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Qualitative Zoning of Groundwater to Assessment Suitable Drinking Water Using GIS Software in Mohammad Shahr, Meshkinshahr and Mahdasht in Alborz Province

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Abstract: Microbiological and chemical sampling of drinking water wells in Mohammad Shahr, MeshkinDasht and Mahdasht of Karaj was carried out. Water quality parameters were analyzed using GIS software. The results showed that the reason for the increase of sulfate could be attribution of acidic atmospheric precipitation and sulfate fertilizers. The level of magnesium in groundwater is less than the standard level. It is predicted that the reason for the relative increase of its concentration in parts of the region is related to the geological structure of that area. The unexpected rise of chloride in some wells has been observed due to geo-electric studies carried out in the region due to the presence of evaporate sediments and the influence of urban and rural post-water pollution and fossil waters. The results of measurement of nitrate and fluoride in the wells showed that the nitrate content is less than the standard values. The highest and lowest nitrate levels were found to be 35 mg / L and 4 mg / L, respectively. It was also observed that nitrate content in the measured seasons did not change much. This is due to the provision of drinking water from the groundwater resources, which are almost in constant quality. In the case of fluoride, the highest and lowest amount was 0.79 and 0.0mg / L. Therefore, it is essential for the Alborz province water and wastewater company to install Fluorination machines on the distribution system.
Keywords: Mohammad Shahr, MeshkinDasht and Mahdasht Karaj, Origin, Qualitative zoning.

Introduction

Safe water is crucial requirements of living humans. Therefore, it is essential to consider water quality factors as on the most indexes of sustainable development (DashtiBarmaki and Saberi, 2014). Groundwater is one of the most important water resources which is extracted for major uses such as drinking, agriculture and industry (Wu and Sun 2016; Chitsaz and Azarnivand, 2016). Uncontrolled exploitation of groundwater in many parts of the world has led to a sharp drop in groundwater levels(Zare Aghbolagh and Fataei, 2016).Therefore, continuous inspections on chemical, physical and biological characteristics of groundwater resources is essential (Karkra et al., 2016; Jang et al., 2013). For instance, Arsenic is a heavy metal existing in water, soil, earth's crust, and air which could be moved in the environment through natural process of weathering, emission of the volcanic ashes and fossil fuel burning (GhomiAvili and Makaremi., 2020).

One of the main problems of developing countries with regard to the expansion of their population is the urgent need for water to be used in their infrastructure, and Iran is no exception to this rule. Particularly in the provinces of Tehran and Alborz, due to their size and population as well as their cultural, industrial, social and economic density and diversity, and their constant growth, the issue of providing healthy and sanitary water from quantitative and qualitative dimensions and control of groundwater resources in terms of contamination and It is important for sanitary and industrial wastewater and is a major challenge for the government and one of the important concerns of people and authorities (Mashallahi, 2011). On the other hand, hazards such as decreasing atmospheric precipitation and, consequently, lowering of groundwater and overexploitation of existing resources, reduce the reservoirs of groundwater aquifers and impair the quality of water (Mashallahi, 2011). On the other hand, these low water sources are also qualitatively exposed to various environmental pollutants such as domestic wastewater, industrial, agricultural and livestock waste. Given that the damaging effects of unhealthy drinking water on human health are more urgent than the quantitative aspects of drinking water supply, more than any water supply operation is required, and according to a documented study on the areas, the sources of the quality of these resources has been identified. In this regard, by studying the water resources of different regions and providing their zoning maps in software environments such as GIS, along with identifying the type and factor and source of pollutants, a suitable platform for providing safe and healthy water from a qualitative point of view and preventing contaminated and controlling them, as well as saving the operating costs of digging new drinking water wells, created before any operations to identify suitable areas for the construction of drinking water wells. Numerous studies have been conducted in Iran on the quality of the groundwater and its qualitative zoning. These researches have surveyed different qualitative factors based on GIS software with regard to water requirements (Kouli et al. 2011; El-Fadel et al. 2013; Babiker& Mohamed 2014; Li et al. 2016; Atikul Islam et al. 2017).

The purpose of this research is to provide qualitative maps of drinking water wells of Mohammad Shahr, MeshkinDasht and Mahdasht of Karaj, and to make the above goals possible as well as providing the necessary technical and legal solutions to the health of drinking water sources. Also, by carrying out the experiments, even if routine quality tests are carried out on the wells of the area in question continuously, it is impossible to obtain a general outline of the process of social pollution, taking into account the hydrological and geological conditions. While having continuous quality information in a specific time period and modeling it in the GIS environment, it is possible to obtain a clear trend in the probability of drinking water wells in the region and use it in water resource management.

Review of the literature

Azarin et al. (2017) investigated the quality of underground water in Dehgolan suburb of Sanandaj for irrigation and drinking water using GIS and land statistics. In this research, ordinary Kriging method was used to produce thematic maps. Water quality parameters including HCO3, SAR, EC, Mg to Cl, TDS, Ca, Nitrate and water hardness were used. The spherical variogram has two qualitative parameters for Cl and water hardness, and in the rest of the model, the exponential model has the best fitting to the data. Distribution maps of irrigation and drinking water quality index showed suitable areas for irrigation and drinking. Karami (2016), with qualitative zoning and study of the origin of drinking water wells in Savojbolagh villages, studied 12 wells from 43 wells of this city, coordinated by Rural Water and Wastewater Company in GIS environment, which has been studied and analyzed in total of 32 samples. According to the analysis, the parameters of turbidity, pH, electrical conductivity, total soluble solids, total hardness, fluoride, chloride, and sulfate were standardized and always lower than the maximum allowed. Due to the lack of fluorine and low cost of fluorination, it is suggested that this activity be put on the agenda of Authorities. Suarez et al. (2017) studied the status of chemical analysis of drinking water wells in the Donnelly suburbs of Bangladesh and its relationship with some of the microbial parameters and the probable sources of contamination with the frequency of time of three months once every four years. In the sampling period, there was a significant correlation between water temperature and total number of fecal form 0.8 and the total number of total form 0.4. In addition, the correlation between total number of total form and phosphate was significant. The main cause of fecal contamination of water wells is the penetration of water from the traditional channel of cultivators to the well aquifer. de Joode et al. (2016) investigated the concentration of manganese in drinking water in Costa Rica villages. In addition to manganese concentration in this study, iron, arsenic, lead and cadmium have also been investigated. According to the results, only 6% of samples are standard and can be drinkable, while in 94% of samples the concentration of compounds is higher than standard and is due to non-seasonal spraying in banana fields of the region. As a result, manganese is considered as a health hazard in the region.

2. Materials and Methods

Society and statistical sample

The statistical population of this study was 3 Water and Wastewater District of Alborz province (Mohammad Shahr, MeshkinDasht and Mahdasht) and statistical samples of 5 geographical points in each area during the fall and winter of 2016. Sampling and measurement of turbidity, temperature, electrical conductivity, pH, total soluble solids, total hardness, fluoride, chloride, sulfate, nitrate, nitrite, sodium, potassium, calcium, magnesium were determined at autumn and winter. Samples were submitted to the Laboratory of Water and Wastewater of Alborz Province Company for carrying out the necessary analyzes. Then the zoning was carried out in the GIS environment. At the end, the analysis of the qualitative data of each well and the final interpretation and presentation of suitable points for digging and supply of drinking water was done.

Research Methodology

The study areas of this research are located on the aquifer of Karaj and Fardis (Figure 1) and the status of exploitation of this plain is prohibited. Alluvial thickness in these areas is about 250 m, which is relatively low due to the rise of the floor. Based on the water content of the alluvial aquifer, this hydrologic unit during the 20 years' period from 1991 to 2011 has a depth of 17 m, with an average annual value of approximately 84 cm.

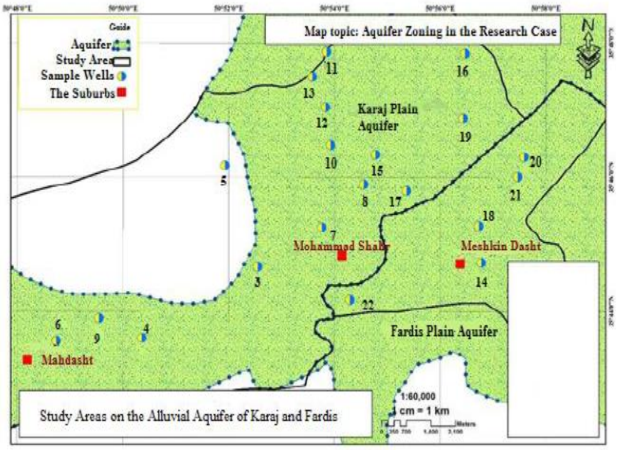

Figure 1: Study Areas on the Alluvial Aquifer of Karaj and Fardis

All microbial and chemical sampling was carried out in coordination with Alborz Water and Wastewater Company and all tests were carried out at the Laboratory of Water and Wastewater Company. Table 1 shows the qualitative parameters related to the analysis of water samples and the recommended test for measuring them according to the standard of the 1998 methodology.

Table 1: Qualitative parameters related to the analysis of water samples and the recommended test to measure it

	Parameter	Recommended test	code
Anions	Fluorine F-	Fluoride Electrode / SPADNS	-F- 4500
	Chlorine Cl-	Argentometry	-Cl-4500
	Sulfate -24	Turbidimetry	-SO42-4500
	Carbonate CO-23	Calculation	2330
	Bicarbonate HCO-3	Calculation	2330
	Phosphate PO-34	Vandomolibdophosphoric Acid	p-4500
	Nitrite NO-2	spectrophotometry	NO2--4500
	Nitrate NO-3	Uv spectrophotometer	-NO3—4500
Cations	Parameter	Recommended test	Code
	Calcium Ca+2	Calculation	Ca2 + -3500
	Magnesium Mg+2	Calculation	Mg2+-3500
	Sodium Na+	Flame photometry	Na + 3500
	Potassium K+	Flame photometry	K + -3500
	Iron Fe+2	PhenanthrolineMethode	Fe2 + -3500
	Manganese Mn+2	PersulphateMethode	Mn2+-3500
Appearance and digestive factors	Temperatures		2550
	pH	Wide range pH meter	A-4500
	Electrical conductivity	Conductivity meter	A-2510
	Turbidity	Nephelometery	2130
	Color	Visual / colorimetry	2120
	Total solids soluble TDS	Total dissolve solids Driedat 180 c	2540
	Total hardness CaCO3	EDTA Titration	2340
	Permanent hardness CaCO3	EDTA Titration	2340
	Alkalinity M.o CaCo3	Acid Titration	2320
	AlkalinityP CaCo3	Acid Titration	2320
	Total alkalinity	Acid Titration	2320

After analyzing the water samples in the studied areas, the water quality parameters will be analyzed using GIS software. Data analysis, data processing and parameter analysis in the groundwater quality of the study area have been used with Excel and Arc GIS 10 software. After generating descriptive information tables in the Arc map and constructing the Geodatabase in the Arc Catalog, it is attempting to produce mapping of the information values of the wells by means of interpolation and the inverse weighted distance (IDW). According to the experiments, the quality parameters measured in sample wells are Na +, Mg2 +, Ca2 +, Cl- (in mg / L) and PH, EC and TDS respectively (in mg / L). Based on the parameters, the qualitative zoning of each parameter is based on the IDW method and the appropriate and inappropriate zones are determined. Then, by laying the layers together and determining the distribution area of the quality zones, the water quality is defined by wells in terms of consumption for drinking, industry and agriculture.

- The first layer of electrical conductivity (EC) of wells in the studied area is the lowest electrical conductivity of water in the area related to wells 3 and 5. The highest electrical conductivity is related to wells 6, 7, 8, 9, 14, 20, 21 and 22.
- The second layer of study, chlorine ion (CL) of wells in the study area, has the lowest chlorine in the area related to wells 3 and 5. The highest chlorine levels are related to wells 6, 7, 9, 14, 20 and 21.
- The third layer, the amount of sodium ion (NA) in the studied wells, has the lowest amount of sodium in the well zone 3 area. The highest sodium content is related to wells 6, 7, 8, 9, 14, 15, 16, 20, 21 and 22.
- The fourth layer of study, the sulfate (SO4) number of wells in the study area, has the lowest amount of sulfate in the well zone 3 area. The highest amount of sulfate is related to wells 6, 7, 8, 9, 10, 12, 14, 15, 16, 18, 19, 20, 21 and 22.
- The fifth study layer, the amount of sodium absorption ratio (SAR) of wells in the study area, had the lowest sodium absorption ratio in the well-12 areas. The highest rate of sodium adsorption is related to wells 6, 7, 8, 9, 14, 15, 16, 20, 21 and 22.
- The sixth study layer, the calcium-magnesium ratio (Ca_Mg) of wells in the study area, had the lowest calcium-magnesium ratio in the wells 10 and 19 area. The highest calcium-magnesium ratio is related to well 13.
- The seventh study layer, the soluble solids content (TDS) of wells in the study area, had the lowest soluble solids content in wells 3 and 5. The highest number of soluble solids is related to wells 6, 7, 9, 14, 16, 20, 21 and 22.
- The eighth study level, the water pH (pH) of wells in the study area, has the lowest acidity in the area related to wells 10 and 16. The maximum acidity of water is related to wells 12 and 16.
- The ninth layer of study, the amount of Cation of wells in the study area, is the lowest cation in the area of wells 3 and 5. The highest number of cations is related to wells 6, 7, 9, 14, 16, 20, 21 and 22.
- The tenth study layer, the number of anions in wells in the study area, the lowest number of anions in the area related to wells 3 and 5. The highest number of anions is related to wells 6, 7, 9, 14, 16, 20, 21 and 22.

3. Results

Groundwater quality of the region

The city of Mashkin-e-Dashte and Mahdasht Alborz province have 58 wells. Due to the dispersion of wells at the level of these three areas and considering that some of these wells are located in residential areas and their quality is different, therefore, 22 of these wells have been selected as wells in the study and the changes in water quality in the region with regard to these wells has been investigated (Table 2).

Table 2: Statistical Analysis of Water Quality at Hydrological Unit of Tehran – Karaj

Characteristic	Unit	Maximum	Minimum	Average	Standard deviation	Coefficient of variation	Skidding	Elongation
Sodium Absorption Ratio (SAR)		27.62	2.31	18.3	4	22	-0.7	3.93
Sodium (Na)	Mg / L	130.4	7.22	43.66	20.19	46.24	1.48	4.56
Sodium (Na)		4.87	1.98	3.65	0.47	46	-0.65	1.7
Magnesium (Mg)	Mg / L	15.7	0.7	4.24	2.29	53.99	2.42	9.93
Magnesium (Mg)		2.75	-0.36	1.35	0.51	54	-0.46	1.85
Calcium (Ca)	Mg / L	32.3	1.1	7.42	4.71	63.55	2.62	11.87
Calcium (Ca)		3.48	0.1	1.9	0.58	63	-0.22	0.6
Sulfate (SO)		42	3.65	14.1	6.79	48.19	2.5	6.89
Sulfate (SO)	Mg / L	3.74	1.28	2.65	0.39	48	0.47	3.13
Chlorine (CI)		147.5	3.5	33.81	25.57	65.75	1.88	37.5
Chlorine (CI)	Mg / L	4.99	1.25	3.26	0.73	75	-0.12	-0.26
Acidity (pH)		8.68	7	7.65	0.25	3	0.66	3.36
Electrical conductivity (EC)	Mg / L	17.87	1.81	5.52	2.87	0.51	1.67	4.5
Electrical conductivity (EC)		2.88	0.02	1.47	0.55	52	-0.49	0.7
Total solvent content (TDS)	Mg / L	10700	1088	3151.5	1493.09	47.37	2.23	9.67
Total solvent content (TDS)		2.37	0.08	1	0.43	47	0.02	0.41

HCO	Mg / L	7	1	3.41	0.88	25.69	1.13	6.36
HCO		2.65	1	1.82	0.44	26	-0.21	5.2

Based on figure 2, which shows the distribution of existing and sample wells on altitudes, most wells are located on the 1200 to 1250 meters.

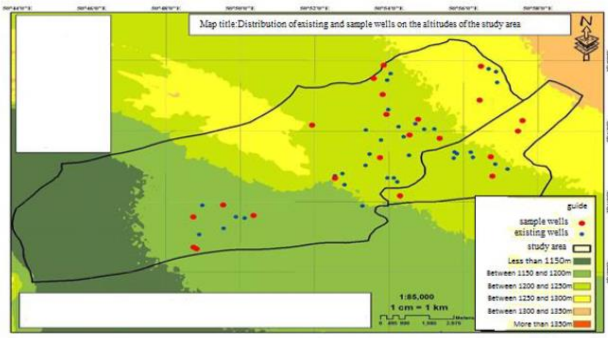

Figure 2: Distribution of existing and sample wells on the altitudes of the study area

Qualitative water quality categorization for drinking based on layer assemblage

After qualitative layers' assemblage of the wells studied, the water quality zonation of the area was obtained in terms of drinking water, as shown in Figure. 3. The water quality classification is based on two Schuler and Wilcox models, the first for drinking and the latter for agricultural use.

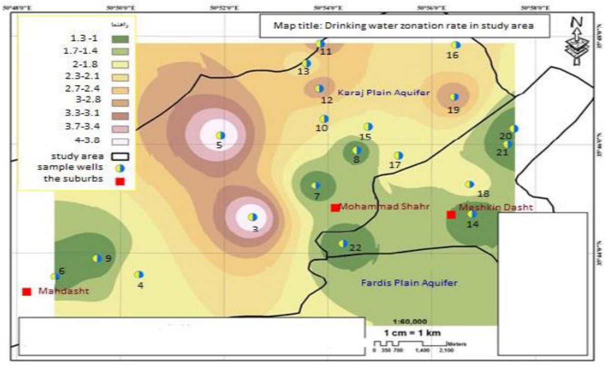

Figure 3: District water quality zonation in terms of drinking due to overlaying of wells

The figure shows that salinity, sodium, sulfate, soluble solids ratio, and chlorine and Cation ions are very high in wells 3 and 5, and in wells 11, 12 and 19, and water consumption in these wells in the long run has been salinization and reduction of soil permeability and sedimentation and corrosion in water pipes. Based on the qualitative water zoning map, the 1-round and close to 4, the qualitative water has been degraded. Wells 3 and 5 have inappropriate status and wells 6, 7, 8, 9, 14, 20, 21 and 22 have good condition and wells 1, 2, 4, 10, 13, 15, 16, 17 and 18 with suitable conditions and acceptance and wells 11, 12 and 19 have average drinking conditions. Therefore, the studied area is classified as good, acceptable, moderate and inadequate, and the last two floors of the Schuler, which are completely unpleasant and non-drinkable, are not seen in these areas. In table (3), drinking ability information is appropriate to the quality of each well according to the parameters studied in Schuler classes. Figure 4 shows the Schuler diagram in the hydrologic unit of Tehran-Karaj.

Table 3: Drinking capacity information for each well based on the parameters studied in Schuler classes

drinkable water	SO4	C1	NA	PH	TH	TDS	Well number
Acceptable	2.92	3.5	4.8	8.1	242.5	636	1
Acceptable	3.2	4.1	7.73	7.81	184.11	605	2
Inappropriate	33.63	10.4	15.4	7.91	971.33	1836	3
Acceptable	5.48	4.2	5.15	8.15	326.57	612	4
Inappropriate	12.37	11.8	9.1	8.16	845.36	1640	5

Good	0.92	0.4	0.7	7.82	142.95	216	6
Good	2.1	0.8	1.15	8.24	193.81	258	7
Good	2.04	1.7	1.75	7.57	220.22	370	8
Good	1.05	0.5	0.7	8.21	154.34	201	9
Acceptable	2.3	1.8	2.38	7.14	265.44	413	10
Medium	5.33	5.2	10.65	8.55	134.33	776	11
Medium	3.12	3.4	12.85	8.84	38.33	766	12
Acceptable	4.81	4.6	9.1	7.61	198.82	842	13
Good	1.29	0.5	0.57	8.22	154.38	195	14
Acceptable	1.66	3.2	1.4	7.66	357.95	554	15
Acceptable	2.13	2.3	3.4	7.24	259.67	414	16
Acceptable	4.25	3.95	7.33	7.71	328.54	768	17
Acceptable	3.41	2.7	6.05	7.62	230.7	648	18
Medium	3.14	3	12.09	7.58	76.38	980	19
Good	1.25	0.3	0.86	7.82	165.32	242	20
Good	2.41	1	2	8.18	179.13	328	21
Good	1.84	1.7	0.6	7.52	248	311	22

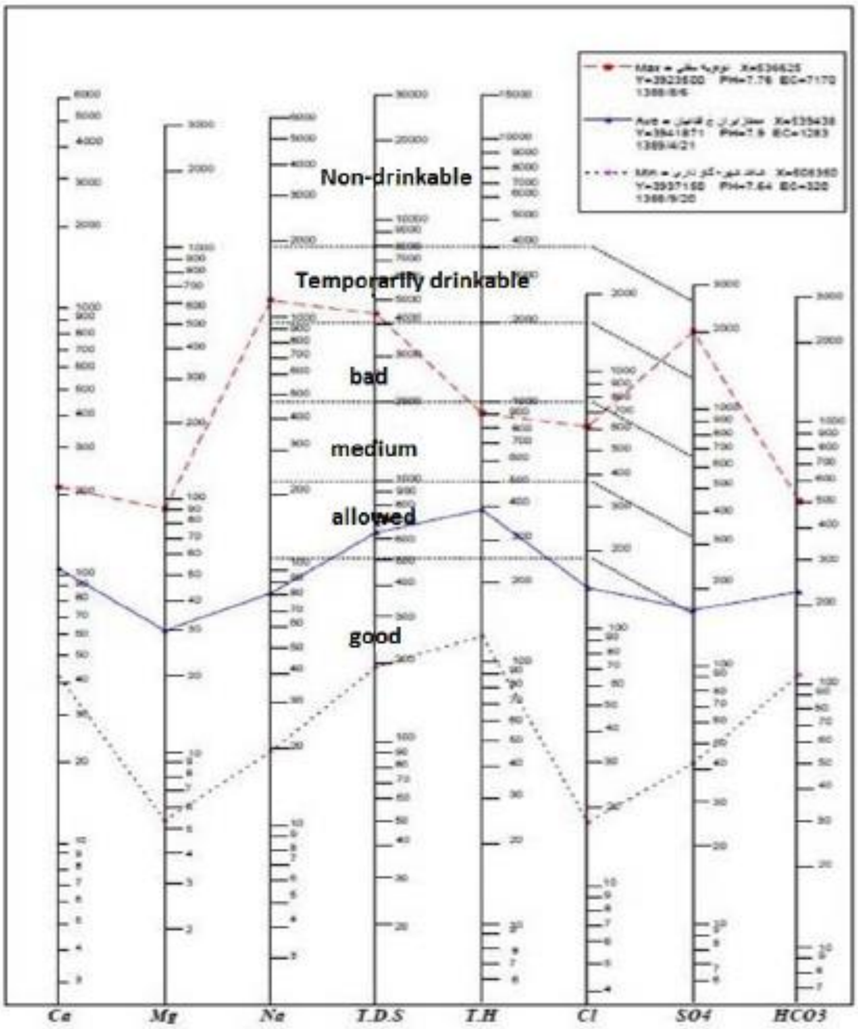

Figure 4: Schuler diagram in Tehran-Karaj Hydrological Unit

In agriculture, water is recommended with low SAR. For classes on water classification for irrigation and agricultural applications, we can comment on the Wilcox table. Table 4 presents the classification of water quality for agricultural use by Wilcox method. In table (5), irrigation class information of each well is expressed based on the parameters studied in Wilcox classes. Figure 5 shows the Wilcox diagram of the Tehran-Karaj hydrologic unit. Figure 6 shows the qualitative zoning of drinking water in the area according to the Wilcox classification, with classes of up to 2 salinities, up to 3 salty and up to 4 salty. In general, the larger the numbers of S and C indexers mean that salinity increases and becomes less suitable for farming. In the above classification, S represents the Sodium Absorption Rate or the sodium absorption ratio, and C represents the amount of conductivity (water conductivity).

Table 4: Classification of Water Resources Quality for Agricultural Use by the Wilcox Method

Approximation of S.A.R	Class			Approximation of	Class		
0-10	S1	Small	Great	0-250	C1	Small	Great
10-18	S2	Medium	Good	250-750	C2	Medium	Good
18-26	S3	High	Medium	750-2250	C3	High	Medium
26-32	S4	Very high	Inappropriate	2250-5000	C4	Very high	Inappropriate

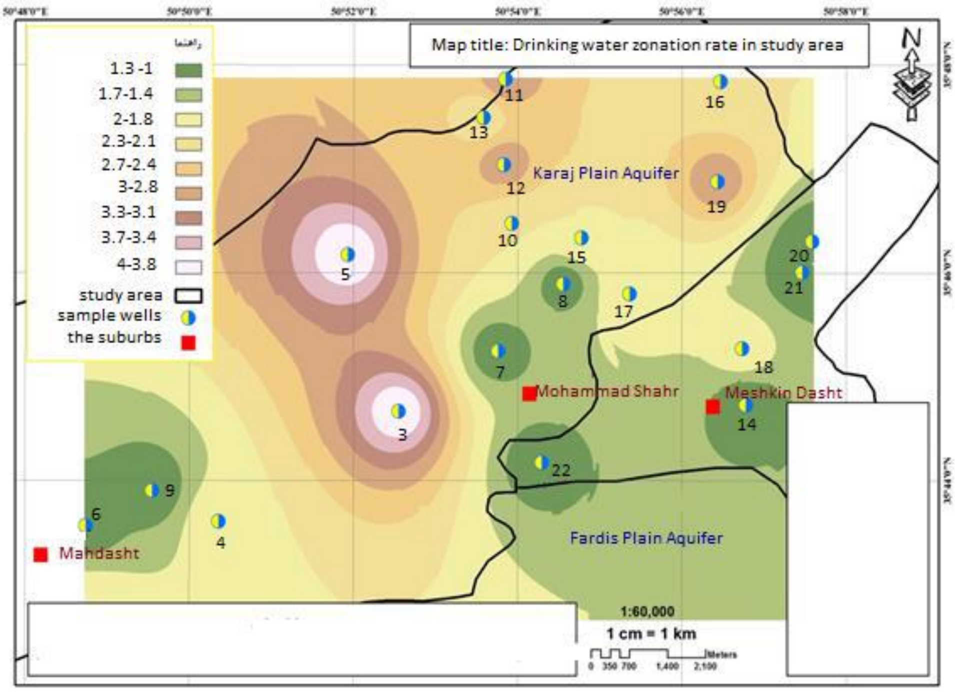

Figure 5: Quality zonation of drinking water in the area by Wilcox classification

Table 5: Irrigation class information for each well based on the parameters studied in the Wilcox classes

Manufacturer type	Agriculture	Irrigation class	EC	SAR	Well number
Dolomite lime	Salty - Can be used for farming	C3-S1	986	3.08	1
Calcareous dolomite	Salty - Can be used for farming	C3-S2	1121	5.68	2
Dolomite lime	Very salty - inappropriate for farming	C4-S2	3280	4.93	3
Calcareous dolomite	Salty - Can be used for farming	C3-S1	1200	2.84	4
Dolomite lime	Very salty - inappropriate for farming	C4-S1	2530	3.12	5
Dolomite lime	Slightly salty- suitable for farming	C2-S1	362	0.58	6

Calcareous dolomite	Slightly salty- suitable for farming	C2-S1	517	0.82	7
Calcareous dolomite	Slightly salty- suitable for farming	C2-S1	596	1.18	8
Dolomite lime	Slightly salty- suitable for farming	C2-S1	360	0.56	9
Dolomite	Salty - Can be used for farming	C3-S1	765	1.46	10
Calcareous dolomite	Salty - Can be used for farming	C3-S2	1412	9.17	11
Calcareous dolomite	Very salty - inappropriate for farming	C3-S4	1344	20.71	12
Dolomite lime	Salty - Can be used for farming	C3-S2	1322	6.44	13
Dolomite lime	Slightly salty- suitable for farming	C2-S1	355	0.46	14
Dolomite lime	Slightly salty- suitable for farming	C3-S1	868	0.74	15
Calcareous dolomite	Slightly salty- suitable for farming	C3-S1	782	2.1	16
Calcareous dolomite	Slightly salty- suitable for farming	C3-S1	1372	4.04	17
Calcareous dolomite	Slightly salty- suitable for farming	C3-S1	1014	3.97	18
Dolomite	Slightly salty- suitable for farming	C3-S3	1482	14.7	19
Dolomite lime	Slightly salty- suitable for farming	C2-S1	401	0.67	20
Calcareous dolomite	Slightly salty- suitable for farming	C2-S1	586	1.49	21
Dolomite lime	Slightly salty- suitable for farming	C2-S1	458	0.38	22

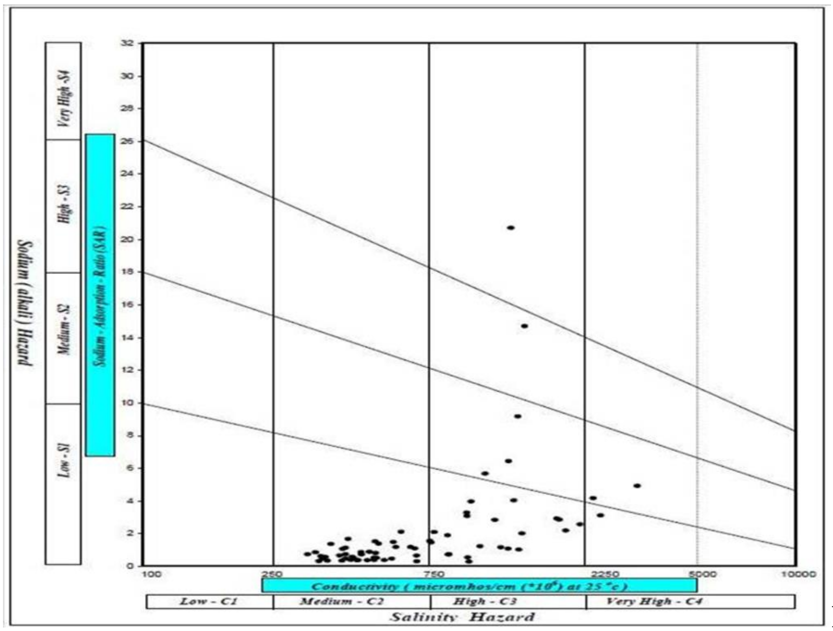

Figure 6: Wilcox Hydrological Unit Tehran-Karaj

Finding source of contamination sample wells in the study area

The chemical quality of water is due to the presence of hardened ions, and in particular the water-soluble Cations and soluble anions and the total water-soluble solids (TDS) and toxins and organic compounds and toxic and rare elements, which for each of them in drinking water, specified values and the desired and maximum standard are set. One of the most abundant ions is water hardness. Chlorine and sulfate were studied in order to determine the source of contamination in the region. Among the chemical formers, chloride is first and secondarily sulfates as a tracer in determining the source of contamination.

The reason for the increase of sulfate in wells number 3 and 5 can be attributed to acidic atmospheric deposition and sulfate fertilizers that were transferred to the soil through rainwater and increased soil acidity and water content. The level of magnesium in groundwater is less than the standard level. Probably the reason for the relative increase of its concentration in parts of the area (well 13) is related to the geological structure of that area. The results of nitrate and fluoride measurements in the wells indicated that the nitrate content was less than the standard values (50 mg / L). The highest and lowest nitrate levels were found to be 35 mg / L and 4 mg / L, respectively, which was lower than the standard values. It was also observed that nitrate content in the measured seasons did not change much. This is due to the provision of drinking water from the groundwater resources, which are almost constant quality. Therefore, it can be concluded that drinking water in the region is in a good condition in terms of the presence of a dangerous substance in nitrate and can be safely used for drinking. In the case of fluoride, the highest and lowest mg / L were 0.79 and 0.0. Also, the amount of fluoride measured in most cases is in amounts below the minimum standard. Considering the standard level of fluoride in drinking water is equal (0.75-1.5 mg / L), Therefore, it is observed that drinking water in the region is suitable for the use of fluoride for drinking. In the case of nitrate, it should be noted that most groundwater does not have the problem of nitrate. In the most ideal conditions, the concentration of nitrate should be zero, but in the current standards, the maximum concentration is 45 mg / L. From this perspective, drinking water in the Karaj distribution system has no serious problem in terms of the presence of nitrates. The highest anionic contamination including nitrate is related to southwest and northwest of Mohammad Shahr, and to northeast is added anionic contamination, which can be attributed to the increasing concentration of human population and green space in these areas. In turn, it increases fertilizer use and increases sewage production. Because of the high solubility of nitrate and the absence of a special process for its precipitation, it has been transferred to the slope of groundwater and its concentration in the end sections of the plain has remained almost constant. In wells Number 3 and 5, nitrate concentrations are higher than the rest of the wells. In the case of nitrate in these wells, it is more than international agricultural standard. The main reason for this is the use of nitrate fertilizers including phosphate nitrate and micronutrient fertilizer, which includes AKEPM urea fertilizer, macro-microcrystalline fertilizers and crystalline fertilizer in farmland. Also, the presence of gravel-sandy and sandy-clay soils in the area on the one hand and the non-observance of the safety of drinking wells on the other hand and high nitrate transport and increasing the amount of watering and transferring the ion to groundwater contributes to water pollution is in these areas. Also, the inclination of pollutants to the well, the depth of excavated wells for irrigation of green space and the use of absorption wells for the disposal of domestic sewage are other factors contributing to the amount of pollution in these wells. On the other hand, the amount of nitrite ion in water in most of the wells studied is from the recommended low-level standard values. The reason for this can be the instability of this ion and its rapid conversion into nature to nitrate ions. The high concentration of nitrate ion while the low nitrite ion concentration is indicative of the fact that the contamination has not occurred recently, but this increase has taken place over many years, if this control is not carried out, this process continues. By observing the wells studied in the area, wells 3 and 5 with TDS above 1500 were found to be over-permitted. The use of salt in winter for melting ice and snow on roads and urban roads is an effective factor in increasing groundwater TDS, and the change in TDS affects the chemical quality of water, such as hardness and corrosive. The results of heavy metals concentration showed that the concentration of heavy metals is lower than the limit. Therefore, the irrigation water resources of the wells in the region are reliable sources for heavy metals. For various reasons, such as the lack of industries in the region, geological composition of the area, the reduction of urban wastewater influx into water resources, geographical conditions and environment governing the regions are not subject to heavy metal contamination. Gain et al. research showed that heavy metal concentrations change over time, and wells in one place can be widely distributed in different concentrations of metals. In fact, the concentration of heavy metals in the wells associated with the location and the depth of the wells is higher in the shallow wells in specific geological areas. Qualitative parametric electrical conductivity is easily measured and represents the average qualitative characteristics of water resources. Therefore, measurement and trend of changes and its review are of particular importance. Usually, water resources are divided into 6 classes in terms of electrical conductivity (EC), which are studied in 3 wells (the electrical conductivity is between 250 and 750 mm / cm), relatively sweetness (the electrical conductivity is between 750 and 2250 micromoles per cm) and salty (the electrical conductivity is between 5000 and 10,000 micron microseconds per cm). Wells 3 and 5 are among salty waters that are used in terms of farming patterns and agricultural desertification plans. Changes in electrical conductivity, chlorine, sodium and soluble solids in 3 and 5 wells are increasing due to the movement of the hydraulic gradient from east to west of the region and the probability of a sedimentary deposit containing evaporative sediments that elevates the foothills in the central regions and creates the conditions of capillarity, namely capillary properties and inverse motion of salts from the lower layers to the surface of the earth, and the scouring of minerals to the lower layers and underlying aquifers, has a significant effect on the increase of mineral contents. In the wells 6, 7, 8, 9, 14, 20, 21, and 22, the further formation of Eocene rocks and green rocks as a geochemical purifier is considered as a local effective factor in reducing the solute concentration of these wells and the existence of calcareous masses and Marly in the southern map of wells 3 and 5 as a factor contributing to the increasing difficulty of water resources in the wells of this central part of the study area. Certainly, at the time of increasing the utilization of these resources, the introduction of contaminated tiles to Marlian lime layers increases the hardness of these sources of water. Figure 7 shows the location of wells in the sampled case for land use.

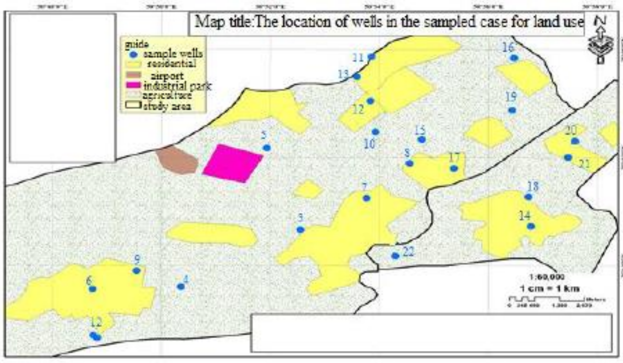

Figure 7: shows the location of wells in the sampled case for land use

4. Discussion

According to the monitoring and quality maps prepared from the study area, electrical conductivity increases in the center of the region, or in the west of Mohammad Shahr. Accordingly, the groundwater resources of this area are part of salty water, but the rest of the wells are suitable and sanitary waters. The electrical conductivity will largely follow the discharge rate. Therefore, in order to prevent undesirable aquifer, control of the level of productivity is necessary for aquifer management. The study area under consideration, regarding the hydrological conditions, is both qualitatively and quantitatively encountered with serious limitations, but because of the model and position of the bedrock, the geological conditions of the West and the East with the center of the region are completely together which is different. The rocks of this region, in the west and east, are very spacious to the surface of the earth, but as we approach the center, the rock is raised up so that it is near the earth's surface. The wells of the center are in poor condition and the depth of the excavated wells is lower, which is good at the beginning of the digging, but it does not last long that the wells are dry and deserted. In addition to the condition of the land and the status of the rock of the area and the loss of texture due to the low opportunity and distance from the origin of erosion to the site of sedimentation and the lack of expansion of sediment transport zones, it decreases the thickness of alluvial deposits, and in this situation the formation of safe aquifers in the plain with restrictions faced. Due to the warm and dry climatic conditions of this zone in warm seasons and due to the conditions of capillarity of underground water (due to the high rock floor), the fine porosity of the vacuum and fine-grained pore passes in the direction opposite to the force of gravity and when rising to the surface of the earth, it raises itself and causes dandruff. The next limitation in this region is due to geological conditions. The geological formations of this plain with evaporative deposits (gypsum-marly) cause atmospheric precipitation to be solved in these areas and to inject into the layers of the earth as a solution and under groundwater quality of this area is highly discharged and increases the electrical conductivity and hardness of the water in this range.

Similar research has been done to determine the groundwater quality by (Sadeghi Aghdam., et al., 2019- Atefeh, et al., 2016) which shows that the type of land use is directly related to water quality parameters.

5. Conclusion

The main factors contributing to water wells in the area include the following:

- Use of chemical fertilizers in agricultural lands according to the extent of green space, gardens and existing parks
- Household sewage and lack of sewage network and refinery in the region
- Surface runoff due to the lack of engineering and sanitary network for the disposal of surface water and sewage from agricultural, industrial and urban
- Solving a considerable amount of minerals during the passage of surface water from the earth's layers and other factors such as the topographic state and the slope of the study area, the geological structure, the lack of a proper distance between the wells of the water and the wells of the sewage and their health care in some areas, the depth of the well, the old texture of the area.

Therefore, it is suggested that the following should be implemented:

- Use of higher irrigation methods such as pressure irrigation
- Land test to determine the real needs of the green space of the area to the fertilizer
- Permitted and Standard Chemical Fertilizer Distribution
- National and provincial standard setting
- Use of environmentally friendly chemical fertilizers

Considering that the western and eastern parts of the region have a better quality status than the central part, it is better to concentrate digging and operations in these areas. Considering the geological and hydrogeological characteristics such as the noticeable thickness of alluvium, suitable drainage and the proper quality of the West and East and the proximity to the source of water, in order to meet the needs of the region in the short term, the northern and southern limits of Mohammad Shahr and MeshkinDasht and East of Mahdashtit is proposed to extract water from selected wells for drinking.

6. Conflict of interest

The authors declare that they have no conflict of interest.

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