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RESEARCH ARTICLE

DYNAMICS OF GROUNDWATER QUALITY IN THE STUDY AREA OF KALYANDURG, BRAHMASAMUDRAM AND SETTURU MANDALS OF ANANTAPUR DISTRICT, AP, INDIA: GIS APPROACH

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ABSTRACT

The present paper examines the quality of Groundwater in the Study Area of Kalyandurg, Brahasamudram and Setturu Mandals of Anantapur district of A.P, India. The water quality analysis helps to know the suitability of water for different uses domestic, Agricultural and Industrial suitability of water for various purposes may be studied through important parameters like TDS (Total Dissolved Solids), pH, Chloride (Cl), Calcium (Ca), Magnesium (Mg), and TH (Total Hardness) and Fluoride contents of the water are the parameters by which water quality is here assessed for 2000 and 2012. For this study groundwater quality samples collected from Groundwater Department for different locations in the study area. The study has found that the pH Value in the study area are found in the range between 7.1 to 8.28 and 8.04 to 8.7 in pre and post Monsoon period of 2000, at the same way for 2012 pH range between 7.1 to 7.38 and 7.55 to 7.97, TDS (Total Dissolved Solids) values range between 367.36 to 651.52 Mg/L, and 395.52 to 666.24 Mg/L for 2000, 673.28 to 1256.32 Mg/L and 520.32 to 1173.12 Mg/L for pre and post monsoon period of 2011, Chloride (Cl) range between 32 to 56 and 70 to 150 Mg/L in 2000, 100 to 350 and 50 to 300 Mg/L in pre and post monsoon period of 2011, Calcium(Ca) range between 32 to 56 Mg/L and 16 to 40 Mg/L in 2000, 24 to 48 Mg/L and 32 to 64 Mg/L in pre and post monsoon period of 2011, Magnesium (Mg) range between 5 to 49 and 19 to 44 Mg/L in 2000, 39 to 126 and 34 to 78 Mg/L in pre and post monsoon period of 2011 and Total Hardness (TH) values range between 100.6 to 321.6 and 138.2 to 260.5 Mg/L in 2000 and 220.5 to 638.5 and 219.9 to 421.0 Mg/L in pre and post monsoon period of 2011.

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INTRODUCTION

Fresh water being one of the basic necessities for sustenance of life, the human race through the ages as striven to locate and develop it, water a vital source of life in its natural state is free from pollution but when man tamper the body it loses its natural conditions. Ground water has become an essential resource over the past few decades due to the increase in its usage for drinking, irrigation and Industrial uses etc. The challenges to facilitate the livelihoods of any region to adopt a judicial and scientific utilization of land and water resources for a sustainable well-being are huge, diversified, quite complex and dynamics. The major problems like over-exploitation, under-utilization and miss-utilization of water resources are presented in one way or other as the significant regional claims and conflicts and ultimately leading to jeopardizing the local environment from micro to macro spatial levels. GIS can be a powerful tool for developing solutions for

water resource problems for assessing water quality, determining water availability, preventing flooding understanding the natural environment and managing water resources on a local or regional Scale. The Kalyandurg area has been selected for this study because a) It falls in the backward region of Rayalaseema, which has been experiencing droughts and famines for several decades, at the same time India's second lowest Rainfall was recorded at Hagiri Valley is located in this region. b) It has diversified landforms.

Study area

The present Study area of Kalyandurg, consisting of Kalyandurg, Brahasamudram and Setturu Mandals of Anantapur District of Andhra Pradesh, India, Lies between 140 17' and 140 40' North Latitude and 760 50' and 770 24' East Longitude. It is located in the middle of the peninsular region and is confined to southwestern part of Andhra Pradesh. It is bounded by Gummagatta, Beluguppa, Atmakur, Kanaganapalli and Kambadur Kundurphi Mandals of the same

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district and western side bounded by Karnataka state. The total geographical area of the study area is 1101.25 Sq Km. Annual temperatures vary between 21°C and 42°C, temperatures will reach up to 45°C in Summer, Annual average rain fall varies between 370 m.m. and 760 m.m. The Hagiri River flowing in Northern side and Penna River flowing in Eastern side of the study area of Kalyandurg, Bhairavanitippa Reservoir constructed across the Hagiri River in Brahasamudram Mandal.

place. The geological environment, climate and drainage have profound influence on its quality. Of late contamination from various sources including the agro-chemicals etc is causing lot of harm and damage to groundwater system. Water samples are collected from Groundwater department, Anantapur for the pre and post monsoon period of 2000 and 2011. Six water sample locations shown in the Figure 8. The parameters that are utilized for study of ground water quality in the study area are pH, TDS, Chloride (Cl), Calcium (Ca), Magnesium (Mg) and Total Hardness (TH).

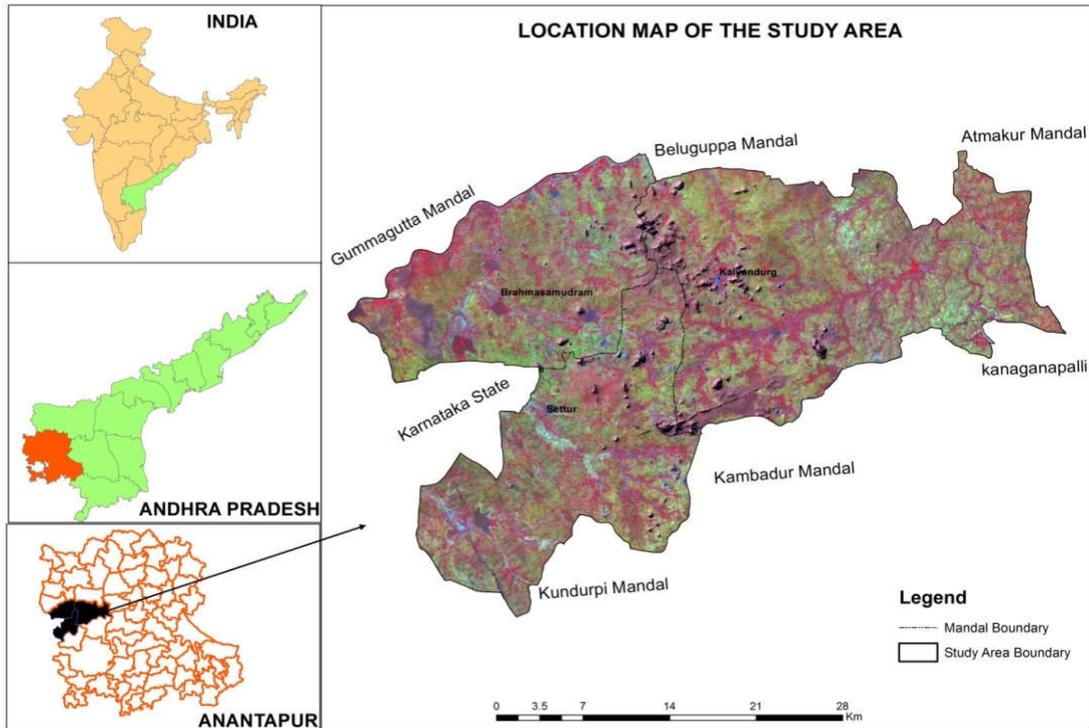


Figure 1. Location Map of the Study Area of FCC Image of Kalyandurg

MATERIALS AND METHODS

Survey of India (SOI) topo sheet No. D43 K14, K15, L2, L3, L6 and L7 of 1: 50,000 scales (latest series of topo sheets procured from Survey of India and Scanned) were used for the preparation of base Layers of Roads, Railways, Settlements and Forest boundaries of the study Area. Ground water samples collected from Groundwater department and analyzed groundwater Quality of the study area and prepared maps and Diagrams. Microsoft Office Excel 2007 and Arc GIS 10.1 Software were used for the preparation of all Diagrams, thematic layers and Maps.

RESULTS AND DISCUSSION

Ground Water Quality

The chemical quality of ground water occurring in the study area changes with time and in order to study the chemical nature of the ground water and their suitability for irrigation and drinking water purposes, the chemical quality of groundwater exhibits considerable variations from place to

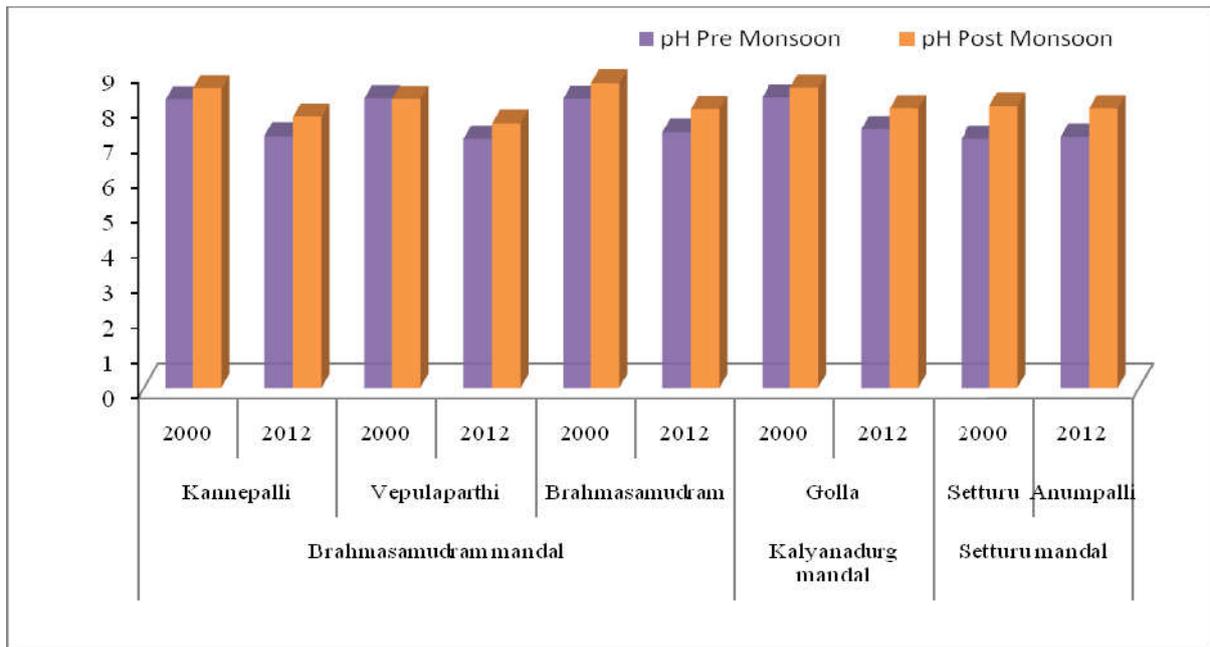
pH

Indicates the intensity of acidic or basic character at a given temperature. Measurement of pH is one of the most important and most frequently used tests in determining water quality. Every phase of water treatment and water supply like acid-base neutralization, water softening, precipitation, coagulation, disinfection, corrosion control etc is pH dependent. pH values in the study area are found in the range between 7.1 to 8.28 and 8.04 to 8.7 in pre and post monsoon period of 2000. The pH values in the study area are shown in Figure 2.

The minimum value of 7.1 and 8.04 was observed at Settur and the maximum value of 8.28 and 8.07 was observed at Golla (Kalyandurg mandal) and Brahasamudram for pre and post monsoon period of 2000. For 2011 year pH range between 7.1 to 7.38 and 7.55 to 7.97 in pre and post monsoon period. The minimum value of 7.1 and 7.55 was observed at Vepulparthi and the maximum value of 7.38 and 7.97 was observed at Golla and Anumpalli (Settur mandal) for pre and post monsoon period of 2011. pH values are observed to be within the desirable range of 6.5 to 8.5. The maximum permissible limit

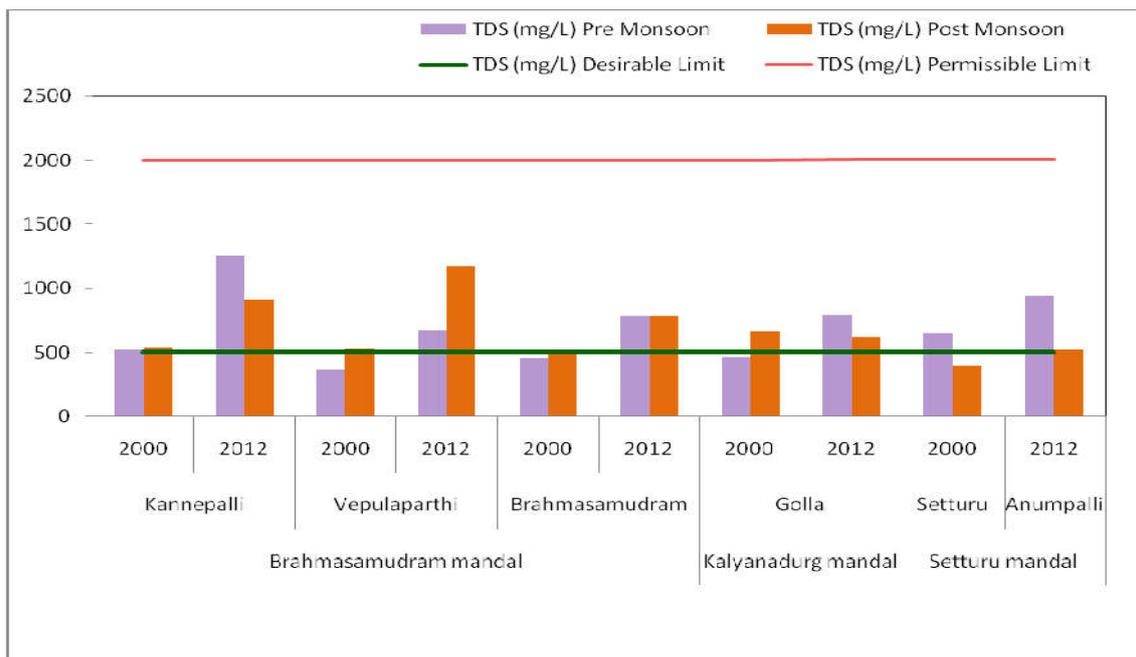
of pH as prescribed by WHO is 7.0 to 8.50. All the locations have pH values within the desirable and suitable range.

between 673.28 to 1256.32 mg/L and 520.32 to 1173.12 mg/L for pre and post monsoon period.



Source: Groundwater Department, Anantapur

Figure 2. pH levels in the study area



Source: Groundwater Department, Anantapur

Figure 3. TDS levels in the study area

Total Dissolved Solids (TDS): TDS in the study area are found in the range between 367.36 to 651.52 mg/L and 395.52 to 666.24 mg/L in pre and post monsoon period of 2000. The TDS values in the study area are shown in Figure 3. The minimum value of 367.36 and 395.52 mg/L was observed at Vepulaprthi and Setturu, the maximum value of 651.52, 666.24 mg/L was observed at Kannepalli (Brahmasamudram mandal) and Golla (Kalyandurg mandal) in pre and post monsoon period of the 2000. At the same time for 2011 year TDS range

The minimum value of 673.28 and 520.32 mg/L was observed at Vepulaparathi and Anumpalli (Settur mandal) and the maximum value of 1256.32 and 1173.12 was observed at Kannepalli and Vepulaparathi I pre and post monsoon period of 2011. TDS values are observed to be within the permissible range of 500-2000 mg/L. Permissible range of TDS in drinking water is different government has different regulations for the TDS level. The U.S. EPA sets the maximum contaminant level for TDS 500 ppm.

Chloride (Cl-)

Cl- in the study area is found in the range between 60 to 110 mg/L and 70 to 150 mg/L. in pre and post monsoon period of 2000. The chloride values in the study area are shown in Figure 4. The minimum values of 60 and 70 mg/L was observed at Brahasamudram and Kannepalli, Setturu and the maximum values of 110 and 150 mg/L was observed at Kannepalli and Setturu in pre and post monsoon period of 2000. For 2011 Cl ranges between 100 to 350 and 50 to 300 mg/L in pre and post monsoon. The minimum values of 100 and 50 mg/L was observed at Vepulaparthi and Anumpalli and the maximum values of 350 and 300 mg/L was observed at Kannepalli in pre and post monsoon period of 2011.

Calcium (Ca)

Calcium (Ca) is the major mineral causing hardness in water. ... Permissible Limit: 200 mg/L. Ca in the study area is found in the range between 32 to 56 mg/L. and 16 to 40 mg/L. in pre and post monsoon period of 2000.

The Ca values in the study area are shown in Figure 5. The minimum values of 32 and 16 mg/L was observed at Golla and Setturu and the maximum values of 56 and 40 mg/L was observed at Kannepalli in pre and post monsoon period of 2000. For 2011 Ca ranges between 24 to 48 and 32 to 64 mg/L. The minimum values of 24 and 32 mg/L was observed at Vepulparthi and Anumpalli and the maximum values of 48 and 64 mg/L was observed at Kannepalli in pre and post monsoon period of 2011. Calcium values are observed are within the permissible limit at the range between 75-200.

Magnesium (Mg)

Magnesium is washed from rocks and subsequently ends up in water. Magnesium Permissible Limit: 100 mg/L.

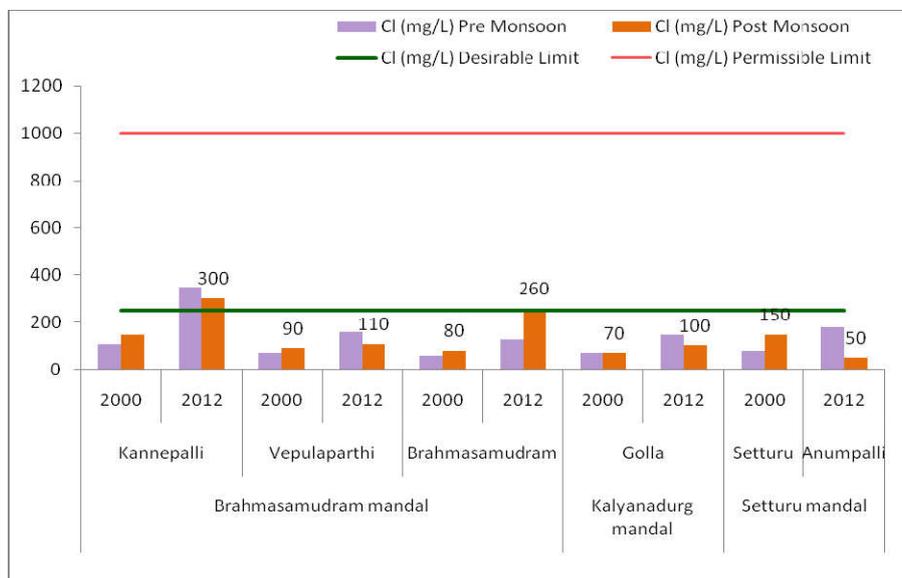
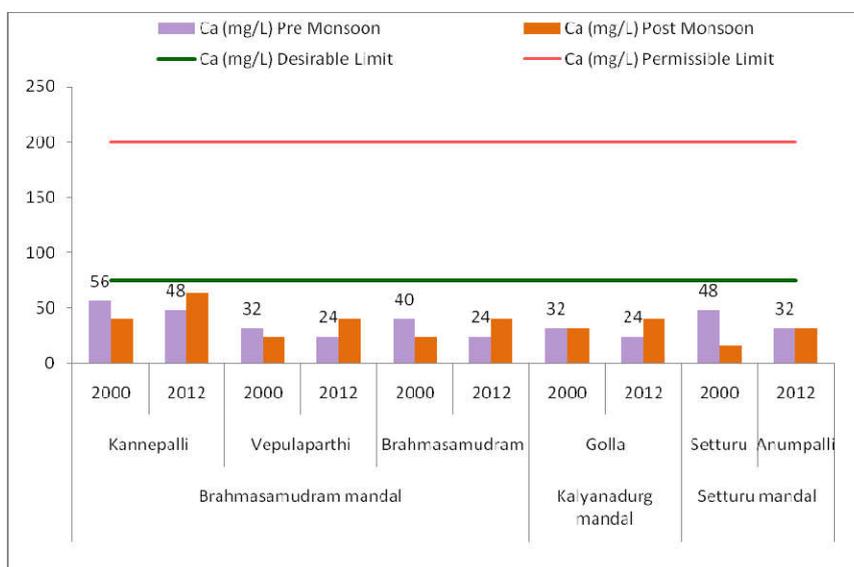


Figure 4. Chloride levels of the study area (Source: Groundwater Department, Anantapur)



Source: Groundwater Department, Anantapur

Figure 5. Calcium levels in the study area

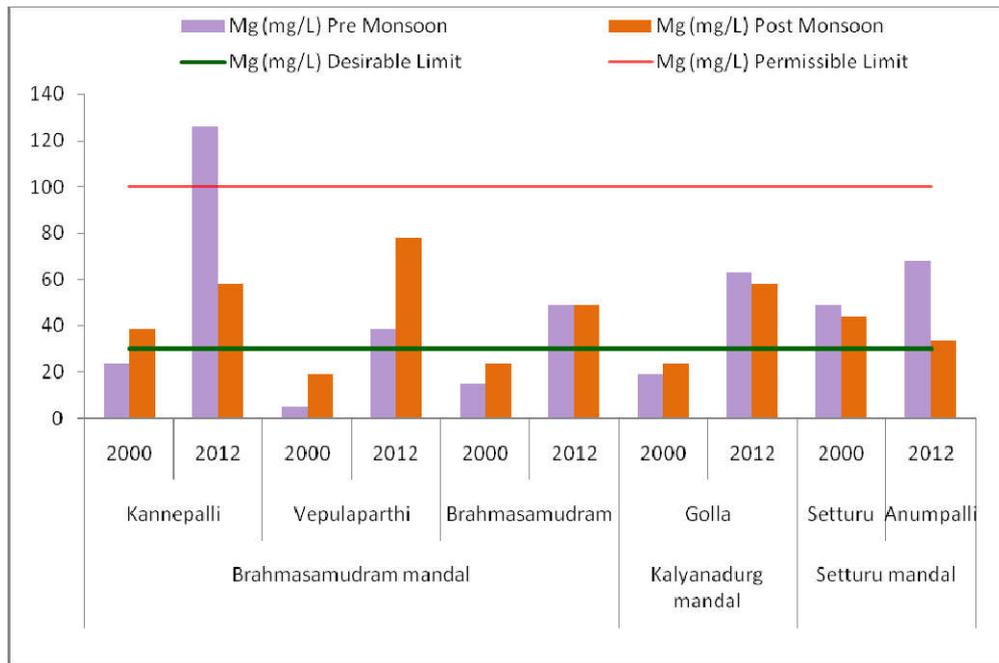
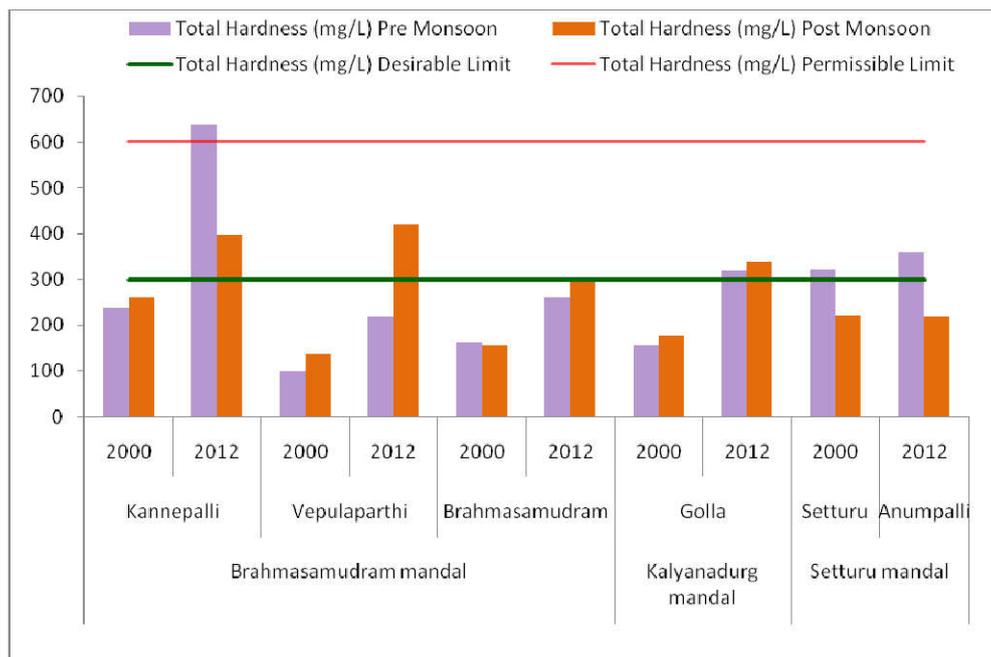


Figure 6. Magnesium levels in the study area



Source: Groundwater Department, Anantapur

Figure 7. Total Hardness levels in the study area

Mg in the study area is found in the range between 5 to 49 and 19 to 44 mg/L. in pre and post monsoon period of 2000. The Mg values in the study area are shown in Figure 6. The minimum values of 5 and 19 mg/L was observed at Vepulaparthi and the maximum values of 49 and 44 mg/L was observed at Setturu in pre and post monsoon period of 2000. For 2011 year Mg range between 39 to 126 and 34 to 78 mg/L in pre and post monsoon period. The minimum values of 39 and 34 mg/L was observed at Vepulaparthi and Anumpalli and the maximum values of 126 and 78 mg/L was observed at

Kannepalli and Vepulaparthi in pre and post monsoon period of 2011.

Total Hardness (TH)

TH in the study area are found in the range between 100.6 to 321.6 mg/L and 138.2 to 260.5 mg/L in pre and post monsoon period of 2000. The TH values in the study area are shown in Figure 7.

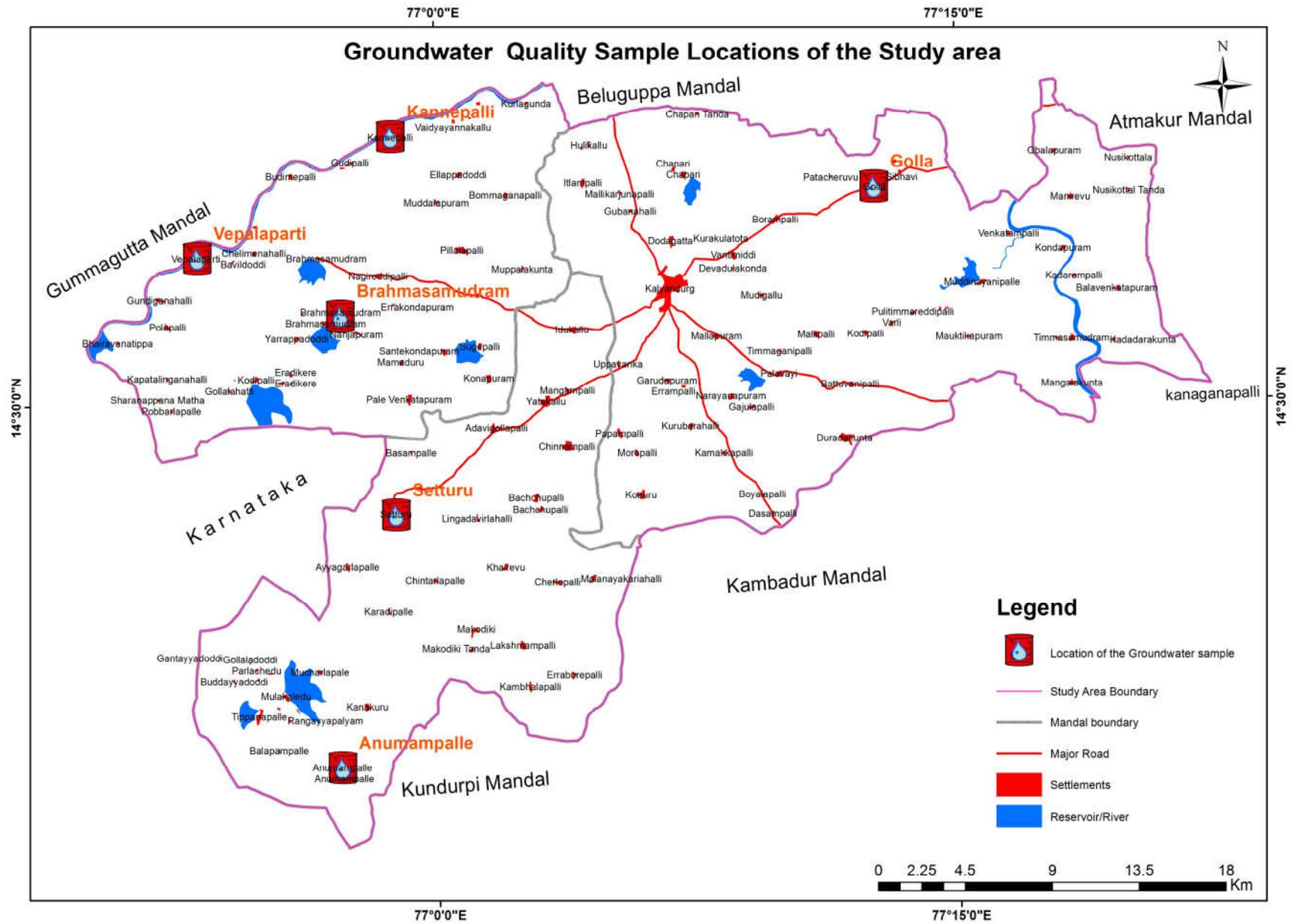


Figure 8. Groundwater Quality Sample Locations in the study Area

The minimum values of 100.6 and 138.2 mg/L was observed at Vepulaparathi and the maximum value of 321 and 260.5 mg/L was observed at Settur and Kannepalli in pre and post monsoon period of 2000. For 2011 TH range between 220.5 to 638.5 and 219.9 to 421.0 mg/L. The minimum values of 220.5 and 219.9 mg/L was observed at Vepulaparathi and Anumpalli and the maximum values of 638.5 to 421.0 mg/L was observed at Kannepalli and Vepulaparathi in pre and post monsoon period of 2011. TH values are observed above permissible limit at within the range between 300-600.

Conclusion

The overall Groundwater quality in the study area of Kalyandurg, Brahmasamudram and Setturu Mandals are below in the maximum permissible limit as prescribed by WHO. All the locations of the study area of pH, TDS, Chloride, Calcium, Total Hardness and Magnesium values have within the desirable and suitable range.

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