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Spatial Distribution of Groundwater Quality Parameters In Nandigam in around Mandals Region- A GIS Approach

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Abstract

Groundwater is the most imperative regular asset required for toasting many individuals around the globe, particularly in provincial territories. The asset can't be ideally utilized and managed unless the nature of groundwater is surveyed. The examination depicted here utilizations geographic data framework (GIS) innovation to delineate quality for drinking and development, using information produced from compound investigation of water tests gathered from the territory under examination. In this work, we will think about different geological highlights of Nandigammandal by gathering diverse sorts of information identified with ground water. This information is utilized to decipher a guide and digitize it with the assistance of ArcGIS 10.3 programming. Using GIS shaping strategies, spatial dissemination maps of pH, TDS, TH, Cl, HCO3, SO4, NO3, Ca, Mg, Na, and K, have been made. Frame this guide one can without much of a stretch survey the nature of water introduce at different spots of this region and furthermore it helps in taking choice of what are the changes that are to be made in the water use and its quality. The physical-blend comes to fruition were stood out from the standard administer regards as proposed by the World Health Organization (WHO) for drinking and general prosperity in order to have a framework of the present groundwater quality.

Keywords:

ArcGIS,

Chemical analysis,

Quality maps

Fifth keyword.

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1. Introduction

GIS in Water Resource Engineering presents a survey of the ideas and uses of GIS in the different sub-fields of water asset designing. After an outline audit of investigations and database works, the book tends to ideas and applications in the separate regions: Surface Water Hydrology, Groundwater Hydrology, Water Supply and Irrigation frameworks, Wastewater and Storm water Systems, Floodplain Management, Water Quality, Water Resource Monitoring and Forecasting, River Basin Planning and Management. In this work we are going to map the ground water quality parameters of Nandigammandal region. This is done using the software ArcGIS the details of water quality of the region are collected and are plot on a map using the techniques in ArcGIS by this project we are going to gain knowledge of quality of ground water in this area and what are the measures to be taken in order increase the quality if there any impurities or irregular properties. Utilizing GIS forming techniques, spatial circulation maps of pH, TDS, TH, Cl, HCO3, SO4, NO3, Ca, Mg, Na and K, have been made. An interjection procedure, standard Inverse Distance Weighted (IDW), was utilized to acquire the spatial dissemination of groundwater quality parameters.

2. MATERIAL AND METHODS:

The proposed Nandigammandal region of srikakulam district of Andhra Pradesh is taken as the area of interest in order to perform this water analysis as this is the rural area due to the mandals have very use by knowing the quality of water one requires the quality of water at that area. The area consists of places in and around Nandigammandals which is total part of our proposed study area.

The proposed rural region of Andhra Pradesh is taken as the area of interest in order to perform this water analysis as this is the undeveloping area due to the backward one has very use by knowing the quality of water one requires the quality of water at that area. The area consists of places in and around Nandigam which is central part of our proposed mandal region. The area extends from bank of vamsadhara river and is extends up to Palasa and Mandasa on other side it is spread in the area of 200 square kilometers. Dependency on groundwater is currently very high and it is preferred for drinking purpose by large number of the population. Because of the inadequacy and concern over quality of tap water, ground water will continue to be a significant source of domestic water supply for this mandal.

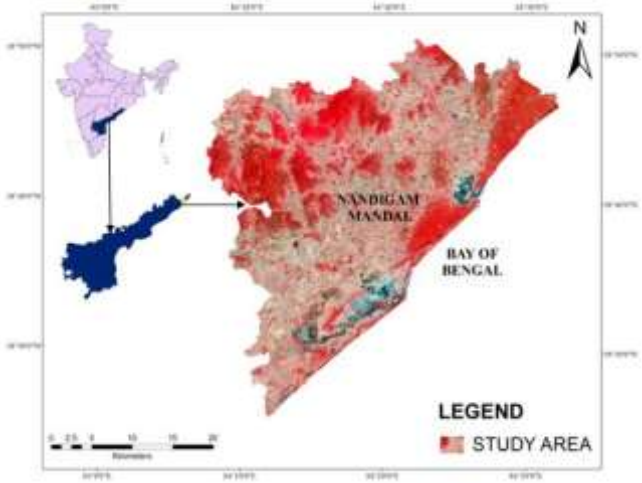

Figure 1. Location map of the Study area

Nandigam is the recent developing city and many changes are going to take place in this region based on various aspects population may increase very rapidly and it is necessary to supplies adequate amount of water to the people who are ought to come and many industries and other

companies are going to be established in future so it is very important to know about the quality of water at this region as it is the very essential to survive.

Ground water sample collection and analysis:

As a part of study the ground water samples from various regions of the Villages are collected for testing. The samples are taken from various villages. The examples taken are broke down for different physico-compound parameters. Bottles used for water sample collection are first thoroughly washed with the water being sampled and then were filled. After collection of the samples, the samples are preserved and shifted to the laboratory for analysis.

Table 1.Attribute table showing the various chemical properties of ground water

Village	pH	Temp	Conductivity(µS)	T.D.S	Salinity	No3	Mg	Ca	T.H	Cl -	HCO3-	Na	K	So4
				ppm	ppt	ppm	Ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Sailada	8.5	37.3	2340	1510.23	1.4	17.40	53.70	12.90	255.74	310.12	299.23	212.45	0.70	27.05
Mujjuwada	8.2	36.6	1620	1050.12	1.5	0.40	50.12	17.50	248.91	80.56	62.55	130.00	12.12	37.55
Pundi R.S	7.5	36.5	1420	920.12	0.9	1.70	25.15	30.12	174.56	241.56	224.55	131.52	65.00	31.12
PeddaBanapuram	7.7	36.5	1550	1000.5	1.5	0.45	35.08	7.70	160.45	59.58	41.55	110.15	6.21	10.55
Jadyada	7.89	36.6	2390	1550.23	2.1	8.50	69.12	15.12	322.56	325.45	310.80	190.00	4.12	60.25
Devupuram	7.77	34.6	1300	840.45	0.9	15.89	35.45	32.12	225.36	213.45	195.45	127.00	3.12	31.44
PeddaLavanipalli	8.2	35	1450	930.45	0.95	7.50	46.12	20.12	240.12	188.45	170.15	90.20	1.50	30.12
Nandigam	8.3	37.2	950	610.74	0.65	0.80	32.55	15.85	170.45	91.75	73.56	54.12	5.50	20.65
Dimlada	8.1	36.7	1250	810.23	0.85	10.92	26.32	24.12	165.35	108.45	90.45	61.23	20.12	22.89
Bingupuram	7.5	35.3	3150	2040.12	1.9	34.50	57.45	113.45	510.78	474.56	460.89	68.50	77.00	60.23
Kandalagudem	8.2	34.7	3000	1950	2.2	54.55	56.75	135.35	560.78	238.75	220.45	21.62	6.00	30.30
Nllapuram	7.8	34.8	2000	1250.45	1.5	31.22	76.45	20.20	371.89	227.85	210.99	58.45	3.00	10.20
PeddaGuruvuru	7.4	34.9	3200	2030	1.8	46.78	143.25	184.56	1040.45	729.45	711.46	43.63	67.55	38.89
Ramapuram	7.2	35.4	1800	1150.23	1.5	5.89	60.12	18.78	295.45	100.95	82.99	92.89	4.00	60.70
Tekkali	7.7	35.4	1300	840.45	1.9	15.44	35.45	7.90	160.45	66.75	48.55	75.45	3.00	69.90
Santabommali	7.9	35.6	2230	1500	1.6	30.33	70.41	60.78	440.78	345.78	327.94	79.46	2.00	31.12
Kokarpalli	8	34.9	1300	840.55	0.9	16.14	48.45	32.45	280.45	115.95	97.88	34.12	2.50	1.50
Kotabommali RS	8.3	37.3	670	450	0.4	0.40	19.50	20.26	124.78	20.50	1.80	44.20	4.50	27.60
Borubhadra	7.4	34.4	1790	1150.45	1.4	11.00	81.00	7.70	360.78	210.45	192.78	68.40	2.00	32.40
PataTakkali	7.5	36.7	2090	1400.23	1.6	24.89	59.12	90.12	470.89	275.40	260.23	130.45	12.00	46.99
Palasa	7.9	34.7	1780	1110.5	1.3	10.00	56.23	9.00	260.49	192.60	175.45	146.85	7.00	58.12
Kasibugga	7.5	35.1	2800	1790.8	1.5	0.50	118.45	32.12	570.86	359.40	350.46	130.00	1.50	14.25
Mellyapatti	7.6	35.6	1250	800.23	0.3	5.80	47.52	9.12	218.78	77.80	69.12	70.12	0.50	93.56
Akkupalli	7.8	35.4	3000	1950	1.4	47.86	112.55	64.55	625.55	730.45	720.48	192.53	26.00	44.25
Bendi	7.4	35.6	1850	1200.5	1	6.60	44.45	62.91	340.12	217.45	210.52	83.00	18.50	35.45
Jallapalli	7.9	36.2	1880	1180.45	1.2	40.30	39.65	70.41	335.45	224.56	214.46	64.00	8.50	3.50
Kambalraddupeta	7.5	37.3	1870	1190.56	1.8	19.30	46.75	30.12	265.47	161.89	151.59	39.00	5.50	2.60
VojrapuKotturu	8.2	36.1	850	540.2	6.1	5.30	25.45	14.99	140.12	67.58	57.45	38.45	1.00	17.12
Boddapadu	8.1	37.3	1170	745	0.8	4.50	50.78	39.85	310.45	42.89	32.45	44.50	5.00	41.12
Laxmipuram	8.3	34.1	1750	1120.5	1.5	30.12	66.58	28.45	345.66	245.90	234.55	85.45	7.70	48.95

Bantu kotturu	7.7	36.7	2780	1790.5	1.2	40.04	100.12	49.65	540.35	390.75	380.75	97.46	5.90	40.52
Rattini	7.65	36.5	1600	1020.5	1	14.56	76.36	14.96	355.85	145.78	135.88	73.00	5.80	20.85
Ravivalasa	7.85	37.3	2000	1230.5	1.5	17.00	53.23	23.46	280.47	135.62	125.65	110.42	0.50	25.50
Sitapuram	7.55	35.6	1850	1180.6	1.6	18.45	71.25	34.12	380.56	196.45	186.47	112.23	6.90	36.70
Chihtapalli	7.88	35.8	1500	950	2.3	10.55	53.00	56.45	360.50	133.75	123.44	58.85	6.80	26.72
Ampuram	7.95	35	1460	920.8	0.92	19.00	49.55	69.23	380.45	121.21	111.66	37.84	12.50	-0.89
Kodandapuram	7.7	34.8	3780	2450	2.5	44.25	127.75	241.78	1150.10	970.85	970.44	240.56	1.50	29.07
Gopalapuram	7.9	34.8	1700	1070	0.99	1.50	72.45	19.95	350.41	210.56	200.12	69.70	7.70	17.22
Sitapuram	7.8	36.4	1200	780.7	0.88	6.50	30.25	44.89	235.69	70.58	60.12	82.30	1.50	20.25
Polavaram	7.7	36.6	1500	960.3	0.95	0.50	33.45	79.90	330.45	126.94	120.45	46.52	1.90	55.66
Lingalavalasa	7.3	35.2	1800	1140.7	1.5	10.50	70.41	85.90	500.00	182.75	179.23	68.85	5.50	-0.93
Parasurapuram	8.35	34.8	1350	850	0.9	0.05	47.75	40.12	290.00	50.12	40.12	15.30	1.50	20.30
Kerasingi	8	35.9	1090	700	0.7	3.45	36.25	42.36	230.12	77.86	68.12	82.12	3.50	25.88
Poluru	7.5	34.5	1280	800	0.88	10.55	57.45	56.49	380.47	105.75	95.45	66.23	2.90	33.99
Rajapuram	7.9	36.8	1850	1180	1.4	20.00	70.89	22.33	345.85	218.90	210.12	46.75	26.00	52.45
SavaraBanapuram	8.4	36.8	940	600	0.6	0.50	26.82	8.90	130.44	42.35	32.45	50.30	1.50	20.65
Rsarasalli	7.8	36.5	2500	1600	1.7	34.45	79.65	74.71	510.12	300.45	300.12	201.23	8.00	145.88
Sandaipeta	7.9	34.9	850	570.8	0.8	2.99	20.45	52.19	205.12	56.12	49.88	42.45	1.00	30.88
Summadevi RS	7.5	34.2	2560	1650.45	0.9	45.85	104.24	124.45	740.78	410.75	410.45	79.56	2.00	70.41
Rajam	7.9	35.3	2400	1530.45	0.7	1.85	66.45	26.54	340.78	460.85	460.52	288.55	16.50	10.55
Bugadapeta	7.8	34.9	1060	670.45	0.8	14.88	30.88	52.89	255.80	49.25	42.78	50.77	9.00	52.55
Katturu	7.4	34.9	3110	1340.5	2.5	25.55	65.90	11.10	305.45	250.40	245.36	127.92	32.50	16.33
Kottapeta	7.9	34.5	1430	950	1.5	8.81	30.45	15.89	160.44	63.20	56.98	158.54	0.90	6.50
Bavanapadu	8	35.2	700	450.8	0.9	6.50	26.36	13.80	140.80	25.82	18.74	23.61	7.50	13.12
Marlapadu	8.3	36.3	1450	930.6	0.8	4.50	22.08	10.77	114.89	63.94	56.85	156.45	1.50	40.12
ChinnaDokulopadu	8.1	34.3	1740	1110.5	1.4	44.77	64.78	30.12	340.78	210.76	210.25	67.89	5.50	1.55
Gunppalli	7.8	36	1200	780.45	0.5	8.30	32.74	32.00	210.53	90.22	83.65	38.45	1.90	18.12
Makarjola	7.5	34.7	1180	750.4	1.1	6.90	34.12	62.00	288.77	56.80	49.78	42.23	2.00	42.45
ChinnaHamsa	7.6	35.5	1850	1160.5	1.2	20.12	46.54	84.23	399.33	210.33	210.55	95.78	2.90	30.12
Bharankota	7.7	34.6	1700	1070.8	1.1	26.56	52.41	86.42	421.66	135.74	129.45	42.78	7.70	48.78
Murrpintihadra	7.8	34.3	1750	1120	1.6	26.45	23.05	84.05	293.44	210.66	210.33	79.46	83.50	47.52
Umilada	7.6	36.4	3050	1950.8	1.8	29.89	86.45	35.12	441.25	355.90	349.00	137.80	0.06	26.25

PREPERATION OF WATER QUALITY MAPS:

The locations of the various points in the city are collected such as the location of each village in the study area is collected by using hand held GPS trackers. The latitude longitudes of these points are noted in a tabular form.

COORDINATE REFERENCE SYSTEM:

It is the reference system of points i.e., any point collected on the ground refers to a certain point the points are calculated as a distance from one fixed point each country has its own coordinate reference system. One need to specify this system in order to locate the points collected in site exactly place at the respective points in maps.

Figure 2. Villages map of the Study area

The points are thus located in the map and then the area of interest is located on map by tracing and joining feature boundaries by using add feature option which is located in toolbar of Arc GIS 10.3 and then the area is clipped in order to get only the area that we are opted to study this layer may be saved as different shape file the data now obtained is the vector data.

COLLECTION OF COORDINATE POINTS:

The coordinates of the bore wells present in each village of the Nandigam region are found by using the hand held GPS tracker. The presence of bore wells in the areas are known previously and then their location with latitude and longitude are located just by placing this instrument over that and by just tracing the location these data is noted down in a prescribed manner for future use. The trackers works on the CRS principle i.e., the locations are given corresponding to the CRS of our country.

MAPS OF VARIOUS PROPERTIES IN pH:

pH might be characterized as the negative logarithm of the hydrogen particle focus estimated in moles per liter. Acidic water has a pH below 7; alkaline water, above 7. The health effects of pH on drinking water depend upon where the pH falls within its range. The U.S. Environmental Protection Agency, which classifies pH as a secondary drinking water standard, recommends a pH between 6.5 and 8.5 for drinking water.

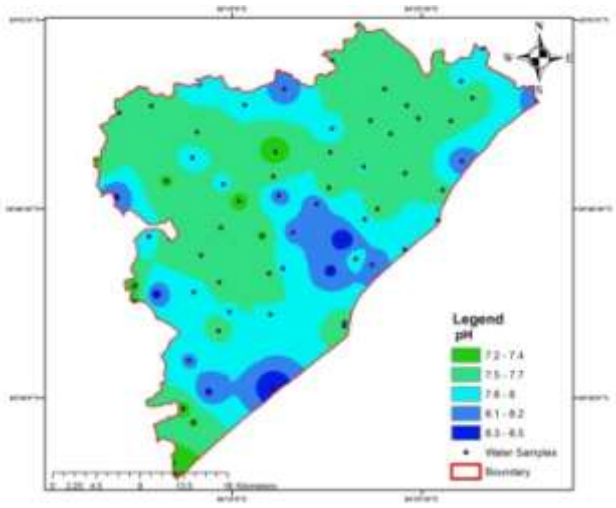

Figure 3.pH map of the Study area

SULPHATES CONTENT IN CONSIDERED AREA:

Sulfate may have a diuretic impact that can prompt drying out and is of exceptional worry for newborn children. With time, individuals and youthful domesticated animals will move toward becoming accustomed to the sulfate and the side effects vanish. Sulfur-oxidizing microbes represent no known human health risk. The Maximum contaminate level is 250 mg/L.

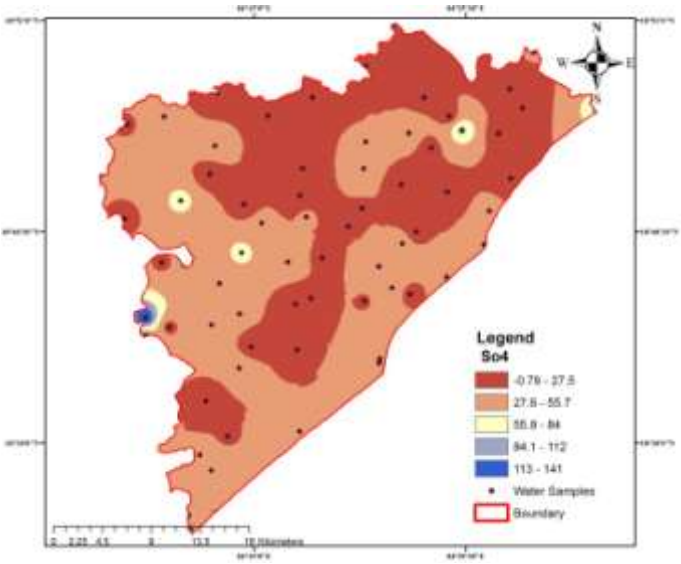

Figure 4. So_4 map of the Study area

CHLORIDES CONTENT IN CONSIDERED AREA:

Chloride is not toxic to human's health at low levels but does pose taste and odor issues at concentrations exceeding 250 mg/l. The good news is that chlorides can easily be removed from water with either a reverse osmosis system or a distiller.

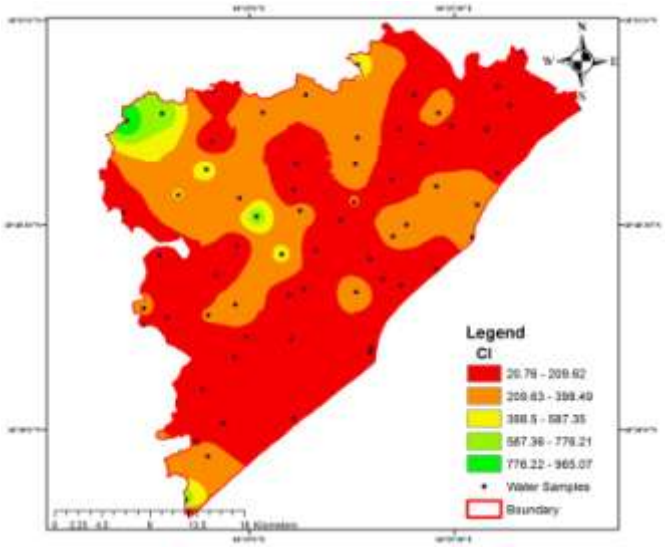

Figure 5.Cl map of the Study area

TOTAL HARDNESS CONTENT IN CONSIDERED AREA:

Total hardness is the combination of carbonate and bicarbonate hardness. Carbonate hardness caused duo to the presence of carbonates and bicarbonates of calcium and magnesium bicarbonate hardness is caused due to the aluminates and sulphates of calcium and magnesium.

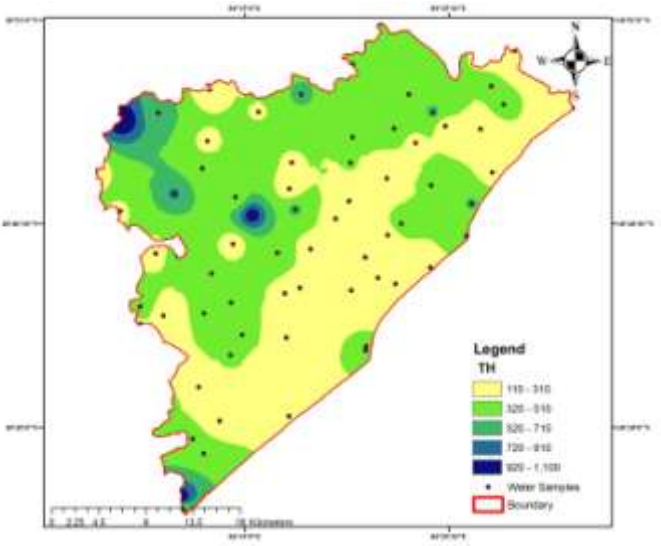

Figure 6. TH map of the Study area

TOTAL DISSOLVED SOLIDS DISTRIBUTION MAP:

A total dissolved solid (TDS) is a measure of the combined content of all inorganic and organic substances contained in a liquid in molecular, ionized or micro-granular (colloidal sol) suspended form. Total dissolved solids are differentiated from total suspended solids (TSS), in that the latter cannot pass through a sieve of two micrometers and yet are indefinitely suspended in solution The two principal methods of measuring total dissolved solids are gravimetric analysis and conductivity Total dissolved solids are normally discussed only for freshwater systems, as salinity includes some of the ions constituting the definition of TDS.

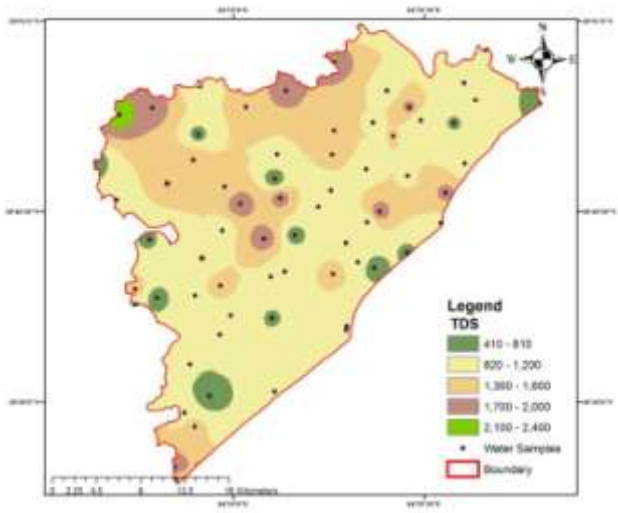

Figure 7. TDS map of the Study area

MAP REPRESENTING THE SODIUM CONTENT:

Sodium is a typical component in the regular habitat and is frequently found in sustenance and drinking-water. In drinking water, sodium can happen normally or be the consequence of street salt application, water treatment chemicals or particle trade softening units. Sodium isn't thought to be lethal. The human body needs sodium with a specific end goal to keep up circulatory strain, control liquid levels and for ordinary nerve and muscle work. Sodium is a mineral commonly found in food and water. Your body needs sodium daily to regulate fluids, maintain blood pressure, and for muscle and nerve functions. If the sodium concentration in your drinking water is 20 mg/L, drinking up to 2 liters of water per day will add 40 mg of sodium to your diet, about 2% of a teaspoon of salt. For healthy adults, this sodium level in drinking water does not pose a risk.

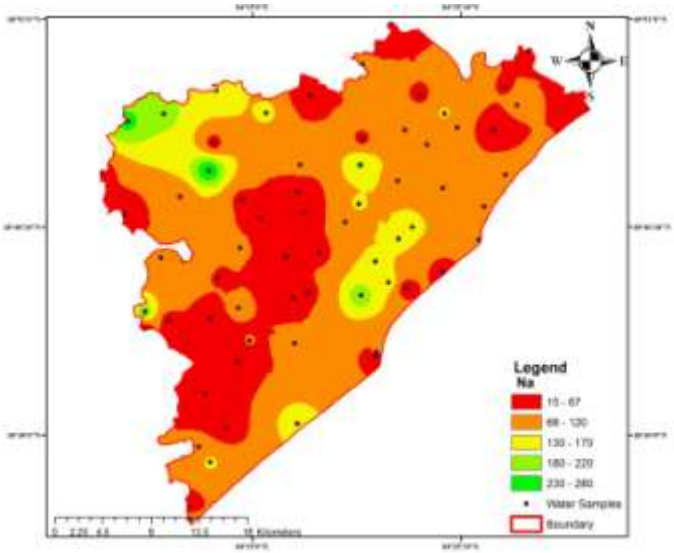

Figure 8. Na map of the Study area

MAP REPRESENTING THE CALCIUM CONTENT IN THE AREA CONSIDERED:

Calcium is LIKELY SAFE for the vast majority when taken by mouth or when given intravenously (by IV) and fittingly. Calcium can cause some minor symptoms, for example, burping or gas.

Calcium is perhaps hazardous for the two grown-ups and kids when taken by mouth in high measurements. Abstain from taking excessively calcium. The Institute of Medicine sets the day by day passable upper admission level (UL) for calcium in light of age as takes after: Age 0-6 months, 1000 mg; 6 a year, 1500 mg; 1-8 years, 2500 mg; 9-18 years, 3000 mg; 19-50 years, 2500 mg; 51+ years, 2000 mg. Higher dosages increment the shot of having genuine symptoms.

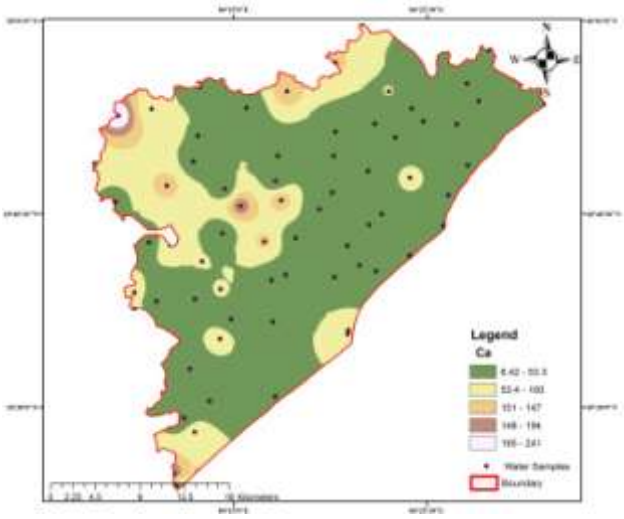

Figure 9.Ca map of the Study area

Hydrogen carbonate DISTRIBUTION MAP:

Carbonate hardness, or carbonate alkalinity is a measure of the alkalinity of water caused by the presence of carbonate (CO2−3)and bicarbonate (HCO−3) anions. Carbonate hardness is usually expressed either as parts per million (ppm or mg/L), or in degree KH (dKH) (from the German " Hydrogencarbonat ").

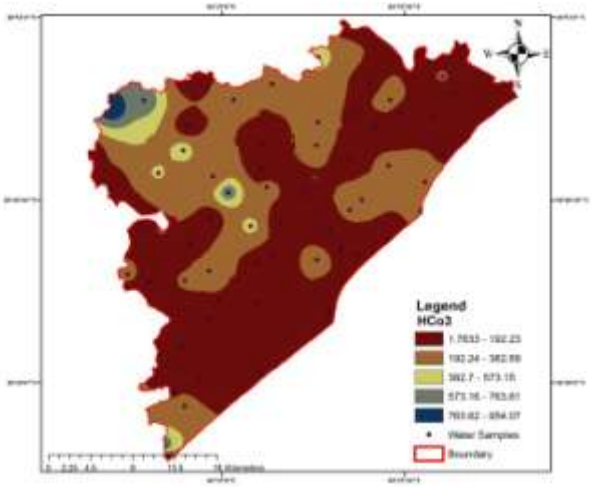

Figure 10. HCo_3 map of the Study area

Results and conclusions:

Table 2: Area within and beyond limits of various parameters

Parameter	Area within the limits km^2	Area beyond the limits km^2
pH	926.10	60.80
CHLORIDES	810.29	170.61
SULPHATES	742.12	244.78
CALCIUM	651.52	335.38
MAGNESIUM	586.52	400.38
TOTAL DISSOLVED SOLIDS	529.34	457.56
TOTAL HARDNESS	626.61	360.29

In the present investigation an attempt was made to evaluate and to map ground water quality of NandigamMandal region. Spatial distribution of ground water parameters was carried out through GIS. These groundwater quality maps are useful in assessing the usability of the water for different purposes. Moreover the maps are made in easily understood format using the GIS. It is demonstrated that most of the examples exhibited a pH esteem inside the greatest allowable breaking point, with the exception of maybe a couple tests which mirrored a pH esteem surpassing this utmost. The Water Quality Index is a very useful and an efficient tool to summarize and to report on the monitoring data to the decision makers after any disasters in order to be able to understand the status of the groundwater quality; and to have the opportunity for better use in future as well. From the above maps it is easily understood the quality scenario of the ground water distribution in our area. One can without much of a stretch access the properties of water. It is seen that some of parameters are exceed in some of the regions in such regions the remedial measures may be taken in order to reduce the effect of the water. It is seen that from maps the water is somewhat within limits in regions of Naupada, Byipalli, Akkupalli, Amalpadu. The water in these regions is within parameters.

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