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Spatial Distribution of Fluoride Concentration in Ground Water by Using GIS in Beed Taluka, Maharashtra

Anand S. Ghorpade[*] & Dr. R.M. Damgir[**]

PG Student, Department of Civil Engineering, Government College of Engineering, Aurangabad, India

****Associate Professor, Department of Civil Engineering, Government College, Engineering Aurangabad, India***

ABSTRACT:

Ground water is the major source of fresh water on the earth. Most of the people in rural areas depend on ground water for drinking water. Because of the variation in fluoride concentration in ground water, the water may cause severe health problem to human beings so for the study of fluoride concentration nine groundwater samples were collected from different locations and fluoride ion concentration was studied every month during Janurary2015 to April 2015. Location and altitudes of these bore wells were also obtained using GPS instrument. Fluoride concentration is tested using spectrophotometer in laboratory and its spatial distribution mapping has been done using GIS tool for the study area. The fluoride ion concentration ranged from the study area is 0.17 to 0.77 mg/l. The results show that most of the places of the study are affected by fluoride concentration.

Keywords - Groundwater, fluoride level, Beed taluka, spectrophotometer, GIS.

1. INTRODUCTION

Water plays vital role in human life. It is extremely essential for survival of all living organism. Fresh water occurs as surface water and ground water. In this, ground water contributes only 0.6 % of total water resources. The sources of surface water are like pond, river and sea are available for agriculture, domestic and domestic purposes. In India depends mainly on ground water for drinking and agriculture. Withdrawal of ground water has led to the spectra of depleting the problem of water .Fluoride is widely present in nature of soil, water, air, vegetation, agricultural products and sea foods.

The fluorides belong to the halogen group of minerals and are natural constituents of the environment. Fluorides are mainly found in ground water when derived by the solvent action on the rocks and the soil of the earth's crust. Fluoride in drinking water cannot be detected by taste, sight or smell. The Indian council of Medical Research (1975) has gives the desirable limit of fluoride is 1.0 ppm and maximum permissible limit is 1.5ppm. The Bureau of Indian standard has recommended the limit of 1.5ppm.

The objective of present study is to determine the fluoride content of drinking water of the study area to understanding the awareness among the people about the people about quality of water which causes fluorosis.

Table -1 Permissible limit of fluoride in drinking water

Name of organisation	Desirable limit (mg/l)
Indian Standards: 10500	1.0 to 1.5
Bureau of Indian Standard (BIS)	1.0
The Committee on Public Health Engineering Manual and Code of Practice, Government of India	1.0
WHO	1.5

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2. STUDY AREA

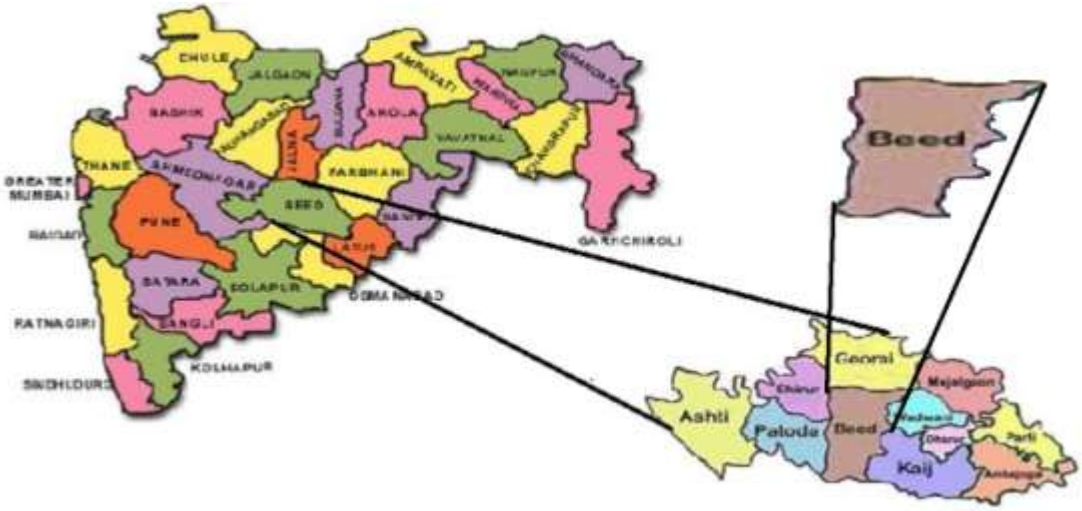

Fig.1- Location of study area.

Beed is one of the district of Maharashtra. It is bounded by north altitude 18^{o} 28' and 19^{o} 20'and east longitude between 74^{o} 48' and 76^{o}45'. The major part of the district comes under Godavari basin .Godavari, Manjra and Sindhafana are the major rivers that the district along with their tributaries.

The climate of the district is characterized by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e. June to September. The temperature rises rapidly after February till May is 42.0^{o}C and the mean daily minimum temperature during December is 12.0^{o} C. The normal annual rainfall varies from about 600 to 800 mm.

The area experiences hot summer and general dryness throughout the year except during the south west season (i.e. June to September). The areas under study is mostly cultivated cotton, soyabean, jawar are grown. The main purpose of this study is to highlight the excess fluoride level in the groundwater of this area.

3. GEOLOGY OF STUDY AREA

The district can be broadly divided into 3 physiographic units namely; Lowland Beed, Highland Beed and Sina basin. Lowland Beed is the low lying northern part comprising a part of Godavari valley and is also known as Gangathari. It has a general elevation ranging from 400 metre above mean sea level (m amsl) in the east to 500 (m amsl) in the west with number of residual hills reaching upto 600 (m amsl).

In the district, rocky and thin layered soils are observed in major part of the district except on the banks of Godavari and Sindphana Rivers, where dark brown to black and clayey loamy to loamy soils are observed. The nutrient levels in almost all the soils are low.

The major part of the district is covered by Basaltic flows commonly known as Deccan Traps of Upper Cretaceous-Lower Eocene age. Alluvial deposits of Recent to Sub-Recent age are observed along the river courses of Godavari and Sindphana. The Deccan Trap includes several flows of Basalt which are supposed to have extruded from fissure volcanoes. Ground water in Deccan Trap Basalt occurs mostly in the upper weathered and fractured parts down to 20-25 m depth.

4. METHODOLOGY

The study was carried out in nine villages of Beed taluka because the people of this taluka use groundwater for drinking and also for irrigation fields. The groundwater samples were collected from

hand pumps at every month during the study from January 2015 to April 2015 from nine different sampling stations. The groundwater samples were collected in polyethylene bottles of 500 ml capacity and the bottles were rinsed before sampling and tightly sealed after collection and labeled in the fields. They were labeled, coded and brought to the laboratory for fluoride determination on the same day. Water sample were analysed by using the sodium-2-parasulphophenylazo-1-8-dihydroxy-3, 8naphthalene disulphonate (SPANDS) spectrophotometric method. The AR-grade reagent and chemicals, distilled water and Borossil glassware's were used throughout the work. The fluoride map was crested for study area by using GIS software.

5. GIS METHODOLOGY

Inverse Distance Weights (IDW)

The interpolation methods can be classified in two major groups: deterministic and geostatistical. Deterministic interpolation techniques create surfaces from measured points, based on either the extent of similarity (e.g. IDW) or the degree of smoothing (e.g. CRS). A deterministic interpolation can either force the resulting surface to pass through the data values or not. An interpolation technique that predicts a value identical to the measured value at a sampled location is known as an exact interpolator. An inexact interpolator predicts a value that is different from the measured value and should be used to avoid sharp peaks or troughs in the output surface. IDW and CRS are exact interpolators.

The inverse distance weighting or inverse distance weighted (IDW) method estimates the values of an attribute at un sampled points using a linear combination of values at sampled points weighted by an inverse function of the distance from the point of interest to the sampled points. The assumption is that sampled points closer to the un sampled point are more similar to it than those further away in their values.

6. RESULTS AND DISCUSSION

The results of analysis of groundwater samples 9 villages of Beed taluka of Beed district are given in table. The fluoride content in groundwater samples ranging from 0.17 mg/l to 0.77 mg/l and the permissible limit given by IS for fluoride concentration varies from 1.0 to 1.5 mg/l.

Table-2 Fluoride in groundwater from nine villages in Beed taluka

Fluoride Concentration in mg/l					
Sr. No	**Name of Villages**	**Jan2015**	**Feb 2015**	**Mar 2015**	**Apr 2015**
1	Rajuri Navgan	0.42	0.34	0.4	0.38
2	Murshadpur	0.65	0.53	0.55	0.52
3	Limbarui	0.51	0.39	0.39	0.41
4	Antharvan pimpri	0.73	0.58	0.62	0.58
5	Nagapur	0.77	0.61	0.58	0.51
6	Kapildhar	0.24	0.17	0.31	0.4
7	Manjursumbha	0.32	0.55	0.59	0.55
8	Neknoor	0.39	0.34	0.38	0.44
9	Beed	0.46	0.31	0.36	0.43

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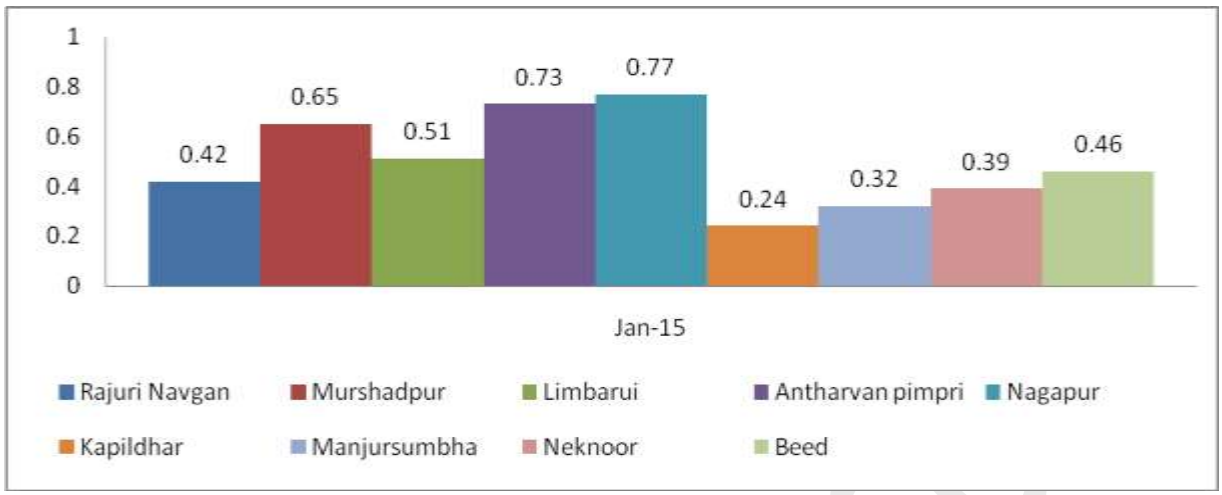
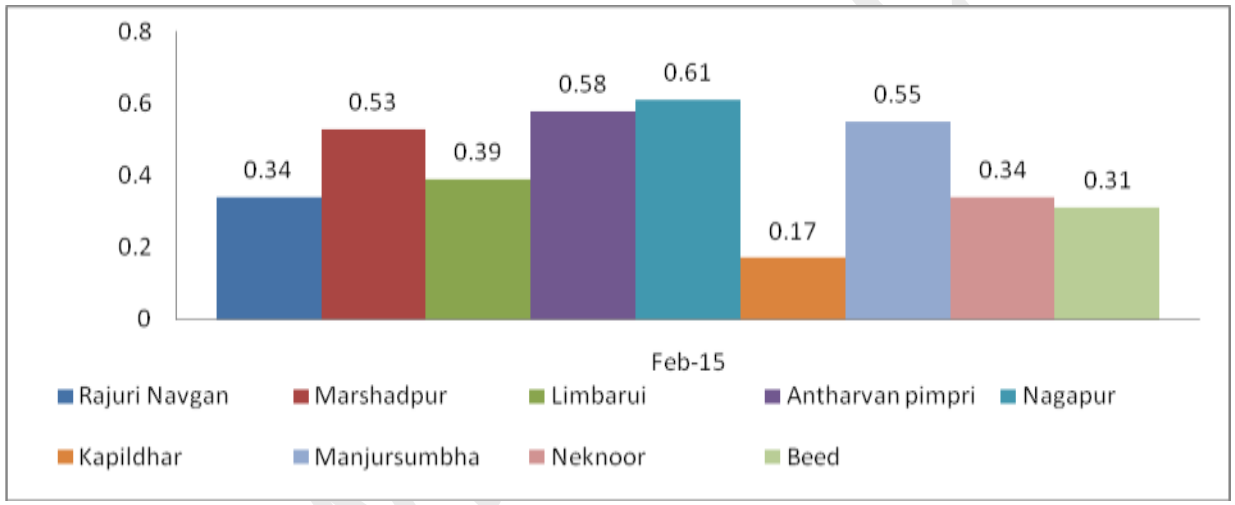
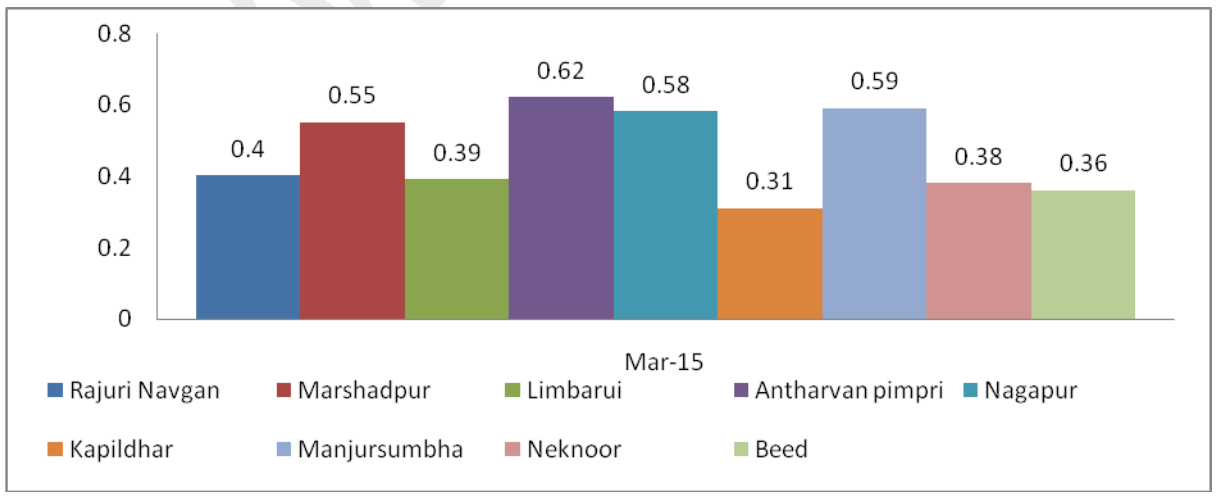


Graph 1- fluoride ion concentration in January



Graph 2- fluoride ion concentration in February.



Graph 3- fluoride ion concentration in March.

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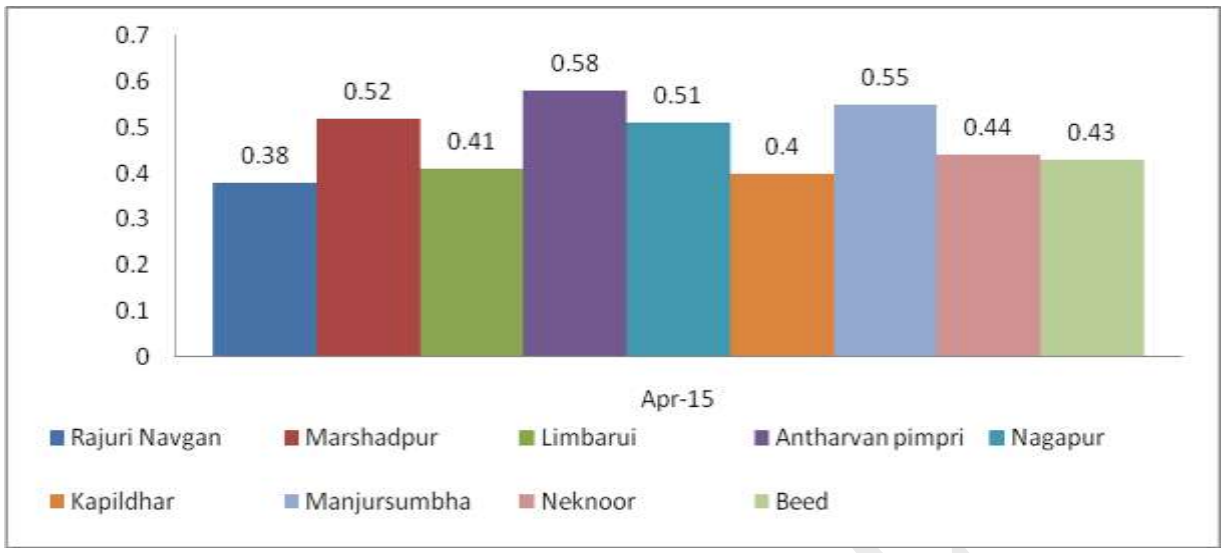

Graph 4- fluoride ion concentration in April.

SPATIAL DISTRIBUTION

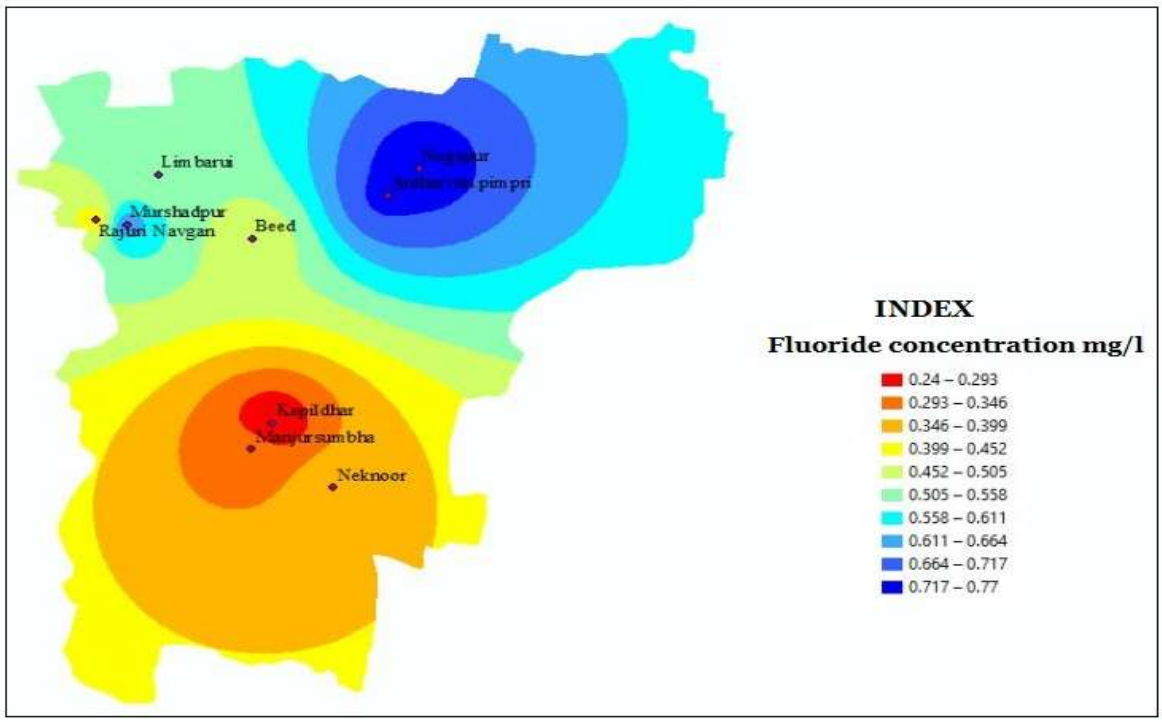

Fig.- 2 Spatial variation of fluoride in January month.

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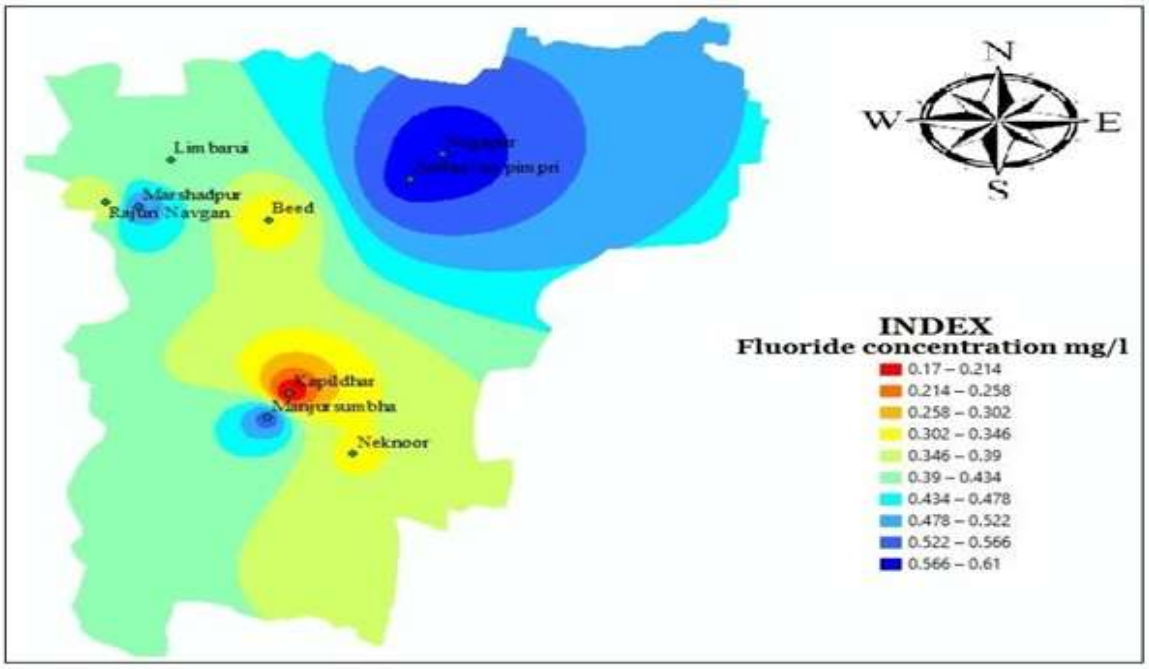

Fig.- 3 Spatial variation of fluoride in February month.

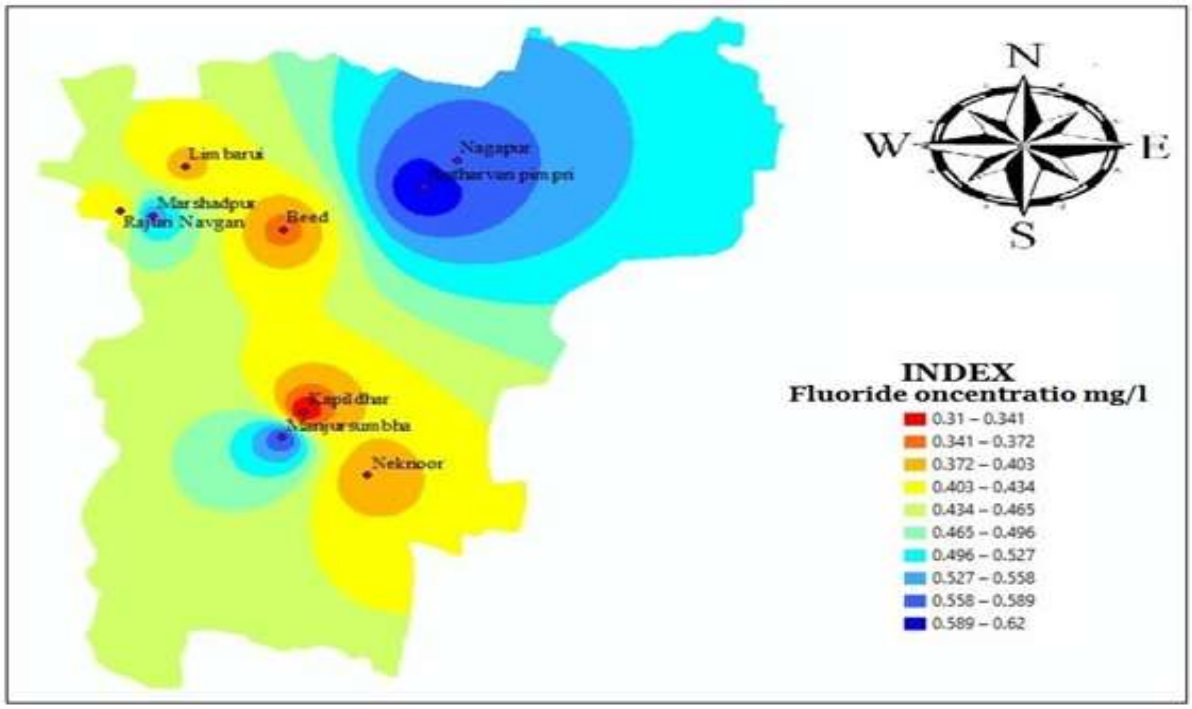

Fig.- 4 Spatial variation of fluoride in March month.

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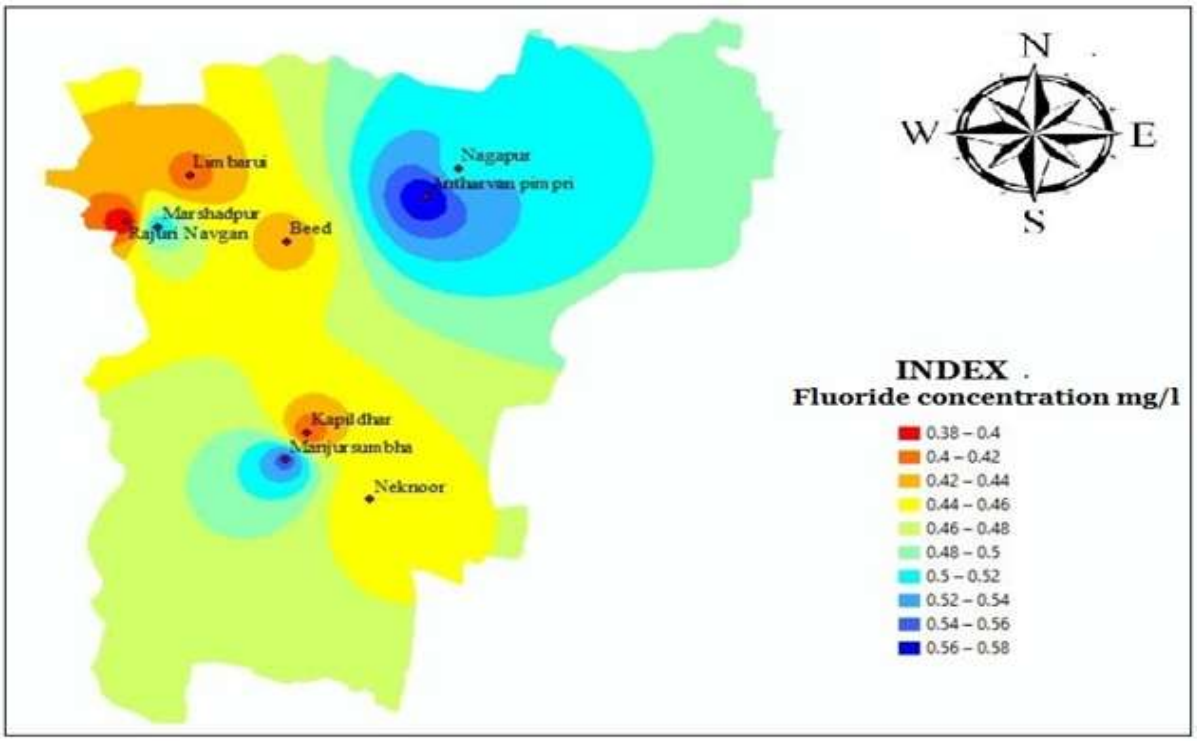

Fig.- 5 Spatial variation of fluoride in April month.

7. CONCLUSION

The study of all most of the samples is affected by fluoride. Recharging the ground water sources in the higher affected area and improving the ground water quality. The increasing the demand of drinking water, increase the groundwater by recharging through rainwater harvesting and to prevent future contamination. There is a risk of dental fluorosis as a result of high level of fluoride. The high fluoride content present in the drinking water should also be given defluoridated water should be provided for drinking purposes in the rural areas. The various techniques are available in purify the fluoride affected water the Nalgonda technique is most commonly used.

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