International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

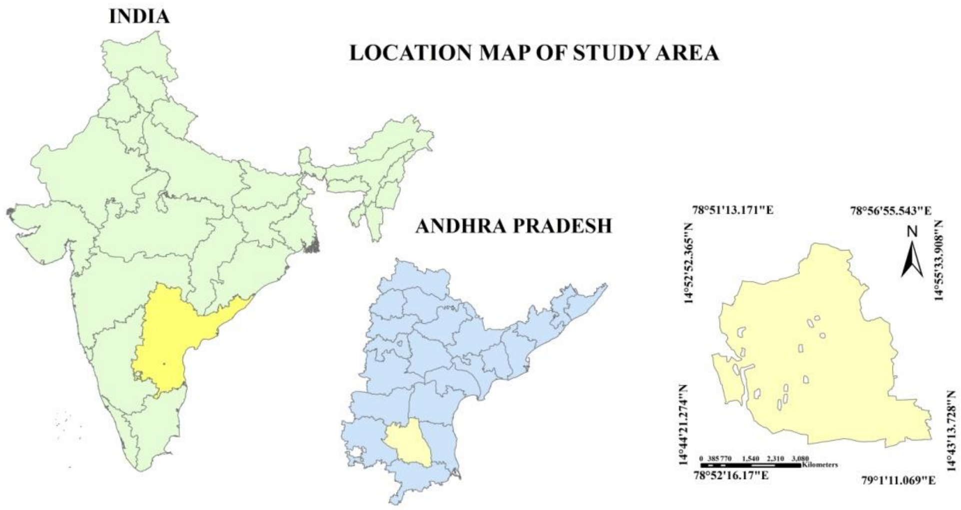
Hydrogeochemical studies of Brahmamgari Matham Mandal, YSR (Kadapa) District – A case study.

S. Srinivasa Gowd, V. Purushotham, K. Rajasekhar and B. Rajesh
Dept. of Geology, Yogi Vemana University, Kadapa – 516005, A.P.

ABSTRACT

Drinking water is an important resource that needs to be protected from pollution and biological contamination. Water is vital to health, well-being, food security and socioeconomic development of mankind. Underground water is clean but it depends upon quality and quantity of minerals dispersed and dissolved in it. Therefore, the presence of contaminants in natural fresh water continues to be one of the most important environmental issues in many areas of the world, particularly in developing countries where several communities are far away from potable water supply. Low- income communities, which rely on untreated surface water and groundwater supplies for domestic and agricultural uses are the most exposed to the impact of poor water quality. The aim of this study is to conduct an assessment of the Hydrogeochemical Studies of Brahmamgari Matham Mandal, YSR District, Andhra Pradesh, using Remote Sensing Techniques. The proposed study area in the Brahmamgari Matham Mandal of YSR District and is shown in the figure 1. The study area falls in the survey of India Top sheet No: 57 J/14 & J/15. Twenty three samples of ground water using for drinking purpose were collected from either hand pumps or open wells at different villages of Brahmamgari Matham Mandal of YSR District, during the summer season month of February 2016. The pH of ground water in the study area is ranging from 7.2 to 8.6. The total hardness of the groundwater in the study area is ranging from 90 to 330 mg/l. Water hardness is primarily due to the result of interaction between water and the Geological

formation. The calcium concentration of



Groundwater in the study area is ranging from 20 to 140 mg/l during the post-monsoon period. The chloride concentration of the ground water in the study area ranging from 81 to 802 mg/l during post-monsoon period. The Carbonate concentration ranges from 6.0 to 100 mg/l and the bicarbonate concentration of the groundwater in the study area in ranging from 48.8 to 536.8 mg/l during the pre-monsoon period. The fluoride concentration of the groundwater in the study area ranging from 0.73 to 2.93 mg/l during the pre-monsoon period. Low concentration of fluoride (0.73 mg/l) is observed in P.C. Palle village and high concentration of fluoride (2.93 mg/l) is observed T.Sundrupalli village. Proper deflouridation techniques have to follow to monitor fluoride contamination.

INTRODUCTION

Drinking water is an important resource that needs to be protected from pollution and biological contamination. Underground water is clean but it depends upon quality and quantity of materials dispersed and dissolved in it. Water picks up impurities in during its flow, which are harmful to man and vegetation. The reason for contamination and pollution of water in the natural surroundings and in the storage are pesticides, fertilizers, industrial wastes, inorganic and organic salts from top soil and geological strata (Nanoti, 2004). The domestic water bodies are being used for cattle drinking, human bathing, cloths washing and other domestic purposes. The quality of groundwater is highly related with local environmental and geological conditions. The quality of soil and rock and the water table determines the quality of groundwater. Groundwater constitutes an important source of water for drinking, agriculture and industrial production. The use of groundwater has increased significantly in the last decades due to its widespread occurrence and overall good quality. The contribution from groundwater is vital; because about two billion people depend directly upon aquifers for drinking water, and 40 percent of the world's food is produced by irrigated agriculture that relies largely on groundwater (Morris et al., 2003). Despite its importance, contamination from natural, human activities, steady increase in demand for water due to rising population and per capita use, increasing need for irrigation, changes in climates and overexploitation etc., among others has affected the use of groundwater as source of drinking water.

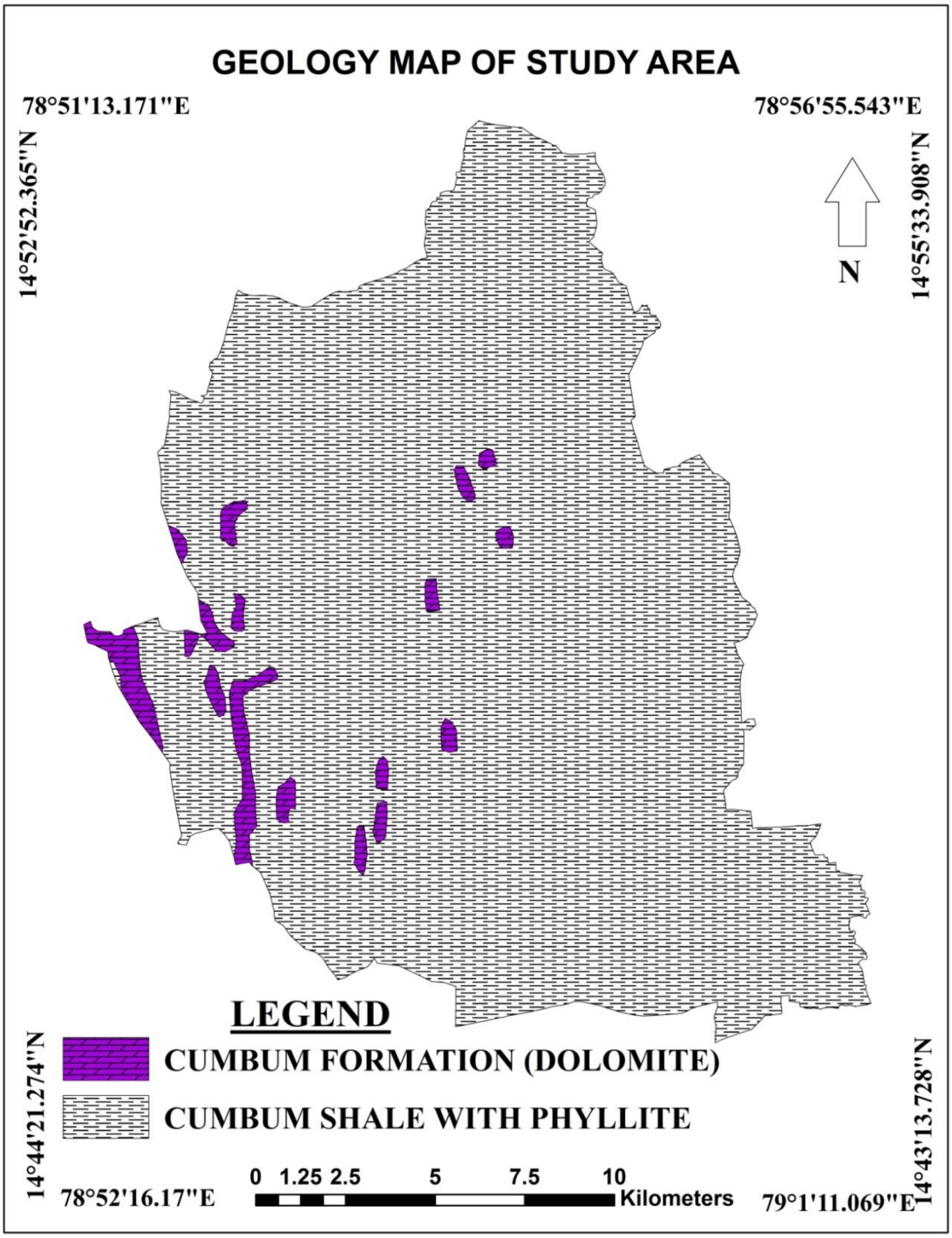
Multidisciplinary scientific integrate surveys were generally carried out to quantify the resource potential of the area, to know the status of exploitation of resources and to identify any degradation due to unscientific management. The investigation agents broadly outline the development options based on available resources. The thematic maps produced on resources will enable planners to formulate programme to optimize productivity from existing resources, and to initiate measures to correct imbalances due to unscientific management and inherent deficiency. Environmental mapping and resource evaluation survey of Brahmamgari Matham Mandal of YSR District is taken up identification of areas for further development.

Analysis of remotely sensed data for drainage, geological, geomorphological and lineament characteristics of terrain in an integrated way facilitates effective evaluation of ground water potential zones. Similar attempts have been made in the generation of different thematic maps for the delineation of ground potential zones in different part of the study area. (Obi Reddy et al., 1994; Krishna Murthy and Srinivas, 1995; Rao et al;, 1996; Srinivasa Gowd et al., 1998). A total of three thematic maps such as geological, geomorphological and hydrological maps were prepared based on image interpretation studies with limited field checks and analysis of available database (Fig.2,3&4). The lithological map portays distribution of several of rock types and structural maps shows the structural frame work of the area. The geomorphology map depicts the various landforms evaluate through timely by geomorphic process and is a basic input to evaluate resource potential associated with the landforms. The hydrological map provides a basis for potential and non potential areas for groundwater development based on geomorphological, geological and structural information.

Objectives

- The present study aims to generate different thematic maps using satellite data along the ancillary data (Geology, Geomorphology, and Geohydrology).

- To prepare action plan for water resources
- Assessment of water quality by studying hydrogeochemistry.



Study Area

The climate of the study area is hot and semiarid. The monthly maximum, minimum and mean temperature as measured at Kadapa are

44°C, 14°C and 27°C respectively. The mean annual rainfall recorded at the Kadapa is 759 mm. The YSR district is aptly called the district of Pennar as almost the entire district is drained by the Pennar River and its tributaries. The important tributaries joining the river from the north include the rivers Kunderu, Sagileru and Tummalavanka while those from the south include the rivers Chitravati, Papaghni, Buggavanka, Cheyyeru, and Kalletivagu. Bahuda, Mandavi, Pukkangi and Gunjaneru are the tributaries of the Cheyyeru. The rivers and streams in the district are mostly ephemeral under the influence of heavy spells of rainfall by cyclonic storms in the Bay of Bengal (MRK Reddy et al., 2000). The study area falls in the Survey of India Toposheet No: 57 J/14and J/15. Sample location of the study area is shown in figure 1.

Geology

The oldest rocks of the area belong to Late Archaean or Early Proterozoic era which are succeeded by rocks of Dharwarian Age and both are traversed by dolerite dykes (Murthy et al., 1979). The older rocks are overlain by rocks of Cuddapah Supergroup and Kurnool Group belonging to Middle and Upper Proterozoic Age. The main lithologic units consist chiefly of quartzite, limestone, and shale. Alluvium consisting of gravel, sand, silt and clay occur along the river courses in the study area.

GROUP	**FORMATION**	**LITHOLOGY**
	Nandyal Shales	Shale
	Koilkuntla Limestone	Limestone
Kurnool Group	Panyam quartzite	Quartzite

---Unconformity--------------------------

Nallamalai Group	Cumbum formation	Shale with Dolomite Shale with Phyllite
	Bairenkonda quartzite (Nagari)	

---Unconformity---------------------------

PENINSULAR GNEISSIC COMPLEX Granite Gneisses, Schist, Granitoids with acidic and basic intrusive

Cuddapah Supper Group

The Cuddapah Super Group is represented by thick sequence of sedimentaries unconformabally overlain by the place or basement complex. In the study area Cuddapah Super Group is represented by rock types belonging to Papaghni group covering an area about 160 sq km.

Papaghni Group

This group is the lower most of the Cuddapah Super Group of rocks and has been divided into two mapable formations viz. Gulcheru formation and Vempalli formation. Gulcheru formation represents a group of clastic sediments.

Basic intrusives

These dykes are generally medium grained and consists mainly of plagioclase, pyroxenes. Field evidence shows that they are of two generation of dykes. The spectral characteristics of these litho units are tone, texture and linear ridge. These dykes are easily delineated during interpretation.

Geological Structures

Structures

Bedding, joints, faults, lineaments, folds, fractures are some of the structure elements interpreted using satellite imagery No: 57 J/14, and J/15. Dykes and faults, Lineaments are the most important structures developed in the area. The lineament either coincide with the drainage directions, alignment with the tanks, vegetation etc.

Bedding

Bedding is manifested by colour banding or compositional layering as observed the formation. The trend of the bedding varies from NW-SE to NNW-SSE with shallow dips (8^0-15^0) two wards NE or ENE.

Lineaments

In the central part of area a major lineament is abuting from Tipparajupalli to Pendlimarri. Another lineament is extending from Eguvapalli to Shivapalle. Quartz reefs is observed in this lineament.

Faults

The faults are manifested either dykes or displacement of the litho unit or Gulcheru quartzite, and Nandyal shale. Another major fault is EW trending, extends from Diguvapalle to Jangamreddipalle.

Joints

Occurrence of Joints is prevalent in the quarzites of Gulcheru quarzites in the Venkateshapuram, Shivapalle. The trend of joints varies from EW, these are observed in these villages.

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

Geomorphology

Geomorphology involves study of landforms, reconstruction of process responsible for their origin and study of influence of tectonics in time space frame. The geomorphological mapping includes inventory and classification of landforms. Each landform depend by its composition depth of weathering structural frame and the environment which includes soil cover, hydrology and hydrogeology. The landforms are classified on the basis of mode of origin, relief slope factor and surface cover. The landforms occurring in the area as grouped as denudational hill, residual hill, pediment, pediplain, cuesta, structural hill, structural valley, and linear ridge.

Residual Hill

In Southern part of the area around Mittamidipalli, Kammavaripalli, Gollapalli isolated low relief hills around denudational hills have been demarcated. A number of linear basic dyke ridges evolved by difference erosional criss cross, the area in EW, NNE-SSW, ENE-SWS directions. Most of these ridges support scrubby vegetation.

Pediment

The pediment show 2^0-5^0 slope and associated with foot slope element of denudational hill, residual hill and ridges. The pediment is weathered considerably to the depth of few cm to 5 m. Thin coarse red and brownish sandy soils and skeletal gritty soil covered the pediments due to intensive sheet wash process operating in pediment area. The natural vegetation of the pediment comprise open scrub and grass land at places the pediments are under dry condition and groundwater condition is low to moderate.

Pediplain

It is gently sloping ramp of 2-5^0 slope originated by coalescence of several pediment and finally merges with major tributary stream valley and floodplain.

Hydromorphology

Ground water occurrence in hard rock terrain is confined to certain landform and fractures. As the aquifer material and alluvium is usually confined to certain landform. Further lineaments, landform development and their elevation and their elevation and distribution is controlled by faults, streams, segments and fractures. Structurally exclusive litho units like dykes and acidic intrusive, it is evident from the above factors it is imperative that detail landform mapping cum classification elevation and an understanding of morpho techniques is imperative for ground water exploration in hard rock terrain.

It is a map which depicts various aspects of geomorphology, geology and character of aquifers so as to have an idea of the possibility of ground water in different units. The hydromorphologic map is to be prepared by demarcating the geomorphic units as the landforms as an important input for land management, soil mapping and identification of potential zones of ground water occurrence. The geological details like lithology, rock types and structural details are also depicted on this map since this information is necessary in identifying the ground water potential. For instance pediment, pediplain without fractures, joints and lineaments normally moderate to poor ground water prospect where as the same geomorphic unit with a network of fractures, joints indicate good ground water prospects. Similarly pediplain area of crystalline/metamorphic rock is marked by poor to moderate ground water prospect where as the same unit in sandstone or limestone sedimentary rock may have a good to moderate prospect.

METHODOLOGY

Twenty seven samples of groundwater used for drinking purpose were collected from either ground water or surface water at different villages of Chennur Mandal of Kadapa District during post-monsoon season in the year 2015. This season was selected because in this season often contamination increases due to low dilution and this tends to the accumulation of ions. Before sampling, the water left to run from the source for few minutes. Then water samples collected in pre cleaned, sterilized polyethylene bottles of one litre capacity. The samples were analyzed to assess various physicochemical parameters according to APHA (2007).

RESULTS AND DISCUSSION

Water Quality Definition The concept of water quality is complex because so many factors influence in it. In particular, this concept is intrinsically tied to the different intended uses of the water; different uses require different criteria. Water quality is one of the most important factors that must be considered when evaluating the sustainable development of a given region. (Cordoba et al., 2010). Water quality

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

must be defined based on a set of physical and chemical variables that are closely related to the water's intended use. For each variable, acceptable and unacceptable values must then be defined. Water whose variables meet the pre-established standards for a given use is considered suitable for that use. If the water fills to meet these standards, it must be treated before use. Water quality is considered the main factor controlling health and the state of disease in both man and animals.

Factors Affected Water Quality

Water is vital to health, well-being, food security and socioeconomic development of mankind. Therefore, the presence of contaminants in natural freshwater continues to be one of the most important environmental issues in many areas of the world, particularly in developing countries, where several communities are far away from potable water supply. Low-income communities, which rely on untreated surface water and groundwater supplies for domestic and agricultural uses are the most exposed to the impact of poor water quality. Unfortunately, they are also the ones that do not have adequate

Table: 1 Physico Chemical Parameters of ground water of the study area

Sample No	pH	EC (μs)	TDS (ppm)	Chloride Mg/L	Total Hardness	Carbonate CO_3	Bi Carbonate (HCO_3)	Calcium Mg/L
1	8.0	1060	360	81	100	42	48.8	64
2	7.6	1470	750	266	110	6	231.8	52
3	7.5	1170	600	166	190	24	195.2	52
4	7.8	1450	740	287	170	6	122	60
5	8.2	2720	1390	418	190	12	256.2	44
6	7.5	1250	640	152	100	60	158.6	92
7	7.2	1890	960	472	120	24	146.4	140

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

8	7.8	1020	518	166	110	18	134.2	68
9	8.0	2620	1340	543	110	42	219.6	76
10	8.0	2420	1240	454	110	72	219.6	24
11	8.2	1580	810	280	140	36	207.4	16
12	7.6	3030	1550	589	190	6	183	96
13	8.6	3420	1750	497	100	30	378.2	40
14	7.6	3500	1780	568	130	24	244	44
15	8.4	5410	2790	802	330	30	536.8	84
16	7.4	2710	1400	482	120	30	219.6	52
17	7.2	1840	930	266	100	100	219.6	76
18	8.0	2680	1370	383	90	84	292.8	20
19	8.0	2440	1280	355	100	54	256.2	52
20	8.0	1610	830	198	140	12	207.4	40
21	7.8	9080	467	131	170	12	109.8	68
22	7.6	4290	2210	500	90	24	402.6	56
23	8.4	8970	460	131	120	66	109.8	48

infrastructure to monitor water quality regularly and implement control strategies. (Ayoko et al., 2007; Kazi et al., 2009) reported that human activities are a major factor determining the quality of the surface and groundwater through atmospheric pollution, effluent discharges, use of agricultural chemicals, eroded soils and land use. Environmental pollution, mainly of water sources, has become public interest. The chemical composition of ground water is controlled by many factors that include the composition of precipitation, mineralogy of the watershed and aquifers, climate and topography. These factors can combine to create diverse water types that change in composition spatially and temporally. (Chenini I and Khemiri S., 2009). Exploitation of groundwater resources beyond their potential renewal capacity, results in a hydrological deficit. Generally, this is expressed as a decline in groundwater levels but in coastal aquifers this may cause intrusion of seawater.

Concept of Ground Water Quality

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

The concept of ground water quality seems to be clear, but the way of how to study and evaluate it still remains tricky. (Chenini I and Khemiri S., 2009). (Badiker et al., 2007), Consider that the definition of water quality is not objective, but is socially defined depending on the desired use of water. Different uses require different standards of water quality.

Safe Drinking water: Potable or "drinking" water can be defined as the water delivered to the consumer that can be not used for drinking, cooking.Only used washing. This water must meet the physical, chemical,

bacteriological and radionuclide parameters when supplied by an approved source, delivered to the consumer through a protected distribution system in sufficient quantity and pressure. (Zuane J., 1997).

Water Quality Standards/Guidelines: 2.2.1 The Guideliness for drinking-water quality: The Guideliness describe reasonable minimum requirements of safe practice to protect the health of consumes and/or derive numerical "guideline values" for constituents of water or indicators of water quality. In order to define mandatory limits, it is preferable to consider the guidelines in the context of local or national environmental, social, economic and cultural conditions (WHO, 2008).

Table 2. Water Sample Locations

SAMPLE NO	NAME OF THE VILLAGE	LATITUDE	LONGITUDE
1	Mallepalli 1	14⁰50'29.9"	78⁰50'33.3"'
2	Mallepalli 2	14⁰51'33.3"	78⁰52'28.1"
3	B.Matham 1	14⁰48'57.8"	78⁰52'0.96"

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

4	B.Matham 2	$14^0 48'56.6''$	$78^0 52'08.4''$
5	Papireddi palli 1	$14^0 50'1.18''$	$78^0 54'22.6''$
6	Papireddi palli 2	$14^0 52'12.3''$	$78^0 55'55.6''$
7	T.Sundrapalli 1	$14^0 49'51.7''$	$78^0 57'10.2''$
8	T.Sundrapalli 2	$14^0 49'51.6''$	$78^0 57'10.5''$
9	Mudumala	$14^0 54'20.9''$	$78^0 55'30.6''$
10	Godlaveedu	$14^0 48'27.0''$	$78^0 58'07.0''$
11	S.Gollapalli	$14^0 50'02.4''$	$78^0 52'40.1''$
12	Joukupalli	$14^0 51'58.2''$	$78^0 55'22.2''$
13	Gundapuram	$14^0 48'27.2''$	$78^0 58'06.9''$
14	Somireddipalli	$14^0 50'10.7''$	$78^0 54'22.4''$
15	G.Narsapuram	$14^0 49'00.6''$	$78^0 58'46.6''$
16	P.C. Palli	$14^0 49'00.6''$	$78^0 58'46.6''$
17	Errlapalli	$14^0 52'12.1''$	$78^0 55'55.6''$
18	Budavada	$14^0 47'63.9''$	$78^0 58'40.6''$
19	Diguva Nelatur	$14^0 48'58.1''$	$78^0 57'38.9''$
20	Eguva Nelatur	$14^0 45'28.8''$	$78^0 58'01.2''$
21	Narsampalli	$14^0 50'20.5''$	$78^0 52'40.0''$
22	Dirasavancha	$14^0 45'21.7''$	$72^0 59'32.4''$
23	Temple place	$14^0 45'77.3''$	$78^0 49'67.5''$

The Standard for drinking-water quality: By definition, a standard "a rule or principle considered by an authority and by general consent as a basis of comparison. It is something normal or average in quality and the most common form of its kind". A proper standard for drinking water quality is thus the reference that will ensure that the water will not be harmful to human health. The framework against which a water sample can be considered good or "safe" is a drinking water quality standard (Solsona F, 2002).

2.2.3 WHO Guidelines: The primary purpose of the Guidelines for Drinking-water Quality is the protection of public health. Water is essential to sustain life, and a satisfactory (adequate, safe and accessible) supply must be available to all improving access to safe drinking-water (WHO, 2008).

Salient features of major ion chemistry

Hydrogen Ion Concentration (pH)

The pH of water is very important of its quality and provides important piece of information in many types of geochemical equilibrium or solubility calculations (Hem, 1991). The limit of pH value for drinking water is specified as 6.5 to 8.5 (ISI, 1983).

In most natural waters, the pH value is dependent on the carbon dioxide-carbonate-bicarbonate equilibrium. As the equilibrium is markedly affected by temperature and pressure, it is obvious that changes in pH may occur when these are altered. Most ground waters have a pH range of 6 to 8.5 (Karanth, 1987). The pH of groundwater in the study area is ranging from 2.45 to 8.54. pH values for all the samples are within the desirable limits. It is observed that most of the groundwater is alkaline in nature. Though pH has no direct effect on the human health, all biochemical reactions are sensitive to variation of the pH.

Total Hardness

Hardness is an important criterion for determining the usability of water for domestic, drinking and many industrial purposes (Karanth, 1987) and results from the presence of divalent metallic ions, of which calcium and magnesium are the most abundant in the groundwater. Other elements could be included are strontium, barium and some heavy metals. These, however are seldom determined under usually present in insignificant amounts relative to calcium and magnesium.

The degree of hardness in water is commonly based on the following classification

Hardness classification of water
(After Sawyer and Mc Carty)

Hardness, mg/l as $CaCO_3$	**Water class**
0-75	Soft
75-100	Moderately hard
150-300	Hard
Over 300	Very hard

The total hardness of the groundwater in the study area is ranging from 80 to 880 mg/l. The limit of total hardness for drinking water is specified as 300 mg/l (ISI, 1983). Water hardness is primarily due to the result of interaction between water and the geological formations. Groundwater of the entire study area exceed the desirable limits. Granitic rocks significantly contribute to groundwater hardness.

Calcium

The range of calcium content in groundwater is largely dependent on the solubility of calcium carbonate, sulfate and rarely chloride. The solubility of calcium carbonate varies widely with the partial pressure of CO_2 in the air in contact with the water. The salts of calcium and magnesium are responsible for the hardness of water. The permissible limit of calcium in drinking water is 75 mg/l (ISI, 1983). The calcium concentration of the groundwater in the study area is ranging from 40 mg/l to 350 mg/l during pre-monsoon period.

Chloride

Chloride bearing rock minerals such as sodalite and chlorapatite which are very minor constituents of igneous and metamorphic rocks, and liquid inclusions which comprise very insignificant fraction of the rock volume are minor sources are chloride in groundwater. It is presumable that the bulk of the chloride in groundwater is either from atmospheric sources or sea-water contamination. Most chloride in groundwater is present as sodium chloride, but the chloride content may exceed the sodium due to base-exchange phenomena (Karanth, 1985) and also weathering of phosphate minerals and domestic sewage (Karanth, 1987). The upper limit of chloride concentration for drinking water is specified as 250 mg/l (ISI, 1983). The chloride concentration of the groundwater in the study area is ranging from 127.8 to 2016.4 mg/l during pre-monsoon period.

Total Alkalinity (CO_3 and HCO_3)

The primary source of carbonate and bicarbonate ions in groundwater is the dissolved carbon dioxide in rain, which, as it enters the soil, dissolves more carbon dioxide. An increase in temperature or decrease in the pressure causes reduction in the solubility of carbon dioxide in water (Karanth, 1989). The alkalinity of natural water is due to the salts of carbonates, bicarbonates, borates, silicates and phosphates along with hydroxyl ions in the free salt. However, the major portion of the alkalinity in natural water is caused by hydroxide, carbonate and bicarbonates, which may be ranked inorder of their association with pH values.

The bicarbonate concentration of the groundwater in the study area is ranging from 24.4 mg/l to 1146.8 mg/l during pre-monsoon period. The permissible limit of carbonate (CO_3) in drinking water is 10 mg/l and the rejection limit is 50 mg/l. The permissible limit of bicarbonate (HCO_3) in drinking water is 500 mg/l. (Todd, 1980). Most of the water samples of the study area contains no carbonate ions.

Conclusion

The pH of groundwater in the study area is ranging from2.45 to 8.54. pH values for all the samples are within the desirable limits. It is observed that most of the groundwater is alkaline in nature. The electrical conductivity of the groundwater is ranging from 357 µSiemens/cm-4180 µSiemens/cm at 25°C. The pH and EC were measured with pH meter and conductivity meter respectively. The Total Hardness of the groundwater in the study area is ranging from80 to 880 mg/l.

The limit of Total Hardness for drinking water is specified as 300 mg/l (ISI, 1983). Water hardness is primarily due to the result of interaction between water and the geological formations. Groundwater of the entire study area exceed the desirable limits. The calcium concentration of the groundwater in the study area is ranging from 40 mg/l to 350 mg/l during pre-monsoon period. The Mg concentration of the groundwater in the study area is ranging from ………during pre-monsoon period. The upper limit of chloride concentration for drinking water is specified as 250 mg/l (ISI, 1983). The chloride concentration of the groundwater in the study area in ranging from 127.8 to 2016.4 mg/l during pre-monsoon period. The bicarbonate concentration of the groundwater in the study area is ranging from 24.4 mg/l to 1146.8 mg/l during pre-monsoon period. The fluoride concentration of the groundwater in the study area is ranging from 0.411 mg/l to 6.18 mg/l during pre-monsoon period. Low concentration of fluoride (0.411 mg/l) is observed in Kalamalla village and high concentration of fluoride (6.18 mg/l) is observed in the village Peddanapadu. Proper defluoridation techniques have to be followed to monitor fluoride contamination.

References:

1. Apambire WB, Boyle DR, Michel FA (1997) Geochemistry, genesis, and health implications of fluoriferous groundwater in the upper regions of Ghana. Environ Geol 33(1):13-24.
2. APHA (2007) Standard methods for the examination of water and wastewater. American Public Health Association, Washington, DC.
3. Ayoko G. , Singh K. , Balerea S., Kokot S. ,(2007) , "Exploratory multivariate modeling and prediction of the physic – chemical properties of surface water and groundwater". Journal of Hydrology 336, 115- 124.
4. Babiker I. , Mohamed M. , Hiyama T. ,(2007) "Assessing groundwater quality using GIS". Water Resources Man agement 21,699 – 715.
5. BIS (1991), Specification for drinking water, IS: 10500:1991, Bureau of Indian Standards, New Delhi.
6. Chenini I. , Khemiri S. , (2009), "Evaluation of ground water quality using multiple linear regression and structural equation modeling". Int. J. Environ. Sci. Tech., 6(3), 509-519.
7. Frank RG. and Shannon M, (2005). Infant Methemoglobinemia: The Role of Dietary Nitrate in Food and Water. *Pediatrics.* 116:784.
8. ISI (1983). Drinking water standars, Table 1, Substance and characteristics affecting the acceptability of water for domestic use 18, 10500. Indian Standard Institution, New Delhi.
9. Todd DK. (1980). Groundwater Hydrology, Wiley-Indian Edition.
10. Krishnaswamy VS (1981) Geological and mineral map of Cuddapah basin. Geol Surv India.
11. Karanth KR (1989) Groundwater assessment, Development and Management. Tata McGraw-Hill, New Delhi, p 720.
12. Karanth, K. R., Jagannathan, V., Prakash, V. S. & Saivasan, V. (1992) Pegmatites: a potential source for sitting high yielding wells. J. Geol. Soc. India 39, 77-81.

13. Kazi T. , Arain M. , Jamali M., Jalbani N. , Afridi H., Sarfraz R ., Baig J., Shah A., (2009) "Assessment of water quality of polluted lake using multivariate statistical techniques: A case study". Ecotoxicology and Environmental Safety 72, 301 – 309.
14. Morris, B.L. et al. (2003), Groundwater and its susceptibility to degradation: a global assessment of the problem and options for management, Early Warning and Assessment Report Series.
15. Nanoti M, (2004). "Importance of water quality control in treatment and provision of safe public water supply", *National workshop on control and mitigation of excess fluoride in drinking water*, 5-7th Feb, 2004.
16. Ramakrishna Reddy M., Janardhana Raju N., Venkatarami Reddy Y., Reddy T.KV.K 2000 Water Resources Development and management in the Cuddapah district, India, Environmental Geology 39(3-4) January.
17. Solsona F., (2002). "Guidelines for Drinking Water Quality Standards In Developing Countries".
18. Srinivasa Gowd, S, Sudheer, A.S., Srinivasulu, S, and Sreedevi, P.D. (1998) Remote Sensing Analysis to Delineate Groundwater Potential Zones of Peddavanka Watershed, Anantapur District, A.P. Geographical Review of India 60, 145-154
19. S. Srinivasa Gowd (2005) 48, 702-712, Assessment of Groundwater Quality for Domestic and Irrigation Purposes: a case study of Peddavanka Watershed, Anantapur District, Andhra Pradesh, India Environmental Geology, 48 702-712.
20. Srinivasa Gowd, S and Govil, P.K. (2008). Distribution of heavy metals in surface water of Ranipet industrial area in Tamil Nadu, India, Environmental Monitoring and Assessment, 136, 197–207
21. Tambekar DH, Waghode SM, Ingole SG and Gulhane SR, (2008). Water quality index analysis of salinity affected villages from the Purna river basin of Vidarbha region. International Quarterly Scientific Journal Nature Environment and Pollution Technology, 7(4): 707 – 711.
22. World Health Organization, (2008), "Guidelines for drinking-water quality". Third edition.

23. Zuane J., (1997), "Handbook of Drinking Water Quality". Second Edition, John Wiley & Sons, Inc..