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### LONGTERM COMPARATIVE STUDY OF GROUNDWATER QUALITY IN TSUNAMI AFFECTED COASTAL AREAS OF SIRKALI REGION OF NAGAPATTINAM DISTRICT, TAMILNADU, INDIA

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#### ABSTRACT

Sirkali region is under Nagapattinam district of Tamilnadu, India. The water quality in this region is affected significantly by Tsunami, 2004. Historical data on groundwater quality of observation wells of the study area before Tsunami were collected (1966 – 2012) and groundwater samples after Tsunami were also collected and analyzed for water quality parameters. Spatial analysis of water quality parameters before and after Tsunami was carried out. Various maps were prepared using ILWIS. Results show that there is significant degradation in the water quality due to Tsunami in the study area. Vertical electrical soundings [VES] were conducted in the study area. Based on hydro geological conditions, the approximate depth to freshwater/saltwater interface of Sirkali taluk is 4.489 m.

**Keywords:** *Tsunami, Ground Water Quality, ILWIS, Vertical Electrical Sounding (VES)*

#### INTRODUCTION

The study area is the coastal region of Sirkali Taluk, Nagapattinam District, Tamilnadu, India, where the Cauvery deposits its rich silt after meandering several hundreds of kilometers. Sirkali region is surrounded by Bay of Bengal on the east, Kollidam River on the west and north Cauvery River on the south.

It lies in between latitudes of N11° 6' 00" and N11° 27' 00" and longitudes in between E79° 36' 00" and E79° 54' 00". It is located in the east coastal region of Bay of Bengal. **Figure 1** shows the location details of the study area. A greater part of region consists of deltaic plains of the Cauvery River with very rich fertile soil. Agriculture is the main stay of rural population. The chief sources of irrigation are canals and tube wells. The water quality in this coastal region is affected significantly by the tsunami of 26 December 2004.

### OBJECTIVES OF THE STUDY

The prime objectives of the study are,

- Assessment and monitoring of Groundwater Quality in Tsunami affected coastal tract of Sirkazhi region of Nagapattinam District.
- Delineation of sea water/ fresh water interface by geophysical methods and studying the chemical constituents in the groundwater.

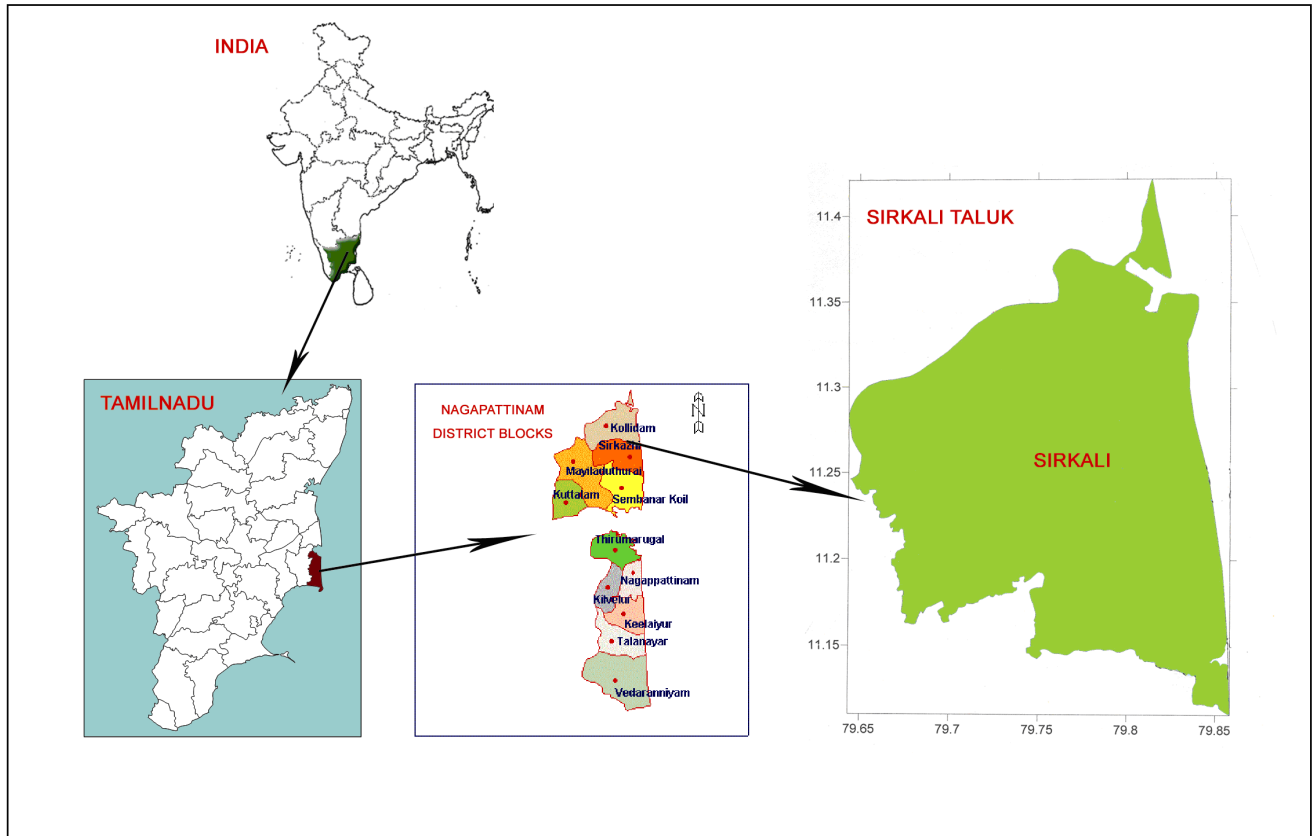


Figure 1 Location and salient features of the study area

## MATERIALS AND METHODS

Figure 2 shows the methodology flowchart.

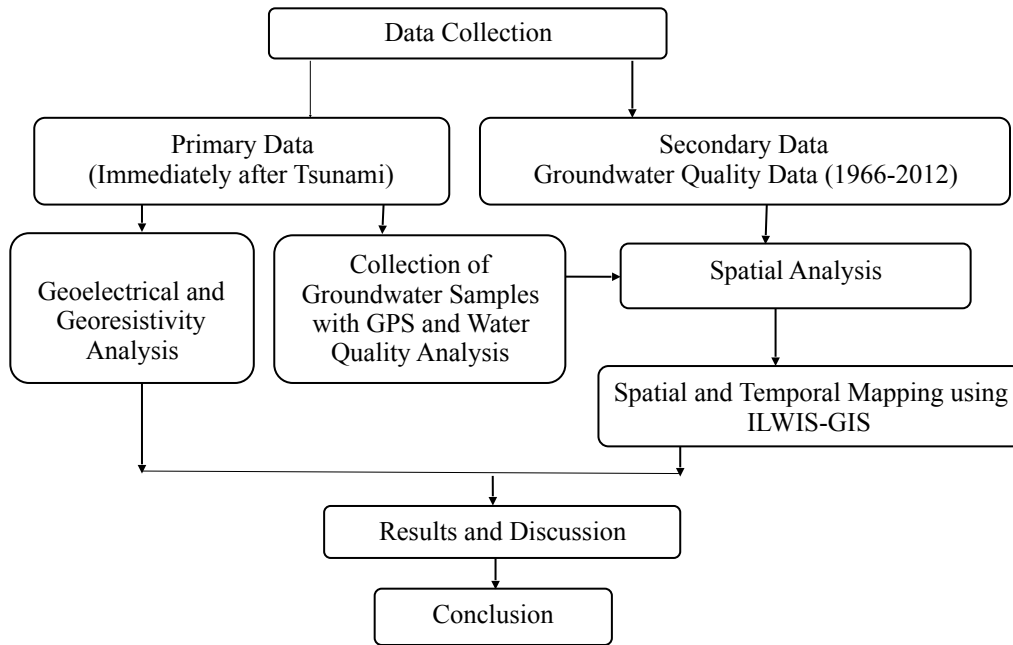


Figure 2 Methodology flow chart.

The methodology of this study depends upon both primary and secondary data. The primary data consists of geochemical, geoelectrical and resistivity data. Collection of groundwater samples during the study period of 2005 to 2012 in Sirkali and Kollidam panchayat unions. The secondary data consists of long - term historical data during the period from 1966 to 2012 on water quality for four observation wells were collected from Groundwater Division, PWD, Tamilnadu. Groundwater quality analysis was carried out in three ways. They are 1. Hydrogeochemistry, 2. Spatial mapping using ILWIS and 3. Correlation analysis.

## RESULTS AND DISCUSSIONS

Spatial analysis of various water quality parameters before and after Tsunami was carried out and various maps were prepared using ILWIS – GIS package as shown in **Figure 3** to **Figure 6**. It is observed that the major pollution is due to Cl, EC, pH and Na. Results show that there is significant degradation in the water quality due to Tsunami in the study area. Also a systematic geoelectrical investigation was carried out of the study. Vertical electrical soundings [VES] were conducted in the Tsunami affected villages at the water sampling locations using Microprocessor based signal stacking digital resistivity meter. The depth of investigation is  $AB/2 - 25$  meters. Based on hydro geological conditions, TDS parameters and VES data interpretations, the approximate depth to freshwater/saltwater interface and the subsurface lithology were delineated. This study reveals that the approximate and average depth to freshwater/saltwater interface of Sirkali taluk is 4.489 m.





## CONCLUSIONS

The following conclusions were made as,

- The primary data ( immediately after Tsunami, 2004) of groundwater samples were collected from the wells shows that the EC ranges from 0.571mhos to 11.16 mhos and the hardness lies between 264 and 2000 mg/L
- Based on the long term (1996 – 2012) comparative study of hydrogeochemical analysis of primary and secondary data of groundwater samples, the following findings are obtained
- The groundwater quality parameters like pH, EC, Chlorides (Cl), Sodium (Na), Hardness, Dissolved Oxygen (DO), percentage salinity and Turbidity present in water samples collected from coastal areas from Sirkali taluk exceeds the limits prescribed by WHO and BIS. The Electrical conductivity (EC) of the groundwater samples immediately after Tsunami from different locations exceeded limits prescribed by WHO
- The maximum EC value obtained from Pazhayar sample is 11.86 mmhos/cm
- Based on the spatial mapping using kriging operation of interpolation of groundwater quality modeling using ILWIS – GIS package, the following values are obtained.  
pH value before and after Tsunami are 8.3 and 6.98 respectively  
EC value before and after Tsunami are 1948 mhos/cm and 4714 mhos/cm  
Na value before and after Tsunami are 527 mg/L and 1631 mg/L  
Cl value before and after Tsunami are 291 mg/L and 611 mg/L
- The quality of water samples collected from different groundwater sources of the study area are affected by Tsunami which is revealed by the test results.
- Contamination of drinking water sources by Tsunami occurred from Saline water incursion which is proved by Georesistivity survey. In general most of the water samples indicated higher concentration of water quality parameters.
- Based on hydro geological conditions, TDS parameters and VES data interpretations, the approximate depth to fresh water-salt water interface and the subsurface lithology were delineated. This study reveals that the average depth to fresh water salt water interface of Sirkali taluk is 4.489 m.

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