Assessment of Water Quality Index of Ground Water in Narsapur Mandal, Telangana

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Abstract

The present work is aimed at assessing the Water Quality Index (WQI) for ground water samples collected from 19 major villages of Narsapur mandal, Telangana state. Telangana state is classified as hard rock area where surface water resources are limited, with the result, groundwater has become a major source of supply to the village population. This has been determined by collecting ground water samples and subjecting the samples to a comprehensive physio-chemical analysis. In order to determine the quality of the water for drinking water purpose, following parameters were considered: Potential of hydrogen (pH), Total dissolved solids (TDS), Alkanity, Total hardness, Chloride, Fluoride, Nitrate, Sulphate and Iron. The results have been compared with the drinking water standard prescribed by Bureau of Indian Standard (BIS). All the physiochemical parameters are within the prescribed limit except Total Hardness for Chippalturthy village and Ibrahimbad village. Regular monitoring of groundwater quality, abolishment of unhealthy waste disposal practices and introduction of modern techniques were highly recommended. The Study also indicates the usefulness of WQI in estimating the drinking water quality of the ground water.

Keywords: Drinking water, Ground water, Narsapur Mandal, Physio chemical and Water Quality Index

I. INTRODUCTION

Water is an elixir of life. It is an important natural resource and is secondary requirement on the earth after fresh air to sustain life not only for survival of human beings, but also for animals, plants and all other living beings. Whenever one is dealing with water resources development and utilization, it has to be kept in mind that not only quantity of water but quality of water is also very important. Further, it is necessary that the water required must be good, and it should not contain unwanted impurities in it. India is a vast country with a total geographical area of 3287.263 km^2 which have numerous rivers traversing the land in every direction carrying the much needed water through dry and thirsty lands. Industrialization, urbanization, religious activities like taking bath and immersion of idol in holy rivers and illegal colonies in India has resulted the pollution of surface water. Recent research conducted by [1] showed that there was an increase in the demand for freshwater due to rapid growth of population as well as the accelerated pace of industrialization in the last few decades. This demand has led to the use of ground water not only for its wide spread occurrence and availability but also for its constituent good quality which makes it ideal supply of drinking water. Once the groundwater is contaminated, its quality cannot be restored by stopping the pollutants from the source. It therefore becomes necessary to regularly monitor the quality of groundwater. Drinking water has to meet certain fairly stringent quality standards and water quality is also important for agriculture and industrial uses. There are a number of methods to analyze water quality data that vary depending on informational goals, the type of samples, and the size of the sampling area. One of the most effective ways to communicate information on water quality trends is by use of the suitable indices. Water quality index is one of the most effective tools to communicate information on the quality of water to the concerned citizens and it incorporates the data from multiple water quality parameters into a mathematical equation that rates the health of the health of water in number. The objective of the water quality index is to make number of complex water quality parameters into information that is understandable to the public.

II. STUDY AREA

Narsapur Mandal is located in the centre of Medak District of Telangana state. It is located between 78.184929 and 78.330182 East Longitude and between 17.689183 and 17.812072 North Latitude. The average elevation is 593 meters (1945.5 feets) above sea level.The area is very rich in biodiversity. It is located 28 km east from district headquarters Sangareddy. Narsapur Mandal is well connected to many other locations in Telangana state, such as Sangareddy, Hyderabad, Medak either through directly or interlinked through intermediate locations. The highway network linking Narsapur Mandal to various part of the country is good. Two State highways pass through the Mandal : SH-6 and SH-17 which connects the Mandal to three National highways : NH-65, NH-44 and NH-161. There is no railway station near to Narsapur Mandal, however Secunderabad Junction railway station is major railway station 48 Km near to Narsapur. Sangareddy and Medak are the nearby towns to Narsapur having good road connectivity, 30 Km and 44 Km respectively from Narsapur Total population of Narsapur mandal is 47,919 living in 9241 houses, spread across 19 panchayats. Males are 24,159 and females are 23,760. Narsapur is too hot in summer. Narsapur's summer highest day temperature is in between 28^0C to 46^0C. In total 19 samples were collected each from 19 Villages. Groundwater in the study area occurs under water table to semi-confined conditions restricted to weathered and fractured formation. Telangana state is classified as hard rock area where surface water resources are limited, with the result, groundwater has become a major source of supply to the village population.

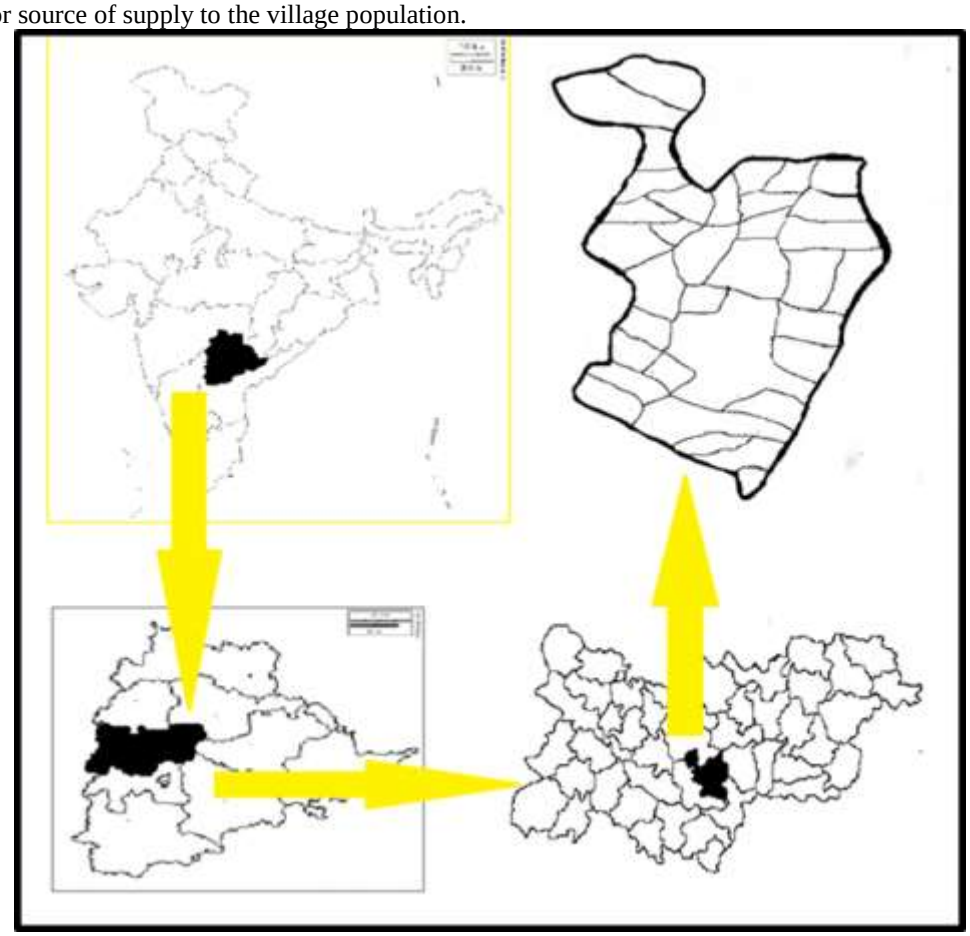

Fig. 1: Location of Narsapur Mandal

III. METHODOLOGY

A. Sample Collection

In order to assess the quality, forty groundwater samples were collected from hand pumps at different locations of Narsapur mandal, one sample from each village. Simplified techniques and methods for physio-chemical parameter are adopted which are given in American Public Health Association (APHA, 1998). Water sample were collected in hard polythene terephthalate bottles of 1 liter capacity. This bottles were properly washed with distilled water and then rinsed with the respectively water samples to ensure compositional originality of water samples. In case of hand pumps, prior to sampling water was pumped out for about 10 minutes. The initial pumping serves to remove water in contact with the metal-well casing from the well-bore and adjacent aquifers and allows for the collection of representative samples of water present in the aquifer. Water bottles were rinsed 3-4 times with water to be sampled and then filled to capacity, tightly sealed and labelled. Chemical parameters like Iron,

Fluoride, Chloride and Sulphates are analyzed in terms of mg/l using DR/850 colorimeter. pH, TDS, Total Hardness and Alkanity are analyzed by standard laboratory procedures recommended by BIS.

B. Water Quality Index

Water Quality Index is a very useful and efficient method for assessing the quality of water. WQI is very useful tool for communicating the information on overall quality of water because the quality of water does not depend on a single parameter. Parameter selection in calculating WQI has a great importance and consideration of too many parameters might unwiden the quality index. pH, Chloride, TDS, Fluoride, Total hardness, Nitrate, Alkalinity, Sulphate, Iron were recognized as preliminary indication of quality as is used in calculating quality index for public water supply [2]. The concept of water quality index (WQI) was introduced by Horten [3]. Water Quality Index has computed using the method proposed by Tiwari and Mishra [4]. According to them Quality rating (Q_n) is calculated as

$$Q_n = (V_{Actual} - V_{Ideal}) / (V_{Standard} - V_{Ideal}) \times 100$$

Where,

Q_n = Quality rating of the n^{th} water quality parameter.

V_{Actual} = Value of the water quality parameter obtained from laboratory analysis.

V_{Ideal} for pH = 7 and for other parameters it is equivalent to zero.

$V_{Standard}$ = Value of that water quality parameter can be obtained from the standards.

Unit weight was calculated by a value inversely proportional to the recommended standard value $V_{Standard}$ of the corresponding parameter

$$W_n = K / V_{Standard}$$

Where $K = 1 / \Sigma^n V_{Standard}$

To determine the suitability of the water for drinking purposes, an indexing system called Water Quality Index (WQI) has been developed from this water quality rating which is formulated as,

$$WQI = \Sigma Q_n W_n / \Sigma W_n$$

Based on the above WQI values, the ground water quality is rated as excellent, good, poor, very poor, and unfit for human consumption.

Table – 1
WHO, ICMR/BIS Standards

Water Quality Index Levels	*Description*
<50	*Excellent*
50 - 100	*Good water*
100 - 200	*Poor water*
200 - 300	*Very poor (bad) water*
>300	*Unsuitable and Unfit for drinking*

IV. RESULTS

The WQI of all the Nineteen sampling stations are calculated according to the procedure explained above and are presented in Table-2. This study was done to check the water quality in different villages of Narsapur mandal. On assessment of drinking water, Total hardness was more than 600 mg/lit for Chippalturthy and Ibrahimbad village, this was more than the Indian desired limits. However pH ranged 6.85 to 7.98 which were less than limits prescribed by Indian Standard (IS) desired limits. Similarly Chloride, Fluoride, Nitrate, Sulphate, Alkanity, TDS and Iron were found less than the BIS desirable limits. By studying table it was also observed that all parameters contents were less than the IS Permissible limits of Drinking water. In this research, the computed WQI ranges from 17.493 to 74.125. The minimum value was recorded for Chippalturthy village and maximum was recorded for Ramchandrapur village. It is observed that majority of ground water sample falls in the range of excellent quality category, indicating groundwater is fit for drinking purpose and no treatment is required prior consumption. Only three samples have falls in the range of good water quality category and can be consumed with minor treatment.

Table – 2
Groundwater Quality of Narsapur Mandal

Sample no	*Village*	*pH*	*TDS*	*Alkanity*	*Total Hardness*	*Chloride*	*Fluoride*	*Nitrate*	*Sulphate*	*Iron*	*WQI*
1	*Ahmednagar*	*7.43*	*759.85*	*440*	*496*	*246*	*0.08*	*1.6*	*32*	*0.08*	*31.85*
2	*Avancha*	*7.96*	*684*	*456*	*560*	*164*	*0.24*	*22.9*	*47*	*0.05*	*18.948*
3	*Brahmanpally*	*7.68*	*422*	*308*	*348*	*65*	*0.46*	*8.3*	*16*	*0.05*	*20.295*
4	*Chinachinthakunta*	*7.1*	*150*	*320*	*368*	*65*	*0.91*	*4.4*	*22*	*0.06*	*26.554*
5	*Chippalturthy*	*6.85*	*1078*	*564*	*608*	*121*	*1.04*	*5.7*	*80*	*0.02*	*17.493*
6	*Ibrahimbad*	*7.04*	*1603*	*1042*	*572*	*616*	*229*	*0.36*	*10.6*	*80*	*51.67*
7	*Khagazmaddur*	*7.58*	*864*	*524*	*568*	*62*	*0.75*	*10.1*	*46*	*0.12*	*42.364*
8	*Khajipet*	*7.98*	*689*	*452*	*496*	*150*	*0.67*	*11.9*	*48*	*0.26*	*74.125*
9	*Lingapur*	*7.11*	*427*	*260*	*300*	*62*	*0.34*	*9.2*	*27*	*0.12*	*33.317*
10	*Moosapet*	*7.87*	*795*	*480*	*530*	*144*	*0.68*	*6.1*	*34*	*0.08*	*25.706*

11	*Nagulapally*	*7.44*	*666*	*460*	*518*	*138*	*1.17*	*3.9*	*45*	*0.12*	*46.457*
12	*Narayanpur*	*7.60*	*795*	*488*	*532*	*144*	*0.68*	*6.1*	*34*	*0.12*	*41.439*
13	*Nathnaipally*	*7.06*	*586*	*392*	*436*	*60*	*0.72*	*13.2*	*27*	*0.15*	*48.835*
14	*Peddachinthakunta*	*7.96*	*424*	*268*	*312*	*85*	*1.3*	*8.1*	*44*	*0.05*	*29.778*
15	*Ramchandrapur*	*7.01*	*570*	*382*	*428*	*124*	*1.04*	*11.8*	*64*	*0.12*	*44.171*
16	*Reddypally*	*7.32*	*586*	*416*	*472*	*130*	*1.08*	*8.3*	*37*	*0.06*	*34.539*
17	*Rustumpet*	*7.26*	*562*	*340*	*388*	*144*	*0.81*	*13.2*	*42*	*0.16*	*52.782*
18	*Tujalpur*	*7.71*	*812*	*520*	*564*	*218*	*0.31*	*7.5*	*50*	*0.11*	*35.243*
19	*Narsapur*	*7.98*	*662*	*416*	*460*	*89*	*0.67*	*9.5*	*36*	*0.14*	*38.52*

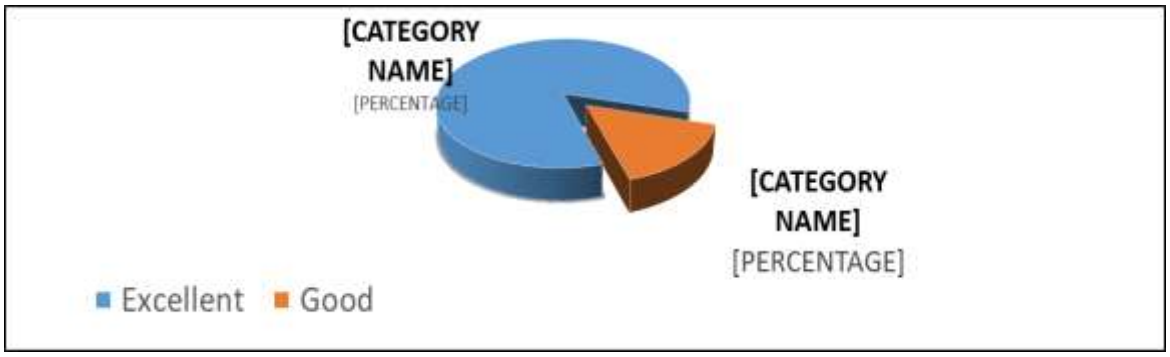

Fig. 2: Pie chart for WQI of Narsapur Mandal

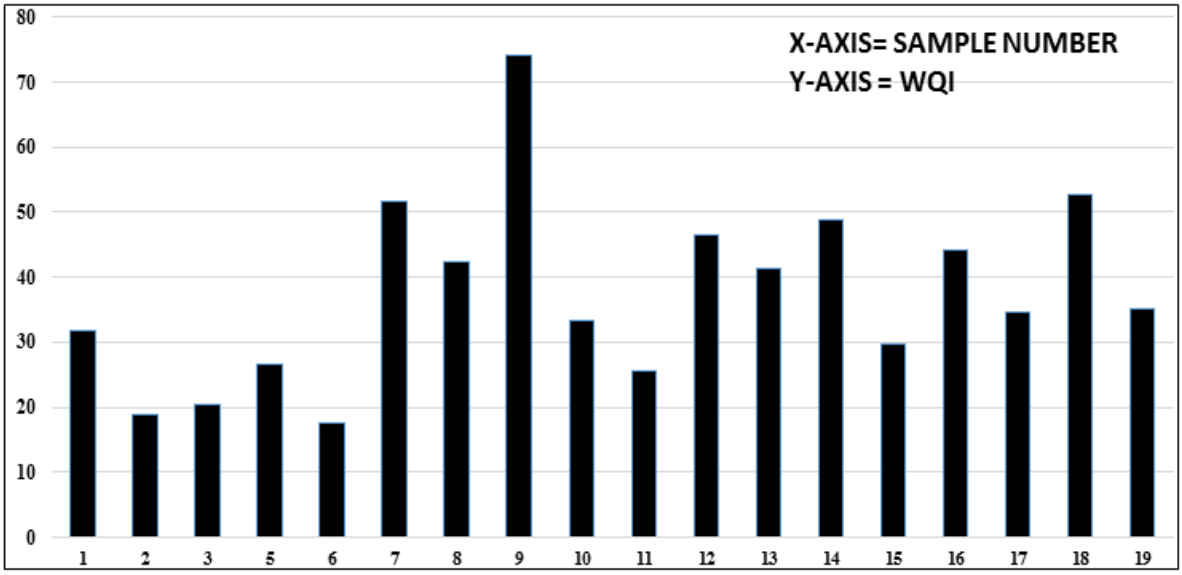

Fig. 3: Distribution of WQI in Narsapur Mandal

V. CONCLUSION

It is necessary that the drinking water should be pure. However the absolute pure water is not found in nature. Even the rain water which absolutely pure at the instant it is formed becomes impure because as it passes through atmosphere it dissolves. certain gases, traces of minerals, dust, bacteria, and various other substances, It is therefore essential to ascertain the quality of water available from the various sources to whether the water is potable or not. So to know the portability conditions various parameters like pH, Chloride, Total Hardness, Alkalinity, Iron, and Fluoride, Nitrate, Sulphate and Total dissolved solids were analyzed for the study area and tabulated. Underground waters are harder than the surface water, as they do have more opportunity to come in contact with minerals. The final output has given in the tabular representation of ground water quality suitable or unsuitable for drinking purposes in the area under study. Out of 19 villages only three villages contain ground water in 'Good' category and rest villages in 'Excellent' category. In sixteen villages, the ground water is fit for drinking and can be consumed without treatment. In remaining villages the water quality is in good condition as per WQI. The analysis reveals that the groundwater of the area needs slight degree of treatment before consumption. The use of water softening plant in Chippalturthy village and Ibrahimbad village is recommended. Regular monitoring of groundwater quality, abolishment of unhealthy waste disposal practices is suggested in Khajipet village. The Study also indicates the usefulness of WQI in estimating the drinking water quality of the ground water. It is also helpful for a common man to understand the drinking water quality.

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