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Integrated Groundwater Quality Assessment Using Gis In Thirukalukundram Area, Kancheepuram District, Tamilnadu

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Abstract: Water, essential for life is obtained in the pure form mostly from ground water. The increase in population leads to drastic increase in water exploitation. Due to this ground water table is disturbed leading to sea water intrusion. The quality of ground water is important with respect to its quantity. In the present study an attempt is made to evaluate the water quality of Thirukalukundram area of Kancheepuram district, Tamilnadu. The groundwater samples have been collected from the study area and analysed for major cations and anions in the laboratory. Various thematic maps have been prepared and integrated using GIS platform. This study helps in determination of the ground water quality. The results have been brought in digital format with the help of Geographical Information System (GIS).

Keywords: Groundwater, seawater intrusion, GIS, overlay analysis

I. INTRODUCTION

Water is the most essential resources of life. It plays an important role in everyday chores such as drinking, industrial, irrigation, domestic purposes, etc. Though 70% of the world is covered with water, only 0.6901% of total water can directly satisfy human needs. Ground water constitutes the major volume of it. The result of infiltration of rainfall and surface water stored in a geological layer of sub-surface is termed as ground water. Its usage has been increased with population thereby decreasing its quality. The salt concentration in water influences its quality. Large and continuous exploitation of ground water results in sea water intrusion near coastal areas. In this study an attempt is made to classify the water based on its quality parameters.

Water quality assessment have been made using GIS at Chennai by the authors during 2003. The result helped the author to identify the good quality groundwater zones of the study area. The integrated study through GIS will give a clear idea about the area.

II. 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°29' and 12°38' North and longitudes 79°58' and 80°11' 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.

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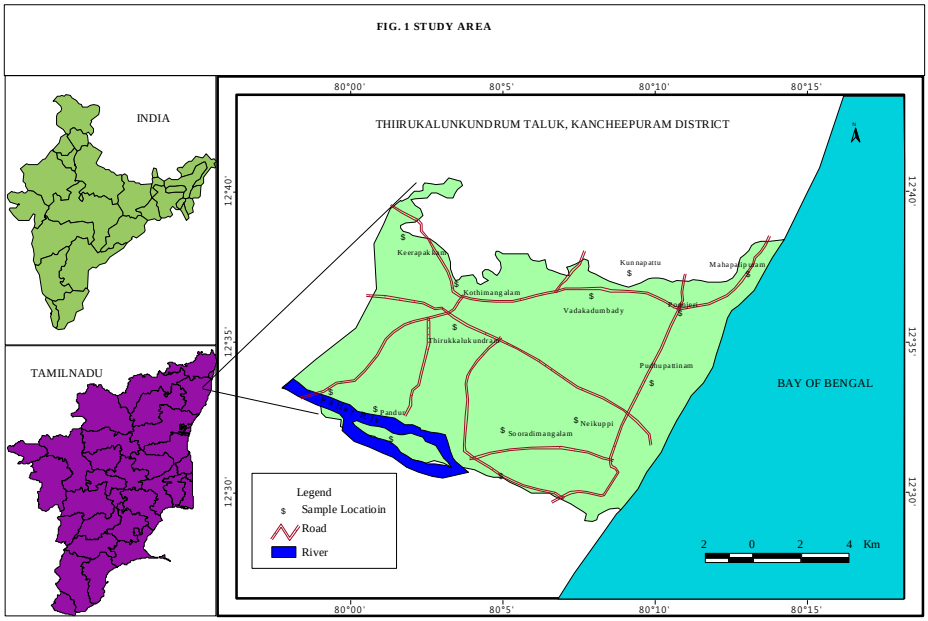

III. METHODOLOGY

The base map has been prepared from the toposheet in 1:50,000 scale and is converted in digital format using GIS. The water samples have been collected from 14 locations from the existing open and bore well of shallow depth. Analysis of water has been carried out in the chemical laboratory based on APHA methods. Based on the analysed result various thematic maps have been prepared. For each parameter, weight is given for integration. The various maps have been overlaid in GIS to get final map, which shows the groundwater quality of the entire study area.

IV. DATA ANALYSIS AND INTERPRETATION

Five thematic maps have been considered for the integration and they are listed below in the priority order.

1. Total Dissolved Solids (TDS)
2. Total Hardness (TH)
3. Corrosivity Ratio (CR)
4. Chloride vs. Bicarbonate and Carbonate Ratio [$Cl/(HCO_3+CO_3)$]
5. Stuyfzand's Classification

In this study area the TDS value varies between 332.80 mg/l to 1280 mg/l. The groundwater having TDS value less than 1000 mg/l is consider to be freshwater or potable (WHO, 1996). As per TDS value most of the locations exceed the permissible limits and they are not potable. Few locations have fresh and potable water (Fig. 2).

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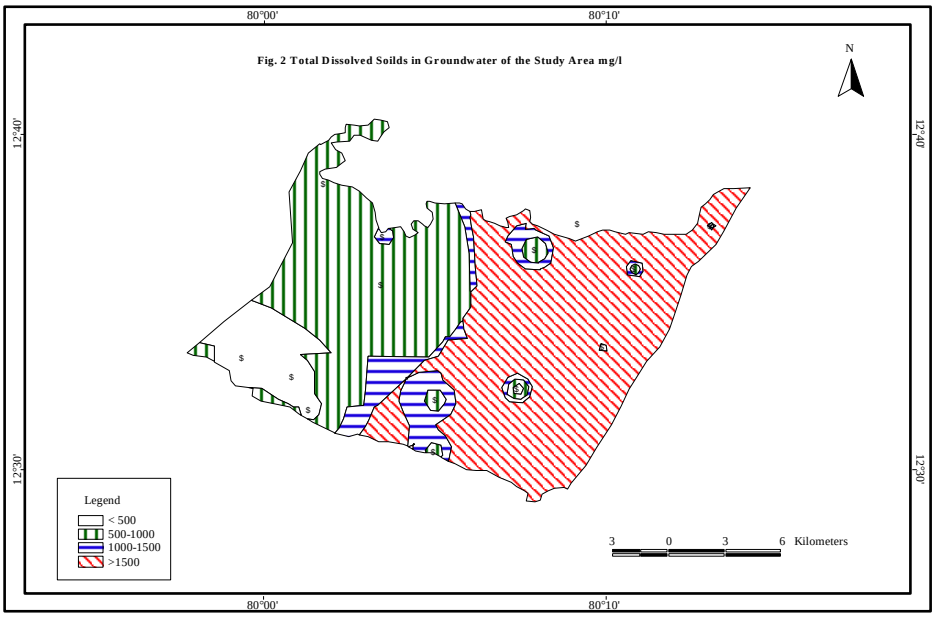
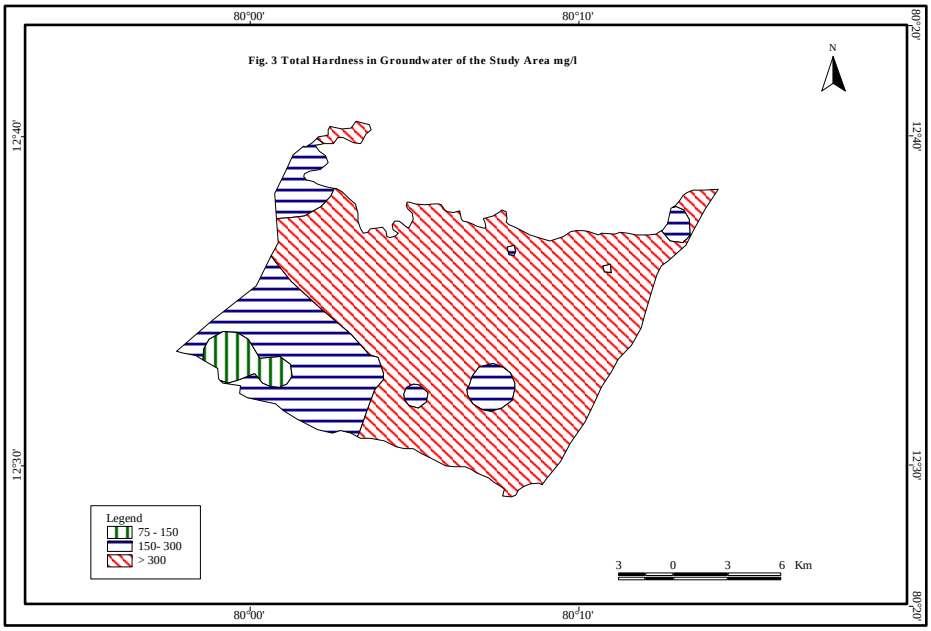


Groundwater with total hardness less than 75 mg/l are considered as soft water, those with total hardness value between 75 – 150 mg/l are considered as moderately hard water, between 150 – 300 mg/l as hard water and above 300 mg/l as very hard water. Most of the study area lies between hard to very hard category (fig. 3).



The corrosivity ratio (CR) of groundwater in this area is found to be more than one, indicating the water is of corrosive nature. Non corrosive water is also present in few locations. Highly corrosive water cannot be transported through metal pipes. It can be transported only through PVC pipes (fig. 4).

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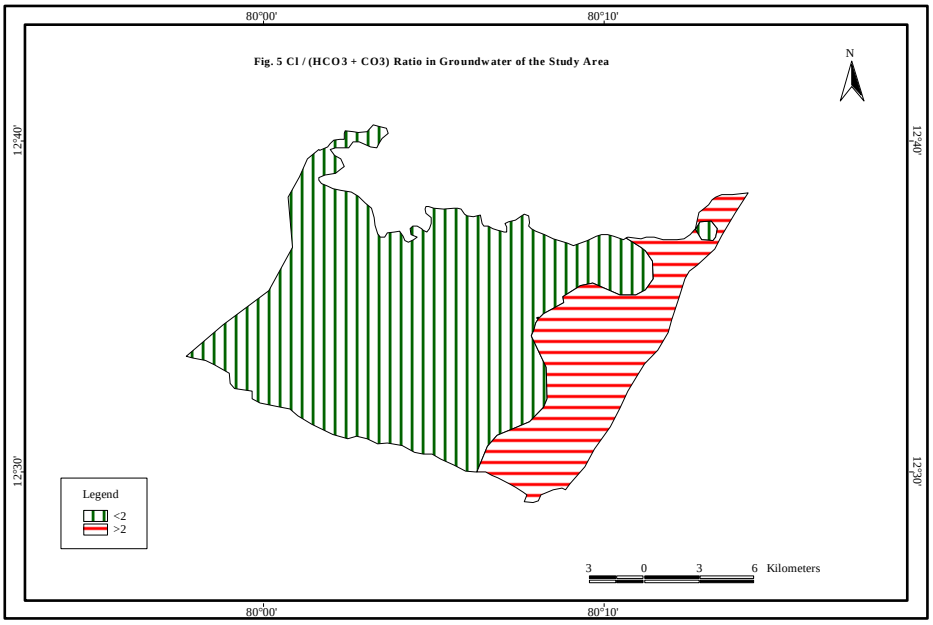
The chloride vs. bicarbonate and carbonate ratio is above two, it indicates that the water is saline in nature which may be due to seawater intrusion. In the study area few locations have Cl/ (HCO_3+CO_3) ratio greater than 2, indicating seawater intrusion in this area. Seawater intrusion is caused by decrease in groundwater due to over exploitation along the coastal area. In the study area only two locations have the Cl/(HCO3+CO3) more than two. These two locations fall near the coastal area indicating saline water intrusion along those areas (fig. 5).



The groundwater is classified as very oligohaline, fresh, fresh-brackish, brackish, brackish-salt, salt and hyperhaline based on the presence of chlorine (Stuyfzand, 1989). In the study area the groundwater falls under oligohaline, fresh,

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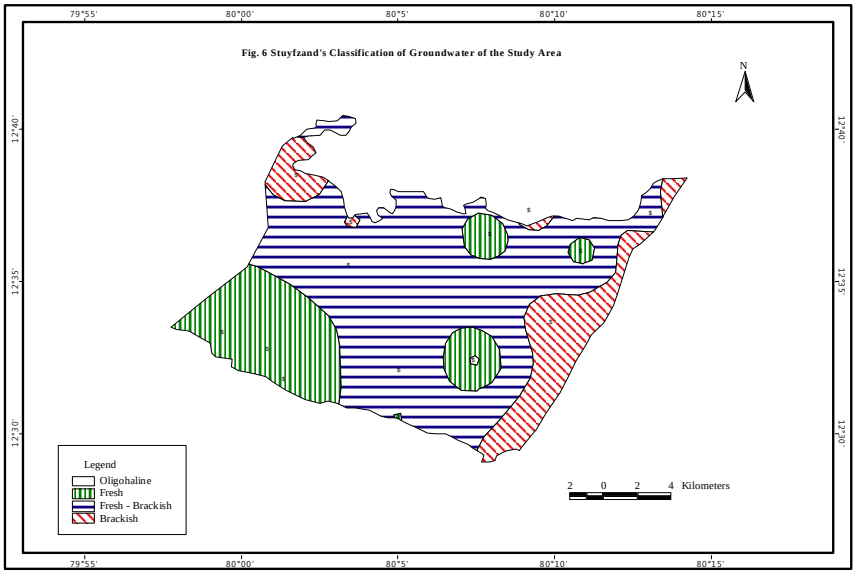
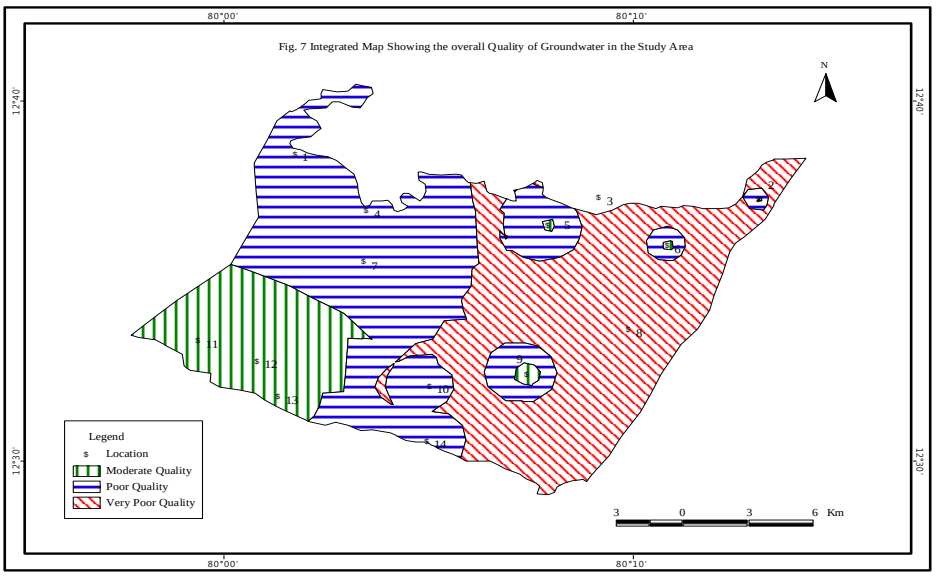
fresh-brackish and brackish category. Most of the water is of fresh brackish and brackish type. Few locations falls under fresh and oligohaline type (fig. 6).



V. GIS ANALYSIS

The thematic maps have been integrated using GIS, to identify the overall groundwater quality. For each thematic map the weightage and rank have been given based on the standards. All the weighted maps have been integrated using overlay analysis using GIS. The area has been classified into four different zones as good, moderate, poor and very poor based on the weightage. The final integrated maps show the areas of good quality and poor quality groundwater. This will help the groundwater authority people to make decision. Most of the study area falls under poor to very poor category and only few places fall under good quality of groundwater (fig. 7).



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VI. CONCLUSION

The integrated GIS study indicates that the groundwater of the study area has moderate, poor and very poor quality. The coastal area has very poor quality of water. This may be due to sea water intrusion. The chloride vs carbonate bicarbonate ratio and Stuyfzand classification also indicates the saline intrusion along the coastal area. The inland area contains potable groundwater. The available surface water resources can be utilized to its maximum level. To maintain the quality of water recharging of water through rainwater harvesting can be encouraged in the study area.

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