DETERMINATION OF WATER QUALITY INDEX OF THIRUKALUKUNDRAM AREA, KANCHEEPURAM DISTRICT, TAMILNADU

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ABSTRACT

Water is an essential resource of life. The rapid increase in population and pollution causes threat to the pure water. The quality of water is important for healthy life and environment. The present study is to calculate the water quality by using Water Quality Index (WQI) a useful tool to easily determine the water criteria. This helps to assess the water usage for drinking, domestic, irrigation, industry etc. The WQI gives the index as number which helps in water quality management. A number of physio-chemical parameters have been analyzed with standard values using mathematical equation. This is more accessible and creates awareness to common people. In the present study an attempt is made to evaluate the water quality of Thirukalukundram area of Kancheepuram district, Tamilnadu through WQI for public usage. The result has been plotted in GIS platform.

**Keywords:** Water quality Index (WQI), Groundwater quality

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INTRODUCTION

The water is one of the essential needs of every life. Though two-third of world is covered with water the accessibility of fresh water is few percent only. Now a day the pure water is being depleted by pollution and rapid growth of population. One of the purest sources is the ground water which is largely affected by various factors. The quality of this water is to be assessed for determining the usage of water to lead a healthy environment. Water quality determination is a tedious and complex process. The water quality index provides a single number which tells the overall quality of water. It includes most of the important parameters and is a simple indicator to quality of water. The various parameters are incorporated to mathematical equation which indicates the health of water in number.

STUDY AREA

The present study area includes Thirukalukundram block, one of the coastal blocks of Kancheepuram district of Tamilnadu. It lies between the latitudes $12^o29'$ and $12^o38'$ North and longitudes $79^o58'$ and $80^o11'$ East (fig. 1). River Palar, a major river course, flow southern side of the study area. The daytime heat of this area is oppressive and the temperature is as high as $43°C$. The average rainfall in this area is about 1105-1214Mm.The annual range of temperature is $20 – 37°C$.
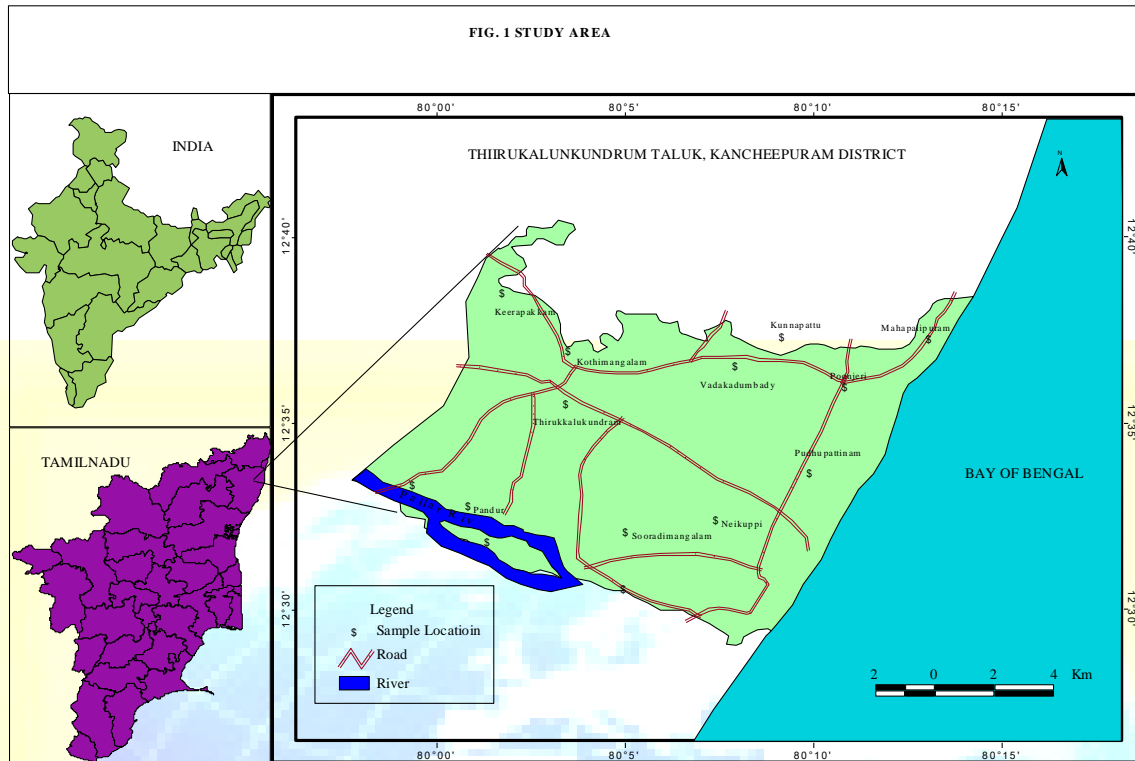
FIG. 1 STUDY AREA

MATERIALS AND METHOD

The water samples were collected from the study area and its locality in a cleaned half – litre bottle for determining the various salts present in it. About 14 samples were collected during July 2012 from the entire study area. The analyses were done by adopting standard procedures (APHA, 1998) in the laboratory. The various physio-chemical parameters such as pH, EC, TDS and certain salts like calcium, sodium, magnesium, potassium, chlorine, bicarbonate, sulphate were analyzed.

From the analytical result an attempt was made to identify the water quality index for the study area. The WQI has been calculated by using the standards of drinking water quality recommended by the World Health Organization (WHO) Bureau of the Indian Standards (BIS) and Indian Council for Medical Research (ICMR). The quality rating Index q_n was calculated using the following expression.

$$q_n = 100[v_n - v_{i0}] / [sn - v_{i0}]$$

q_n = Quality rating for the nth water quality parameter

V_n = Estimated value for the nth parameter at a given sampling station

S_n = Standard permissible value of the nth parameter

V_{i0} = Ideal value of nth parameter in pure water (i.e, 0 for all other parameters except the parameter pH – 7.0)

Unit weight was calculated by a value inversely proportional to the recommended standard value S_n of the corresponding parameter.

$$W_n = K/S_n$$

W_n = unit weight for the nth parameters

S_n = Standard value for n^{th} parameter

K =constant for proportionality.

The overall water quality Index was calculated by aggregating the quality with the unit weight linearly

$$WQI = \Sigma q_n\, W_n\, /\, \Sigma W_n$$

Table.1 Water Quality Index (WQI) and status of water quality (Chatterji and Raziuddin, 2002)

| Water Quality Index Level	Water Quality Status
0-25	Excellent water quality
26-50	Good water quality
51-75	Poor water quality
76-100	Very Poor water quality
>100	Unsuitable for drinking

Eight parameters have been considered for the WQI calculation. The unit weights were calculated from the above expression for each parameter. The drinking water standards, recommending agencies and unit weights are listed in the table.2 (All the values except pH and EC are in mg/l).

Sl. No	Parameters	Standards	Recommended Agency	Unit Weight
1	pH	6.5-8.5	ICMR/BIS	0.623636
2	Electrical Conductance(EC)	300	ICMR	0.01767
3	Total dissolved solids (TDS)	500	ICMR/BIS	0.010602
4	Total Hardness (TH)	300	ICMR/BIS	0.01767
5	Calcium (Ca)	75	ICMR/BIS	0.070679

6	Magnesium (Mg)	30	ICMR/BIS	0.176697
7	Sodium (Na)	200	ICMR/BIS	0.026505
8	Chlorides (Cl)	250	ICMR	0.021204

RESULT AND DISCUSSION

Chloride is one of the most important parameters in assessing the water quality. Higher concentration of chloride shows the higher degree of organic pollution and sea water intrusion. In the study area the chloride concentration ranges from 24.822 mg/l to 379.422 mg/l. The thematic map has been prepared based WHO standards using GIS (Fig. 2). From the map it is identified that along the coast the chloride ion exceeds the maximum permissible limits and the quality of water is poor.

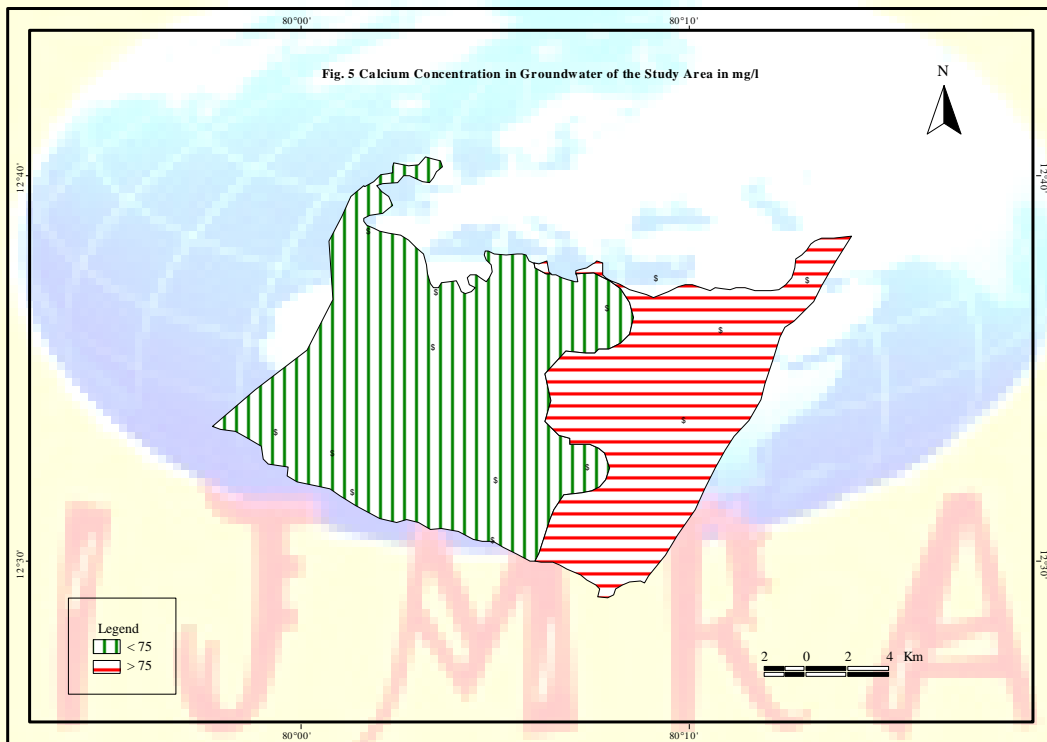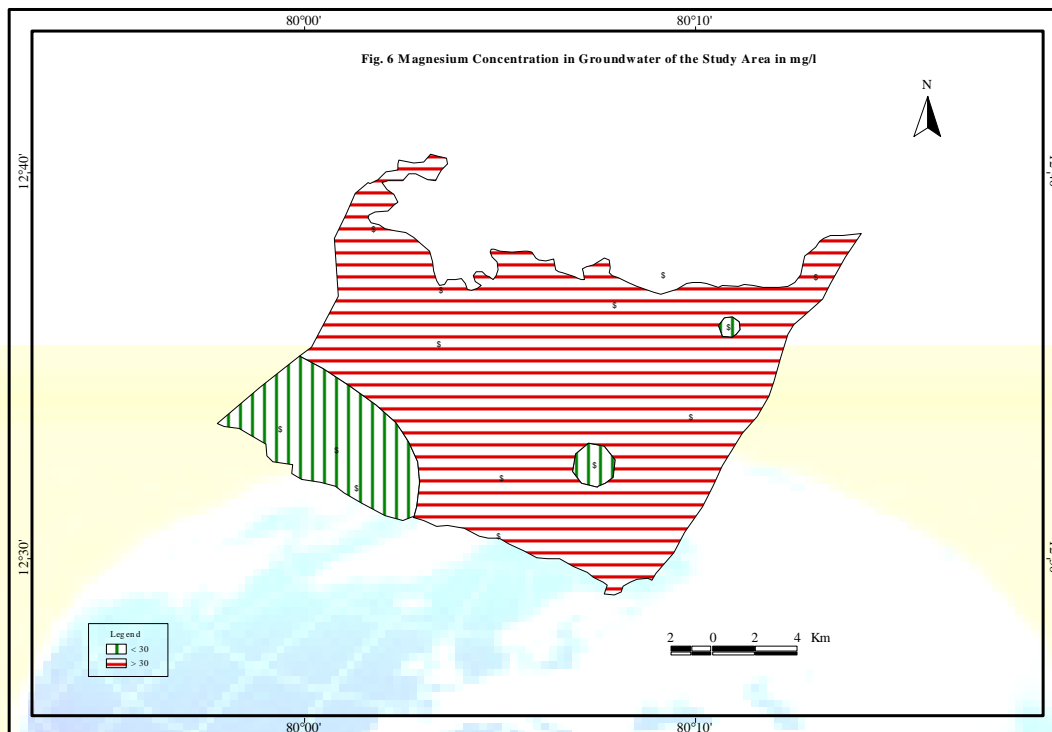Fig. 2 Chloride Concentration in Groundwater of the Study Area in mg/l
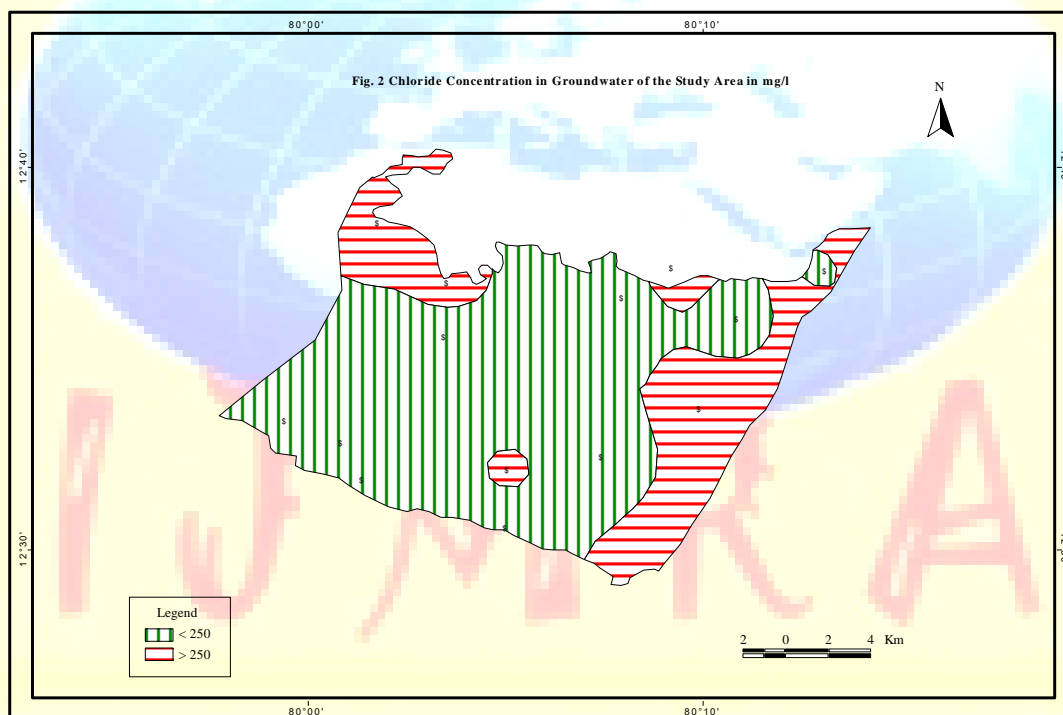
Besides chloride, total dissolved solids and total hardness plays the dominant role in the water quality assessment. In this study area the TDS value varies from 332.80 mg/l to 1280 mg/l. Most of the locations the TDS value exceed the permissible limits. Few locations have fresh and potable water (Fig. 3).

Fig. 3 TDS Concentration in Groundwater of the Study Area in mg/l

Legend
< 500
> 500

Fig. 4 Total Hardness in Groundwater of the Study Area in mg/l

Legend
< 300
> 300
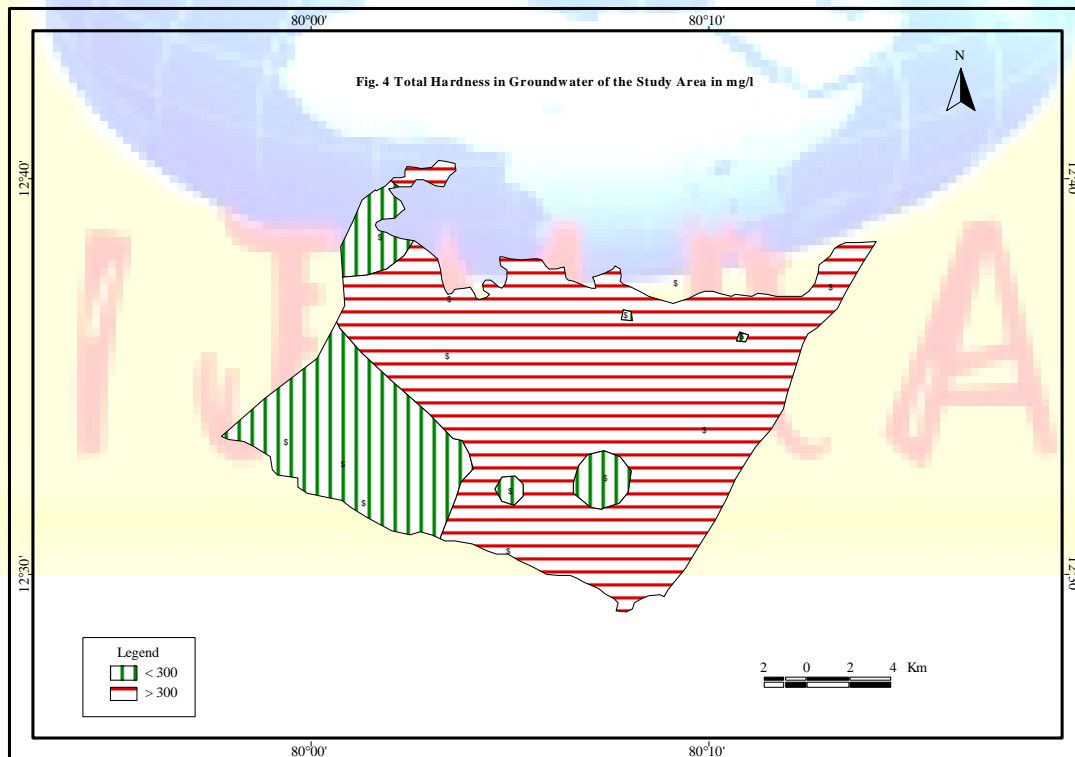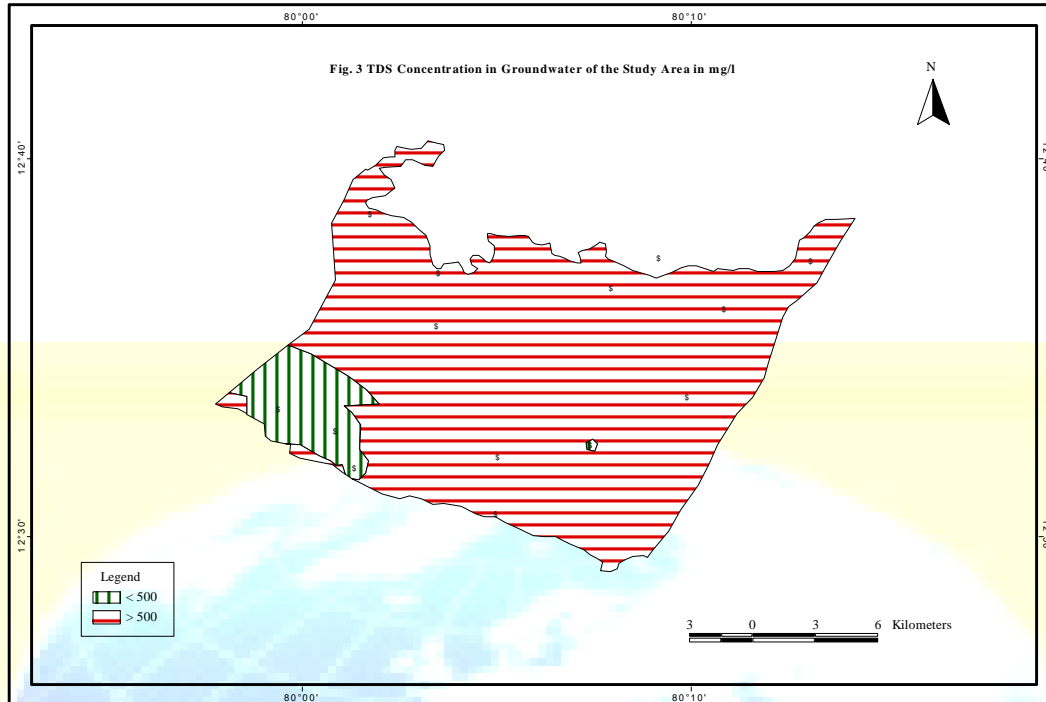
The total hardness in the groundwater ranges between 119.95 mg/l to 374.60 mg/l. Along the coast the total hardness value exceed the permissible limits. Few locations have total hardness value within the limits (Fig. 4). The water has to be treated before using for drinking.

The concentration of calcium ion varies from 24.05 mg/l to 176.35 mg/l. The Magnesium ion concentration ranges from 4.05 mg/l to 97.28 mg/l. The thematic map shows the concentration of calcium and magnesium exceed the limits along the coast and the ion concentration is within the limits in few locations away from the coast (Fig 5 & 6). Which indicate the quality of water along the coast is poor. The pH and sodium ion has within the limit in all the locations.

Fig. 5 Calcium Concentration in Groundwater of the Study Area in mg/l

Fig. 6 Magnesium Concentration in Groundwater of the Study Area in mg/l

Water quality index for the collected samples is established from various physicochemical parameters. The values of various physicochemical parameters for calculation of Water quality index are presented in the table.

L. No	Location Name	WQI	L. No	Location Name	WQI
1	Keerapakkam	75.744	8	Pudhupattinam	72.194
2	Mahabalipuram	61.581	9	Neikuppi	45.379
3	Kunnapattu	98.595	10	Sooradimangalam	82.308
4	Kothimangalam	114.961	11	Near Palar River 1	21.087
5	Vadakadumbady	70.461	12	Pandur	8.515
6	Poonjeri	47.252	13	Near Palar River 2	23.451
7	Thirukalukundram	42.184	14	Near Palar River 3	59.345

From the result it is informed that most of the areas have poor and very poor groundwater quality. And few locations fall in good and excellent category. In two locations the groundwater is found unsuitable for drinking.

Fig. 7 Water Quality Index of Groundwater for the Study Area

Legend
- Excellent
- Good
- Poor
- Very Poor
- Unsuitable
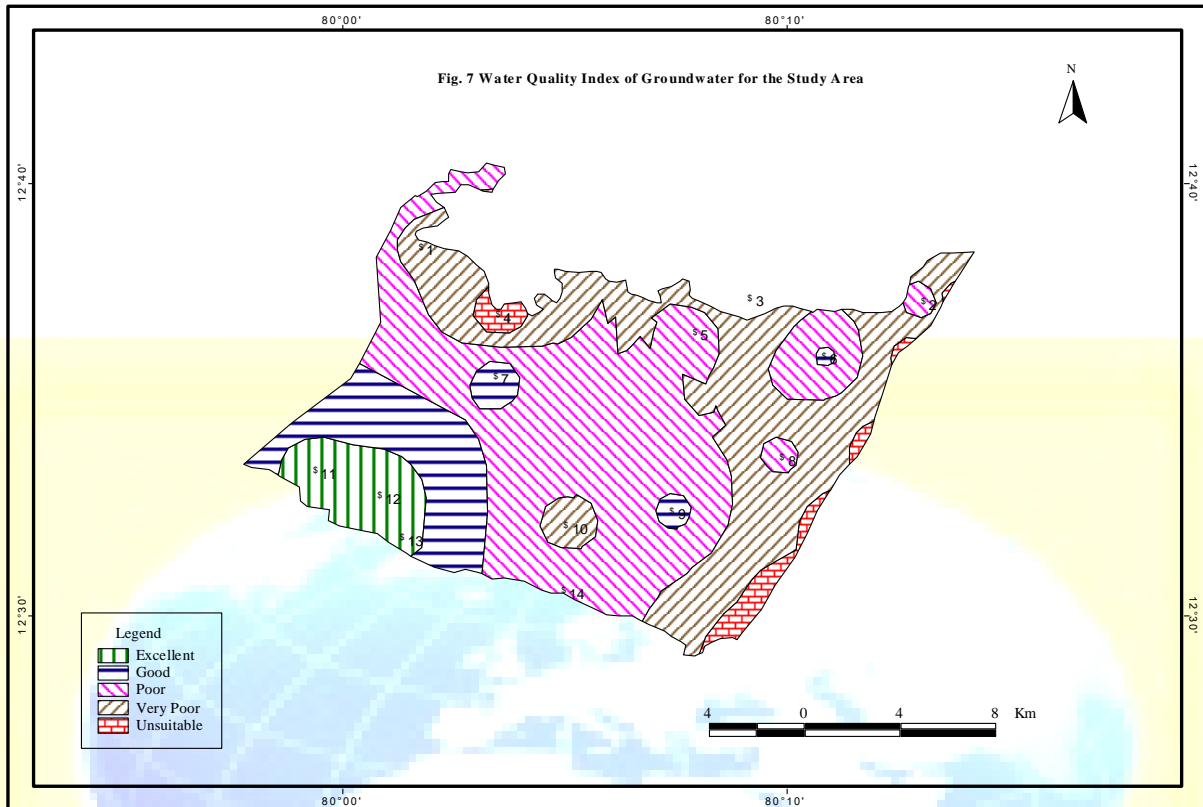
This water quality rating study clearly shows that the status of the water body is more suitable for aquatic, recreation and livestock and less for drinking and irrigation purposes.

This study clearly indicates that the groundwater quality is poor in the selected area. The high concentration of chloride, TDS and TH indicates the saline intrusion. Hence the groundwater has to be used to its optimum level to protect the available resources. The available ponds and lakes have to be maintained properly. The poor, very poor and unsuitable groundwater can be used after proper treatment. Rainwater harvesting can be practiced to improve the groundwater quality of the study area.

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