MAPPING THE GROUND WATER QUALITY OF SIVAKASI TALUK BY USING ARCGIS

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Abstract—

The spatial variation of shallow ground water levels and quality data pertaining to sivakasi taluk have been studied using geographic information system (GIS) technique. GIS, a tool which is used for storing, analyzing and displaying spatial data is also used for investigating ground water quality information. For this study the analyzed water samples parameters like pH, chloride, fluoride, ammonia, total hardness and magnesium, about 20 observations groundwater sources collected from the various villages of sivakasi taluk . after the test results the values are compared with the WHO standards. The ground water quality information maps of the entire study area have been prepared using GIS spatial interpolation technique for all the above mentioned parameters. The spatial distribution maps of pH, chloride, fluoride, ammonia, total hardness and magnesium in the study area have been mapped for the year 2017. It is also observed that there is significant change in water quality from pre-monsoon to post monsoon period. The results obtained in this study and the spatial database established in GIS will be helpful for monitoring and managing ground water pollution in the study area. Mapping was coded for potable zones, in the absence of better alternate source and non-potable zones in the study area, in terms of water quality.

Keyword--ArcGIS10.2,Kanchipuramdistrict,GIS,Land use,Land cover,Remote sensing

I. INTRODUCTION

ACROSS THE WORLD, THE CONCERN FOR WATER RESOURCES IS GROWING AS A RESULT OF POPULATION GROWTH AND CLIMATE CHANGE. MOST ALARMING SIGN IS THAT IN SOME AREAS OF THE WORLD, GROUNDWATER RESOURCES AND QUALITY ARE BEING DEPLETED AT AN UNSUSTAINABLE RATE. THIS HAS PROMPTED A RE-EXAMINATION OF THE WORLD'S WATER RESOURCES. IN MANY COUNTRIES, TO MEET THE INCREASED DEMAND FOR WATER GROUNDWATER RESOURCES MUST BE TAPPED. HOWEVER, TO ENSURE SUSTAINABILITY, MUCH GREATER EMPHASIS MUST BE PUT ON TO THE GROUNDWATER MANAGEMENT THAN THE EXPLORATION OF NEW GROUNDWATER RESOURCES, SINCE MOST PRODUCTIVE AQUIFERS HAVE ALREADY BEEN IDENTIFIED.

Groundwater is one of earth's most vital renewable and widely distributed resources as well as an important source of water supply throughout the world. The quality of water is a vital concern for mankind since it is directly linked with human welfare. In India, most of the population is dependent on groundwater as the only source of drinking water supply. Groundwater is particularly important in arid and semi-arid regions that lack perennial sources of surface water due to low rainfall and high Evapotranspiration.

Groundwater is an important source of irrigation which caters to more than 45% of the total irrigation in the country. People's lives and livelihoods depend on water. Demand for clean water increases continuously with world population growth. Many areas of the world lack the fresh, drinkable water essential to survival of mankind. It has now become evident in many countries of the world that groundwater is one of the most valuable natural resources, which supports human health, economic development and ecological diversity.

II OBJECTIVES OF THE STUDY:

Analyse the various ground water quality parameters using GIS.To interpreting various ground water quality parameter with WHO develop an integrated groundwater quality map of sivakasi taluk using GIS.

III LITERATURE REVIEW

K.K.Tangi (2006) have studied and stated that due to decrease availability of the fresh water, there is need to consider the expanded use and reuse of marginal quality water for irrigation. He has been addresses broad issues related to the potential reuse of Treated municipal wastewater, food processing, saline water, inclining irrigation drainage water on cropland. However, their use requires more intensive management and monitoring than use of higher quality water. Finally in the result he as suggested that strongly recommends long-term monitoring and evaluation in the use of marginal quality wastewater.

T.Elampooranan et.al, (2006) have discussed about the irrigational suitability of groundwater. The author has describing that chemical characteristic of groundwater an attempt was made to determine their suitability for irrigation purpose. Groundwater always contain at least small amounts of chemical substances and these substance depend on the sources for the recharge of the groundwater and chemical found excess in the groundwater is unsuitable for irrigation. Samples collected chemical analysis for suitability of groundwater for irrigation is assessed on the basis of the following quality parameter Electrical conductivity, Residual sodium carbonate (RSC), Sodium Adsorption Ratio (SAR), Soluble Sodium Percent (SSP). In the final result,Suitability of groundwater for irrigation has been evaluated on the presumption that the water will be used under average condition with respect to characteristics, efficiency of sub-surface drainage, amount of water used and method of applying it, type of crops and climate characters of the area. When the concentration of dissolved salt (TDS), sodium, carbonate and bicarbonate these will affect plants growth and soil character

Anbalagan and Nair (2011) have used GIS techniques to map the groundwater quality in Panvel Basin of Maharashtra State to identify the regions having suitable/ unsuitable water for drinking and irrigation purposes within the basin. The geo-chemical analysis of groundwater indicates the level of quality for drinking and irrigation purposes. The chemical parameter such as chloride, hardness, TDS and salinity were represented using GIS techniques.

A.A.Ganga et.al, (2013) discussed about the minerals in soil and forages irrigated with secondary treated sewage water. This Study is based on production of forages using treated sewage water is a viable practice internationally. They determined Heavy metals were Fe, Mn, Cu, Zn, Ni, Pb, and Cd and from the treated sewage water contain of metal like Zn, Ni, and Mn concentration were below the detectable level. In the sewage water while soil and plants had low level of metal. The use of sewage water for irrigation is positive way to dispose of sewage, cleaning the environment, direct economic benefits and from domestic source supply of nitrogen and much of the phosphorus and potassium that are required for crop production. However, the sewage water, soils and forage mineral concentration were within the internationally allowable metal with respect to irrigation. Finally in the result he as suggested that mineral concentration were require for irrigation water compared to desirable level.

Gimra et.al, (2014) discussed about extent and significant use of low water quality for agriculture. He has been determining that surface and ground water are mainly polluted due to the concentration of heavy metal from domestic and municipal waste. Increasing of concentration of heavy metal pollution, then Nitrate concentration in surface is higher than accepted normal concentration of 10mg/1. Nitrate are found naturally in soil it's important to plants growth and field application of commercial fertilizer and manure increases soil nitrate level for crop production. Then excess nitrate in soil can increase the risk of contaminations of ground water. Spreading manure or commercial fertilizer rates matching plant needs (based on soil tests and manure analysis) will reduce the risk of contaminating the groundwater. Irrigating with polluted water increased accumulation of heavy metal in the soil. In the result, Use of wastewater for irrigation should be studied thoroughly and due to the low quality impact of wastewater utilization on human health and livestock crop should be studied.

Rajeev Kumar et al., (2016) have discussed about the groundwater quality. They pointed that hydro geochemical analysis were carried out on ground water by taken sample from different location and that samples have high concentration of sodium, chloride, total dissolved salt. However high concentration of Na, CI, TDS, NO_3 and PO_4 indicates contribution from domestic and municipal sewages. In the result they have described that localized pollution groundwater causes during monsoon due to water logging and poor drainage.

The groundwater quality in Yermouk Basin, North Jordon has been investigated by Rakad et al., (2016). Water quality was investigated by calculating the TDS, Electrical Conductivity and pH value. The results showed the water quality was in permissible limits. Hence the groundwater is found to be suitable for agriculture, domestic and industrial purposes.

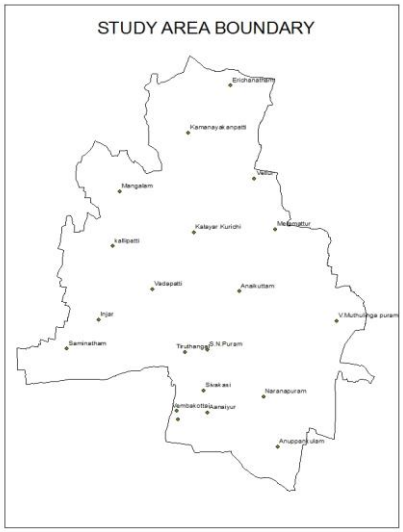
Emmanuel et al., (2016) have studied the geo-chemical characteristics and salinity level of Rio de Janeirno, coastal aquifer in South East Brazil for 30 samples. They used Pipers diagram, to study the geo-chemical type. Result revealed that 53 per cent of the water belongs to Na-Ca-HCO_3 type, 20 per cent consists of Na-Ca-C1-SO_4 type and 27 per cent of the samples belong to Na-MgCa-HCO_3-C1-SO_4 geo chemical type. Statistical methods such as Factor Analysis and Principal Component Analysis were used to study the relation between the chemical variables.

A study on the hydro geochemical assessment of groundwater quality in parts of Niger Delta, Nigeria was studied by Amadi et al., (2016). They studied the major chemical constituents TDS and Total Hardness of groundwater in the delta. The results revealed that the drinking water was below the WHO standards. The geo-chemical types were analyzed and five major types were identified. The geo-chemical types found in the study region are Na-Ca-Mg-HCO_3type, Fe-Ca-HCO_3, Na-Ca-Mg-SO_4 type, Fe-C1-HCO_3 type and Mg-Cl type.

Imran A Dar et al., (2016) carried out studies Nitrate contamination in groundwater of Sopore town and its environs, Kashmir, India. The study indicates that the concentration of nitrate is higher than permissible limit (50 mg/1) in most of groundwater collected from bore wells. The chief sources of nitrate pollution in the study area are agricultural activities, septic tanks, and human and animal wastes.

IV DESCRIPTION OF STUDY AREA

The geographical extent of sivakasi taluk is 6.8 km^2 accounting 1.49 percent of geographical area of tamilnadu state. The taluk has well laid out roads connecting all major towns . For administrative purpose, the taluk has been bifurcated into 40 villages consisting . This taluk falls within the co ordinates of latitude and longitude 9.45°N & 77.8167°E .the town is located in virudhunagar district of south indian state, tamilnadu at the distance of 74 k.m Madurai. sivakasi is located to the east of western ghats and to the west of sattur In general, the sivakasi has no notable mineral resources available in an around the town.the soil types are black and red that are conducive for cotton,chilles and millets. These crops are predominant because of poor ground water supply and soil type. sivaksi experience hot and dry weather through the year the temperature ranges from minimum 23°C to maximum 39°C.like the rest of the state, April to june are the hottest month and December to January are the coldest month. The average humidity of the town is 76.2% and varies between 65.6% to 79.2%.



III DATA AND METHODOLOGY

3.1 GENERAL -

To evaluate ground water levels and quality in shallow aquifer of sivakasi taluk, total 20 observation ground waters have been considered. The continuous ground water level and groundwater quality data for the year 2017 are available. Therefore the spatial

distribution maps of ground water level and water quality parameters (pH, chloride, fluoride, ammonia,

PARAMETER	STANDARD VALUE
PH-VALUE	5.8-8.6
HARDNESS	500mg/l
CHLORIDE	200mg/l
FLUORIDE	0.8mg/l
AMMONIA	0.2mg/l
MAGNESIUM	30mg/l

WATER QUALITY STANDARDS OF DRINKING WATER BY WHO

RESULTS AND DISCUSSION

4.1 INTRODUTION

The ground water levels and quality evaluation has been carried out for sivakasi. The ground water levels and quality data of 20 observation ground water have been used in the present analysis. The topographical and groundwater table (MSL) contour maps have been prepared for the study area. the major recharge to groundwater in the study area.

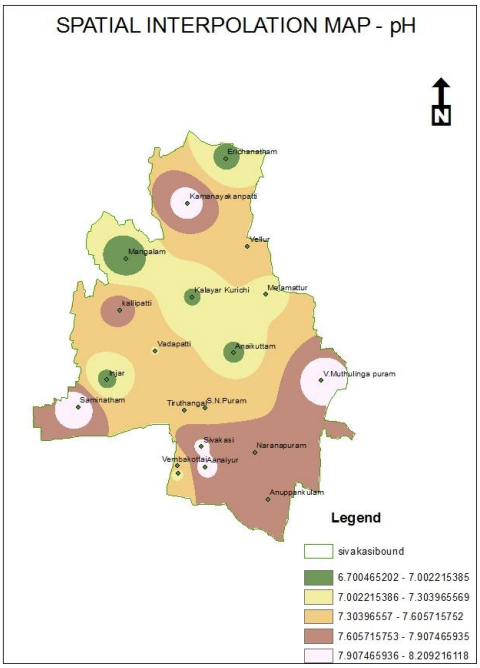
4.2 GROUNDWATER QUALITY

The groundwater quality data of shallow observation wells (20 nos) for a year of 2017 have been taken for the present analysis. The data include parameters (pH,chloride,fluoride,ammonia,totalhardness,magnesium).
The spatial distribution maps of parameters in the study area have been prepared only for the year 2017 due to non availability of chemical analysis data for all the wells.

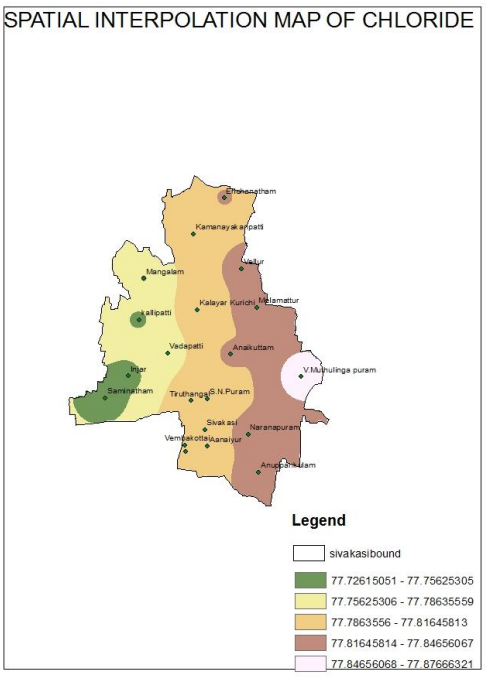
PARAMETER VALUES:

S.N	LOCATIONS	pH	Chloride mg/l	Fluoride mg/l	Ammonia mg/l	Totalhardness mg/l	magnesium mg/l
1	aanayur	8.1	119	0.4	0.1	100	15
2	m.L puram	8.15	132	0.7	0.1	50	22
3	anupankulam	7.74	112	0.2	0.2	75	21
4	erichanatham	6.92	142	0.3	0.1	120	17
5	injar	6.88	120	0.5	0.1	100	19
6	kalayarkurichi	6.95	79	0.5	0.1	150	23
7	Kalli patti	7.8	146	0.2	0.1	75	20
8	melamattur	7.2	134	0.6	0.2	150	18
9	mangalam	6.7	178	0.2	0.1	400	26
10	naranapuram	7.68	152	0.2	0.1	125	14

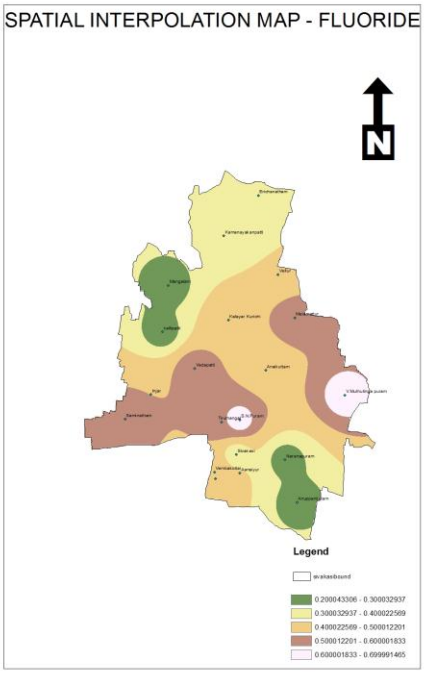
pH REPRESENTATION MAP



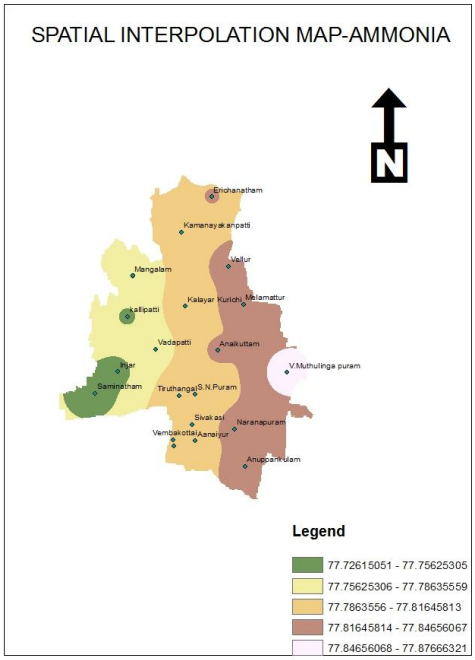
CHLORIDE REPRESENTATION MAP



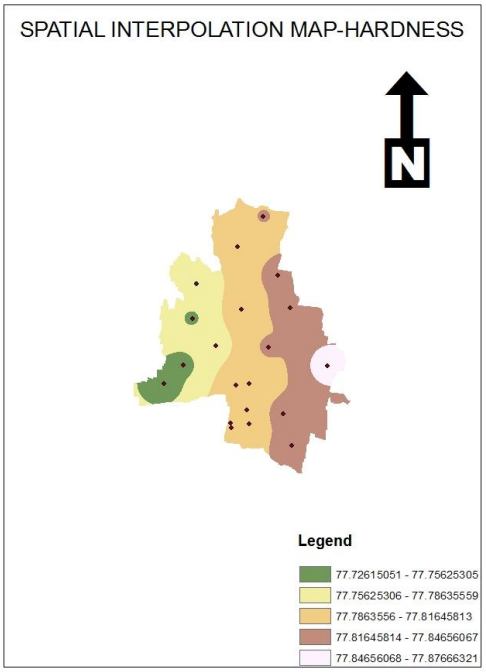
FLOURIDE REPRESENTATION MAP



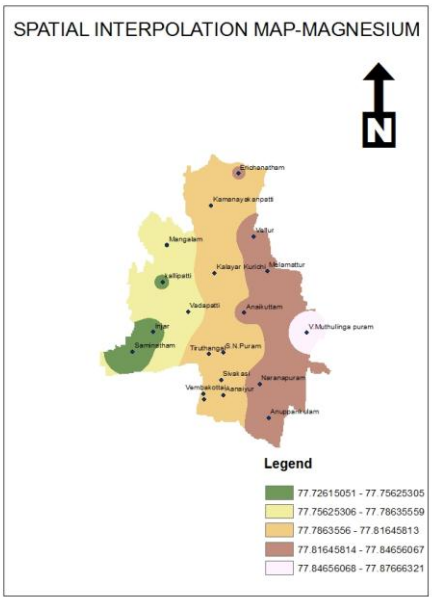
AMMONIA REPRESENTATION MAP



TOTAL HARDNES REPRESENTATION MAP



MAGNESIUM REPRESENTATION MAP



9 SUMMARY ON RESULTS

Summary on Drinking Water Quality in sivakasi taluk

S.NO	CONTENT	RANGE FROM IS 10500	RANGE IN sivakasi		REMARKS
			MIN	MAX	
1	Ammonia	0.1 to 0.4	0.1	0.2	Within permissible limit, so least chance of encrustation of water supply structure and adverse effects on domestic use.
2	Chloride	250 to 1000	79	178	Chances of Potential aesthetic problems associated with the taste of the water and facilitate the corrosion of piping and fixtures.
3	Fluoride	1 to 1.5	0.2	0.7	Fluoride may kept low as possible otherwise it will cause fluorosis. Elevated levels of fluoride may cause bone disease. Low levels of fluoride may help to prevent cavities in teeth.
4	Magnesium	30 to 100	12	26	Magnesium may kept low as possible otherwise it will cause dangerous. Magnesium may cause neurological disorder, greying of eye and infections in skin.
5	pH	6.5 to 8.5	6.7	8.2	It will not Exceeds Permissible
6	Total Hardness	300 to 600	50	400	It will not exceed the permissible limit

V CONCLUSION

It can be seen from the maps many regions have groundwater that is potable without treatment in sivakasi taluk. However in central parts of the sivakasi taluk the water is potable only after the treatment. In this potable zone the parameters that are studied are below permissible limits for majority of the sample wells. The pH concentration of the level for most of the sample is in below the indian standards. Cl concentration for most of the samples is above 150 mg/L and the minimum value and the maximum values observed are 79 and 178 mg/L respectively. The maximum desirable level for chloride is 200 mg/L according to Indian standards. The TH is observed to be well above 150 mg/L for majority of the sample wells in this zone. The maximum and minimum levels observed are 400 and 50 mg/L respectively. The maximum desirable level for this parameter is 300 mg/L in Indian standards.

The spatial distribution analysis of groundwater quality in the study area indicated that many of the data collected are satisfying the drinking water quality standards prescribed by the IS with almost half of the district having non-potable ground

water.by analyzing the overall result the groundwater quality is in very poor condition in mangalam and its nearby regions. Ultimately, we came to know that the overall groundwater quality of the sivakasi taluk is sustain over a year (2017).

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