INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

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GROUNDWATER QUALITY MAPPING OF MORNA RIVER BASIN IN AKOLA DISTRICT, MAHARASHTRA, INDIA USING GEO-INFORMATICS TECHNIQUES

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Accepted Date: 05/03/2015; Published Date: 01/05/2015

Abstract: Spatial variations in ground water quality of Morna river basinin the Akola district of Maharashtra India have been studied using geographic information system (GIS) technique. GIS, a tool which is used for storing, analyzing and displaying spatial data is also used for investigating ground water quality information. For this study, water samples were collected from 8 bore wells and open wells representing the entire watershed area. The water samples were analyzed for physico-chemical parameters like Na, Mg, Cl, and Ca using standard techniques in the laboratory and compared with the standards. The ground water quality information maps of the entire study area have been prepared using GIS technique for all the above parameters. The results obtained in this study and the spatial database established in GIS will be helpful for monitoring and managing ground water pollution in the study area.

Keywords: Groundwater pollution, drinking-water, physico-chemical parameters, spatial interpolation

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Access Online On:

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How to Cite This Article:

Khadri S. F. R., IJPRET, 2015; Volume 3 (9): 36-44

PAPER-QR CODE

INTRODUCTION

Water, air, food and shelter are the basic requirement of any living beings. It is possible to survive without food and shelter for some days. But without water it is not possible to survive for much time. Water is life. Water for drinking should be fresh and free from impurities and water borne diseases. It is, therefore, important that water works must remove all the impurities and pathogenic micro- organisms from the water and make it wholesome. Groundwater is of major importance in providing water supply, and is intensively exploited for private, domestic, and industrial use in many urban centers of the developing world. At the same time, the subsurface has come to serve as the receptor for much urban and industrial wastewater and for solid waste disposal. There are increasingly widespread indications of degradation in the quality and quantity of groundwater, serious or incipient, caused by excessive exploitation and/or inadequate pollution control. The scale and degree of degradation varies significantly with the susceptibility of local aquifers to exploitation related deterioration and their vulnerability to pollution .Over 50% of the world's population is estimated to be residing in urban areas, and almost 50% of the mega-cities having populations over 10 million are heavily dependent on ground water, and all are in the developing world. In India, there are over 20 million private wells, in addition to the government tube wells Datta, (2005). The large-scale need for food security and urban drinking water supply is dependent on groundwater.

2. Area of Study

Akola district is bounded by the Melghat hills and forest region. Morna River flows through North Southern part of the Akola district. The Morna River basin which is a major tributary of Purna River lies towards the northern and southern part of Akola district and parts of Washim district and which drains the mid-south portion of the district. The total area covered by Morna River basin is 941 Sq Kms and is located between 76^{o}47'54" to 76^{o}6' 44" E longitude and 20^{o} 53' 26" N to 20^{o} 22'22" N Latitude . The Morna River is 90 Kms long, The Purna River is an important right bank tributary of River Tapi. The study area falls in Survey of India (1:50,000) toposheet No. 55H/1, H/2, H/15, D/3, and 55D/15 (Fig.1).

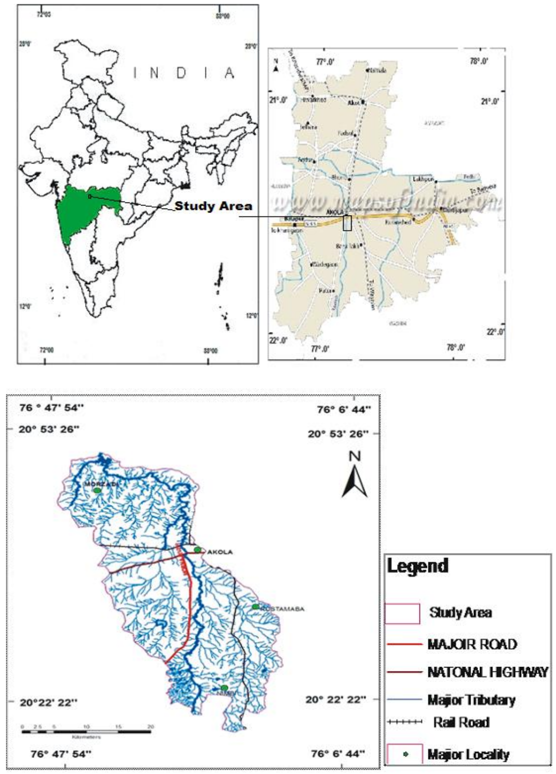

Fig.1: Location map of the Morna River basin.

Table1. Natural process controlling human influence on ground water quality (after Veba and Zaporozec, 1994).

Geochemical Processes	Physical Processes	Biochemical Processes	Biophysical Processes
Acid – base reactions	Advection / Convection	Cell synthesis	Filtration of Pathogen's
Adsorption-desorption	Dispersion	Organic decomposition	Transport of pathogen's.
Complexation	Evaporation	Transpiration	-
Oxidation-reduction	Filtration	-	-
Solution-precipitation	Gas transport	-	-
-	Radioactive Decay	-	-

3. Groundwater Chemical Quality

In nature, water never occurs in pure form. Pure water is only that which has two ions of hydrogen and one ion of oxygen (H_2O) Rain drops, when it comes just out of clouds, are in pure state. But, while reaching the surface on the earth some of the atmospheric gases get dissolved in all and make it impure. Being a very good solvent, it dissolves all the impurities and carries with it insoluble matter and disease producing bacteria. As soon as it comes in contact with rocks, minerals or soils it starts the process of solution and chemical alteration of rocks. Geochemical studies give logical conclusion that these processes are influenced by regional environmental set up in general and geology of the area in particular. The derived constituents from waste products of human activities and their imparted properties are the basic criteria in determination of water quality.

4. Data for hydro geochemical Analysis

Samples are collected from 55 bore wells, representing one from each village of the basin area, in the morning and immediately transferred to the laboratory. Water is discharged from the sample well for 2-3 minutes and container washed with the same water two to three times before collecting the water in 2 liters plastic cans. Samples are analyzed for various physico-chemical parameters such as Na, Mg, Cl, Ca(APHA, 1985) .Spatial coordinates and levels of sampling points are measured on site using a hand held GPS instrument GARMIN GPS-.The handheld GPS instruments are time and cost effective when compared to traditional surveying equipment and techniques. Various attributes of the sampling wells collected on site include well type, location, pump type, year of installation, water use, depth of well, maintenance condition of public wells and photos of wells. Depth of groundwater below ground level is measured on site by inserting a rope through the casing of the well shows primary data based on field measurements and laboratory analysis of the study area conducted during Pre-2008.

5. Quality of Groundwater

Water quality is a term used to describe the chemical, physical, and biological characteristics of water, generally in terms of suitability for a particular or designated use. Like the quote above from Alan Levere, the quality of a water body in most cases a river is the best indicator of what's in the rest of the watershed, both uphill land upstream. Water quality is also a function of the geology of the watershed. For example, highly mineralized soils and rock may result in highly mineralized water. The quality of water in the river system varies greatly. This is due to variation in precipitation, physical conditions, waste input, and biological activities taking place in the river. Being a very good solvent, water dissolves all the impurities and carries with it insoluble matter and disease producing bacteria. As soon as it comes in contact with rocks, minerals or soils it starts the process of solution and chemical alteration of rocks. Geochemical studies give logical conclusion that these processes are influenced by regional environmental set up in general and geology of the area in particular. The physicochemical parameters of water samples of the dug wells have demonstrated the quality of groundwater.

6. Results and Discussion

Groundwater quality maps are useful in assessing the usability of the water for different purposes. Figures 2, 3, and 4 shows the spatial distribution of Na, Mg, Cl and Ca in study area, respectively. A groundwater quality map is created for each parameter following the classification shown in Table1.

7. Chloride (Cl)

Chloride is minor constituent of the earth's crust. Rain water contains less than 1 ppm Chloride. Chloride in drinking water originates from natural sources, sewage and industrial effluents, urban runoff containing de-icing salt, and saline intrusion (WHO, 1996). Its concentration in natural water is commonly less than 100mg/L unless the water is brackish or saline. High concentration of chloride gives a salty taste to water and beverages and may cause physiological damages. In the present study Water with high chloride content usually has an unpleasant taste and may be objectionable for some agricultural purposes. The maximum chloride concentration in the study area is 28.90meq/1which indicates that the groundwater can be grouped as 'High chloride' water.

Fig. 2: Spatial distribution of Cl (meq/l) Pre-2008.

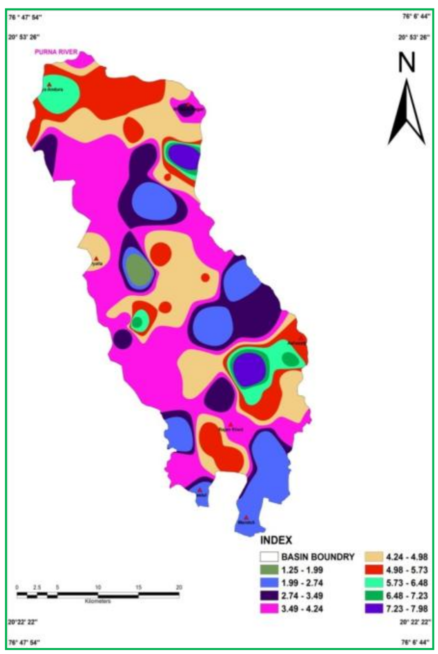

Fig. 3: Spatial distribution of Ca (meq/l) Pre-2008.

8. Magnesium (Mg)

Magnesium and calcium are the two elements mainly responsible for hardness of water. Olivine, biotite, hornblend, serpentine, is the some major magnesium bearing minerals. The presence of carbon dioxide influences the solubility of magnesium. The desirable limit of magnesium in natural water is 30 mg/Lit (ISI.1983). The observation of the Mg value in study area ranges between 2.96 to 9.91 for Pre-monsoon 200. Magnesium distribution map (Fig.4) indicates the high and lower value of Magnesium in study area.

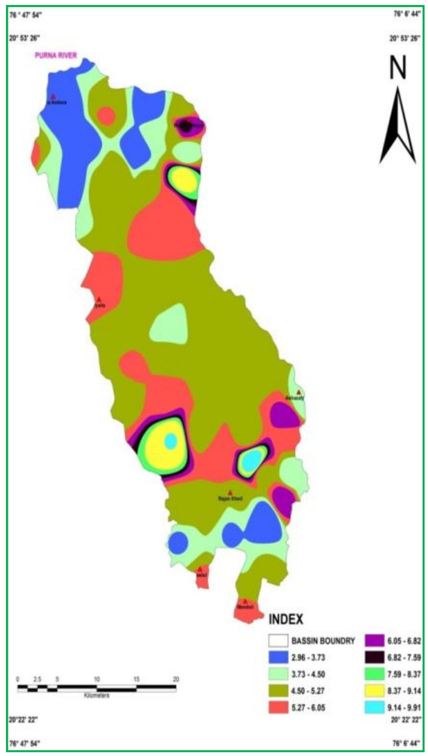

Fig. 4: Spatial distribution of Mg (meq/l) Pre-2008.

9. Sodium (Na):

Sodium is released in ground water due to weathering of plagioclase feldspar, clay mineral and amphiboles. The observation of the Na value in study area ranges between 0.52 to 3.86, for Pre-monsoon 2008.

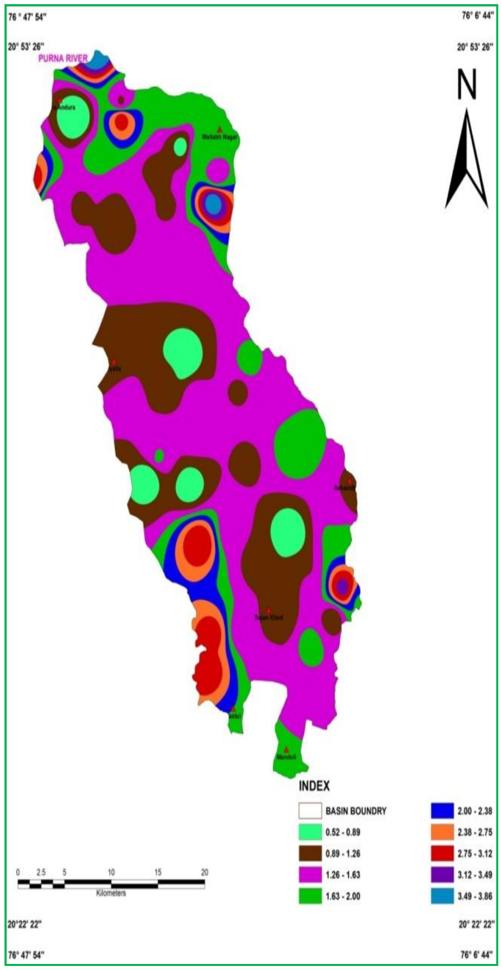

Fig.5: Spatial distribution of Na (meq/l) Pre-2008.

10. CONCLUSIONS

A procedure that integrates the traditional groundwater sampling analysis methods and GIS capabilities combined with conditional overlaying techniques was adapted in order to locate the suitable areas of the basin for drinking purposes. All analytical results compared with WHO, BIS standards and classified as desirable and undesirable groundwater in seasons. Groundwater is one of earth's most vital renewable and widely distributed resources as well as an important source of water supply throughout the world. The quality of water is a vital concern for mankind since it is directly linked with huMoranawelfare. In India, most of the population is dependent on groundwater as the only source of drinking water. Groundwater is a valuable natural resource that is essential for human health, socio-economic development, and functioning of ecosystems. Considering the above aspects of groundwater contamination and use of GIS in groundwater quality mapping, the present study was undertaken to map the groundwater quality in Morna river basin in the Akola district of Maharashtra, India. This study aims to visualize the spatial variation of certain physico-chemical parameters through GIS. The main objective of the research work is to make a groundwater quality assessment using GIS, based on the available physico-chemical data from 55 locations in Morna river basin in the Akola district of Maharashtra. The purposes of this assessment are (1) to provide an overview of present groundwater quality, (2) to determine spatial distribution of groundwater quality parameters such as Ca, Mg, Cl, Na etc. and (3) to generate groundwater quality zone map for the Morna river basin. The spatial distribution analysis of groundwater quality in the study area indicated that many of the samples collected are not satisfying the drinking water quality standards prescribed by the WHO and ISI. The government needs to make a scientific and feasible planning for identifying an effective groundwater quality management system and for its implementation. Since, in future the groundwater will have the major share of water supply schemes, plans for the protection of groundwater quality is needed. Present status of groundwater necessitates for the continuous monitoring and necessary groundwater quality improvement methodologies implementation.

11. REFERENCES

1. WHO (1996, Guidelines for drinking-water quality. 2nd ed. Vol 2: health criteria and other supporting information. World Health Organization, Geneva

2. APHA WWA and WPCF, (1985)**,** Standard method for examination of water and wastewater, 16th edition. Washington D.C., APHA. pp. 1268.

3. Datta, P.S (2005), Ground water ethics for its sustainability, Current Science 89 812-817.

4. ISI, (1983), Indian Standards Institution, Indian Standards specification for drinking water, IS 10500.