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Assessment and Comparison of Ground water Quality in Guntur District, Andhra Pradesh by using ARC GIS

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Abstract:- Groundwater normally clean and free of bacteria as it is filtered through various soil layers. But due to Rapid urbanization, industrialization and improper disposal of waste that polluting even groundwater. Objective of this study is to assess and map the spatial distribution of groundwater quality in Guntur District Andhra Pradesh, using geographical information system (GIS). As the capital region is laid in between Guntur and Krishna district. Groundwater is the main source for industrialization and urbanization. Here the physical and chemical properties analytical data of groundwater sample data of 30 well points of various regions in Guntur district are being collected from the ground water department of Andhra Pradesh. These data is predefined into attribute database. Thematic map from the attribute tables were generated using ArcGIS software. The inverse distance weighted (IDW) spatial interpolation technique was used to estimate the spatial distribution of groundwater parameters like pH, hardness, chlorides, sulphates, sodium, magnesium, potassium, carbonates, bicarbonates and specific conductivity. However, this analysis helps us to compare between different parameters and with different years. The present work is available for future planning and management of groundwater resources in the Guntur district. Suitable remedial measures are also suggested for the improvement of the quality of groundwater uniformly throughout the district.

Keywords:- *Arc GIS, ground water, spatial distribution, thematic maps, quality.*

I. INTRODUCTION

Much of the Earth's fresh water is ground water. Groundwater is the water that exists below the surface of the ground in the space between particles of rock or soil, or in the crevices and cracks in rocks. Most groundwater is within 100 meters of the surface of the Earth. Groundwater cleanup is very important World-wide because many communities and individuals get their drinking water from wells. Groundwater is stored below the surface of the ground in the tiny pore spaces between rock, sand, soil, and gravel. It happens in two "zones" ahigher, unsaturated zone where most of the pore spaces are filled with air, and a deeper, saturated zone in which all the pore spaces are filled with water. The top of the water layer signifies the water table. Below it, where the gravel is covered with water, is the saturated zone. Above it, where there is just gravel, would be the unsaturated zone.

How well loosely arranged rock (such as sand and gravel) holds water depends on the size and shape of the rock particles. Layers of loosely arranged particles of uniform size tend to hold more water than layers of rock with materials of different sizes. This is because smaller rock materials can relax in space between larger rocks, decreasing the space available to hold water. It is usually much cleaner than surface water. Source of ground water is rain and snow that falls to the ground a portion of which percolates down into the ground to become ground water.25-40% of world population is using groundwater for drinking purpose.

- *Contamination of Ground Water*

Over 50% of the United States population depends on ground water for drinking water. Groundwater is also one of our most significant sources of water for irrigation. Unfortunately, groundwater is susceptible to pollutants. Groundwater pollution occurs when man made products success gasoline, oil, road salts and Chemicals get into the groundwater speak to become a safe and unfit for humanoid use. Materials from the land surface can move through the soil and end up in the groundwater. For example, pesticides and fertilizers can find their way into groundwater supplies over time.

- *Effects of contaminated groundwater*

Drinking contaminated groundwater can have serious health effects. Diseases such as Hepatitis and dysentery may be caused by contamination from septic tank waste. Poisoning may be caused by toxins that have reached into well water supplies. Wildlife can also be harmed by contaminated groundwater. Other long term effects such as certain types of cancers may also result from exposure to polluted water.

A. Need of Proposed Project Work

- Assessment of groundwater resources yields knowledge necessary for their informed management and governance. Assessment means more than hydro geological characterization alone: it includes all other aspects (e.g. social, economic or environmental) that are needed for understanding of the resource and its state, in accordance with purpose of the assessment.

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- Groundwater is connected to many goods and services people depend upon, including food and energy production. Over the years, groundwater situations have changed rapidly in many places around the world due to intensive use of the resource, particularly for irrigation and domestic water supply.

B. Scope of Ground Water Potential Maps

- It helps mainly in identification of prospective locations for narrowing down target zones for follow-up detailed hydro geological and geophysical surveys at appropriate places for drilling. These maps are the good inputs for aquifer mapping.
- The maps are prepared based on the availability recharge conditions i.e., rainfall, depth to water table, availability of water in the water bodies during the period of the mapping. Hence depth and yield will vary.

C. Objectives Of The Project

The main objective of doing this project is to meet the following:

- To analyze the ground water parameters of Guntur district
- To analyze the thematic maps of different years
- To take decisions for establishment of new industries and wells

D. Limitations Of Ground Water Potential Maps

Pin pointing bore / tube well points (41/2" & 61/2" dia.) may not be accurate. Reasons:

- Scale of mapping (1:50,000 scale)
- Accuracy of map: The accuracy of the map is around 100 meters (which includes satellite data accuracy and other mapping errors).
- Heterogeneity of the terrain: These maps are generated with limited field checks hence in many cases the hydro geomorphic units are extrapolated with the help of satellite image features.

➢ *Recommendations*

- Ground survey to estimate the detailed hydro geological conditions
- Ground geophysical survey
- Up scaling keeping the map as base to assess the micro level changes

II. LITERATURE SURVEY

- Mahesh Ramakrishna Huchhe et.al stated that Management of water quality is very important as demand is increases day by day. Water is the most important source for living things on earth which is threatened on its quality and quantity. pH, DO, COD, BOD, Chloride and Hardness are basic water quality parameter. Management of water quality in University campus is important as it is the source of drinking for student's hostels, departments and irrigation in campus. Deterioration of water quality receives more attention to mapping the current situation of water quality parameter provides the better management of resources. Water sample collected from various resources located in Dr.BAM University campus during dry period, whereas when entire Marathwada including Aurangabad under great water stress. Interpolation methods facilitate to estimate values for unknown point and create a continuous dataset to study the spatial distribution. The IDW (inverse distance weighted) and Spline tools are deterministic interpolation method and Kriging are based on a statistical model. Kriging the best fit method of interpolation was used with help of Geographic Information System (GIS) software Arc GIS 10.2 to visualize the spatial distribution of above water quality parameters. This study has shown that rigging interpolation and statistical analysis perform better mapping of water parameter...

- Ramesh Pandian R et.al investigated that Groundwater is widely distributed than surface water and is used for domestic, industrial and agricultural purpose throughout the world. In many coastal towns or cities, groundwater seems to be the only source of fresh water to meet domestic, agricultural and industrial needs. Mapping of spatial variability of groundwater quality is of vital importance and it is particularly significant where groundwater is primary source of potable water. In the present study, a detailed investigation was carried out to analyze the spatial variability of groundwater quality for the coastal region of Tuticorin District. Geographical Information System (GIS) based spatial analysis method has been proven to be a powerful tool to represent the distribution of major ions in the study area. The major water quality parameters such as pH, Electrical conductivity, Total Dissolved Solids, Total Hardness, Calcium, Magnesium, Bicarbonate, Chloride and Sulphate etc. were analyzed.

- P. K. Kumaresan et.al has been stated that Water is the basic element of social and economic infrastructure and is essential for healthy society and sustainable development. Due to rapid increase in density of population, fast urbanization, industrialization and agricultural, use the demand of water is increasing day by day. As a result surface water and ground water level is decreasing; pollution and increased demand have made good quality water scare and more expensive. Groundwater is the favorite alternative is facing threats due to anthropogenic activities in India, which has lead due to deterioration in ground water quality. The possibility of ground water contamination is due to the mixing up of toxic chemicals, fertilizers, waste disposed site and industrial sites. Hence

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monitoring of ground water quality has become indispensable. GIS not only facilitates data capture and processing but also serve as powerful computational tools that facilitate multiday integrations.

- Gogana Venkateswarluet. alhas been stated that Water is essential to people and the largest available source of fresh water lies underground. Increased demands for water have stimulated exploration of underground water resources. As a result techniques for investigating the occurrence and movement of ground water have been improved, better equipment for extracting ground water has been developed. Ground water samples were collected at pre- determined sampling locations based on Satellite Imagery of the study area. All the samples were analyzed for various physicochemical parameters adopting standard protocols for the generation of attribute data. Based on the results obtained maps showing spatial distribution of selected water quality parameters are prepared using curve-fitting method in GIS Software. Water quality index (WOI) in the study area is calculated to determine the suitability of ground water for drinking purpose.

- Ramamoorthyet. alinvestigated that Groundwater is an important natural resource for its use in domestic, agriculture, and industries purposes. There has been a tremendous increase in the demand for groundwater due to increase in population, advanced irrigation activities and industrial uses. GIS is an effective tool it provides large information with in short period for planning and managing of groundwater related problems. A case study was conducted to find out the groundwater potential zones in Varahanadhi watershed, Tamil Nadu, India. The thematic maps such as geology, geomorphology, soil, land use and drainage map were prepared in the Arc GIS 9.3 for the study area. The thematic layers were first digitized from satellite imagery, supported by supplementary data such as top sheets and file survey data, finally all thematic layers were integrated using Arc GIS software to identify the groundwater potential zones. From the study the groundwater potential zones were classified in to, Poor, Moderate and Good.

- Asaad Y. Shamseldin et. alinvestigatedthat Surface water bodies are normally linked to groundwater. Rivers, lakes, wetlands and estuaries may act as recharge sources for an aquifer or vice versa (Braaten and Gates, 2001). Understanding the basic principles of groundwater/surface water (GW–SW) interactions is essential to effectively manage water resources. The necessity for sustainable use of groundwater and surface water in New Zealand will continue to increase in the future due to global warming, contamination of water resources and increasing demand for water. A good understanding of groundwater-surface water interactions is important for decision makers and water resources managers. Remote sensing is a powerful tool to identify the spatial distribution of groundwater discharge and improve our knowledge of the interactions between groundwater and surface water. Discharged groundwater in the surface water features have some signatures such as thermal or chemical which is different from that of surface water and can be sensed remotely. Assessing the thermal infrared imagery from satellite or airborne is an effective method to quickly assess large areas and obtain information about specific locations of the interactions and regional groundwater flow pattern at larger spatial scales. This technique can help in designing groundwater monitoring networks, sampling sites in groundwater and surface water, establishing a baseline for the future of ground level monitoring systems and also for estimating the environmental effects of contaminant migration.

III. METHODOLOGY

ARC GIS (Aeronautical Reconnaissance Coverage Geographical Information System):

Arc GIS is developed and sold by Environmental Systems Research Institute, Inc. (ESRI). It has a extended history and has been through many versions and changes. Initially established for large Mainframe computers, in the past 10 years it has changed from a system based on typed commands to a graphical user interface (GUI), which makes it much easier to use. Because of the size and trouble of the program, and because users have come to depend on certain aspects of the software, much of the code is carried forward and included in the new versions.

Arc GIS, released in 2001, is a synthesis of the powerful Arc/Info system with the easy-to-use interface of Arc View, updated to use the latest advances in desktop computing and database technology. It contains two programs, collectively referred to as Arc GIS Desktop.

- Arc Map provides the means to display, analyze, and edit spatial data and data tables. Similar in appearance to its ArcView predecessor, it nevertheless contains powerful new functionality.
- Arc Catalog is a tool for viewing and managing spatial data files. It resembles Microsoft Windows Explorer,

but it is specially designed to work with GIS data. It should always be used to delete, copy, rename, or move spatial data files.

- ArcView provides all of the basic mapping, editing, and analysis functions for shape files and geo databases and is the level of functionality most users will require on a regular basis. It includes Arc Map, Arc Catalog, and a subset of Arc Toolbox functions.

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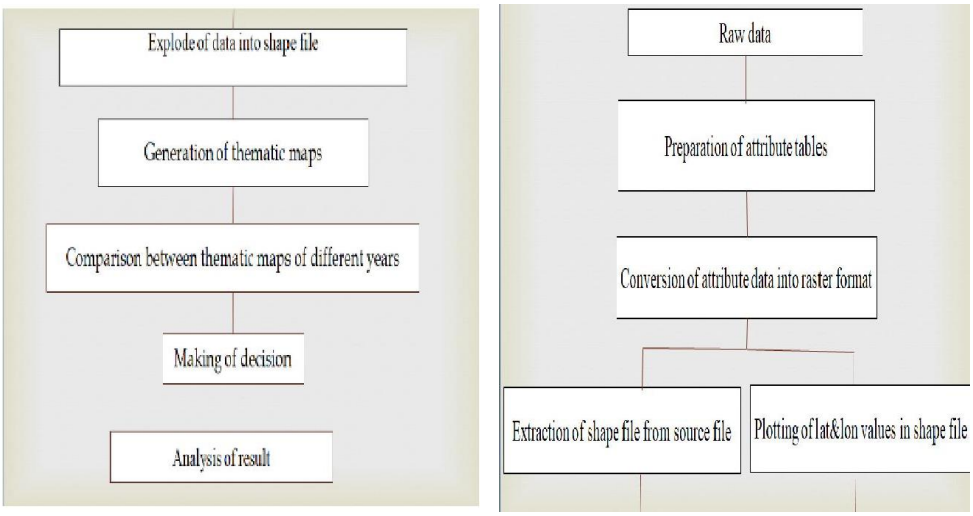
- Arc Editor includes all the functions of ArcView but adds editing capabilities needed to work with the advanced aspects of the geo database, such as topology and network editing. Additional functions reside in Arc Toolbox at this level.
- Arc Info delivers access to the full functionality of the ArcGIS Desktop tools and the full version of Arc Toolbox. In addition, it includes the original core Arc/Info software, now called Workstation Arc Info.

Arc GIS can read a variety of different file formats. Many of these come from older versions of the software. Some can come from other programs such as image processing packages and computer-aided design (CAD) systems.

Data Files In Arcgis

ArcGIS can read a variety of different file formats. Many of these come from older versions of the software. Some can come from other programs such as image processing packages and computer-aided design (CAD) systems. Many of the data sets than can be used in ArcGIS with the icons showing how they appear in Arc Catalog.



IV. RESULTS AND DISCUSSIONS

For the analysis of Results of ground water data collected from Deputy Director of Ground Water Department of Guntur District. These results included presentation of thematic maps of

- Hardness
- Carbonates
- Bicarbonates
- Sulphates
- Chlorides
- Magnesium
- Potassium

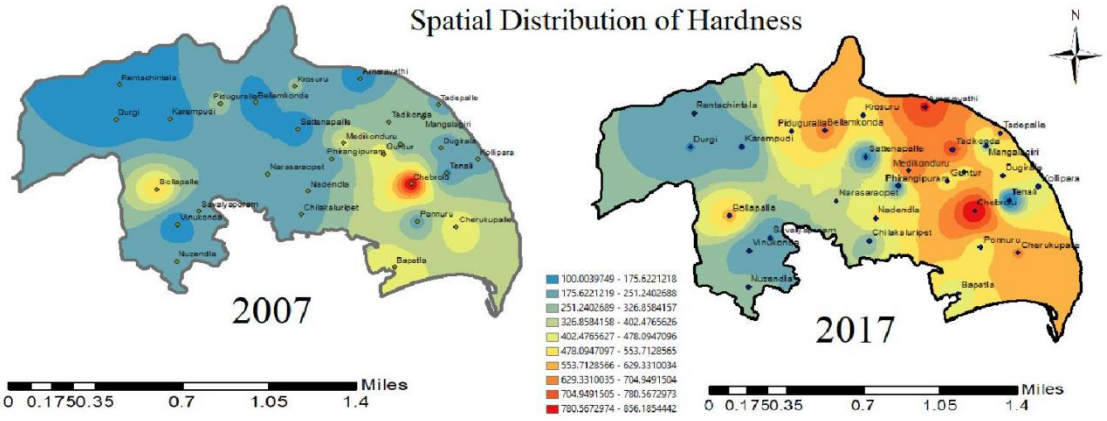


Fig 1:

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A. Hardness

The presence of carbonates and bicarbonates of calcium or magnesium is called hardness. From figure 1we can say that hard waters are generally considered to be those waters that require considerable amounts of soap to produce foam and that also produce scale in water pipes, heaters, boilers and other units in which the temperature of water is increased.

Hardness (mg/L) Degree of hardness

- 0-75 Soft
- 75-100 Moderately hard
- 150-300 Hard
- >300 Very hard
- The range from 0 to 60mg/l is known as soft water. The range from 60 to 120mg/l is known as medium hard water. The range from 120 to 180mg/l is known as hard water. The hardness decreases the life time of boilers.

From the thematic maps it can be seen that some regions like Amravathi, Piduguralla and Tadikonda are with in permissible limit in 2007, but these changes into unsafe in 2017 with hardness of 780-850mg/l.

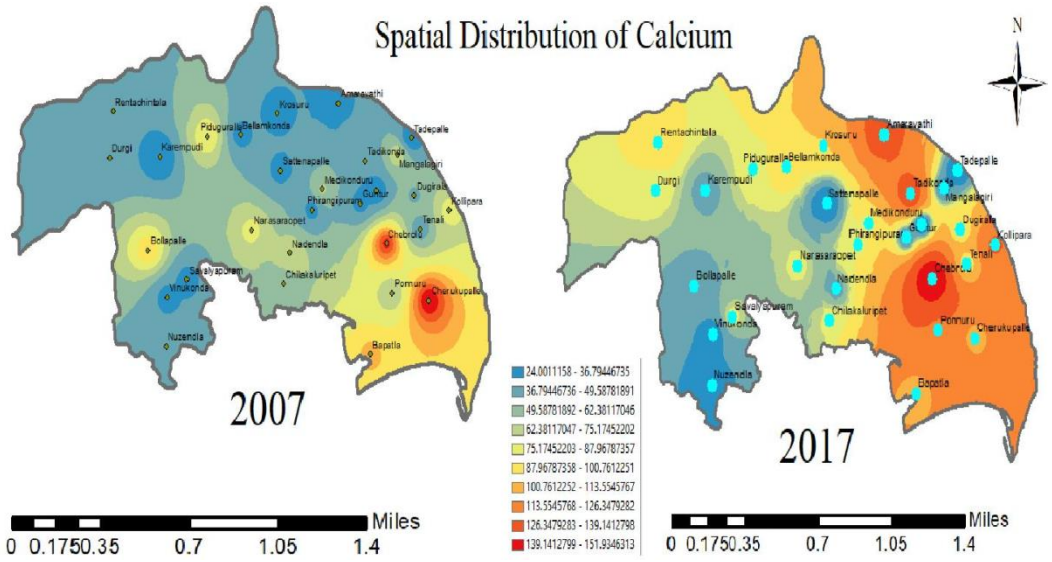

Fig 2:

B. Calcium

A mineral mainly present in the hard part of bones. The range is lies between 75 to 200mg/l. The calcium is more in drinking water causes to bone deformation. Calcium is more in drinking water causes to bone deformation. Calcium can also originate as lime in agricultural fertilizers. This involves the exchange of calcium in groundwater with magnesium or sodium, on clay particles forming the aquifer. This may explain the lower concentrations associated with deeper groundwater in the coastal area, in what are calcium rich sediments. The main calcium sources are the dairy products, but also nuts, some green vegetables like spinach, and cauliflower, beans, lentils.

Calcium works together with magnesium to create new osseous mass. Calcium should be taken together with magnesium in a 2:1 rate, that is to say, if you ingest 1000 mg of calcium, you should also ingest 500 mg of magnesium. Some magnesium sources in the diet are seafood, whole-grains, nuts, beans, wheat oats, seeds and green vegetables. The western regions of district are more affected with calcium contain in ground water. Some regions like Vinukonda, Nuzendla, Karempudi and Sattenapalli are within the limit of 35mg/l in 2007.There are tremendous changes in regions like Amaravathi and Tadikonda from the year 2007&2017.

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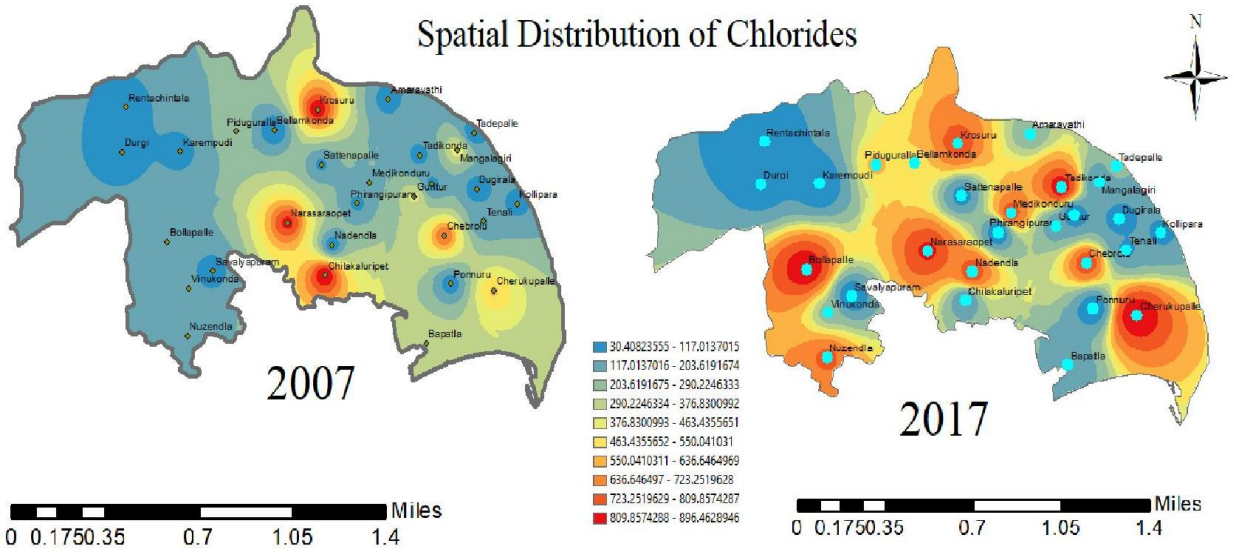

Fig 3:

C. Chloride

Most chloride in inland groundwater originates indirectly from evaporated seawater that enters aquifers as rainfall recharge. Rainfall contains high levels of chloride near the coast and as a consequence it is found at higher concentrations in groundwater's that originate nearer to the coast. This effect does not apply to deeper coastal wells which are recharged from waters that originate inland. These salts will persist for a long time to come. Chloride is a conservative constituent of groundwater. This means that it doesn't readily react with other chemicals, and isn't chemically altered as it travels along its underground flow path. For this reason it is commonly used by hydrologists to track natural flow patterns. All type of natural water and raw water contains chlorides.

It comes from activities carries out in agricultural area, industrial activities and from chloride stones. The permissible limit is from 250 to 1000mg/l.

From the thematic maps of chlorides it can be observed that Ponnur remains same with 210mg/l in both years. Bollapalli region is initially with 117mg/l in 2007.But, when it comes to 2017 the scenario has totally changes as it has the maximum amount of 890mg/l in 2017.

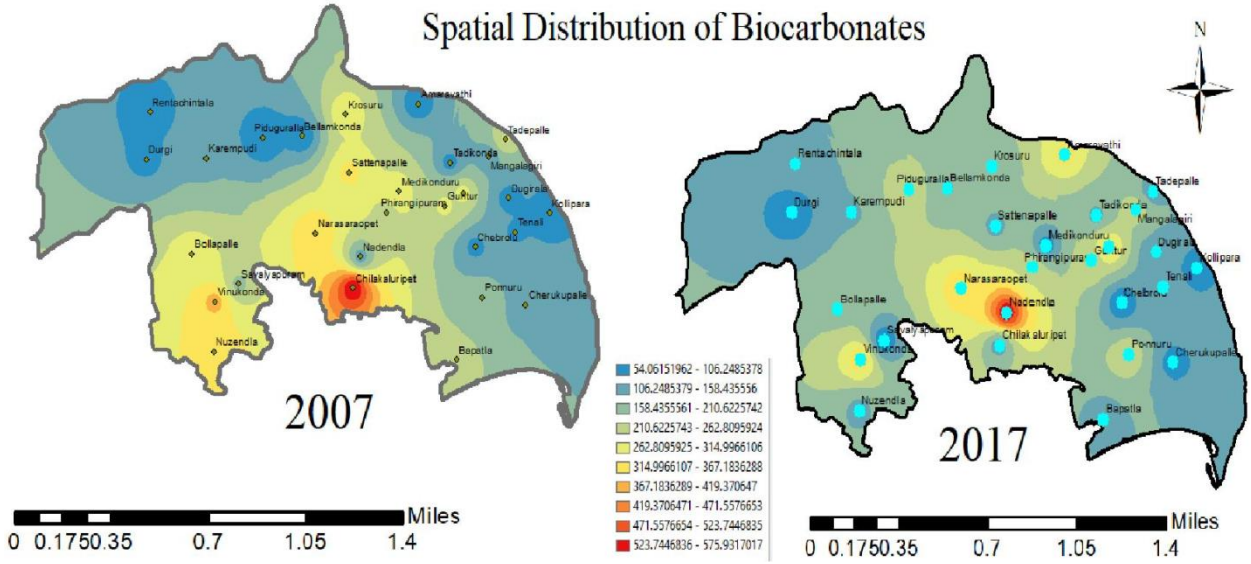

Fig 4:

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D. Bicarbonate

Permanent hardness is caused by dissolved calcium sulphate. Range is lies between 90 to 180 mg/l. Bicarbonate is removed by reverse osmosis method and ion exchange method. Permanent hardness is also called as bicarbonate or non-alkaline.

A salt containing the anion HCO3which is the most important buffer in the blood, it is regulated byte kidney, which excretes it in excess and retains it when needed; it increases with ingestion of excess antacids, diuretics and steroids; it is decreased with diarrhea, liver disease, renal disease and chemical poisoning.

For digestion, bicarbonate is naturally produced by the gastric membrane in the stomach. This production will be low in alkaline conditions and will rise in response to acidity. In healthy individuals this adaptive mechanism will control the pH perfectly. To modify this pH with exogenous doses of bicarbonate, some clinical experiments have been conducted with sodium bicarbonate loads as high as 6 g. Only a transient effect on pH has been obtained. It is quite possible that bicarbonate in water may play a buffering role in the case of people sensitive to gastric acidity. Thus bicarbonate may be helpful for digestion. It can be observed that there is no huge variation between 2007&2017 but Chilakaluripeta is having maximum amount of bicarbonates of 525mg/l in 2007 but when it comes to 2017 it falls to 150mg/l.

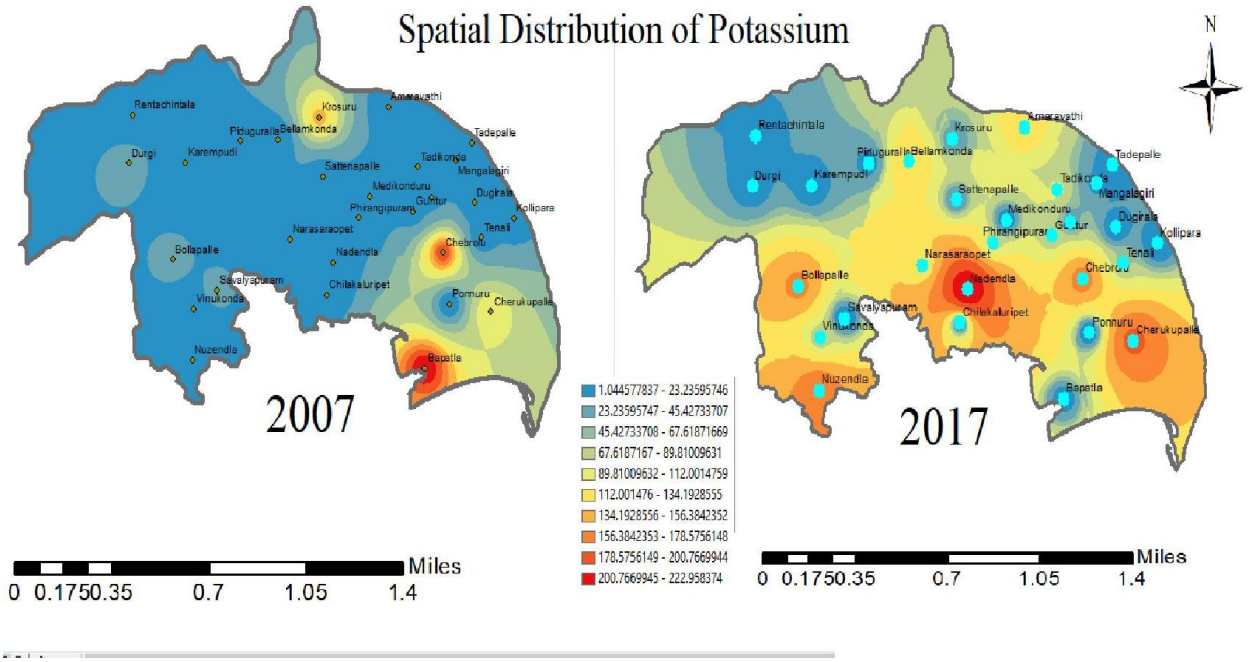

Fig 5:

E. Potassium

The chemical element of a salt silvery-white reactive metal of the alkali-metal group. The permissible limit ranges from 8 to 51mg/l.

Potassium is a soft, silvery-white metal, member of the alkali group of the periodic chart. Potassium is silvery when first cut but it oxidizes rapidly in air and tarnishes within minutes, so it is generally stored under oil or grease. It is light enough to float into water with which it reacts instantly to release hydrogen, which burns with a lilac flame.

The chemistry of potassium is almost entirely that of the potassium ion, K+. Potassium can be added to groundwater through fertilizer use and the breakdown of animal or human waste products. Potassium concentrations follow a similar pattern to that of other naturally evolved parameters. This suggests that potassium originates as a result of natural water rock interaction, rather than from agricultural fertilizers. Potassium levels are monitored in case there is an increased contribution from land uses in the future through agricultural processes disturbing the soil structure.Where as in 2017, Nadendla has changed from 25-200mg/l in the year 2007&2017. And rest of the regions like Bollapalle, Cherbrolu, and Ponnur are having between 70-90mg/l.

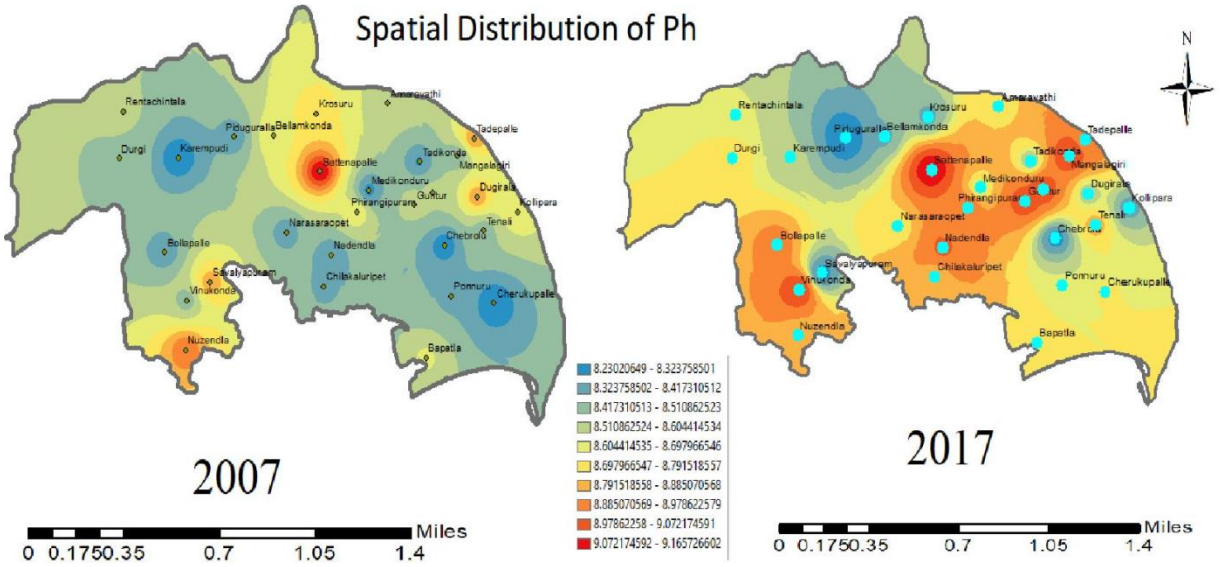

Fig 6:

F. P^h

pH is a measure of the acidity or alkalinity of groundwater. pH 7 groundwater has equal numbers of hydrogen (H+) and hydronium (OH-) ions and is termed neutral. pH of rainfall is slightly acidic at5.7 and tends to evolve to more neutral conditions in the environment. pH is important because it controls many of the chemical reactions involving groundwater and it also strongly influences the presence or absence of arsenic, iron, manganese and nitrogen. Generally acidic ground waters are corrosive in nature, while alkaline ground waters tend to be incrusting.

The aim of the treatment is to reduce corrosion of water mains and household plumbing. The pH of Marlborough ground waters is variable and reflects both the nature of the recharge water, catchment geology and its evolutional history while surface waters such as the Wairau River are generally slightly alkaline, nearby shallow groundwater has a pH of 6 to 7 due to the acidifying influences of natural soil and atmospheric processes. pH of 6.5 to 8.5 is mainly used for drinking water. The region like Chebrolu, Piduralla are same in both the years, but dramatic changes occurs in regions like Nadendla, Guntur, Bollapalle, Vinukonda with 9 in 2017.

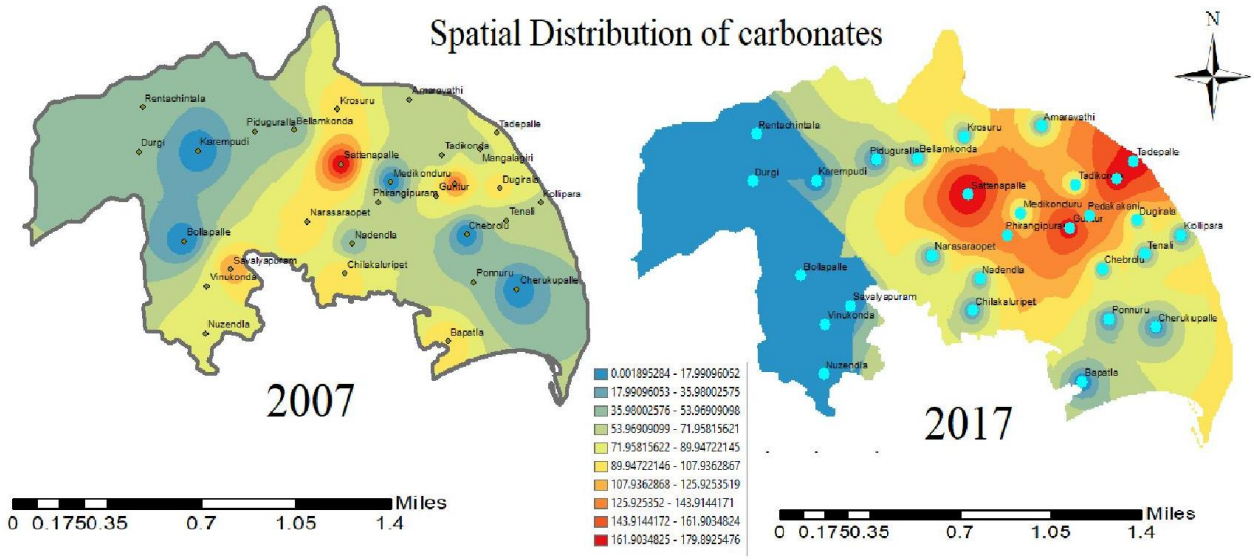

Fig 7:

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G. Carbonate

Carbonate, any member of two classes of chemical compounds derived from carbonic acid or carbon dioxide (q.v.). The inorganic carbonates are salts of carbonic acid (H_2CO_3), containing the carbonate ion, $CO_2/3$-, and ions of metals such as sodium or calcium. Inorganic carbonates comprise many minerals (see carbonate mineral) and are the principal constituents of limestone and dolomites; they also comprise the hard parts of many marine invertebrates. Organic carbonates are esters; that is, compounds in which the hydrogen atoms of carbonic acid have been replaced by carbon-containing combining groups such as ethyl, C_2H_5.

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Temporary hardness is caused by dissolved calcium hydrogen carbonate. Carbonate range lies between 0 to 90mg/l. Carbonate can be removed by boiling. Temporary hardness is called as carbonate or alkaline hardness.

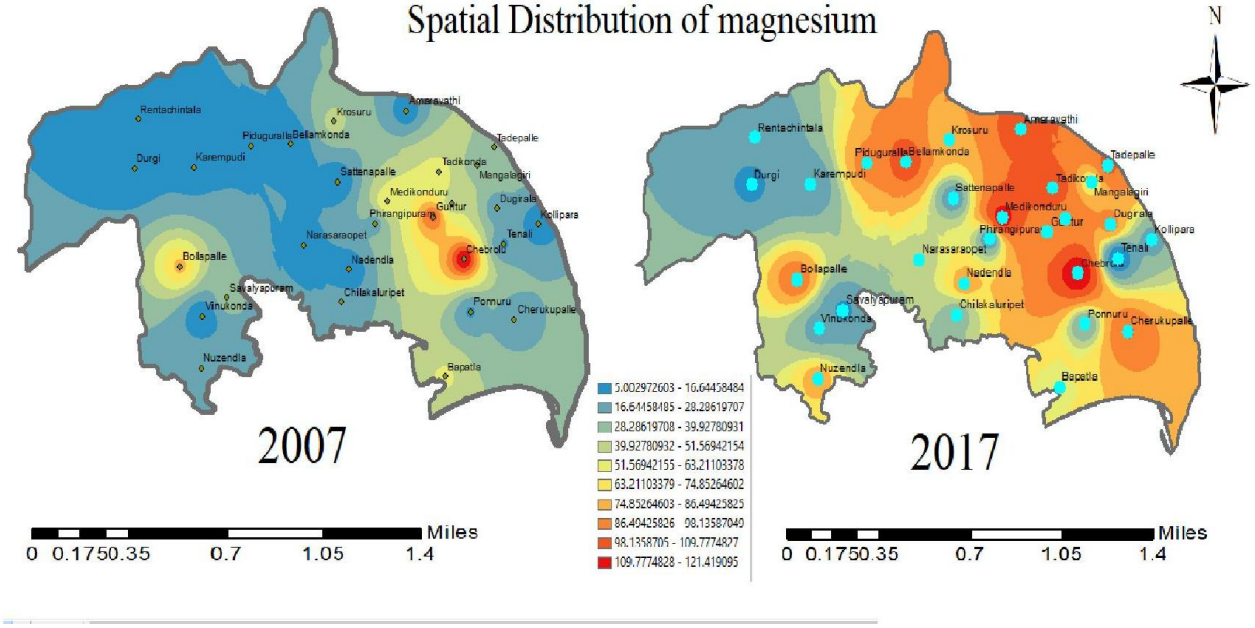

Fig 8:

H. Magnesium

A chemical element with a shiny gray solid bear a close physical resemblance of other elements like alkaline. The range of magnesium is from 30 to 100mg/l.As rocks are eroded and transported by rivers as alluvial sediments, they slowly dissolve and release magnesium and other chemicals into the groundwater over time. A small amount of magnesium may also come from the use of agricultural fertilizer.

No specific treatment or antidote. Supportive care recommended. Treatment should be based on reactions of the patient. Remove to fresh air. Eyes: flush eyes with water thoroughly. Consult a physician. Skin: wash with soap & water thoroughly to remove particles. Ingestion: if large amounts of magnesium powder are ingested, induce vomiting & consult a physician.

The regions like Rentachintala, Durgi, Pideguralla, Bellamkonda, Narasarpet, Nadendla are within limits of 10mg/l in 2007.Western regions like Amravati, Medikondure, Ponnur, Chebrolu and Guntur are having very high range of 120mg/l in 2017.

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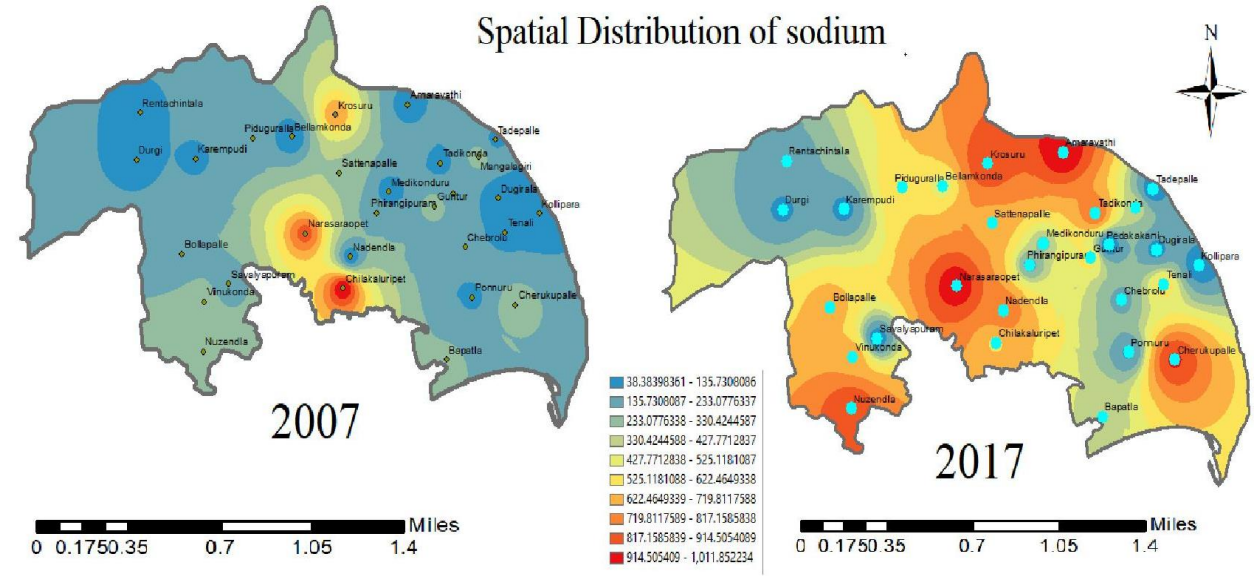

Fig 9:

I. Sodium

A soft silver-white metallic element that oxidizes rapidly in moist air and also reactive metal of the alkali-metal group. The distribution of sodium in groundwater is similar to that of chloride. Both salts occur together in marine deposits, although sodium is a more common byproduct in groundwater as a result of the breakdown of clay minerals. The permissible limit ranges from 20 to 40mg/l for drinking water.

The amount of sodium a person consumes each day varies from individual to individual and from culture to culture; some people get as little as 2 g/day, some as much as 20 grams. Sodium is essential, but controversial surrounds the amount required. Contact of sodium with water, including perspiration causes the formation of sodium hydroxide fumes, which are highly irritating to skin, eyes, nose and throat. This may cause sneezing and coughing. Very severe exposures may result in difficult breathing, coughing and chemical bronchitis. Contact to the skin may cause itching, tingling, thermal and caustic burns and permanent damage. Contact with eyes may result in permanent damage and loss of sight. The western region of district are having minimum contain of sodium in 2007. Certainly in 2017 region like Narasaraopeta, Amaravathi are having with 900mg/l Here initially Amaravathi, is having 30mg/l in 2007 but it reaches to maximum limits of 900mg/l in 2017.Some of the regions like Kollipara, Phirangipuram, Chebrolu, Tenali, Pedakakani are same in both years.

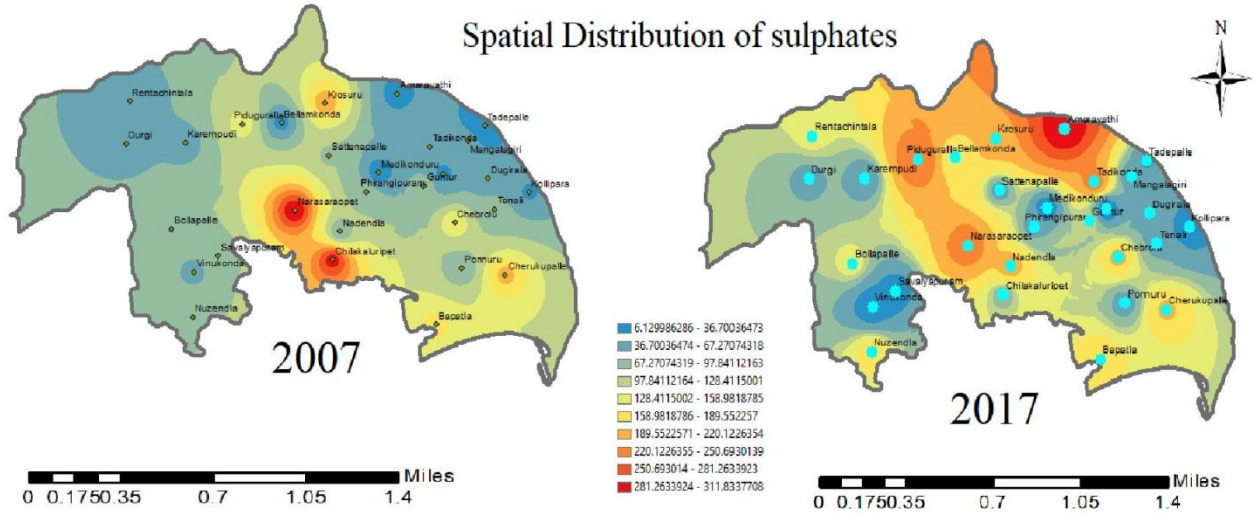

Fig 10:

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J. Sulphates

Sulphates are combination of sulphur and oxygen and are a part of naturally occurring minerals in a same soils and rock formation. The permissible limit ranges from 200 to 400mg/l. Sulphate is more in water causes gastro intestinal irritation. Sulphate exists at relatively low levels in local groundwater.

This same chemical one way of identifying the source of sulphate in local groundwater is to compare the ratio of magnesium and sulphate in a particular groundwater sample, to that of groundwater. It could be due to the loss of sulphate from groundwater by natural chemical processes, or the addition of magnesium through ion exchange, or fertilizers. Sulfates occur naturally in drinking water, usually as a combination of sulfur and oxygen. Some minerals present in soil also get dissolved and are ultimately released to groundwater as Sulfates.

Regions like Narasaropeta, Chilakuripet, are having 208mg/l and rest of the regions like Amaravathi, Tadepalle, Guntur, Piduguralla, and Medikonduru, are same in both year.

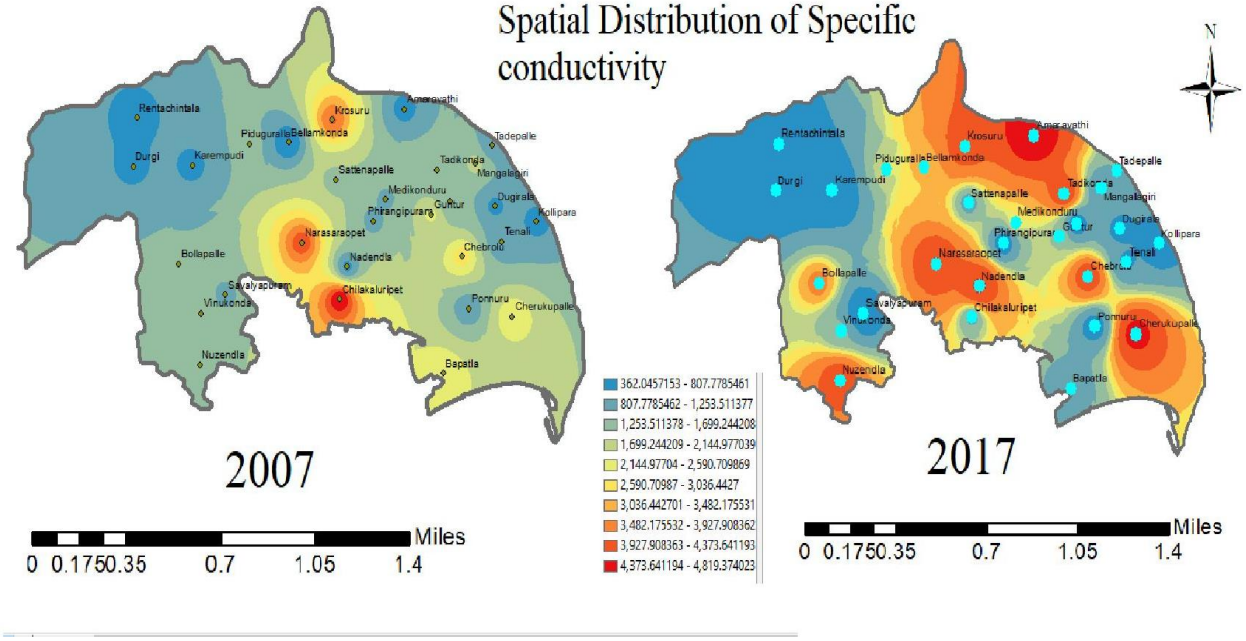

Fig 11:

K. Specific Conductivity

Conductivity is the capacity of water to carry an electrical current through it. The range is lies between -200 to 100Eh (mille volts).Electrical conductivity is widely used as an indicator of the dissolved solids or salts in groundwater. The more dissolved salts a groundwater contains, the easier it passes electrical current and the higher its conductivity becomes.

In 2007, Chilakaluripet, Narasaropet, Krosuru, are 4000Eh and other regions are having medium range.When it comes to 2017, some of regions like Amaravathi, Krosuru, Cherukupally, Narasarpoet, Nadendla, Nuzandla, Bollapalle are having extremely high range of about 4500Eh.

V. CONCLUSION

From the present study the following conclusions can be drawn

- The groundwater quality at the Guntur District region of AP is not so good. As most of the regions are not fit for direct consumption but the groundwater in some of the regions is fit for agriculture and industry purposes.
- The Western parts of the district like Amaravati, Tadepalli, Tatikonda, Sattenapalli, Chebrolu and Guntur regions are having high concentration of and physical and chemical parameters in both the years.
- The Eastern part of the district is quite opposite as regions like Durgi, Rentachintala, Bollapalli, Vinukonda, Nuzendla

are in the safe zone because most of the parameters are within the permissible limits.

- Monitoring of pollution patterns and its trends with respect to urbanization important task for achieving sustainable management of groundwater.
- The poor water quality in the mentioned areas may be attributed to miss management practices like poor waste management and poor farm management practices
- Samples containing high value of chlorides need to be treated by and desalination process like reverse osmosis are electrical dialysis, which are provided to be costly for large scale difference.
- This study is useful for artificial recharge planning and other Environmental studies where the ground water availability in Guntur district.
- This analysis gives a satisfactory result concerning identification of groundwater potential areas.
- This study can widely use for groundwater exploration and sustainable watershed management in the district.
- This type of potential zone mapping could be used for various purposes like irrigation drinking and management of groundwater.
- Raster overlay techniques can be used to generate the spatial distribution maps by merging all the parameter for the better and easy understanding to the farmers and other uneducated people.
- Spatial distribution maps of various pollution parameters are used to demarcate the locational distribution of water pollutants in the comprehensive manner and helps in suggesting the groundwater pollution control and remedial measures in a Holistic way.
- And samples consist of high content of hardness and TDS should be treated by using filtration method.
- Some of the reasons within the district are best suitable for industrial purpose as all the parameters are within the permissible limits.
- Overall it is observed that the levels of groundwater are decreased year by year. To overcome this problem water recharge structures must be built in fields and unused areas and extraction of groundwater must be restricted in some areas.

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