

STUDY OF GROUND WATER QUALITY WITH GIS APPLICATION FOR ARIYALUR DISTRICT TAMIL NADU

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Abstract

Water is one of the most important commodities which man has exploited than any other resource for his life. Due to rapid increase in density of population, fast urbanization, Industrialization and agree cultural use the demand of water is increasing day by day. Ground water quality has direct implications for domestic, industrial and drinking water purposes. The paper presents a case study on the water quality analysis carried out at the Ariyalur District, Tamil Nadu. Six physico - chemical parameters were considered in the analysis. The analysis was carried for pre monsoon, monsoon and post monsoon seasons.

Accurate estimation of the temporal and spatial distribution characteristics of water resources are required to manage the optimum use of water resources in a sustainable manner. Recently with advances in computer technology and computational capabilities geographical information system (GIS) and remote sensing (RS) technologies have been widely used in hydrologic water quality modeling areas and thus in related decision – making contexts.

KEYWORDS: Groundwater Quality, GIS Application, Ariyalur district.

1. INTRODUCTION

Water is the basic requirements of all life on Earth. The increase in population and urbanization and urbanization necessitates growth in the agricultural and industrial sectors which demand for more fresh water. When surface water is the non-available mode the alternative is to depend on ground water. When the polluted water seeps into the ground and

enters an aquifer it results into ground water pollution. The most of our villages and many townships, ground water is the only source of drinking water. Therefore, pollution of groundwater is a matter of serious concern [1]. Groundwater gets polluted in a number of ways. The dumping of raw sewage on soil, seepage pits and septic tanks cause pollution of groundwater. Water is very important to life without water our life cannot move. Water shortage has become an increasingly serious problem in India, especially in arid and semi-arid regions of the country due to scarcity of surface water and vagaries of monsoon.

Ground water quality depends on the quality of recharged water, atmospheric precipitation, inland surface water and sub-surface geochemical processes. Temporal changes in the origin and constitution of the recharged water, hydrological and human factors may cause periodic factors may cause periodic changes in ground water quality [2].

Water pollution not only affects water quality but also threatens human health, economic development and social prosperity. The water pollution is not only devastating to people but also to animals aquatic life and birds. The impact of tannery waste water disposal leads to environmental problem, even though this problem persists for a long time, it has attracted serious attention only in recent time [3]. In developing countries like India around 80% of all disease are directly related to poor drinking water quality and polluted conditions. The principals governing the chemical characteristics of groundwater were well documental in many parts of the world [4].

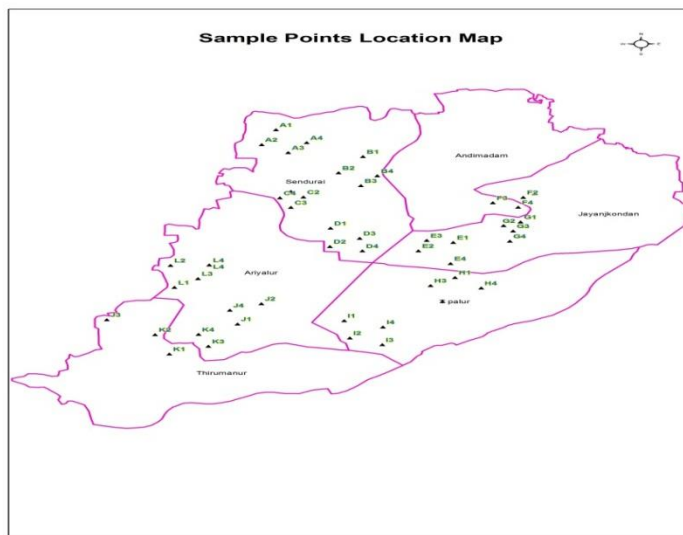
GIS is a power tool for collecting, storing, transforming the spatial information and arriving decision from the real world for particular set of purpose in real time, where the stored information are geo-references (or) geo-coded [5]. In this project the water quality is analyzed using GIS and mapped. In recent years remote sensing systems have advanced in leaps and bounds. Several efforts have been put in worldwide by researchers employing remote sensing (RS) and geographical information systems (GIS) techniques for acquiring water quality data [6]. In the present work attempts to identify the extent of groundwater pollution in and around Ariyalur district.

Study Area

Ariyalur is a rich limestone and surrounded with five cement factories. All the people used the ground water for domestic purposes. The Agricultural communities utilized the ground water for forming in their lands. It is situated between $10^{\circ} 50' 0''$ to $11^{\circ} .30' 0''$ of the Northern latitude and $79^{\circ} 0' 0''$ and $79^{\circ} .30' 0''$ of the study area have been shown in fig (1). Ariyalur district consists of 2 Revenue Divisions and contains 3 taluks and 6 Blocks.

Location map of the study area

Figure -1



Materials and methods

The 48 groundwater samples collected during pre monsoon, monsoon and post monsoon seasons during the year 2015 to 2017. The samples have been collected from the bore wells. Samples were analyzed for different physico-chemical parameters such as pH, EC, TDS, TH, CO₃ and HCO₃. pH and Electrical conductivity have been measured using digital meters immediately after sampling have been analyzed for chemical constituents such as major ions in the laboratory using the standard procedure. Assessment of groundwater vulnerability by DRASTIC index through GIS analysis and geo – processing framework.

Results and Discussion

The average values of the various physico-Chemical parameters of water samples collected during pre monsoon, monsoon and post monsoon season 2015-17. GIS is used to evaluate the quality of ground water in Ariyalur District. This integrated ground water quality map help us to know the existing map help us to know the existing ground water condition of the study area

Table – 1 Ground water quality analysis for Ariyalur district.

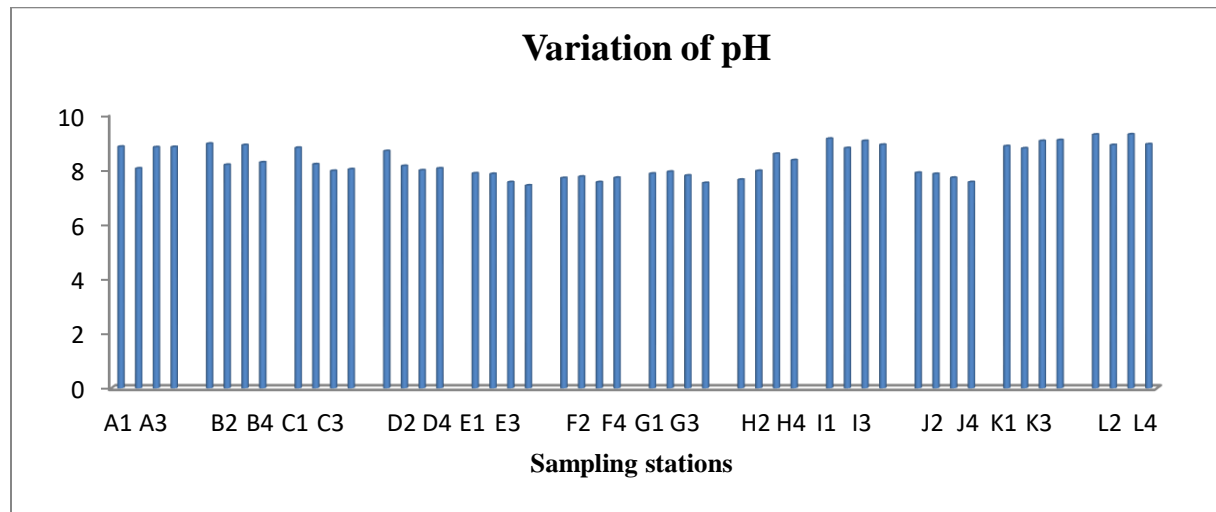
Sampling Station		Latitude	Longitude	pH	EC	TDS	TH	CO ₃	HCO ₃
	Dalmiapuram								
A1	Govt Hr.sec	10.9733824	78.9497904	8.8	3253	2329	431	34.2	159
A2	Indian Bank	10.9757071	78.9506705	8.0	2994	2224	382	ND	189
A3	Gas stationn	10.9789041	78.946094	8.8	2645	2139	360	37.3	159
A4	PG network	10.9804253	78.9505887	8.8	2658	1760	398	40.2	179
	Kezhapalur								
B1	Govt Hosptial	11.0425011	79.0614179	8.9	2099	1379	327	41.7	261
B2	Panian grama Bank	11.0403984	79.0690179	8.1	2191	1481	299	ND	296
B3	Balagi petrol bank	11.0475191	79.0788288	8.8	2043	1407	308	41.8	236
B4	ARS Welding works	11.0509176	79.0710852	8.2	1960	1316	322	38	247
	Ariyalur								
C1	Stell company	11.1192671	79.0721591	8.7	2555	1756	428	45	202
C2	State Bank of india	11.1331583	79.0708479	8.1	2842	2194	410	32.5	152
C3	collector office	11.1277373	79.085603	7.9	2330	1424	389	ND	142
C4	Rithanya mahal	11.1409459	79.0843461	8	2440	1519	423	ND	124
	Sendurai								
D1	Limra sales and service	11.253401	79.1730957	8.6	2200	1293	330	80	135
D2	Talk office	11.247409	79.1841132	8.1	2404	1622	336	ND	171
D3	Ramasamy theater	11.2527933	79.1806468	7.9	2790	2159	333	ND	234
D4	M.R.F tyres	11.259065	79.1864514	8.0	2553	2097	358	37.7	234
	Andimadam								
E1	Indian Bank	11.3363699	79.374315	7.8	3624	2913	320	ND	206
E2	Sri kamesh motors	11.3387341	79.3779011	7.8	3174	1695	326	ND	215
E3	Mariyamman temple	11.3365159	79.3790538	7.5	3085	2387	314	ND	212
E4	Bharath petrol bank	11.3270531	79.3754344	7.4	3241	2478	340	ND	215
	Kallathur								
F1	Chruch	11.2664006	79.38283	7.6	2175	1507	360	ND	154
F2	Ranjth auto stores	11.2601393	79.3737708	7.7	2384	1722	289	ND	197
F3	Muniyappan temple	11.2550691	79.3501654	7.5	2608	2140	310	ND	175
F4	Karuppasamy temple	11.2475096	79.3719449	7.6	2250	1729	263	ND	174
	Jeyankondan								
G1	Rasi agency	11.2206763	79.3679367	7.8	1961	1317	295	ND	240

G2	Sun maligai	11.2124078	79.3649759	7.9	2085	1455	294	ND	230
G3	Govt hospital	11.2094206	79.3666331	7.7	2162	1465	303	ND	225
G4	K.K.C vinayagar temple	11.1927251	79.3666543	7.5	2188	1385	313	ND	217
	T,Baloore								
H1	Pillaiyar temple	11.1027323	79.3710678	7.6	4920	3119	327	ND	190
H2	Muthumariamman temple	11.0988658	79.3689516	7.9	4057	3102	320	ND	174
H3	Pandiyar hotel	11.09488	79.3713867	8.5	3730	3249	325	51.9	201
H4	Uma maligai store	11.0993955	79.3813223	8.3	3265	2053	323	51.7	214
	Udaiyaarpalayam								
I1	Palanivilas hotel	11.1865477	79.3022923	9.1	2333	1358	342	48.9	210
I2	Thiruvalluvar wedding mahal	11.1851909	79.2938061	8.7	2220	1300	301	36.7	248
I3	Selva mariyamman temple	11.1813772	79.2890754	9.0	2026	1349	293	36.9	212
I4	R.D.O office	11.1808099	79.2936727	8.8	2061	1435	303	36.4	189
	Thathanoore								
J1	Meenatchi Ramasamy college	11.1622217	79.2790081	7.8	2851	1928	437	ND	178
J2	Kavin samosaa corner	11.1535177	79.2737567	7.8	2772	1972	416	ND	168
J3	S.K traders	11.146471	79.2619093	7.6	2680	1794	396	ND	176
J4	Govt primary health center	11.1419913	79.2645962	7.5	2333	1793	396	ND	174
	V.Kaikatti								
K1	HP petrol bank	11.1137977	79.1752837	8.8	1936	1277	348	54.7	309
K2	Ultra tech cement	11.1079022	79.1749437	8.7	1869	1235	343	38.9	322
K3	SBI (near)	11.1148182	79.1683049	9.0	1740	1242	333	33.9	302
K4	Bharat Gas	11.1109259	79.1659224	9.0	2139	1559	338	35.6	274
	Poiyur								
L1	Chinnammal rice mill	11.0667541	79.1118679	9.2	3156	2207	350	34.4	255
L2	Maha mariyamman kovil	11.0643432	79.107452	8.8	3210	2374	345	43.3	234
L3	mariyamman temple	11.0729621	79.0104721	9.2	3284	2276	410	27.8	198
L4	Karuppasamy temple	11.0515432	79.098394	8.9	3004	2218	423	31.4	188

pH

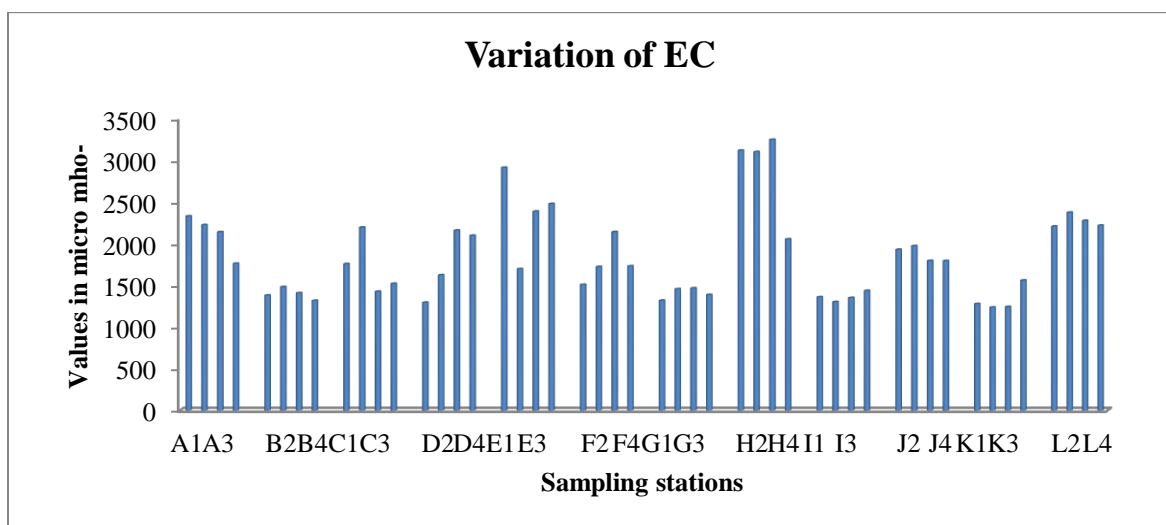
pH value is an important factor in maintaining the carbonate and bicarbonate levels in water. The slight alkalinity may be due to the presence of bicarbonate ions [7]. Which are produced by the free combination of CO₂ with water to form carbonic acid, which affects the pH

of the water. The pH values of the analysed samples ranges from 7.4 to 9.2. The ranges are classified in the spatial variation map shown in figure in (2).



EC

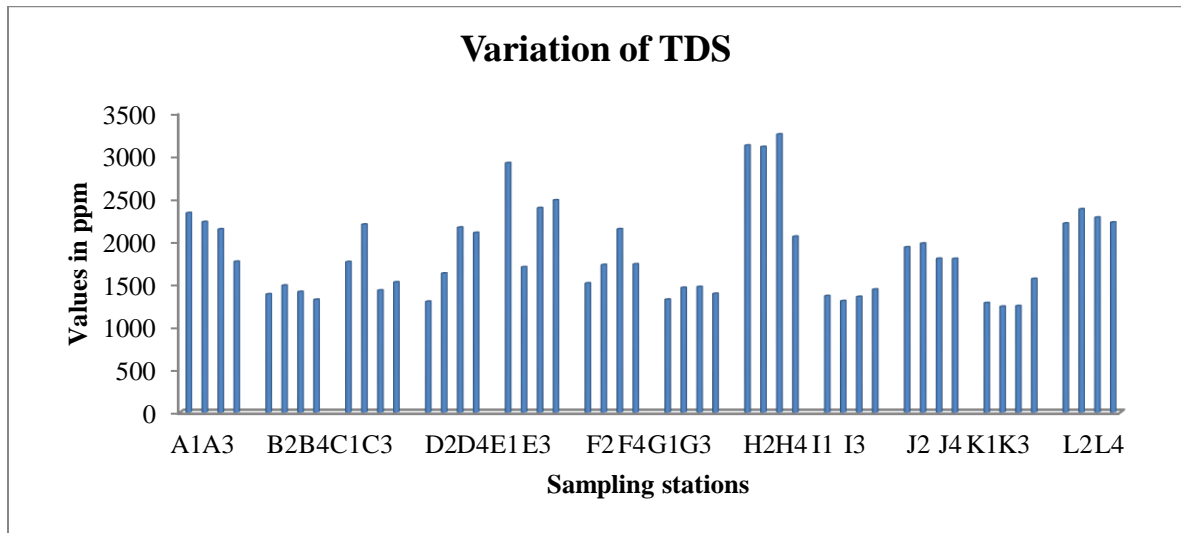
The specific conductivity of water or a solution in its capacity to conduct electric current and depends on the nature and concentration of ionized salts. EC is the most important parameter to demarcate salinity hazard and suitability of water for irrigation purpose. It signifies the amount of total dissolved solids [8]. The EC values of the analyzed samples ranges from 1740-4920. The ranges are classified in the spatial variation map shown in figure in (3).



TDS

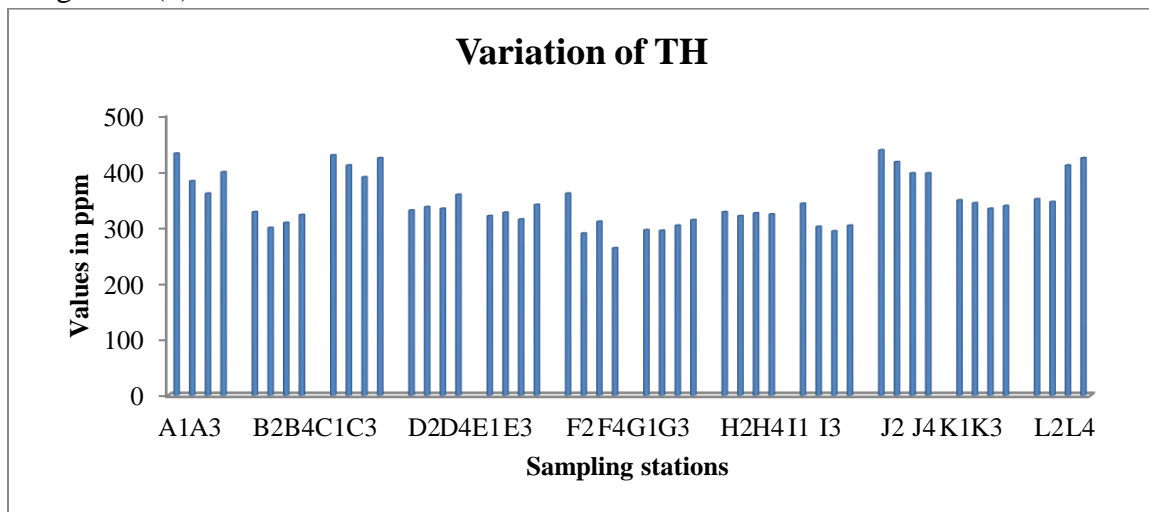
Total dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, phosphates and nitrates of Calcium, Magnesium, Sodium, Potassium, Manganese,

organic matter salt and other particles. TDS is mainly attributed to anthropogenic activities and geo chemical processes prevailing in the region [9]. The TDS values of the analysed samples ranges from 1235 to 3249. The ranges are classified in the spatial variation map shown in figure in (4).



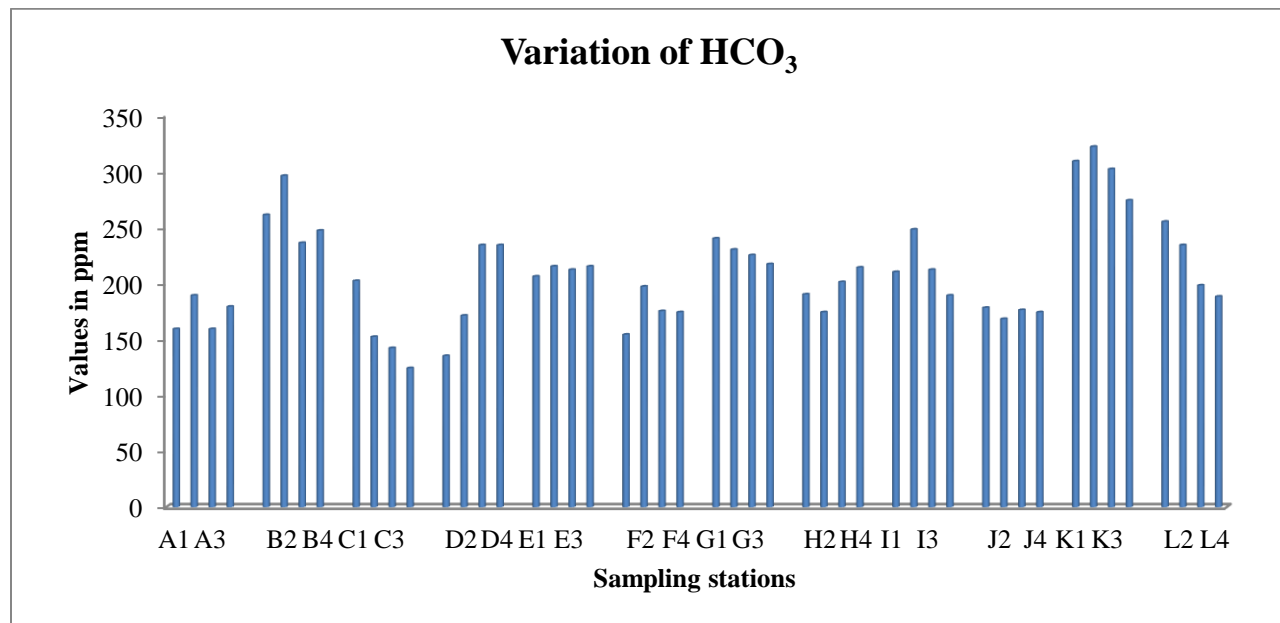
TH

Total hardness of water is the sum of the concentrations of alkaline earth metals cations. Hardness in water is caused primarily by the presence of Carbonates and Bicarbonates of calcium and magnesium, sulphates, chlorides and nitrates [10]. The pH values of the analyzed samples ranges from 263 to 437 ppm. The ranges are classified in the spatial variation map shown in figure in (5).



Carbonate and Bicarbonate

Carbonates and bicarbonates are the main causes of alkalinity in nature of water. Bicarbonates represent the major form since they are formed in considerable amount from the action of carbonates upon the basic materials in the soil. Ground water containing high concentration of carbonate and bicarbonate ions tends to precipitate calcium and magnesium as carbonate. Quality of bicarbonate and carbonate in excess of alkaline earth also influence the suitability of water for irrigation purpose. The carbonate values are detectable for the some of the ground water samples. Since the observed pH values is 7.8 – 8.0 ppm. The bicarbonate values observed in the range of 135-322 ppm for ground water samples. The ranges are classified in the spatial variation map shown in figure in (6 and 7).



Mean spatial distribution of pH and EC in ground water samples collected during the year May 2015 – August 2017

Figure - 2

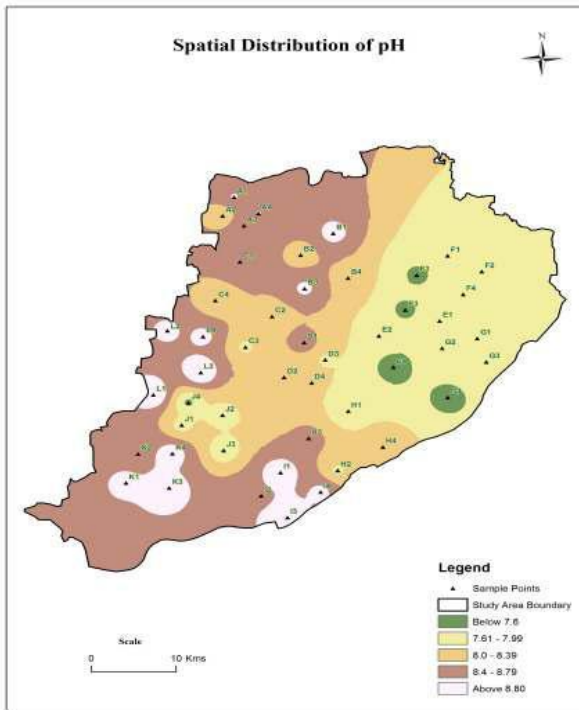
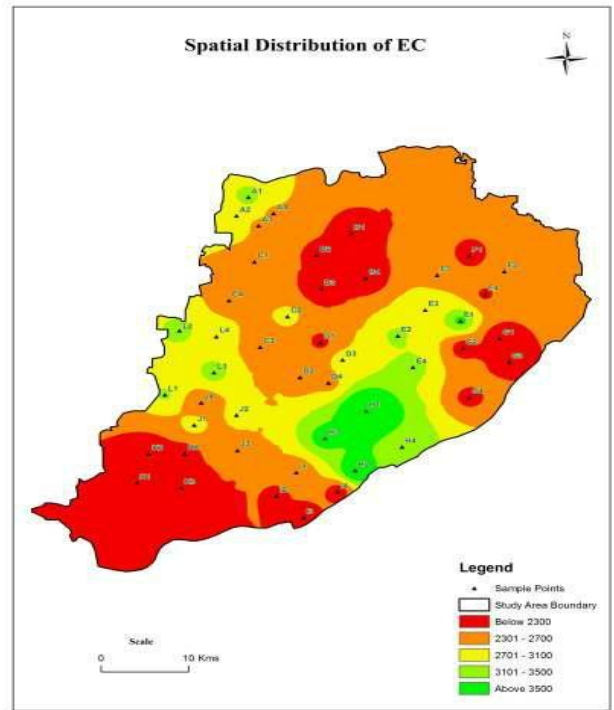


Figure - 3



Mean spatial distribution of Total Dissolved Solids and Total Hardness in ground water samples collected during the year May 2015 – August 2017

Figure - 4

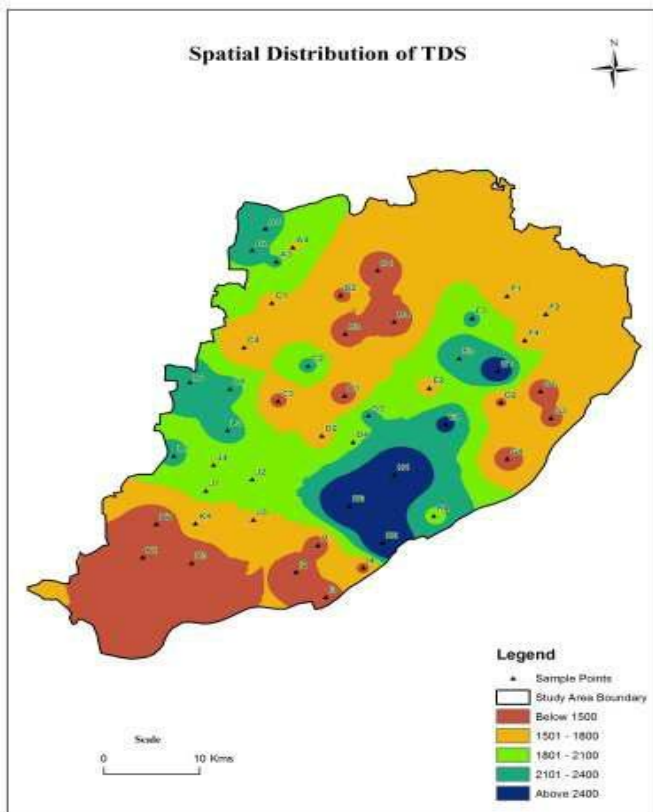
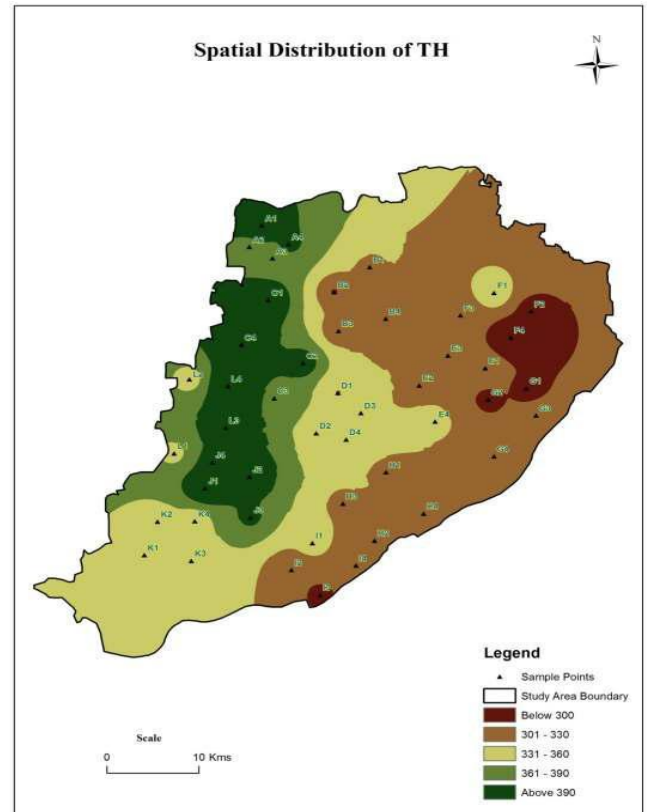


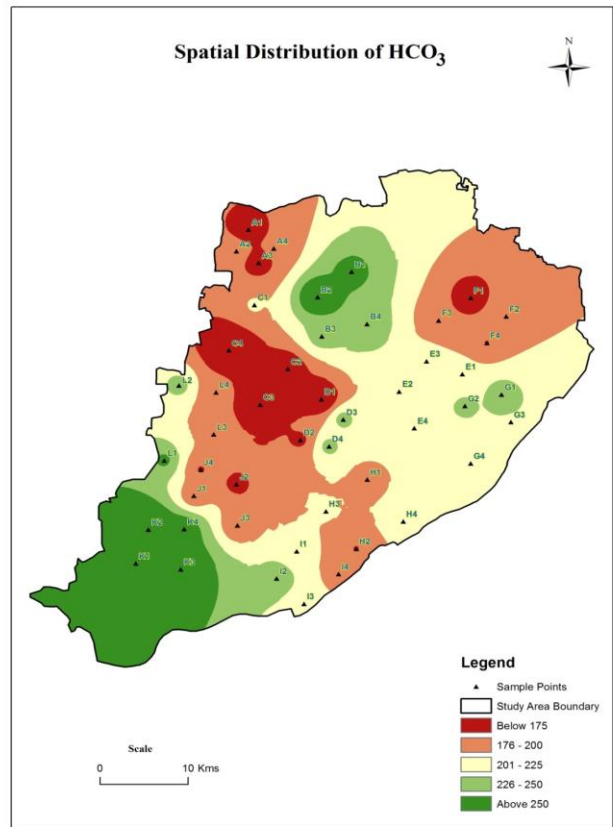
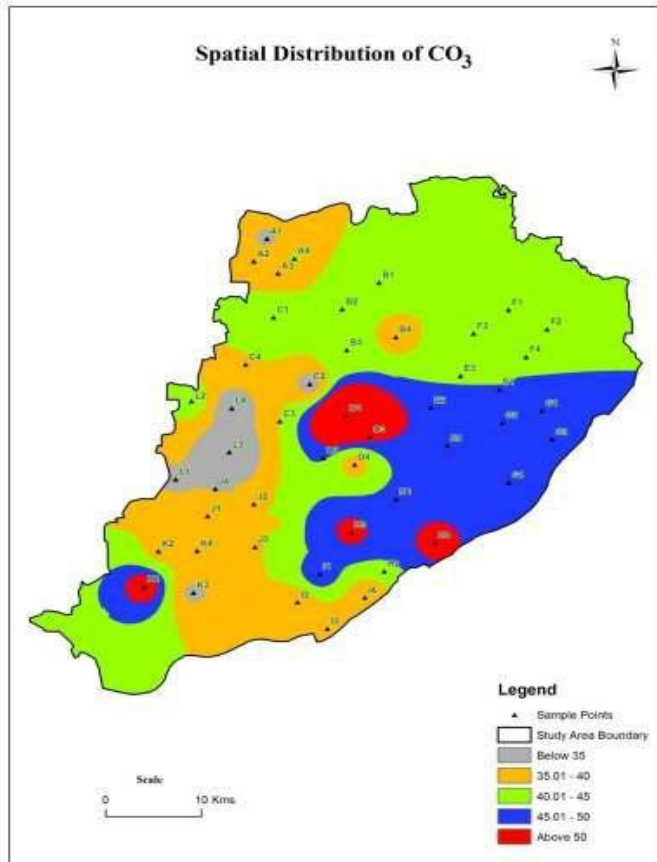
Figure- 5



Mean spatial distribution of Carbonate and Bicarbonate in ground water samples collected during the year May 2015 – August 2017

Figure- 6

Figure- 7



CONCLUSIONS

The ground water samples are collected from 48 different stations at Ariyalur district in and around the areas. The samples were subjected to physico chemical analysis. The groundwater quality in Ariyalur district has been increased due to pollution. GIS technologies can provide appropriate platform for convergent analysis of large volume of multi-disciplinary data and decision making for ground water studies can be effectively done. The GIS bare zoning of groundwater quality map may be used as a guideline for predicting the groundwater quality to new areas. The present study provides a guideline for solving water quality problem in Ariyalur district.

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