. Also it is a wonderful please for the touristists that has a great economic role for the district. The length is 11.2 km from the recourse till it pours Darbanikhan Lake.

Three dams have been constructed on this water source:

A. Satrike Dam: This dam had been made at the end of Osmanic Empire and begin of English Empire. There were some muddy streams with 5 km length. Some of the farmers from Seraw, Qilirgh, Hayas, and Tape Rash villages use this stream and the rest pour to the Choman stream (Ahmed 2001).

b. Qelebo Dam: This dam firstly had been built with mud and stones then after Kurdish Tamuz Revolution on July 14th. 1958 it had been concreted. There are some streams that takes a part of the dam the most important one is Qelebo stream with 9 km length that water from Seraw, Qilirgh, Hayas, and Tasluje villages and then por to Choman stream.

c. Jawgege Dam: This dam firstly blocked with stones, sand, and grasses, but after Kurdish Tamuz Revolution on July 14th. 1958 it had been concreted. Both of the Serawy Khwaru (5 km) and Serw (9 km) streams have taken a part of it. it waters several villages (like Main Doll, Kani Spike, Tasluje, and Qumash) then it pours to Choman stream (Ahmed 2001).



Figure 4.31. Qelebo Dam

7. Doman steam

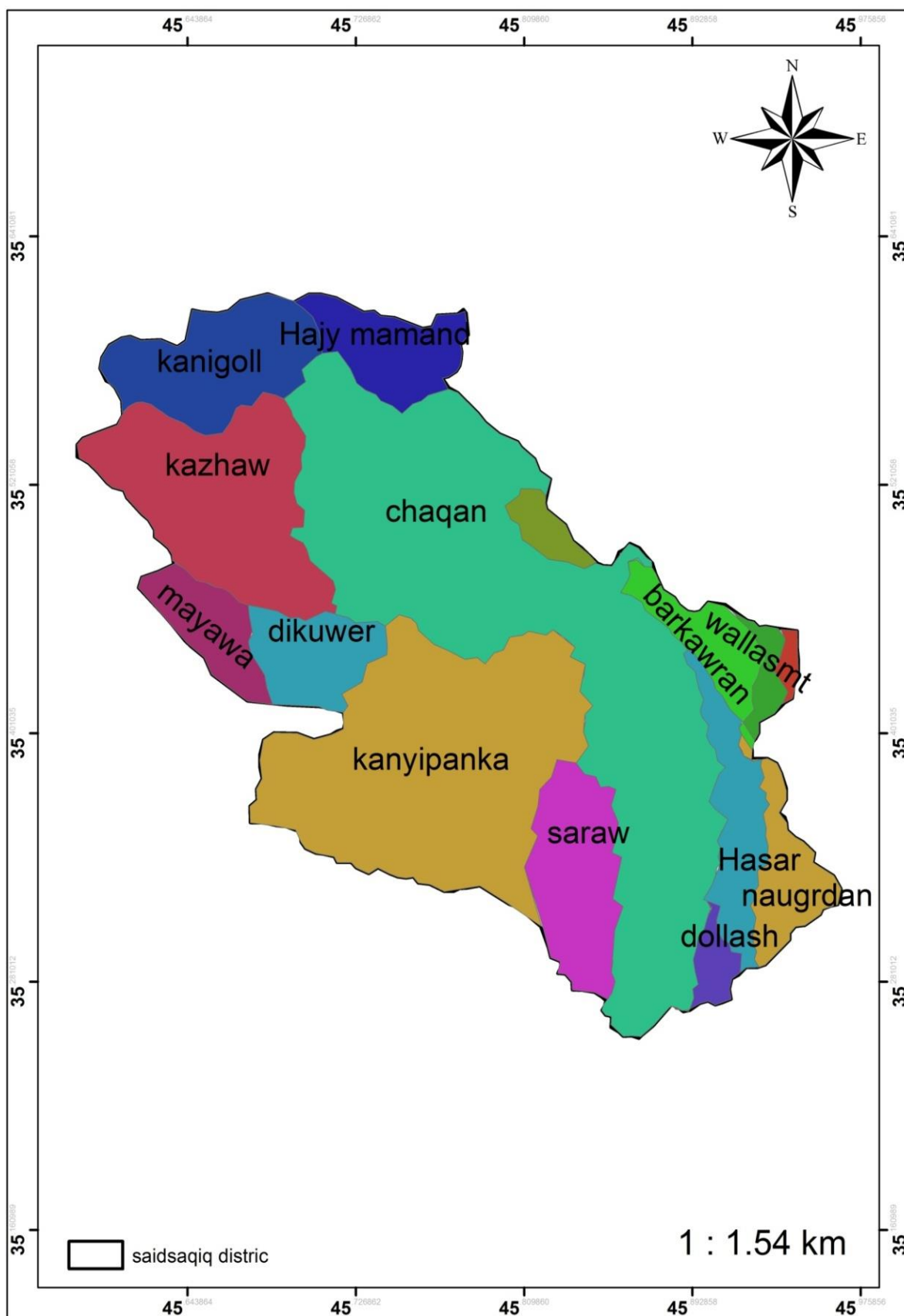
The length is 15 km at the southwest of Saydsadiq. It contains from the rest of the three dams. There were some other streams like Ashekan, Shule Barza, Chawg, and Qelebo streams pour to the stream. It longs toward south and then Hayas and Soylemish streams take a part of the Choman stream. It waters hundreds yards of farming lands below Bosh lake. Then in the winter with the rest of other streams like Zalim and Tanjero come together at (Twaqute Bridge) ten pour Darbandikhan lake that leads toward Kalar and Jelewla districts (Ahmed 2001).

8. Balinteran Stream: This stream located in the west of Saydsadiq in the Kani Panka Village. It is one of the everlasting streams. it waters (Kani Panke, Qalli Joey Serw and Muan Hassan) villages. Then it pours Darbandikhan Lake, the distinction point is that

this stream's water got a level that isn't reducing in the summer. Also it is useful for irrigation and farming.

9. Dollash Stream: This stream located in the south of the district that sourced from Dollash spring. It is the nearest stream of Darbandikhan Lake. As a result it passes beside of the district till pours the lake.

10. Shoke Stream: This one located in the north of the researched area that sourced from Shoke village. There are Wanderene village in the northeast and Baraw village in the northwest. Its length is 5 km then mixes to Gull spring (Researcher 2017). Look at Figure 33. to have enough information about streams. Despite of all these streams there are several other streams in the area especially in the south of the district like (Bereshke, Shatwan, Soilamish, Qadefery) streams. We have some other seasonal streams in the south of the area that have relativity with the lakes water level.



Figuer 4.32. Water resources

b. Seasonal Streams

They are all of those water resources that depended on the rain and snow of the mountains. There are drought in some seasons or may have changing to a waterway like a creek (Ali 2011). there are some seasonal streams in the researched area that got a high level of water at the end of winter till the middle of summer. There are the significance ones:

1. Barzinje Valley

It is one of the widest valleys of the area that got some accommodation places and an easy transportation area. Now Srochik sub-district located at the center of the valley. It ranged from Baezinje Mountain with 1620 m elevation. It goes toward south till at the bottom attaches to the Sarochik plain. Despite its seasonal streams that passed through it it gets a large amount of water in the rainy seasons. It holds rainy water and snowy water at the north and east then goes toward west till mixes with Kazhaw stream. Then it passes by the district till pours to Dukan Lake. It has 15 km length but the width is unknown because of the valleys wide range.

2. Kawllos Valley

This valley is surrounded by Tutaqach village in the east and Ashkewtan village in the west. Both of the Chwale and Pari Hero valleys located in the north and south of it. it has got 750-850 m. Kawles stream passes by this valley for 4 km. it is a seasonal stream that got many other creeks and waterways (like Basic, Zilzil, Chwale) streams. Then ranges toward mountainous areas till reach plains after Pari Hero villages that called Chaqan after that.

3. Barkawran Valley

It locates in Barkawran Village in the east of the studied area. It sideling from (km) heights, its length is 2 km, its width center is 450 m. There is a spoor of drift in this valley This valley has seasonal river and in summer the water dries up. But in rainy season accumulates a plenty sum of water from the mountains by the amount of the rain and it

goes towards south from east of Shanadar merges with some other creeks. In the plains expanse and stream of the creek is so wide, this makes a good opportunity to storage underground water because the valley's water distributes to a very wide breadth. This distribution has two benefits, the first ones of them is descending much amount of water into earth core. And the other one is lessening the waterway speed of the valley. So this increasing the waterway speeds vertically.

4. Basak Valley

It is regarded as one of the biggest river valleys in the district. Kazhaw Mountain is sloping; its width intermediary is between 900 and 1100 m. During sloping just like the other valleys of the area tens of valleys and rivers merges together the most obvious one is Zella valley. This river valley through the wideness of the valley its river length reaches 26,9 km this caused accumulation of lots of water from Kasha mountain and Bask, Basak Chnara, and Zlzla river villages, goes towards east near Pary Hero village flows down to Chaqan creek (Researcher 2017).

5. Hajimamand creek – Hajimamand valley

Since heights 1345 m from Hajimamand mountain slopes down, from north east is Gwezakwera village and towards east is Baqala village. In the middle of the valley is Hajimamand village. Its width intermediary is between 1000-1200 m. This valley pours in it the water of villages Barqala, Gwezakwera, and surrounding and behind mountains of Hajimamand. Because of the mountain heights and plenty of creek and river braches in raining season lots of water outflows from it. Towards west goes down Hajimamand village leaves the boarder of the district and comes to the boarder of Sulaimani Governorate and Sahrbazher district, the length of this river is 11,7 km.

6. Dekwer valley: Since heights 1420 m from Dewkera mountains slopes down, its width is between 900 and 1000 m. Plenty water of flows into this valley from Garmadara and Daratat mountains. Ayaraconi countryside merges with it that collects the water of Sherabara and Moryas. Both water merges and form a big river, that along (8 km) crosses the district boarder goes towards south and flows to Tanjaro river.

7. Zlzla Valley: From Miri Stone of Zlzla mountain slopes since heights 1500 m form seafront goes towards south along 9,24 km then flows into Basak creek (Researcher 2017).

8. Hasar Creek: This creek locates in Saidsadq next to Saydsadq mountain. From the east of the district between both Hasar and Haji Qadir tenement quarters, its reference is Hasar spring and fountain. It is one of the well-spring drinking resources of Saydsadq. It goes towards south of the district goes through Berashka&Shatwan countryside and flows into Darbandikhan lake, its length is 10 km (Researcher 2017).



Figure 4.33. Hasar stream

These river valleys that are discoursed are including some main creeks and valleys of the studied area. Despite these creeks there are lots of others that covered in the area. All of them or most of them directed from the mountains towards Sahrazwr plain, and from it their waters flows into Darbandikhan Lake, which contains much of the south boarder of the district. Also the north mountains which are the highest mountains in the area, thir slopes direction is towards south east and Sharazwr plain. This means that it is towards the studied area. So we can see till we go towards east and west to south there will be ascending from seafront becomes less and true oppositely. This feature makes it that the rivers and poured waters of surface water from the mountains comes to the studied area.

And because of this the geological composer of Sharazwr plain and Saydsadq district is a concavo-convex texture. This makes sloping down from the surrounding areas and through hundreds of valleys and mountains towards the plains. Especially those creeks and valleys that water pass through them. In a collateral from north to south. So the outflow of them is in a way that is symmetrical, those mountains and valleys are just like water accumulators for surface and underground water of Sharazwr plain. This makes that in the time of much raining and floods, surface water of Sharazwr plain covers most of the area.

4.3.1.3. Underground Water

Underground water includes all of those waters that are stagnated in the underground, appears on earth in two forms: naturally like springs and artificially like wells and fountains (Said 2008). having underground water has a great value in filling water needs, particularly in those areas that raining is not adequate. Or in dry seasons can get benefit from underground water for a good amount (Said 1998).

Underground water is regarded as the third water resource, that snow and rain are the reason for structuring it. And some other natural factors has great influence on accumulation of this water, its types and division. Including climate, relief, the nature of the stones and their poriferous level, since underground water has a tough relation with relief (Al-Samaray 2007).

Underground water is regarded as the most important source of fresh water for human usage, several cities, towns and villages of Kurdistan and the studies area are depending on this for daily assurance needs. And it is an important natural reference for river's and lake's water (Rashid 2011).

We should know that not all waters in underground are regarded as underground water. If we make dig up a hole from upper layers of earth is a humid or a refection layer. If it doesn't inter the well or the hole spontaneously, it cannot be considered as underground water. Only accounted as underground water when water of that soil layer inters that directly to hole. That time the pressure in the well is equal to earth pressure to inters that water easily to that well. So the underground pressure should be higher than earth

pressure, Here we can differentiate between underground and surface water with some points. The first one underground water has a higher pressure than surface pressure. But the other kinds of water has a lower pressure than surface pressure. Generally adequate depth for reaching underground water is more than 1-100 m. We can see that most places can't reach underground water by digging up (Aziz 2007).

Having underground water is in two levels, near underground water to sod which its depth reaches 797 m from sod. Approximately making (44.3%) of whole extent of world's underground water. But farer underground water from sod is far between 797-3963 m depth from surface. Approximately making (55.7%) of whole extent of world's underground water (Wahb 2001).

Because of the nature of much rain and ebb action in the area, it likes that inters water to underground . The amount of underground water of the studies area considerably is so fine. Structure and type of the rocks and stones has a great role on quantity and quality of underground water. Since the poriferousity of the stones and melted water makes to produce the best type of underground water.

Examining the distribution of underground water includes two parties. First examining the wells regarding their quality (instrumental and handy), their numbers and geographical distribution in the area. As well their depth, capacity of producing, and level of stable and changing water.

Second, examination of the resources and springs in terms of their distribution in the area with indicating their capacity in producing and the average of outflowing. This action will indicate the rich and poor areas with underground water in the area. The underground water in the area includes springs and water resources. Water beneficial in the area is in the form of (well, spring and fountains).

First: Wells

Well is counted as one of the ancient ways of pulling water from ground in The Region. They dig it for the sake of providing the various needs of population. By using the water descending factors or pulling through hydrolic pressure or using gas force which pulls out

underground water and pulls water from the wells (Sahahf 1983). pulling water from the wells in the studies area is in the form of (handy and instrumental).

Artificial wells

Are those wells that in a vertical form are dug in purpose of descending water into surface. Much number of the handy wells in the studied area locates in the south of the district and Saydsadq city center. The cause of having many handy wells in the district are the accumulative water layers and near underground water from sod. As well population mostly distributed with these area. Comparing to the north and Srwchk sunb district which is a dry, tough area and it is higher from seafronts and this makes not having handy wells in those areas and if available it is rare.

Artificial Well Depth

Among of seventy artificial wells were taken as example which is shown in attachment (1), the depth of artificial wells is about 4-40 meters, the number 40 is the deepest one between latitude 35.24.71 north and longitude 45.44.54 east, the height above sea level is 610 meters, the depth of artificial wells as below.

A- The wells which are between 4-8 meters deep: these are 29 wells about %41.4 of all artificial wells, the average is about 6 meters deep, the well number (53) has the least deep, the deepest one is the well number (4) between latitude (35.20.45) north and longitude (45.00.57) east, the height above sea level is (520 meters).

b- The wells which are about 9 meters deep: these are 23 wells about 32.8% of all artificial wells, the well number (8) has the least deep, the deepest one is the well number (4) between latitude 35,21,80 north and longitude 45.45.00 east, the height above sea level is 508 meters.

c- The wells which are between 15-20 meters deep: these are 10% of the whole researching area wells which are 7 ones, the least deep is 10 meters from number 2 which is located between latitude 35.20.50 north and longitude 45.54.54 east, the height above

sea level is 605 meters also the wells number 36,46, the least registered deep is 20 meters, the average is 2.17 meters.

Production performance of artificial well

The production performance of artificial wells of the area is between 0.1 and 6 liter/sec), the average is (2.3 liter/sec) as shown in table (1-4). The production performance of the wells is as below:

- A.** The production performance of 22.8% of the whole researching area wells is between 1-6 liter/sec the average is 2.8 liter/sec which are 54 wells.
- b.** The production performance of 77.1% of the whole researching area wells is between 0.1 and 0.8 liter/sec the average is 0.4 liter/sec which are 16 wells.

Varying water level of artificial well

The varying water level is between 3 and 19.1 meters, the least varying level is located at south of the town in the village 'Dollash', the varying level of water is 3 meters, the level of water not changed more because of nearby from the lake, the well number 27 has the deepest varying level which is located at the village 'Mwanakon', the varying level is 19meters, the average varying level of wells is 9.12 meters as shown in attachment .

The varying level deep of artificial wells is as follows:

- a.** 64.2% of the wells depth is between (3-9) m the average is (6 m).
- b.** 35.7% of the wells' depth is between (10-1, 19 m) the average is (12.7 m).

Constant water level of artificial well

Constant level of the wells is between 2.5meters at the well number 17 and 18 meters at the well number 40, the average is 6.5 meters, as shown in attachment (1), the characteristic of the level as below:

Constant deep level of 60% from the whole researching area wells is between (2.5-8.8) meters, the average is (5.7 meters) which are 42 wells.

Constant deep level of %40 from the whole researching area wells is between (9-18) meters, the average is 11.8 meters which are 28 wells.

Drilled Wells

The wells their deep reached the groundwater permanent level, the water flows to earth surface naturally because of hydrostatic pressure, or extracted using gas or electricity, the depth of artesian wells are different from one place to another, this difference refers to several reasons, the important reasons are:

The shape of earth surface, highs and lows of the area.

The slope of the layers which hold water.

The distance of the water-holding layers from the earth's surface.

Some of these wells were dug by the directorate of Sulaimani groundwater between years 1948-2015 in direct spin to provide drinking water and irrigation, some of them were dug by the companies and merchants to provide water for factories and fields, also some of them were dug by people for agricultural works. The wells that were dug by people and possessors of agricultural fields compose 90% of the artesian wells (Ali 2011). They are called (Syrian Wells) which are managed by companies therefore a correct data is not available about artesian wells.

Sometimes the water of artesian wells is continuous and sometimes not, when the wells depth is lower than the groundwater source level of that area, the water is continuous.

The wells' depth at Saydsadiq town

The difference of well depth is changed according to the purpose of the well, for example if it is used just for home requirements, the depth according to the place is less, but if the

well is used to provide a continuous water in order to provide permanent water for people such as the wells are dug by the government, or those are dug for agricultural fields, they are dug deep more so as to keep them from drying up especially in summer which is the season of seeping down of groundwater (Ali 2011). also the well depth is different according to the difference of topography, difficulty and dry of the area.

Drilled Well Depth

After taking 118 examples from artesian wells shows that the depth of artificial wells is between 42 and 400 meters according to attachment (2), the least depth is the well number 73 which belongs to (Ibrahim Mohammed) at the south of the area which is 42 meters deep, the height above sea level is 522 meters, it was dug in 2006, it has the least deep in the researching area, and the well number 81 in 'Kelakawa' at the second grade.

Machine-Drilled Well's static Water Level

Machine-Drilled well's Static level is between 0 and 295 m, as it is shown in the Annex (2), Machine-Drilled well's static water level is as below:

-11% of the whole wells are of static water levels and is (zero), 13 wells.

-16.9% of the whole wells are of static water levels between 0,5 and 6 m, average (1,3 m), 20 wells.

-43,2% of the whole wells are of static water levels between (6-20 m).

-22% of the whole wells are of static water levels between 21 and 75m, 26 wells , average (0.45) meters.

-3 wells with static water level between 183 and 295 m average 239 m. A ratio of %2.5 of hand drilled wells.

Highest static water level is the well No. 107 in (Kotror) village, lowest level is the well No. 112 , 38 and some others, which are of zero static water level.

Herein needs to be said big difference between static and dynamic water levels means that the area is poor in underground water, and vice versa. Richer the area with underground water will be as the difference between those two levels goes down. Richest area will be when the difference between those two levels is zero, as it is in table No. 2 the difference between the two levels is equal to zero in the (Kawchkh tash , Berashka and Nawgrdan) villages, in the second place of minimum difference comes well no 12 with (6 cm) in difference.

Regarding the maximum difference between those two levels, the well No. 90 is in the first place with 81,5 m in difference between static and dynamic water levels, and the well No. 109 is in the second place in Bardarash Village (Researcher 2017).

Generally, the difference in the well levels is in a good range, which this means that the area is rich in underground water, but going up to the north of the district; near sub-district Srochkh, Bardarash, Kaneh Goll and Waratat villages; shows bigger difference between those two levels, and this means less underground water in that area, going down to the southern part of the District and Darbandikhan lake shows richness in underground water.

4.3.2. Underground water Quality analysis in Saydsadiq District

At first, we have to bring up the world health organization (WHO) standards for the potable water elements, as it is shown in the Table 19. Also Iraqi standards in the year of (1996) as it is shown in the Table 20. so to decide on the water drinking suitability because the targeted area for the research is underground water dependent, and there are agricultural , dairy and poultry uses of the water. Therefore, it is needed to show the suitable measures for the water which make underground drinkable for the animals as it is shown in the Table 21.

Classifying and usages of the underground water requires chemical analysis so we know that the water is drinkable, is it acceptable for irrigational and industrial usages, because there is always reactions between water, geological layers and gases which this made underground water impure. It is important to measure the salt and Total Dissolved Solids

in water, as this measures will identify the limitations for different usages of water. High range of Total Dissolved Solids will harm human health and is not suitable for drinking, cannot be used for irrigation and will affect the crops.

After collecting 40 water well samples (machine and hand drilled wells), 12 spring water samples, chemical tests has been done for 12 water elements. Through these analyses; it will be known if the underground water in this area is drinkable or not. We will explain the chemical analyses for the both sources as it is shown in the Table 20 and 21.

Well water's Chemical specification in Saydsadiq

1. Potential of Hydrogen concentration (pH)

Water treats in regard of Hydrogen ions, it is classified into two parts in regard of existing Hydrogen ions (Acidity or Alkalinity), which indicates Acidity and Alkalinity. Better understanding needs further Chemical clarification on this subject:

Acidity means Existing Hydrogen ions or the number of Hydrogen, Hydrogen number starts from zero up to 14. Hydrogen number 7 means neutral (neither Acid nor Alkaline). If the Hydrogen number is above 7, this means the water is Alkaline, but if it is below 7, the water is Acid (Khalil 2003). As a result of some reactions they will change to (=H) ion or Negative Hydro chemical (-OH), increase in the average Hydrogen means increase in the liquid Acidity, increase in Hydroxyl means increase in Alkalinity, in the state of Neutrality, the number of Hydrogen ions should be equal to the numbers of Hydroxyl ions. (Fahd and Mashan 2010).

Negative logarithm of the hydrogen ion concentration ($\log(h) = -pH$), is a numeric scale used to specify the acidity and basicity of water, in the Annex (3) –the well water's treats- in the research area, we can see that; the pH differs from one location to another, using the range 6.5-8.7; well No. 15 in Sara quarter close to (Bardarash) village has the maximum value, the minimum value is in the well No. 21 in Qawila village which belongs to Srochk sub-district. The average range in the area of research is 6-7.7, overall the water is Alkaline. Two wells has Neutral value of pH which are the well No. 17 in

Gellara village and the well No. 27 in Kazhaw village which belongs to Srochk sub-district. Regarding the suitability of the water, comparing the water treats to table 4.19 and table 4.20. which are representing the Iraqi and World Health Organization standards for drinking water; all the well's waters can be used for drinking for both Human being and animals.



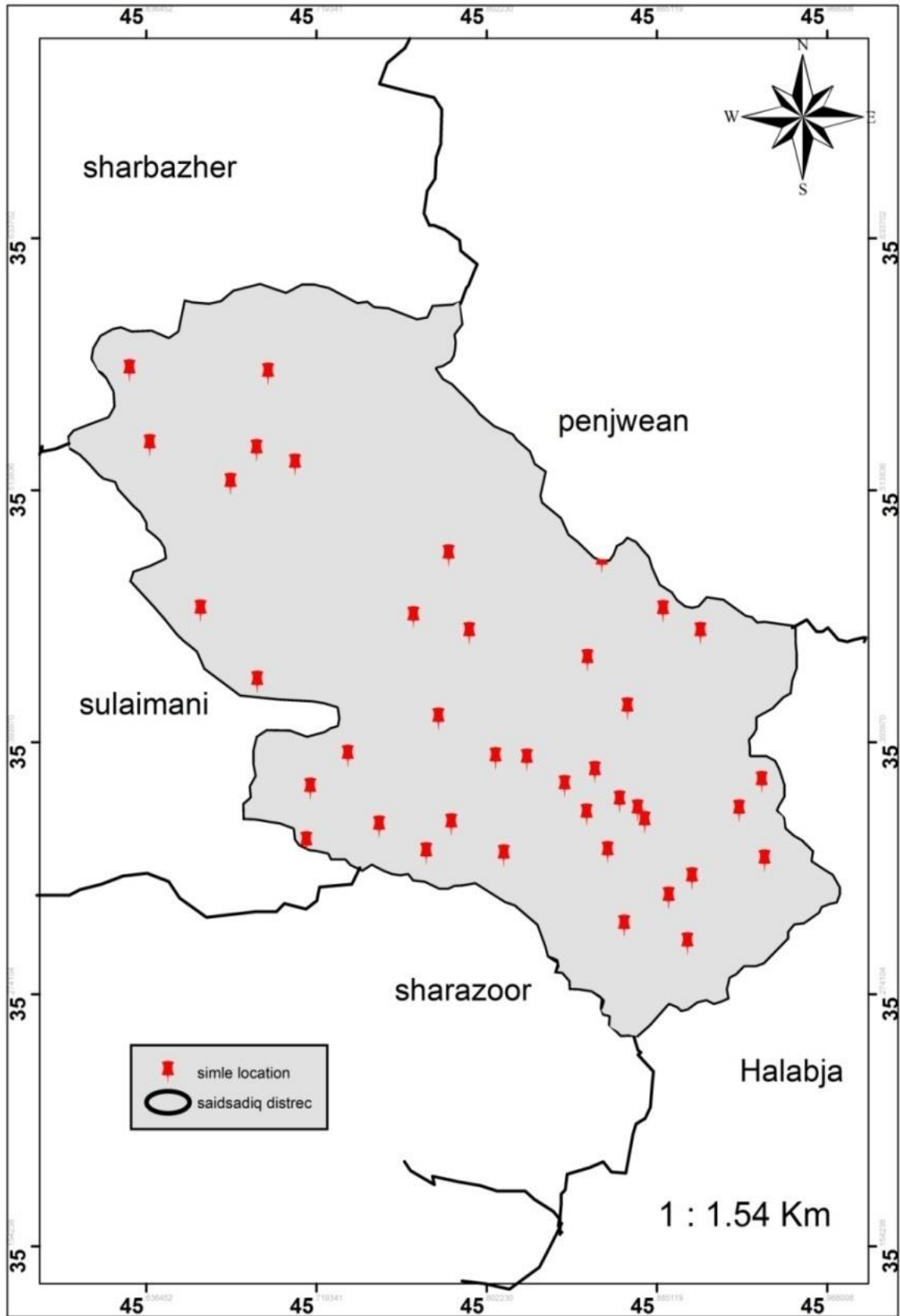


Figure 4.34. The collected samples locations in Saydsadiq

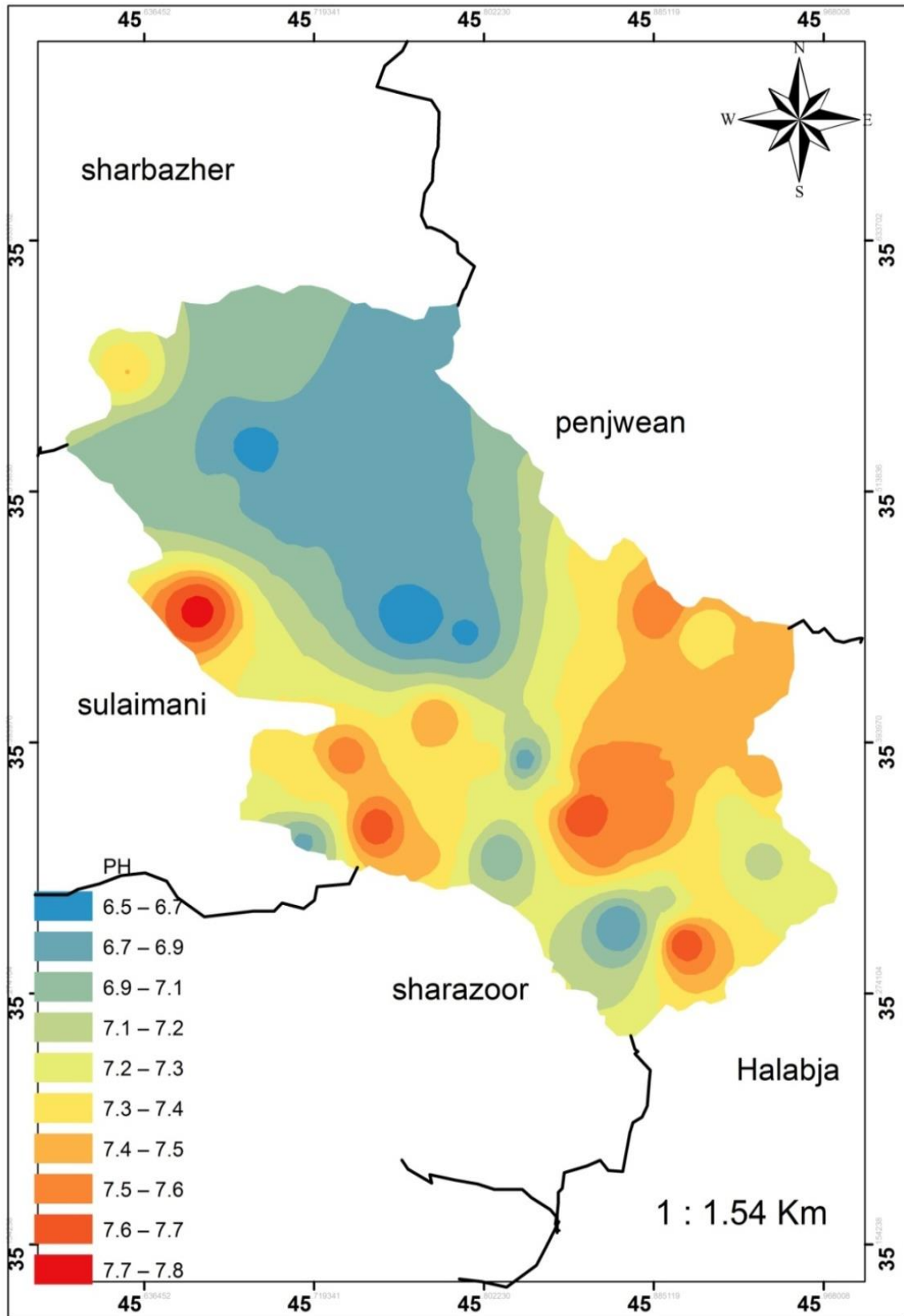


Figure 4.35. Location and graphic lines of (pH) for the collected underground water samples in Saydsiguadiq District

Table 4.16. World Health Organization, year 2006, for potable water

SO ₄	HCO ₃	Mg ⁺⁺	Ca ⁺⁺	NO ₃	ALK	CL	TH	K ⁺	Na ⁺	TDS	EC	pH	Levels
200	125	30	80-150	10	80-125	100	80-150	2-3		500	300-800	6.5	Minimum
-	-	-	-	-	-	-	-	-	200	-	-	-	
250	350	150	200	50	200	250	500	3	0	1000	2500	8.5	Maximum

Table 4.17. Iraqi Standard for year 1996, for potable water

SO ₄	NO ₃ ⁻	MG ⁺⁺	K ⁺	Na ⁺	Alk	TH	TU	TDS	EC	PH	Cl	Ca ⁺⁺	Potable water standards
250	50	50	0	200	1	500	0	1000	1,500	6.5-8.5	250	150	Iraqi Standards

Table 4.18. Water drinking suitability standards for Animals

Elements	Verely suitable	Suitable	Accepted water	Can be used	Maximum accepted limit
Na	800	1500	2000	2500	4000
Ca	350	700	800	900	1000
Mg	150	350	500	600	700
Cl	900	2000	3000	4000	6000
So ₄	1000	2500	3000	4000	6000
TDS	3000	5000	7000	10000	15000
TH	1500	3200	4000	4700	4500

2. Dissolved salt – Total Dissolved solid TDS

The measurement unit is mg/Liter or ppm, being proposed to rain precipitation, river water amount, geological texture and human activities; the limit is below 1000 mgm/liter of Total dissolved solids or salts in the water, which means the water is pure (Majid 2014). Solids exist in two forms in water; soluble and residual. In genral (TSS) is used for Total soluble solids (TDS) is the dissolved solids in water, mostly used for dissolved salts (Omer 2006). Dissolved salts concentration differs in different sources of water, this depends on the water which has been stored and the underground water movement speed, with maximum speed we can find less dissolved salts, because when speed increases it means water does not stay longer in a place and this decreases Chemical reaction with it's surroundings (Al-Manmi 2002).

As it is shown in the Annex 2, maximum TDS for the collected samples are located in Qawila village, values 1,400 mgm/liter, minimum TDS is located in the well No. 22 in Shanadaree nawarast, total dissolved salts in the research area range showing that the water is drinkable in the research area, except one sample , all the others are suitable due to Iraqi standards. This is the evidence for the low concentration of salts and metals like calcium and potassium in the underground water in the area. Figure 4.37. shows the location distribution and existence of this element. Based on TDS we can classify water in the below table:

Table 4.19. Water classification based on TDS14

TDS value	Water type	No.
Less than 1,000 mgm/liter	Sweet water	1
1,000 -3,000 mgm/liter	Neutral salted water	2
1,000 -3,000 mgm/liter	Salty	3
More than 3,500 mgm/liter	High salty	4

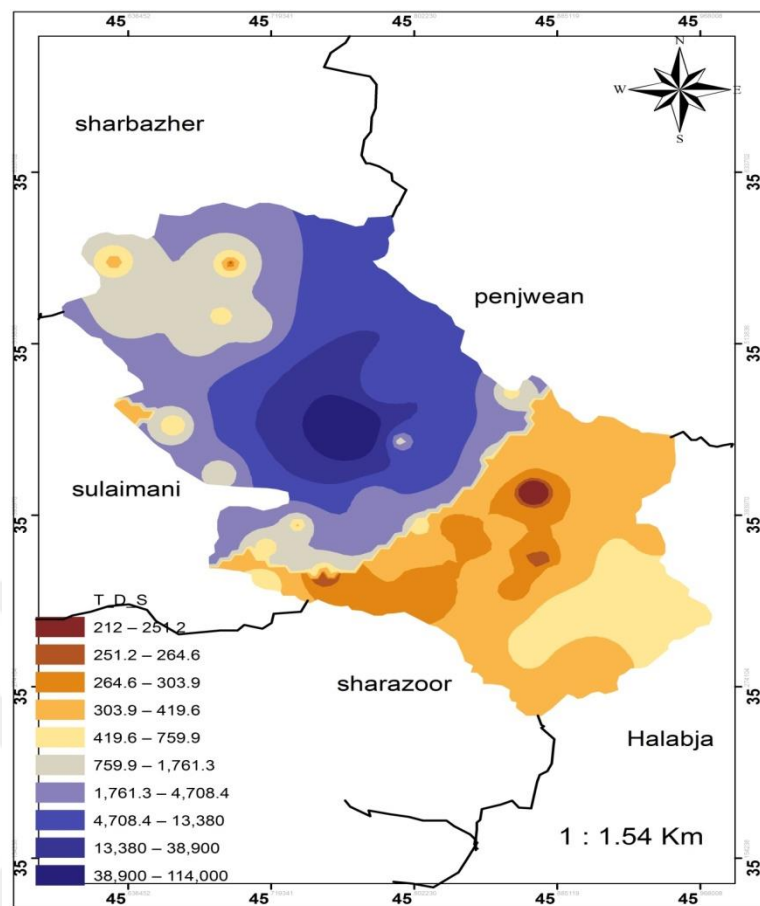


Figure 4.36. Location and graphic lines of (TDS) for the collected underground water samples in Saydsadiq District

3. Total Hardness (TH)

Water in general, and especially underground water includes some types of salts and hard metals, as a result of passing water through soil and stone grains they get mixed with water. The worst types of those salts are calcium carbonate and magnesium carbonate.

Existing these salts in water makes no soap foaming, and this water cannot be used for cleaning purposes, also cannot be used for neither cooking nor boiling. Those salts who are stopping soap to make foam like Sodium and Potassium salts and contains fatty acids, therefore mixing soap with a water ;which has those salts; there will be an exchange between the soap and the salts. Calcium and magnesium salts, will bind with the fatty acids and the salts will not dissolve in the water, they change the water color and will sediment at the bottom of the plates and the kits, and will stop the soap making foam.

These types of water for cooking and boiling will leave a hard layer at the bottom of the kits, because these salts lose their dissolving ability when water temperature degree rises, will result in food taste and color change. May result in (steam pot) explosion as a result of non equal distribution of temperature degree at the bottom of the pot.

Hardness in water is two types:

1. Temporary Hardness: Exists because of carbonate, bicarbonate and magnesium salts, boiling water will make these salts lose their dissolving ability and will sediment at the bottom of the plates and the kits, dissolving these salts will cause under high temperature degrees, but as a result C_2 or CO_2 gas will be released, these gases are Acids and will cause erosion in the kits.

2. Permanent Hardness: This type of hardness contains calcium, cagnesium, phosphate and sulfur salts. These kind of salts are recognized by their stability and are not easily solvable as the carbonate salts. They are similar to the other salts only in case of high temperature as they lose their dissolving capacity and will sediment at the bottom of the plates and the kits (Abdulrahman 2008).

Regarding the TH amount in the underground water in the research area, the maximum amount lies within the well No. 27 in Kazhaw village and the amount is 2,300 mgm/liter, and the minimum amount lies within the well No. 35 in Kawchk tash village at the south west of Saydsadiq town 200 mgm/liter, the average TH for the whole 40 samples is 423 mgm/liter. In the annex 3 and the both scales, we can obtain that the water in the wells No. 21 in Qawila village, No. 27 in(Kazhaw village, No. 28 in Bardbard village and No. 17 in Gellara village with some other wells that are all located in Srochk Sub-district, the TH value is not in the acceptable range and those waters are not drinkable. Those wells which are located in the south and Center of Saydsadiq town, have suitable water for drinking for humans and animals, because their maximum TH value is less than the accepted value, this is the indicator for the acceptable value of accumulated concentration of the dissolved salts like Calcium, Magnesium and Sodium, etc.

Table 4.20. Classifying water by Hardness

TH	Water type
0-75	Soft
75-150	Moderate Hard
150-300	Hard
More than 300	Very Hard

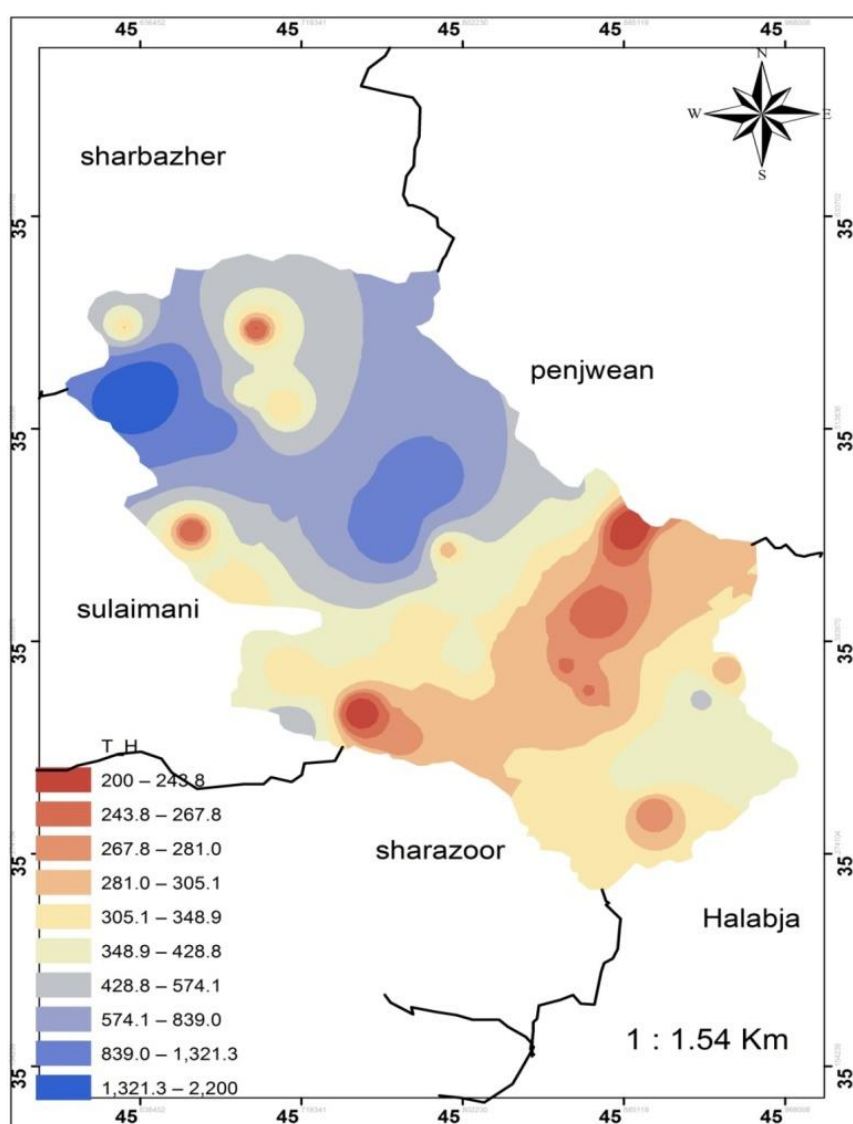


Figure 4.37. Location graphic lines of (TH) for the collected underground water samples in Saydsadiq District

4. Chloride (Cl)

The main source for Chloride in water is the stone and mineral layers in the old sea, in addition to some other sources like Organic wastewater, Potassium fertilizer, animal feed and irrigation industrial water, large ratio of those ions in the water will cause pipe erosion and metal structures, also affects the agriculture (Ali 2011).

Chloride ion in average reaches 19,000 mgm/liter, generally, in underground water reaches 12-13 mgm/liter, water with Chloride ratio less than 150 mgm/liter is suitable for all usages. If this ratio is more than 250 mgm/lite), then it is not suitable for drinking, more than 350 mgm/liter is not suitable for all the industrial and irrigation purposes. For animals, chloride in range 3,000 – 4,000 mgm/lite) is accepted (Khalil 2003) .

Analyzing the Saydsadiq samples, we can obtain that the maximum level of this element is 109 mgm/liter in the well No. 3 in Berashka village in the south-east of the district, this shows the high level of Sodium Chloride and lime, the minimum level is 12 mgm/liter in the well No. 39 in Greza village, the average in the whole collected samples is 26,72 mgm/liter. Their suitability for human drinking, as per the table , the research area underground water is excellent for all the creatures , chloride wise, because according to the scales 250 mgm/liter, so the maximum in level in the area is below the accepted limit.

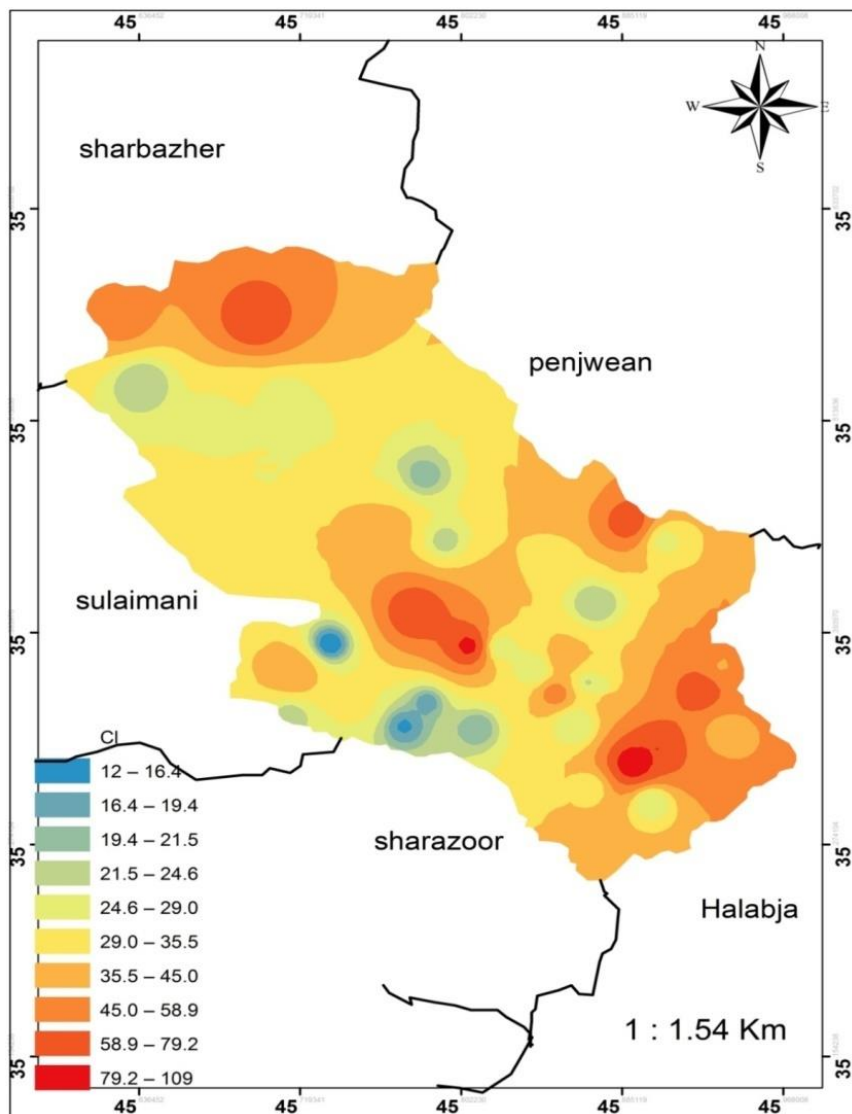


Figure 4.38. Location and graphic lines of Cl for the collected underground water samples in Saydsadiq District

5. Calcium Ion (Ca^+)

Is one of the main elements in the underground water, its source is Lime stones (calcites) and anhydrite, because of their richness with Calcium ions (Hussen 1989). Calcium ratio is small in the river waters 10 mgm/liter, but in the underground water is 50 mgm/liter because of travelling across the lime stones and calcites with high dissolving ability and it will be a source for increasing calcium carbonate. It could be find in both Surface and Underground water, due to the friction between the metals in the soil and the stones most of the calcium is in the form of sedimentary rock which consisted of

carbonate. Its measurement unit is mgm/liter, accepted range is between 80-200 mgm/liter, World Health Organization and Iraqi standard is 150 mgm/liter. Their suitability for human drinking, in the light of the calcium amount we see that per the both scales, water from the wells No. 21,27 and 17 which are the previous wells are not suitable for drinking. Because the stone layers in the research area are dissolved layers and are from whitened calcite, Faced many chemical weathering, this means that the layers are rich with Lime, the minimum level in the research area is in the well No. 39 in Greza village, the average calcium for the collected samples is 57.81 mgm/liter, this means that the water samples are in a good range and are drinkable.

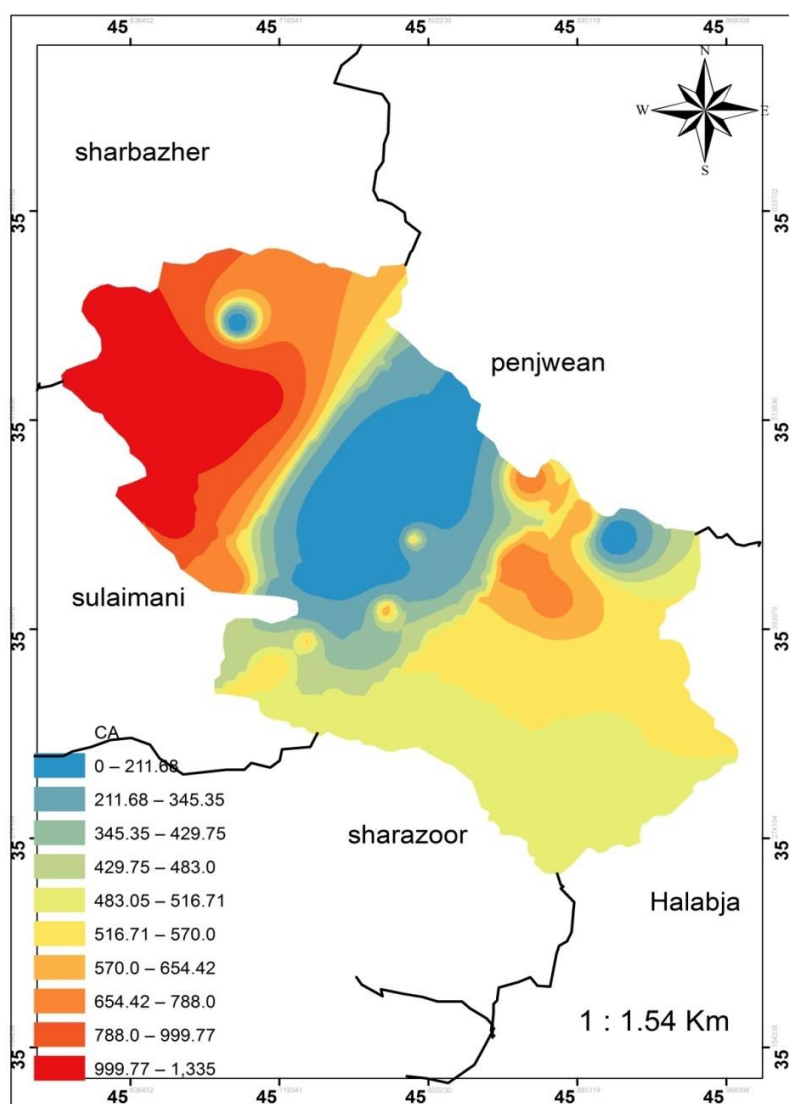


Figure 4.39. Location graphic lines of Ca for the collected underground water samples in Saydsadiq District

6. Turbidity

Water is turbid or impure when there is organic or microscopic creatures (microbes) in it, but surface water will be turbid regardless of these two factors, like the soil clay residual, because of this the sunlight will be obstacle to reach a significant deep into the water, and will cause the stoppage of photosynthesis and this will lead to less biological products, water turbidity is measured by Nephelometer in NTU measures (Ali 2011). High ratio level of turbidity affects the drinking quality of water for humans and animals, according to World health Organization standard, the allowed level of turbidity is between 0 and 50, and out of the range is not drinkable (Sahaf 1976).

Saydsadiq water Turbidity is mostly (zero) Nephelometer, except some samples with 37-93.4 Nephelometer, as it is shown in the table; all the samples are suitable for human and animal drinking, and this is a testimony on the underground water purity in the research area.

7. Sulfate

Sulfate ion exists in different ratio in all the water sources (Al-Jibury 1991). Sulfate ion comes from the steamed rock layers, through the chemical fertilizers, bleachers and stones, sulfate will get into drinking water, another source for phosphate is gypsum, from the large caves and geological textures will sediment. Also, the human activities and sewage leakages are sources for underground water Sulfate (Al-Manmi 2008). In the Annex (3), the maximum Sulfate amount is in the well No. 21 in (Qawila) village, and the amount is more than the allowed limit, as per the two standards, the water from this well is not accepted for drinking purpose. In average, the whole collected samples has 39.65 mgm/liter, this amount means that the water from all the wells is suitable for drinking and other usages, the reason is because of no industrial structures and activities in the area.

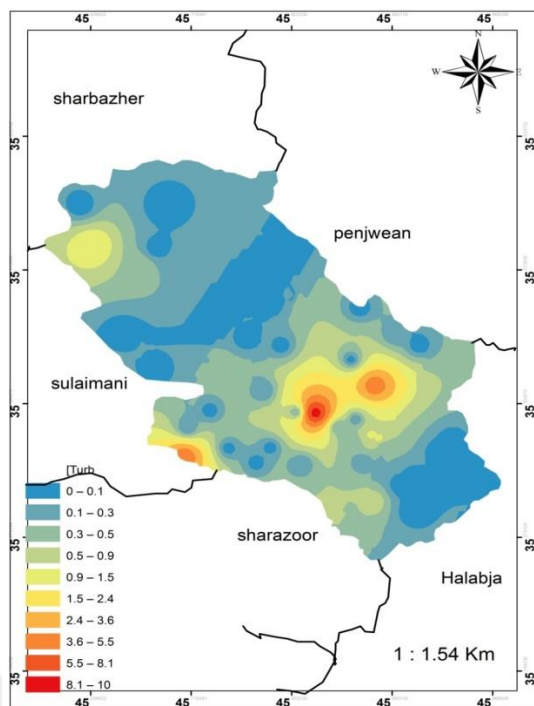


Figure 4.40. Location and graphic lines of (Turbidity) for the collected underground water samples in Saydsadiq District

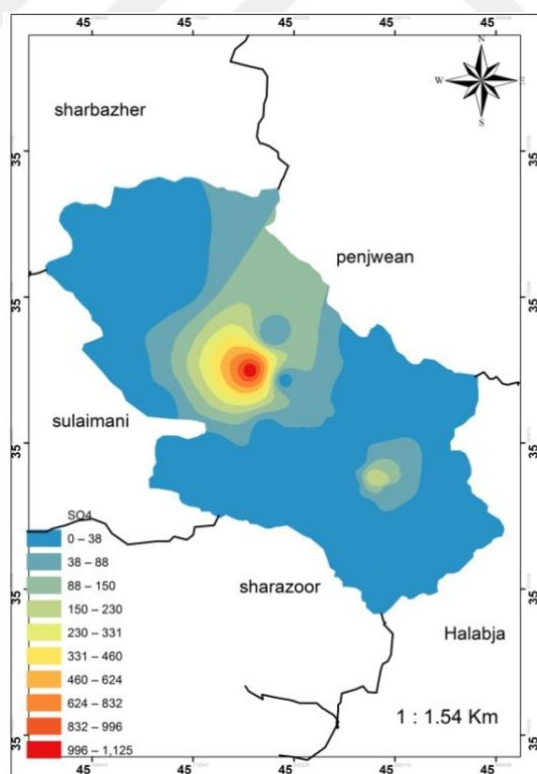
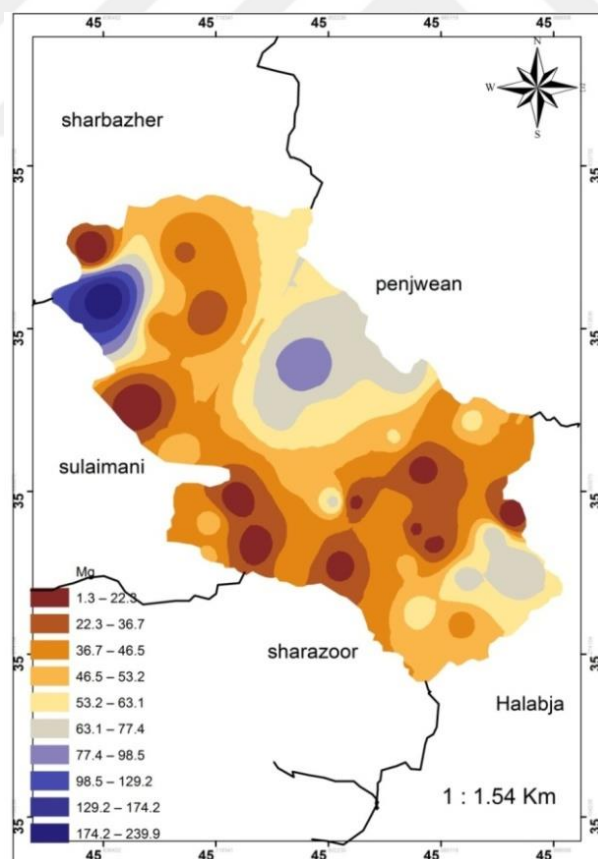


Figure 4.41. Location and graphic lines of (SO4) for the collected underground water samples in Saydsadiq District

8. Magnesium Mg

Sedimentary rock; especially dolomite sedimentary rock is counted as the main source for the magnesium ion, in igneous rocks and metal clay existed with the ratio 47%, Magnesium concentration in the rain water is 288 mgm/liter, in river water is 1.4 and in underground water is 7 mgm/liter (Ali 2013). Analyzing the collected samples within the area, out of the 40 samples of the wells, the value of Mg varies from one location to another between 103-239 mgm/liter, the maximum value located in the well No. 27 in Bardbard village at the northern part of the area in Srochk District, the minimum value is located in the well No. 8 in Qaynja village at east of Saydsadiq, average Mg in the area is 47.37 mgm/liter, this a good sign that the water in these locations is suitable for drinking, this is because of existing no iron metals in the rock layers in the area. Magnesium in the natural water is less than calcium, the reason is because of the dolomite sedimentary rock solution is slow and spreading Limestone in the earth crust.



Figuer 4.42. Location and graphic lines of Mg for the collected underground water samples in Saydsadiq District

9. Alkalinity

Alkalinity means the ability of water to react with Hydrogen (Muhammad 2009). the source of basicity is carbonate and bicarbonate ions, meanwhile the nitrate carbonate and bicarbonate ions do not affect the Alkalinity (Khalil 2003). It is measured in the Calcium carbonate powers in spite of the carbonate and bicarbonate ion powers, all of the mare measured in mgm/liter, represents in calcium carbonate, bicarbonate concentration in rain water is 120 mgm/liter, in surface water 58 mgm/liter and in underground water 50-250 mgm/liter. In the Annex (3), we see that the maximum amount is 315 mgm/liter in the well No. 16 in Saraw village, the minimum amount is in the well No. 33 in Mayawa village, the average is 241 mg/liter for the all samples, as per the two standards, the alkalinity is not affecting the drinkability of water.

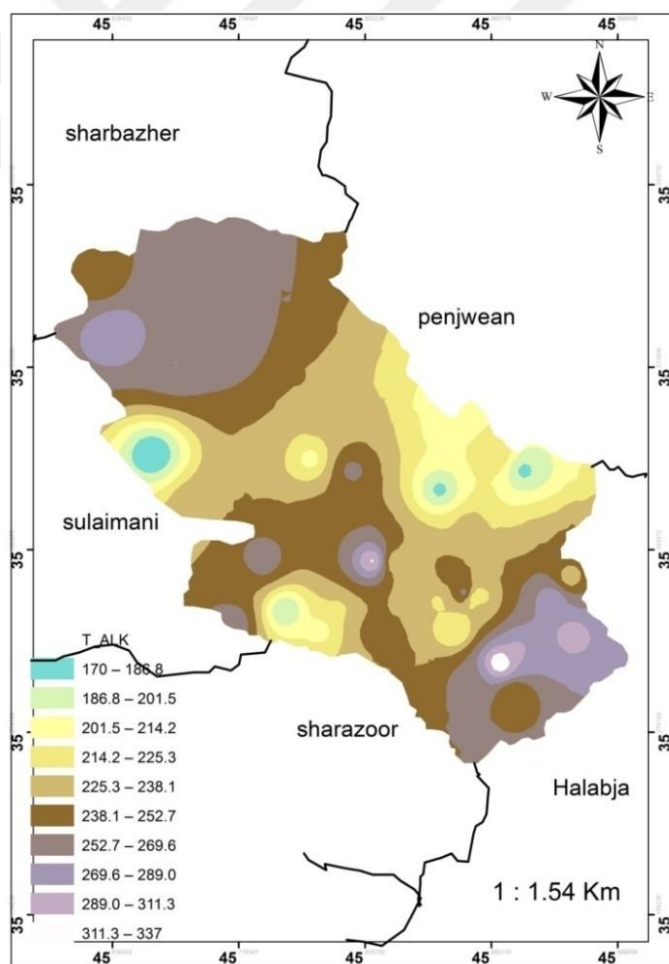


Figure 4.43. Location and graphic lines of (Alkalinity) for the collected underground water samples in Saydsadiq District

10. Sodium Na^+

Is one of the wide spread metals in nature, feldspar metal is the main source for sodium. It's existence in nature is because of the metallic salt dissolving and rock weathering especially those ones containing large amount of sodium ions, like Aplite (Muhammad 2015).

Sodium has many different salts, like; sodium bicarbonate which dissolved less than the other salts, and Calcium Carbonate which exists in aqueous solution and sodium sulfuric, Temperature degree has influence over it is dissolving, in cold weather it sediments, on the other side, human activities affects Sodium concentration in the water (Al-Menmi 2002).

Sodium amount figures in the research area shows in the Annex (3), that the maximum amount is in the well No(21 in Qawila village, the minimum amount is in the well No. 40 in Wandarena village, Sodium value should lie within the range 102-1525 mg/liter, the overall average of sodium in the wells is 11.38 mg/liter, this explains a good treat of the water in the wells , can be used for drinking, except one of the wells which it's sodium is out of the range , in Srochk sub-district, the water from this well is unique and was in the first place having high value of chemical elements. Has to be said that this element has huge difference between all the wells and different locations, and this is because the different geological layers in the area and those layers who has Sodium ion.

11. Nitrate No^3

Nitrate sources are many, most available sources are sedimentary rocks and organic hydrogen peroxide in soil, animal waste and domestic garbage, car exhaust and car dumping affect the unstable nitrogen in the atmosphere, it will transfer to Ammonia then nitrate, less ratio of it makes it better for drinking (WHO 2011). The ratio is large in the ocean water, larger in shallow wells comparing to the deep wells, in a condition if those wells are close to the agricultural lands that has been through fertilizers, or to be close to the large scale of sewages (Ali 2007).

One of the materials affecting the color and taste changes is nitrogen. Analyzing the collected samples in the area, we obtain that the maximum level of this element is in the Greza well, the large amount in this well results from it has been located in the large scale agricultural area and fertilizers has been used on the land. The minimum level in almost the all wells is (zero), like the wells in Kazhaw, Bardbard and Darata villages in Srochk Sub-district, also, the well No. 1 in Barkew quarter in Saydsadiq, each of them has (0 mgm/liter, the average Nitrate in all the wells is 14.2 mgm/liter. As per this result, the water in this area is suitable for drinking for both human and animals, because according to the both standards, the average in the wells is less than the range.

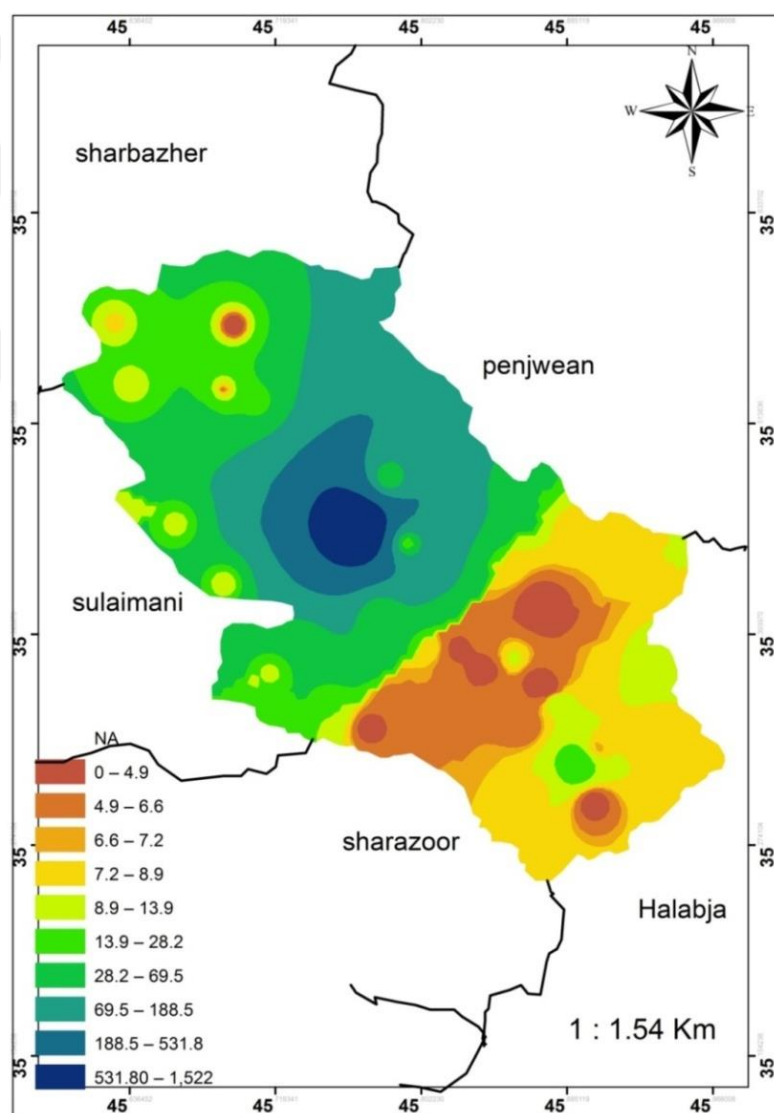
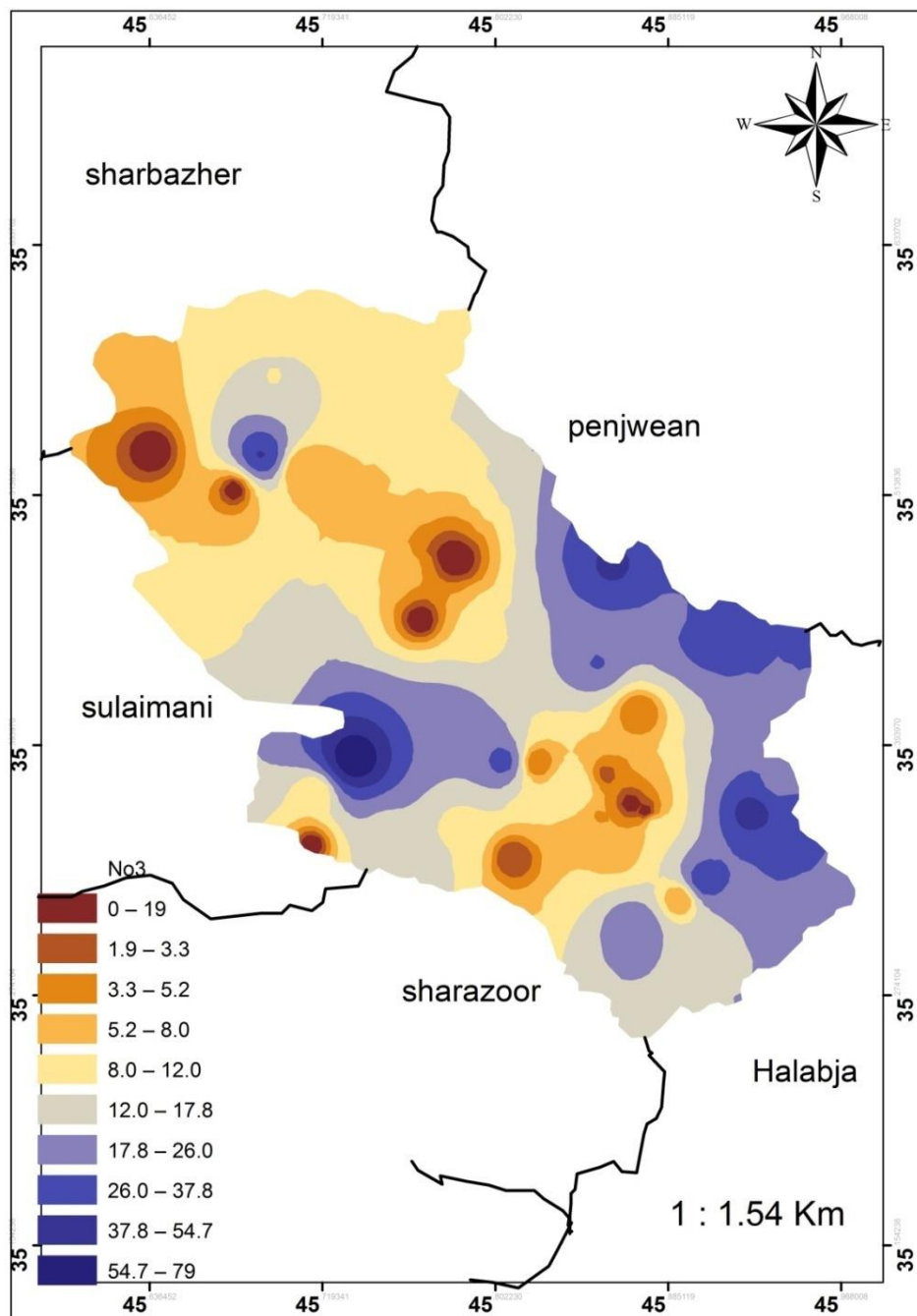


Figure 4.44. Location and graphic lines of (Na) for the collected underground water samples in Saydsadiq District



Figuer 4.45. Location and graphic lines of (NO₃) for the collected underground water samples in Saydsadiq District

12. Potassium K⁺

This ion concentration in the rain water is 312 mgm/liter, in the underground water is 3 mg/liter (Ali 2014). the main source for Sodium ion formation is Allawr, Sukls, Microklain, Mica and Sulphate and rock melting (Muhammad 2003).

Is one of the important ions for plants and animals, can hold itself on the soil grains surface. The underground potassium source is feldspar and mica from the igneous rocks and transformable. potassium is like Sodium is dissolving easily, so it cannot be removed without changing the ion. Showing the Potassium amount in area, we can see that the maximum amount is in the well No. 8, second maximum is in the well No. 33 in Mayawa village, third place is well No. 19 in Srochk subdistrict, minimum amount is in 8 wells, with the amount 0.4-0.5 mgm/liter in the Saydsadiq Municipality, Dollash, Qlirkh, Mwan, Taparash and Kalwran wells.

This element average in the collected samples is 5.18 mgm/liter, as per this result, the water in this area is not suitable for drinking according to Iraqi standard, as it maxes the standard, but World Health Organization has larger scale, so out of 40 samples, only 9 of them are not suitable. The reason for this amount of Potassium in the area's underground water is because of the geological layers, especially Dolomite and Limestone which are the main source for Potassium ion.

At the end of the explanation on the chemical specifications for the underground water in Saydsadiq, it's necessary to highlight on the wells which are suitable for drinking, out of the collected samples, testing and analyzing for all the 13 Chemical elements, only, 1 well is not drinkable, which outs most of the ranges, that is well No. 21 in Qawila village. Also, the wells No. 6,17,27 and 28 which are all located in the northern part of the area at Srochk sub-district, has calcium ion and dissolved salts more than the standard, and the other 11 elements are too way below the standard, so, further inspections can lead them to better specifications for human and animal drinking. At the end, after comparing the water from the research area wells to the Iraqi and WHO standards, the water is suitable for drinking, except one of the wells which was mentioned. For animal drinking, as there are different standards and is not the same as used for human drinking, is shown in the Annex (3), analyzing the results and comparing of the two standards, we can see that only one well is not suitable for drinking, and is out of the range, all the other wells are suitable for animal drinking.

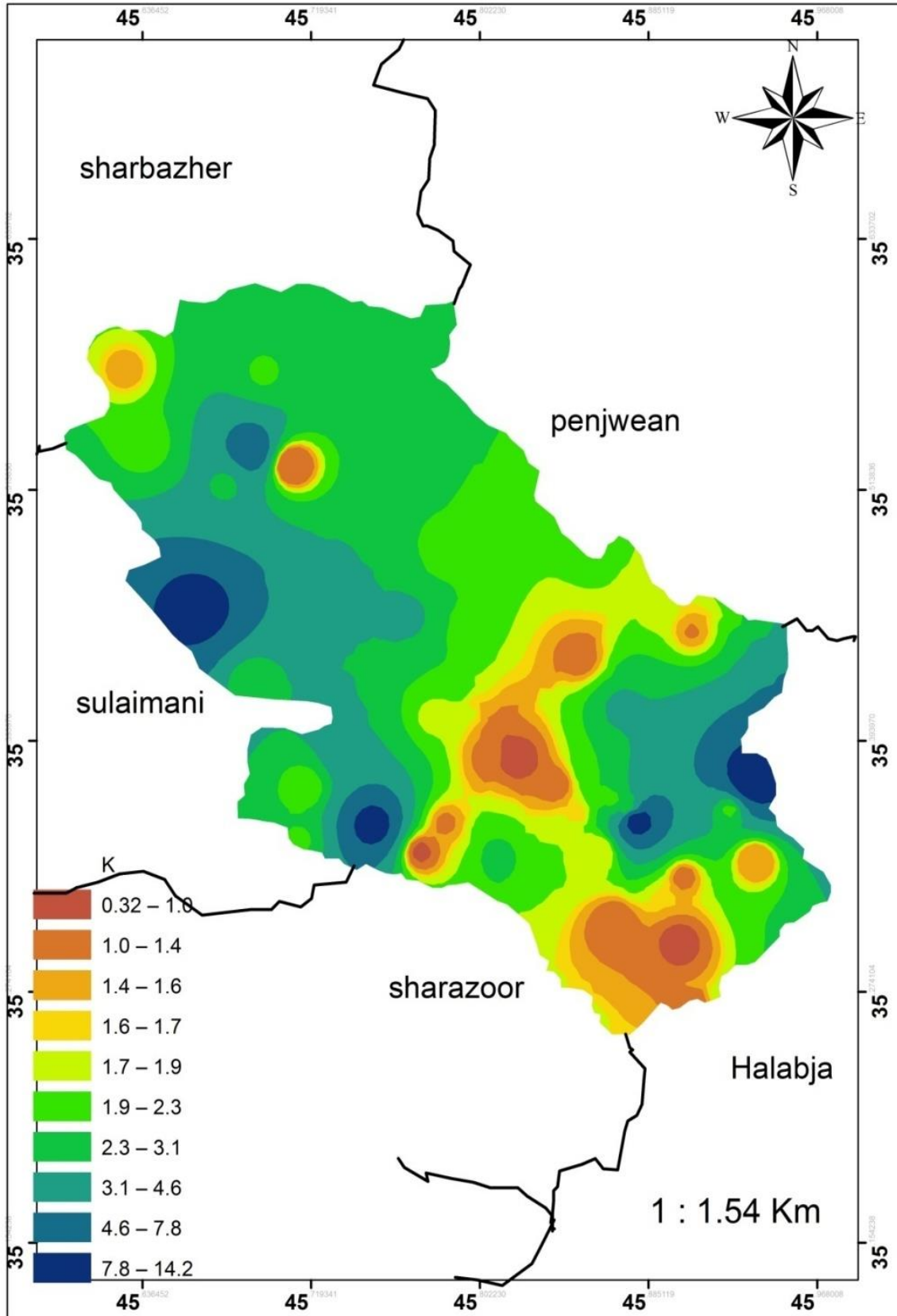


Figure 1.46. Location and graphic lines of (K) for the collected underground water samples in Saydsadiq District

Second/Spring

Spring is one of the underground water forms, spring formation is from some Geomorphology factors, like a porous layer at the bottom front of the mountains and the stone cracks and the space between stones, which makes way for the confined water to release to the surface (Abdallah 2003). The stable cover layers over the cover layers holding water and lots of cracks and voids are all factors to spread the water sources and springs (Kenane 1967). Geomorphology forms and geology textures are main factors affecting the water sources and spring numbers in Kurdistan. Porosity, stone cracks, earth crust cracks and a non porous rock layer made underground water to rise and sprung springs, this way all the springs in the research area are located in the canyons, flat lands and valleys, Springs in this area are like:

1. **Saraw Spring:** One of the biggest and continuous springs in the District, yield is 50 liter/second, the basin area is 20 km², because of the large yield amount, it is used for irrigation and agricultural purposes.
2. **Greza spring:** Located in Greza village, has many springs in the form of Kariz, yield is 0.7 liter/second, at 558 m sea level, the basin area is 2 km².
3. **Qaeencha Spring:** Located at the east of Saydsadiq town, at 556 m sea level, the water flows at 0.6 liter/second, the basin area is 2 km².
4. **Kanee Speakay Parkh Spring:** At 569 m sea level, has continuous water flow, used for daily usages, yield is 0.5 liter/second, the basin area is 5.1 km², it is consisted of river sediment.
5. **Sarawee Subhanagha Spring:** Has the largest yield amount, counted as the largest and most continuous spring in the area for it's area and flow amount, at (520 m) sea level, the flow amount is 589 liter/second, the basin area is 50 km².
6. **Qwmash Spring:** Located in Qwmash village at south west of Saydsadiq town, yield is 20 liter/second, covers most of the village watery needs, the basin area is 6 km², at (504 m sea level, the basin material is Comitán).

7. Awayee Hajee Qadir Spring: This village is on of the Saydsadiq's quarters, located at the east of the town, the basin area is 6 km², yield is 4 liter/second, the rock layers are marble stone and Shiransh, at 504 m sea level .

8. Kanee Pankay xwaru Spring: At 599 m sea level, the basin area is 10 Km², because of it's large yield amount 50.7 liter/second it supplies drinking and irrigation water for the villages of Kanee Panka, Mwan, Qaleejo and some other villages.

9. Kanee Saraw Choga Qwreena: This Spring from the first beginning when the population gathered there, has been used, because of the large amount of yield 258 liter/second, irrigation channel has been constructed at the bottom of it, and it's water distributed over the Sharazoor lands and agricultural plots, the basin area is 50 Km², at 532 m sea level, the basin layers are comitan and carbonate calcium jiri Rocks.

10. Soilamish Spring: Located at south of Saydsadiq District, at 485 m sea level, yield is 5 liter/second, the basin area is 2 km².

11. Swaree Spring: It's basin is river sediment, at 500 m sea level, yield is 1 liter/second, the basin area is 15 km².

12. Saraw / Kaleew Spring: Has the second maximum yield, it has 470 liter/second, because of it's large size ,became the main source for the downstream villages, the basin area is 50 km², at 512 m sea level.

13. Dollash Spring: Located in Dollash village at the south of the research area, the basin area is 2 km², yield is 0.2 liter/second.

Other springs are named here (like Kanee Tuqach, Kanee Mwan, Kanee Baram and kanee Srochk), other than these springs, many other seasonal sprigs are there, this means only, in rainy season they flow, the high topography and drought in the area make it hard to form a permanent spring, seasonal springs (like Gole and Siyanzar), Figure 2. It is worth mentioning that at the beginning of building the cities and the villages, these springs were the first water sources to provide population needs due to increase in population size, more sources have been found and used to fulfil the needs.

Springs Specifications in Saydsadiq

Depending on the samples from 12 springs in the area, the yields are between m 0.2- 89 liter/second, minimum yield is at the spring No. 4 in Dollash village, maximum yield is at the spring No. 6 in Sarawee Subhanagha, the average yield is 120.3 liter/second.

The District springs specifications are shown below, Annex (4):

33.3% springs yields 0.2-0.7 liter/second, average of 0.5 liter/second, one spring yields at 1 liter/second.

25% springs yields 20-50.7 liter/second, minimum recorded yield is at the No. 13, maximum yield is at the No. 7 in Kanee Speeka village, the average for the 3 springs is 40.2 liter/second.

41% The other source's yield is 258-589 liter/second, the average is 40.2 liter/second (Muhammad 2008).

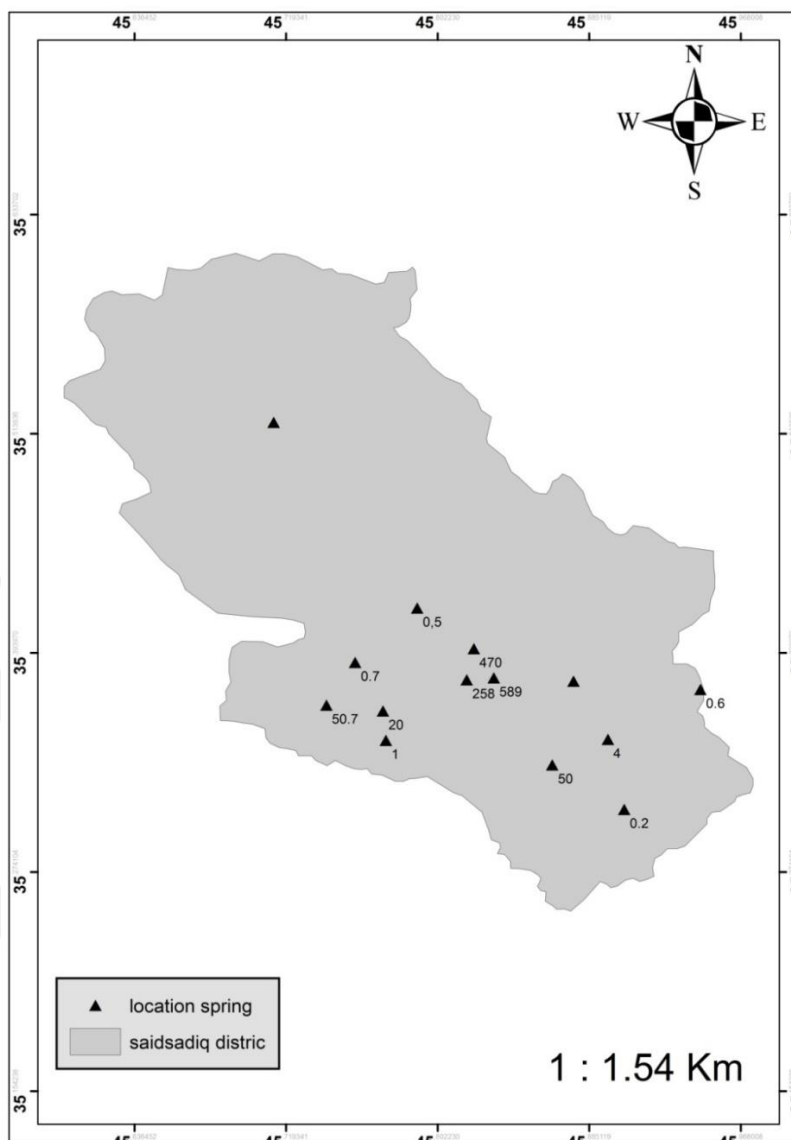


Figure 4.47. Geographical location for the springs and the yield in Saydsadiq District

Spring's water Quality analysis in Saydsadiq District

1. Potential of Hydrogen Concentration (PH): According to both World Health Organization and Iraqi Standards, the potable pH should lie in the range 6.5-8.5, we see that the maximum PH in the springs is less than the maximum amount in the scale which is 7.67, in the well No. 11 in Greza village, the minimum is in the well No. 7 in Awayee Hajee Qadir, and Spring No. 8 in Qaeenja village, the value is 5.6, the average pH value for the springs in the District is 7.1, all the spring waters are drinkable and classified as excellent.

2. Electrical Conductivity (EC): Maximum amount located in Kanee Pankay xwaru, No. 12, the EC value is 642 mohs/cm, the minimum located in the well No. 2 in Srochk Sub-district, it's value is 372 mohm/cm, the average EC for the springs is 502 mohs/cm, all the spring waters are suitable for drinking and other usages.

3. Total Dissolved Salts (TDS): the average Total Dissolved Salts is 235 mgm/liter in the springs, the maximum value is in the Spring No. 5 in Hasar area, the value is 410.8 mg/liter, the minimum value is in the spring No. 2 in Srochk Sub-district, the value is 238 mg/liter, comparing to the potable water standards, all the spring water's are suitable for drinking.

4. Total Hardness TH: Hardness is because of the positive dual charge metals like calcium and magnesium ions, which related to the negative charges (like sulfur, Bicarbonate and Nitrate (Namiq 2008). regarding the TH for the springs we see that the maximum amount is in the spring No. 4 in Sarawee Subhanagha village, the value is 362 mgm/liter, the minimum amount is in the spring No. 1 in Kanee Speaka, the value is 110 mgm/liter, the average is 266.7 mg/liter, based on these results , all the springs has suitable water for drinking for both animals and humans, as the maximum amount lies below the accepted value.

5. Turbidity: Water is turbid or impure when there is Organic or microscopic creatures microbes in it, it measures in Nephelometer, abbreviated by NTU, as it is in the Annex 5, the springs turbidity in the research area is (zero), except 4 springs which has turbidity 0.9-64.1 Nephelometer, in average 0.4, all of the spring water's are suitable for drinking.

6. Alkalinity: The maximum value of this element located in the spring No. 10 in Soilamish Village, the value is (300 mg/liter), the minimum value located in the spring No. 11, the value is 171 mg/liter, average value in the springs is 243 mgm/liter, as per the two standards; the Alkalinity is not affecting the drinkability of water.

7. Calcium Ion: Maximum value is in the Sarawee Subhanagha and kanee Panka springs, the value is 120 mgm/liter, this is a sign of the rich rocks with lime. The minimum value

is in the Srochk spring, has small amount of calcite, average Calcium in the springs is 66.5 mgm/liter, all of them are drinkable and are excellent.

8. Chloride: In the Annex (5) we can obtain that the maximum amount of it lies in the Grea village spring with the value of 58 mgm/liter, because this spring lies next to the area sewerage, the minimum value is in Qaeenja 3 mg/liter, the average is 0.23 mg/liter, all the springs has suitable water according to the both standards for both human and animal drinking.

9. Sodium: Is one of the wide spread metals in nature, Feldspar is the main source of this element, the maximum value of this element is in the spring No. 1 it's value is 19.5 mg/liter, the minimum value is in the Dollash village spring, it's value is 8.7 mgm/liter, the average is 9.41 mg/liter for the all springs.

10. Potassium: Potassium amount can be found at it's maximum amount in the northern part of the research area in Srochk Sub-district as it is shown in the table, it's value is 7.2 mg/liter, the minimum value is in the Villages of Kanee Panka, Kanee Saraw/ChogaQwlrina and Hasar source inside Saydsadiq, the average Potassium for the samples is 7 mg/liter.

11. Magnesium: As per the Iraqi standard all the samples showing that the spring's water are suitable for drinking, because the maximum amount of magnesium in the spring water is below the maximum accepted amount, it's value is in the Soilamish 6.27 mg/liter, the minimum is 1.7 mgm/liter, the average is 9.3 mgm/liter.

12. Nitrate: This Ions is almost (zero) in the springs' water, except two springs, their value is 12 mg/liter, the average is 2 mgm/liter. There is a difference between Nitrate amount in the Springs and wells in the District sources, less amount could be found in the springs comparing to the wells, this difference has two main factors: First; most of the selected springs are located at the bottom front of the mountains, which filters the water, as the high the mountains be the better the filtration will be for the rain and melted snow water, Second; the spring sources are far from the population occupied area, which will make them far from being polluted with human waste and activities and the fertilizers,

but the wells are located in the concentrated population areas and the agricultural plots. Also, the springs in the research area has the best physical components and is classified as the best water sources in Kurdistan and Iraq, though, no rehabilitation needed, their average salt is less than the known values, in the Annex (5) it can be obtained that:

1. Total Dissolved Salts in the springs is 238-410 mgm/liter, this amount is too low, therefore the water from springs is Soft and sweet.
2. Hydrogen amount is 6.5-7.59 and it is light Alkaline, this is because the cover layers which are lime stones.
3. Because of the low amount of dissolved salts in the spring water, they have low electrical conductivity; this is because of the layer texture and the area weather, nevertheless that the electrical conductivity has a direct relation with the total dissolved salts.

Based on this, we can say that the water sources and springs in this area, their geographical distribution, chemical and physical specifications make them suitable for very human usages, Tourist attraction area can be built close to the continuous sources with large yield amount, and most prominent example is Saray Subhan Agha source that became a tourism place.

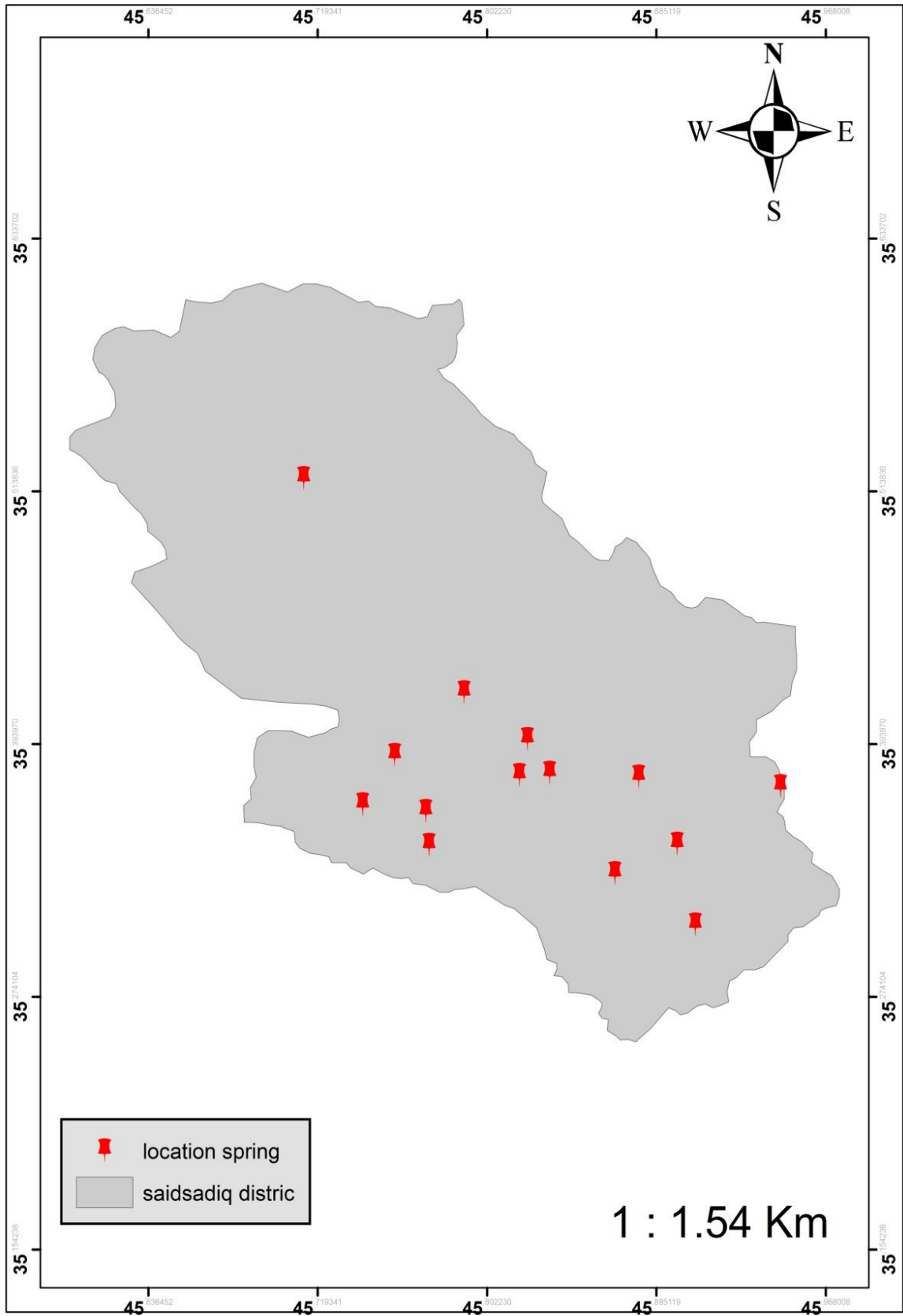


Figure 4.48. Spring's Water sample location in Saydsadiq District

5. CONCLUSION AND RECOMENDATION

5.1. Conclusion

After a hard work toward the goal of the research, we can expose the most vital consequences we have reached in the research in some points as follows:

1. The geological components in the research area are the middle geological era, modern geology era, and the sediments of fourth era. Middle geology era is components of Balambo, Garawa's mountain, Komitan, and Tnajaro, modern era is the component of Kollosh, and the fourth era sediments are the sediment components of rivers, floods, hills, steep rivers, and abundant sediments.
2. The research area has been made of essential geomorphologies, which are portions of heights and deserts. Heights contain hills, mountains, and deserted areas which are made 62% surface of the area. Deserts make a wide range of the region that its surface is approximately 38% of the area.
3. In topography, the highest level in the research area is located in the North and the height is 2154 meters. The lowest part is located in the South of the town which is (444) meters. The middle height reaches up to 1710 meters. The total amount of the steepness of the research area is 22 degree, and the highest line of equal height is 2100 meters and the lowest is 500 meters.
4. There are differences of places in the surface of the earth in the area. The reason is due to the weather condition and the geological specialty. Particularly, the lands which have the essential components of morph tectonic are mostly located in the North part of the town, because it is situated in the bended-heights and is closer to the Iranian and Iraqi boundaries.

5. A wide surface of the soil component of the research area is a thin stoned-soil and the rest of the soil which is located in Sharazur desert is a seafront soil. Each of these types is different in thickness. The general speciality of the soil in the research area is the consequence of the interacting between causes and geomorphological actions, especially, according to physics soil and mud are made the highest amount of pellet. The physical specialities of the soil in the research area, in some of the taken samples, are exposed to have troubles, but they can be cured with the use of chemical netrins as a way to evolve agricultural activities.

6. The area of the research betwixt the range of mountains holds a group of hills and deserts, which creates a complete phenomenal geomorphology on the ground.

7. In the consequence of exposing water resources, soil, topography, and geological conditions which are appropriate and abundant, there are appropriate places that can be determined to build small and huge leve (dam).

8. The richest place in SaydSadiq town in underground water are those located in the South of the town and are close to Darbandikhan lake, because they are the lowest place in the town as well as the desert of Sharazur. The direction of the underground water in the South of the town and mountains are toward the lake.

9. The topographic of the town has a huge role in enriching the town with underground water. Due to the height of the mountains in the North part of the research area to which the direction of the water is toward the South part of the town and the desert of Sharazur, are caused to raise the level of underground water in the area.

10. Water resources and springs are physically the best and purest springs in using and do not need any kind of intervene to improve as well as their amount of saltiness is less than usual.

11. The climate of (Saydsadiq) town, according to the years between 2003 and 2016, have the highest temperature degree that have been recorded in the months of July, which is 40.7°C . The lowest quantity of temperature has been recorded in January which is 3.3°C Concerning the total amount of raining during the last fifteen years has reached

(523.3 mm). What is relevant to the wind in the research area is the direction of the wind is toward the East-North and is mostly on summer. The census of wind in a year is known to be (1.7 m/s) the speedy is in September which is (2.3m/s) the highest level of moisture in the research area is in January which is (1.7 m/s) the most amount of vapour is in July which is 403mm There is an opposite relationship between vapour and level of moisture.

12. Regarding the speciality of weather in the area, it has been faced moisture and dryness in the past years and has changed a lot. The condition of weather in the research area is depicted as half-dry weather and has a high continent level.

13. We have got some results from 52 samples of drinking water flexibility in various resources like springs and wells; it demonstrates that the water of most of the area is flexible for drinking with a low ratio of exceptionality. There are some factors that interact with water resources to raise and fall the rate. Some of them are natural and some of them are results of human activities like:

A.The geological formation of the area that affects water inflexibility. As a result of carbonate and CO_2 which are reasons beyond melting intense rocks or dolomites in the area. These rocks consist of calcium carbonate and magnesium then changes to ions and make the dirt.

B. Pouring: the kinds of nitrate depend on pouring rate because of having nitrogen oxides that happens as a result of electrostatic discharge. This made a high rate of nitrate in the rainy season.

C. Soil and Natural Plant: those areas that have natural plants have a high rate of salt because the plants derive the salt.

D.Evaporation: evaporation is a main reason beyond raising chloride in underground water and has a direct impact on the other substances because evaporation reduce water level as a result the substances' intensity get higher.

Human Factors:

There are several human factors that affect underground water like those wells and ditches that used for hiding water pipes and sewers that hold dirty substances. Another human factors is agriculture and using chemical neutrons. The highest rate of nitrate locates in Greza village because of using too much neutrons by the farmers.

14. The researched area has many good characteristics which made the area appropriate for tourism like:

A. Having enough time of sunlight for nine months with a warm weather, despite the low rate of humidity in air.

B. The average of air speed is 1.7 m/s that is a good and proper standard for several activities. Despite a good breeze at the area and yet there isn't any igh wind.

C. Lack of pouring days, thunders, fog, and hailing are good reasons to be a good area for tourists.

5.2. Recommendation:

In the light of what was covered in the research and demonstrated in the conclusions we can add the following recommendations:

1. Giving more attention to this kind of thesis to announce the area more and more.
2. Establishing some weather broadcasting foundations in the area to get enough information about the various climate changes in the district and surrounding areas.
3. Establishing tourist places especially in those areas that come between (1500-2000) elevations because it has a proper weather for a long period of time.
4. The forests have a major role of tourism factors so developing the forests by widening and planting various types of trees especially those ones that has a wonderful scene and endure the climate change like temperature, lack of water, and wind. For instance (olive)

that endure a long period of time without enough water despite its economic benefit. As we know that having forests means animals, lack of erosion, tourist and etc.

5. Constructing barriers and fences to protect the forests with ban burning and cutting the trees without any previous plan. Also hunt banning is another need for the area to have more and more wild birds and animals.

6. Endeavouring to get benefit from all of the water resources from the highlighted zone by constructing dams, concrete streams, pools, and etc. reasons to save the water of floods, rainy water, snow melting and used in a proper way.

7. Encouraging people to use filter or using purified water to know the rate of pollution. Also giving away from those resources or streams that the water is not flexible to be a source of drinking water.

8. Water purification and those waters that has a low rate of inflexibility. Yearly chemical investigation for water is another reason that has to be taken care of because rainy water, snow melting, sometime sewer water, and etc. have the same waterway. All of these factors must be taken into consideration for the sake of raising water sources otherwise all of the water polluted and pour to the Darbandikhan Lake.

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APPENDICES

Attachment 1. Varying water level and static Water Level ofartificial well

no	well name	Static Water Level(m)	Dynamic Water Level(m)	yield (lit/sec)	X	Y	Z	DEPTH	Yars
1	barkew(saidsadiq)	13.5	14	1			545	14,5	1998
2	baer muhamad(gerdanaze villge)	13	14	3.3	35.34722	45.915	605	15	2000
3	Awaey-hajey kadir	8	9	2	35.34861	45.886111	506	10,5	2000
4	Qadafarey village	6.6	8	3	35.34583	45.95	520	8	2004
5	mastakn village	7.8	9.5	1.2	35.33083	45.9375	510	10	1995
6	hasan rashed(qadafarey)	5.6	14.6	0.8	35.33194	45.951389	530	8	2002
7	hasan mahmud(griza village)	6	15	1	35.39806	45.734444	588	19	1999
8	Aziz abdulrahman(kawchktash)	7	7.5	0.6	35.36333	45.75	508	9	1999
9	Qumash village	6.7	7.3	0.5	35.36361	45.796667	510	8	1998
10	Qlirkh village	12	12	0.5	35.36028	45.845833	516	12,2	2001
11	Ahmad mahmud(nawgrdan)	5.4	6.5	1.6	35.3	45.736111	610	7	1996
12	Dollash village	4.4	5	3.3	35.4625	45.902778	512	6,5	1995
13	saber sharef(saidsadiq)	7.8	10	0.7	35.34667	45.881944	540	12	2000
14	suwarey village	6	6	1	35.34528	45.782222	508	7	1984
15	muwaney merza village	11	11.5	0.5	35.35083	45.762222	508	4	1983
16	hasan abdulkarem(Greza)	7.8	9	1.5	35.39833	45.733889	580	10	2000
17	kawchktash village	2.5	3.3	0.8	35.34333	45.763611	507	4	2001
18	Ahmad marf(kawchktash)	5	5.5	0.5	3635.333	45.751111	509	6	2002
19	taparash village	5.4	6	2	35.36111	45.852778	510	8,5	1999
20	Aso muhamad(taparash)	4.2	5	3	35.35139	45.860833	521	6,5	1998
21	Ali ahmad(taparash)	5	6	3	35.34167	45.861111	520	7	1996
22	saidsadq	4.6	9	0.5	35.33889	45.869444	540	10	2001
23	muwan muhamad village	8.2	8.5	2.5	35.36389	45.713889	580	9	1996
24	Abdulkarem (nawgrdan)	5.5	6	3.3	35.325	3645.9	623	7	1998
25	hsaen muhamad	11	12	0.1	35.35222	45.761389	508	12	1985
26	Abdulla Ali(nawgrdan)	4	5	3.3	35.49167	45.905556	630	6	2000
27	wali hama(dollash)	3	3	3.5	35.30278	45.919444	530	5	1996
28	Azad muhamad(dollash)	7.7	8.5	3.4	35.30972	45.913889	525	10	1995
29	nawgrdan village	5.3	5.5	3.5	35.27222	45.888889	620	6,5	2004
30	Gamishtapa village	8	9	3	35.3475	45.901389	605	10,5	1999
31	hsain qader(gameshtapa)	12	12	3.6	35.35417	71.26	610	13	2000
32	sarkawt salam(gamishtapa)	11.5	11.5	2	35.35833	45.914167	613	12	1998
33	kanspeka village	15.4	17.6	0.1	35.40278	45.798056	634	19	2001
34	qager villae	5.6	7	2.5	35.31194	45.9475	492	7	2002
35	Kalluran villag	6.3	7	3.3	35.47879	45.8847	503	7	2001
36	Ali fatah	12	12	1.8	35.31090	45.9465	495	15	2002
37	muhamad Ali(kawchktash)	4.5	5	3	35.34417	45.947778	506	6	1981986

38	salihaman amin	11	11	3	35.34972	45.760278	496	12	1983
39	Abdulla muhamad(kawchktash)	6.6	7	4.2	35.34361	45.760278	510	8	2001
40	muwanakon village	18	19.1	1.2	35.41194	45.776944	610	20	1981
41	racha nasraden	9.9	10	0.5	35.36306	45.7475	517	11	1983
42	Ahmad muhamad(Qlirhk)	17	17.5	3	35.36444	45.843333	528	18	2002
43	Aziz shaswar	10.8	11	0.1	35.36278	45.861389	415	11	1997
44	Abdulla hasan	11.2	12	0.1	35.36194	45.845833	516	12	2001
45	karem farage(saidsadiq)	14	14.6	3	35.36306	45.880278	534	15,5	1999
46	baker farage(saidsadiq)	11.5	12	0.3	35.36361	45.863889	514	12	2000
47	muhamad kader(saidsadiq)	12	12.3	3	35.37972	45.877778	522	13	1997
48	kawchktash\2	5.5	6.2	0.5	35.34361	45.780833	491	7	1996
49	muwaney malataher	8.3	8.5	3	35.35389	45.769444	508	10	1987
50	ahmad ali(qumash village)	7.1	7.5	3	35.36278	45.795	507	8	1998
51	tasluga village	5.6	6.3	5	35.33556	45.797778	508	8	2001
52	muhamad said	4.5	5	3	35.36056	45.780833	508	6	2001
53	Abdul omer(suware village)	3.5	3.5	6	35.34444	45.726111	501	4	2002
54	dollash\2	7.5	7.5	5	35.29833	45.9	620	8	1992
55	Ahmad salar	8	8	4.1	35.31806	45.900556	612	9	1989
56	Qainaga village	12.5	12.5	1.6	35.38472	45.929722	550	13	1999
57	barkawran village	9.3	9.5	1.2	35.45833	45.881667	575	10	1995
58	kawillos village	8.8	8.8	2.7	35.48	45.858333	761	9	1994
59	shanadarey	7.5	7.5	2.5	35.41	45.870833	699	8,5	1996
60	maw village	9.6	9.8	3.3	35.42278	45.86	718	10	1995
61	shanadarey\2	10	10	3.8	35.43333	45.875	716	11,5	1992
62	Gllazarda village	9	9	3.3	35.45278	45.866389	803	10	1993
63	Tutakach village	9.7	9.7	2.2	35.45833	45.893333	755	10	1994
64	hagenamiq villae	9	9	2.4	35.38333	45.902778	642	10	1991
65	kallwran village	6.5	8.5	4.8	35.48056	45.863333	490	9	1998
66	namiq ahmad (kallwran)	5.6	6.5	1.2	35.31806	45.869444	492	7	2000
67	muhamad sofi(kalluran village)	4.5	6	3	35.47778	45.88	502	6	2000
68	Omer abdulla	9	9	2.9	35.38	45.91	662	10	1993
69	samer ali(Awaey-hajey namiq)	0	10	4.8	35.39444	45.919444	653	11,5	1991
70	saidsadiq\saraey	10	10.5	3	35.40278	45.733333	800	11,5	
	average	6.5	9.12	2.3			563.02	9.93	

Attachment 2. Varying water level and static Water Level of Machine well

no	well name	X	Y	Static Water Level(m)	Dynamic Water Level(m)	yield (lit/sec)	Z	depth	year
1	gameshetapa village	35.355555	45.911111	3	5	6.5	524	49	1961
2	plantantion qainaja village	35.322777	45.9166667	0	4.5	22.5	545	159	___
3	smko hsen(srochk)	35.545239	45.695494	15.2	18.3	6.8	120	130	___
4	plantation\14	35.364722	45.8833333	9	23	15	539	124	1976
5	plantation\13	35.364722	45.9	12	17	16.8	556	116	1976
6	plantation\18	35.361944	45.8947222	2	10	20.2	553	139	___
7	plantation\17	35.373333	45.8938889	11	16	15	552	140	1977
8	plant\16	35.381388	45.8944444	13	17	12	551	157	___
9	plantation\10	35.382222	45.9113889	10.6	15.2	15	550	116	___
10	plantation tutaqaj	35.365555	45.8655556	3	12	22.5	549	125	___
11	plantation barkawran	35.356666	45.8566667	10	14	15	552	100	___
12	Awe majare saidsadiq\3	35.348611	45.8486111	4	4.6	18.3	517	76	___
13	sharawane saidsadiq	35.033333	45.8611111	7	8.2	6	518	284	___
14	Awe majare saidsadiq\6	35.353333	45.8533333	9	25.5	3.3	519	55	___
15	Awe majare saidsadiq\5	35.351666	45.8516667	6.9	8	13.5	523	70	___
16	awe majare saidsadiq	35.35667	45.8566667	13	18	15.3	521	100	___
17	sadsadiq	35.370555	45.8705556	5	12	8.5	525	50	___
18	qadqfare village	35.334722	45.9013889	0	6	18.7	523	85	___
19	muhataey saraw	35.386111	45.8194444	16.5	36	7.5	524	73	___
20	hasar(sadsadiq)	35.354166	45.8686111	41	145	1	518	171	___
21	barkew\sadsadiq	35.502777	45.8758333	4	10	7.4	531	120	___
22	grdanaze village	35.3125	45.8916667	0	15	11.2	525	75	1976
23	taparash village	35.3375	45.8769444	6	18	25	429	80	1977
24	Ahmad hajy rashed-	35.365	45.9097222	9	9	10	522	125	1973
25	shex adbulqader-mosque	35.346666	45.8944444	6.5	12.2	6	529	60	___
26	kanipankaey2	35.377777	45.7	58	76	4	572	155	1985
27	mashtal kanipanka	35.375	45.7266667	8.5	40	8.2	574	97	1979
28	anwar kuexa (greza)	35.37778	45.7138889	20	30	0.5	599	52	___
29	muhatae kanipanka	35.366666	45.7194444	10.5	18	9	545	90.5	___
30	kanispekae\3	35.400277	45.8027778	13	45	8	635	75	___
31	Greza Nursery	35.378333	45.7236111	50	14	1	600	182	___
32	kanispika	35.405555	45.8055556	29	68.8	4.8	633	88	___
33	muhamad abdulla	35.361111	45.8661111	15.1	15.8	1.6	520	150	2007
34	saraw vilage	35.380555	45.825	25.7	55	12	537	146.5	___
35	hajeqader village	35.343333	45.8902778	7.4	7.8	11	60	50	___
36	kanepanka village	35.422777	45.6972222	40	45	2	575	95	1998
37	kanispekai parx village	35.4	45.8027778	54	68	6	630	134	___
38	kawchktash village	35.3525	45.7808333	0	0	45	510	100	1995
39	muwanakon village	35.370833	45.7688889	18.5	53	15	538	73	___
40	di kwere	35.410555	45.6877778	180	183	0.7	615	183	___
41	hasan tofiq (greza)	35.383333	45.7366667	46	47	0.4	581	90	1985
42	mayawa villae	35.470379	45.652219	20	85	5	111	106	1979
43	Radio Subrtion Kani Panka	35.375	45.7694444	48.6	54.2	4.5	610	96	___

44	muwani rostam village	35.347222	45.7183333	6	59	4.5	501	81	—
45	muwani malataher village	35.364722	45.7205556	15	62	25	516	86	—
46	Ali mustafa(mayawa village)	35.479734	45.652576	12	22	11.2	111	82	—
47	jalal abulla (greza villag)	35.393888	45.7352778	30	45	0.6	582	62	—
48	qadre marf village	35.354166	45.8844444	1.7	6.8	13.5	816	110	—
49	saraee near taparash hill	35.352777	45.8627778	2	26	17	523	90	—
50	shexan\saiadsadq	35.355833	45.8622222	7	12	25	526	150	—
51	shexan near mosque	35.357777	45.8622222	7	12	18	528	150	—
52	barkew near baetara	35.360833	45.8747222	20	35	25	531	130	—
53	saraee near chala qeeraka	35.352777	45.8577778	10	31	30	520	150	—
54	kaney zard	35.363333	45.8675	30	60	16	528	150	—
56	hasar near koraw school	35.351666	45.8722222	18	30	25	520	120	—
57	hasar near mla ali-mosque	35.348611	45.8725	18	31	25	520	120	—
58	awaey-hajey kader	35.362777	45.8425	26	42	22	517	120	—
59	Hasar near women center	35.3525	45.8838889	1,7	6.8	48.6	521	110	—
60	Hasar near school	35.351666	45.8786111	0.5	2.5	48.6	523	110	—
61	Hasar near hospital	35.351388	45.8811111	0	1.8	48.6	524	110	—
62	Hasar inside	35.349722	45.8777778	2	4.5	48.6	518	110	—
63	Hasar south	35.35	45.8788889	0	2.7	45.36	521	110	—
64	hasar horeezad	35.348611	45.8775	1	2.5	42.66	517	110	—
65	saraey insaide garage	35.347777	45.875	5	10.5	40.5	516	78	—
66	saraey sanaey1	35.355	45.8558333	4.5	9.5	48.6	520	95	—
67	saraey electric staition	35.354722	45.8544444	3.2	5	42.66	520	60	—
68	shexan -school	35.354166	45.8519444	7	23	36.45	520	85	—
69	saraw village2	35.36	45.8641667	7	17	32	531	120	—
70	Kani Panka tobacco Research	35.376944	45.7305556	11	22.3	15	535	90	—
71	parehero village2	35.464661	45.851491	26.6	78	4	683	120	—
72	tofiq qader (greza village)	35.394722	45.7355556	30	22	0.6	599	62	—
73	ibrahem muhamad	35.369444	45.8763889	4.2	5	6.3	522	42	2006
74	parehero village1	35.464538	45.851544	2	25	12	683	61	—
75	Qliorkh village	35.358888	45.8505556	6.3	10	3	522	100	—
76	kanispika2	35.413611	45.7833333	54	67.8	4.8	632	133	—
77	birashka village	35.32	45.8908333	0	0	46	481	59	—
78	nawgrdan village	35.329166	45.9022222	0	0	44	503	65	—
79	kilakawa village\2	35.383333	45.925	17	19.7	18.5	554	123	—
80	Awaey-hajey nameq	35.361111	45.8758333	55.6	64.7	6	548	150	—
81	kilakawa village	35.402777	45.8483333	14	17	9.7	57	47.5	1976
82	plantation shanadarey village	35.4125	45.8833333	24.5	25.8	16.8	555	126	1976
83	plantation\3	35.356666	45.8947222	7	15	18.9	528	126	—
84	plantation\5	35.391666	45.95	0	0	12	560	120	1976
85	plantation\15	35.361944	45.9219444	0	5	22.5	531	150	—
86	plantation\11	35.371944	45.9058333	8	18	16.8	529	120	—
87	plantation\9	35.382222	45.9166667	7	10	18.7	534	154	—
88	plantation\7	35.377222	45.9116667	1.5	4.5	22.5	538	160	—
89	plantation\6	35.367222	45.9277778	6.5	14.7	22.5	530	160	—

90	shanadarey village\2	35.397222 22	45.9	6.5	88	3	560	110	1949
91	shanadarey village\1	35.411111 11	45.8791667	27	30	12	595	74	1948
92	kajalley village	35.408055 56	45.8591667	37.5	50	8.5	545	118	—
93	sacane\1	35.391388 89	45.8886111	10	24	15	543	98	1978
94	sacaney\2	35.4125	45.8911111	8	22	13.2	545	98	—
95	sacaney\3	35.3975	45.8733333	5	25	11.2	536	100	1978
96	sacane\4	35.387222 22	45.8933333	16	20	18.7	563	90	1978
97	sacaney\5	35.394722 22	45.8908333	21	31	8	556	95	1978
98	sacaney\6	35.396944 44	45.8963889	12	32	9	568	100	1979
99	sacaney\8	35.396666 67	45.8944444	13	28	9.4	560	68	—
100	kajalley village\2	35.408333 33	45.8583333	16	21	9	546	70	1979
101	Siloplant Project	35.396666 67	45.8791667	11	28	6	572	110	—
102	shanadare village\3	35.396666 67	45.9152778	20	23	5.2	576	59	190
103	shanadarey kone	35.4	45.8861111	40	42	5	574	74	—
4	Arif marf village	35.386111 11	45.8666667	15	25	2.6	543	61	2007
105	omer rashed (qainaga village)	35.339444 44	45.8916667	5.9	21	10	556	70	—
106	Awaey hajey namiq	35.395	45.88	0.6	26	6	549	100	—
107	fayaq rashed	35.4246	45.808126	60	103	56	592	150	2004
108	daratat village	35.576688	45.676528	19.5	66	25	774	98	1998
109	bardarash village	35.3306	45.4937	75	130	56	629	170	2004
110	Ahmad mahmud\srochk	35.543438	45.691281	103	132	25	120 0	160	2004
111	Gilare village	35.539444 44	45.6672222	16	24	56	119 0	121	2009
112	kharib muhamad\srochk	35.532862	45.690195	0	23.88	48	105 0	69	2006
113	srochk\5	35.544739	45.690911	59	23.1	67.5	120 0	85	2009
114	Ali ahmad\srochk	35.581344	45.615837	12	75	54	133 0	121	2009
115	kashaw village	35.542938	45.630143	36	39.25	25	112 0	94	2008
116	qaweyla village	35.273912	45.47024	155	192	72		265	2005
117	brdbard village	35.3306	45.4937.63	--	--	3.48		300	2002
118	zindana koter mar	35.581344	45.615837	295	--	45		400	2005

Atteachment 3. Well water's Chemical specification in Saydsadiq

NO	well name	type	N	X	Z	PH	T.D.S	T.ALK	T.H	Ca	Mg	NA	K	Cl	No3	SO4	Turb
1	barkew near baitara\sajdsadq	machine	35.360833	45.874722	531	7.6	263	260	260	52	13.2	2	1.98	23	0	230	1.1
2	Qlrkh village	machine	35.360278	45.845833	520	6.82	268.5	225	270	86.4	12.96	4.13	0.42	20	0	0	10.03
3	berashka village	machine	35.320000	45.890833	481	7.2	763	337	400	70	54	27.4	1.7	109	0	0	0
4	nawgrdan village	machine	35.329167	45.902222	503	7.4	495	293	420	41	76	6.4	1.1	80	37	0	0
5	kanepankai xuwaru village	machine	35.422778	45.697222	575	7.4	325	239	300	32	53	7.2	1.5	49	5	0	0
6	muwani rostam village	machine	35.347222	45.718333	501	6.91	490	270	544	136	48.96	29.35	2.15	21	0	0	4.87
7	hasar near woman center	machine	35.352500	45.883889	521	7.6	214	200	280	52	36	0.7	1.1	22	0	231	1.2
8	Qainaja village	machine	35.339444	45.891667	556	7.51	363	230	280	38	1.3	12	14.2	44	24	0	0
9	sharawane saidsadq\2	machine	35.355411	45.858347	513	7.36	284	209	300	35	51	3	0.9	17	16	0	0
10	tasluja village	handcraft	35.349444	45.797778	508	7.39	309	223	290	41	45	5.2	1.3	17	9	0	0
11	ahmad salara\dulash village	handcraft	35.191971	45.954769	512	7.73	259	225	240	64	42	2	0.5	16	13	0	0
12	muwanakon villaje	handcraft	35.411944	45.748333	517	7.51	282	209	270	32	46	2.7	0.7	15	13	0	0
13	kawllows villaje	handcraft	35.480000	45.858333	761	7.45	445	204	440	51	75	35.6	2.1	39	41	0	0
14	Ali ahmad\taparash village	handcraft	35.341667	45.861110	520	7.6	265	196	300	32	53	4	0.9	12	5	0	0
15	saray near taparash hill	machine	35.352778	45.862778	523	7.85	337	223	300	41	53	7.2	1.6	56	5	0	0
16	saraw village	machine	35.360000	45.864167	518	7.45	465	315	420	51	70	8.9	1.3	91	32	0	0
17	gillara vilage	machine	35.539444	45.667222	1199	7	834.5	270	1040	352	38.4	32.11	2.85	25	0	0	0.58

18	gamishetapa village	machine	35.355556	45.911111	524	7.3	543	285	460	54	78	9.2	1.9	75	48	0	0
19	kharib muhamad\srochk	machine	35.532862	45.690195	1056	6.59	451	262	334	46.7	52	5.2	7	31.5	40	0	0
20	kanespika village	machine	35.405556	45.805556	633	7.6	410	252	280	25	52	7.6	1.8	84	24.7	0	0
21	qawila village	machine	35.459452	45.782684	0	6.5	114000	210	1300	520	72.8	1522	3.55	40	0	1125	0
22	shanadare nawarast	machine	35.410000	45.870833	699	7.5	212	230	238	80	9.22	0	3.5	16	0	0	4.93
23	fayaq rashed\srochk	machine	35.424600	45.808126	592	6.7	329	257	266	39	56	3.3	2.2	21.3	9	0	0
24	twtaqage village	handcraft	35.458333	45.893333	659	7.63	411	228	200	12.8	40	6.7	1.8	73	24.9	0	0
25	barkawran village	handcraft	35.458333	45.873333	0	7.4	366	183	300	25	57	7.8	1.4	25	36	0	0
26	kalluran village	handcraft	35.315570	45.920902	492	6.61	449	257	340	38	59	8.3	0.8	28	30	0	0.95
27	kazhaw village	machine	35.537026	45.648249	1119	7	840.5	290	2200	480.1	239.9	7.42	1.85	18	0	0	1.65
28	bardbard village	machine	35.477444	45.807555	0	6.93	828	230	1100	280	96	6.98	2.2	19	0	0	0
29	srochk well 5	machine	35.544739	45.690911	1203	6.8	264	260	256	70.4	19.2	19.8	0.32	22	0	0	0.14
30	muwane merza village	handcraft	35.349722	45.760278	496	6.92	256.5	250	304	107.2	8.64	6	2.5	17	0	0	0
31	Glazardavillage	handcraft	35.452778	45.866389	803	7.38	367	182	300	28	55	8.8	1.1	30	27	0	0
32	Qdafare village	handcraft	35.331944	45.951389	530	7.2	535	303	398	14.7	87	6.9	0.8	36	27	0	0
33	mayawa village	machine	35.479734	45.652576	1207	7.78	221	170	240	22	1.4	7	10.5	31	10	0	0
34	kani gol village	machine	35.581344	45.615837	1335	7.46	333	243	300	27	1.5	7.2	1.5	52	6	0	0
35	kawjktashe village	handcraft	35.353889	45.769444	507	7.72	225	182	200	28	1.5	15	10.9	31	15	0	0
36	de kwer	machine	35.434476	45.701503	770	7.36	348	237	314.2	34.7	55	2.1	2.4	31.5	12	0	0
37	hasar near hospital\sajdsadq	machine	35.351389	45.881111	518	7.63	320	234	280	44	1.8	15	13.1	48	12	0	0
38	shexan\sajdsadq	machine	35.354167	45.851944	531	7.62	334	251	260	30	44	10.3	2.3	46	2	0	0
39	greza village	machine	35.394722	45.735556	582	7.6	337	268	360	12	5.2	30	3.8	12	79	0	0
40	wandarena village	machine	35.576688	45.676528	0	7.06	232	256	240	38	34	1.2	2.2	78	12	0	0

Atteachment 4. Springs Specifications in Saydsadiq

NO	name	X	Y	Z	Area (km2)	Yield m\sec	Reservoir Typ	Layaer Typ
1	Qainaga	35.38861111	45.94083333	539	2	0.6	Allvial chart Qulqula	River sedimentation
2	Suwarey	35.34611111	45.77388889	500	15	1	Allvial depisit	crossing wate tabesurface
3	Qumash	35.36222222	45.77222222	504	6	20	komitan	find depost
4	Dollash	35.30833333	45.90416667	511	2	0.2	Modern deposition	fine clastic clay
5	Awaey-hajey Qader	35.34666667	45.89527778	504	6	4	komitan	marll – shiransh
6	sarawey subhanakha	35.38333333	45.80555556	520	50	589	Quamitan - stone stone	Tanjaro
7	jawgaey muwan	35.37861111	45.71222222		10	50.7	komitan /trsibat	find depost
8	Kanispika	35.4	45.79361111	569	1.5	0,5	Alluvial	Clay
9	Saraw\calyw	35.39166667	45.7975	512	50	470	Quamitan - stone stone	marll – shiransh
10	Sarawe\Gogaqurena	35.38333333	45.72166667	532	50	258	Quamitan - stone stone	marll – shiransh
11	Greza	35.38611111	45.73194444	588	2	0.7	Alluvial	Shiransh
12	Soilamesh	35.21888889	45.83444444	489	20		Alluvial	
Average						120.39		

Attachment 5. Spring's water Quality analysis in Saydsadiq District

NO	name	PH	E.C	T.D.S	T.ALK	T.H	Ca	Mg	NA	K	Cl	NO ₃	SO ₄	Turb
1	Kaneyspika	6.7	390	250	298	110	-	-	19.6	0.7	4.8	-	-	-
2	srochk	7.7	372	238	204	190	38	1.7	10	2.7	22	12	-	0.00
3	Dollash	7.7	523	345.6	250	173	-	-	8.7	0.3	18	0	-	0.90
4	Sarawey subhan Akha	7.6	455	410.8	250	372	120	17.5	13.8	1.37	25	-	-	0.00
5	sarchawaey hasar	7.15	511	255.5	220	300	88.8	18.72	7.96	0.7	20	0	0	0.00
6	Suwarey	7.59	482	308	227	205	-	1.2	12	0.6	15.1	-	-	0.00
7	Awaey-haje qader	6.5	510	-	240	262	84	12.6	-	-	7	-	-	1.64
8	Qainaja	6.5	481	-	260	278	89.6	13.1	-	-	3	0	-	1.36
9	Saraw\caleu	7	461	321.5	246	334	84.2	18	12	0.8	25	-	0	0.00
10	Soilamish	6.6	620	-	300	340	90.4	27.6	-	-	15	-	-	1.40
11	Greza	7.63	584	373	171	320	85	2.3	16	2.3	58	12	-	0.00
12	kaneypanka\chawgaey muwan	7.06	642	321	250	353	120	17.28	13	0.5	26	0	0	0.00
Average			502.58		243	269.75							0	0.48

CURRICULUM VITAE



Full Name: Bilal Fatah AMIN

Place of Birth: Sulaimaniyah_Saydsadiq- Iraq

City: Saydsadiq_ Iraq

Marital Status: Single

Nationality: Iraqi –Kurdish

Date of Birth: 1987

Bilalfatahamin@gmail.com

Current work: Master student in Bingol University Faculty of Agriculture
Department of Soil science and plant Nutrition

Education:

University	College	Department	Type of Certificate	Year
Sulaimani	College of Education/Kalar	Geography	BSc	2008-2012

Language:-

Language	Status	Note
Kurdish	Excellent	Mother tongue
Arabic	Medium	Second language
English	Medium	-
Turkish	Fair	-

Computer skill:-

Program Name	State Using
Microsoft word	Good
Microsoft Excel	Good
Microsoft presentation	Good
Internet and Email	Good

Good Lucks

Bilal Fatah AMIN