



Topic : Ground Water Quality In Ratnawati Basin

Author : Dr. Suhas G. Joshi

V.W.S's Art's, Commerce & Science College,
Sakri Road, Dhule

INTRODUCTION :

Planets 71% surface area is covered by gigantic water bodies, which gives a very sound and satisfying scene but the astonishing and vulnerable fact which hampers human hearts is that only a meager portion is the share of fresh water i.e. 2.8% of the total water content available. This picture becomes profoundly deleterious in the light of Fact that out of the 2.8% potable water 2.14% lies in from of glaciers and ice sheets, leaving only a very small quantum (0.66%) of usable water that too is unevenly distributed.

Groundwater is the almost source of water in drought prone monsoon semiarid or arid regions, for drinking deomestic, industrial and irrigation purpose. Groundwater never found in pure state. As water come from the atmosphere CO₂ and failing on the ground carbonic acid as a powerful corrosive agent. It react with geomaterial and acquires a certain characteristics before entering in the ground its chemical properties may changes from its place of entry to the point of exit. (Trainer 1981) Natural quality of water depends upon its interaction with rocks and various geochemical reaction.

STUDY AREA :

Rathanawati river is the nouthern obsequen tributary of the river Tapi. It is surrounded by a major range from Satpuda mountain region. Forming the water divide between the Guali river and Aner river. It is rises in Satpuda muntain region near karjana forest area. [The area hight is 1509 feet] its flow in north to south and then it is turns in to Chopda west side and going into Tapi river near Dondawade. Village its length is 43 Kms. The basin 'extent in Chopda Tahsil of Jalgaon district Rathnawati basin extent in between 21° N latitude to 21° 35' N latitude and 75° 12' E long itude to 75° 18' E longitude & Total basin area is 368 sq. km.

METHODS AND MATERIALS :

The study is entirely based on the chemical analysis of borewell and dug well water sample from 23 different localities in Ratnawati basin Amongst the many

chemical properties pH, Tds, Ec, Hardness, Cation constitutents like Fe, Ca, Mg, Na, k and anionic constitutents like Co₃, HCo₃, Cl, SO₄, No₃ etc. have been attempted Rathnawati basin have divided into five aquatone zones on the basis of gemorphic controls and water table.

In which chemical parameters like alkalinity total hardness, weak acids and strong acids have determined on the basis of HCo₃, CaCo₃, (HCo₃+Co₃) and So₄+Cl respectively. Classification and Salinity have been determined on the basis of both cations and anions. Besides, qualities of water for various purposes determined on the basis of chloride carbonate ratio and corrosivity ratio.

pH :

The pH of weak carbonic acid (H₂CO₃) ranges in between 5 and 6 The weak carbonic acid reacts with the ground material and becomes alkaline in nature. It means that there is an increase in a pH value. The pH value of ground water in Ratnwati basin ranges in between 7.4 and 8.8 with mean of 8.08 and S. D. 0.42 the mean value of pH 8.08 itself indicates the alkaline character of groundwater. However alkalinity varies greatly in different acquations zone of the Ratnawati basin (Table No.1) In the upper 1st and variable. It is reduced in middle, zone and remained fairly constant. In the lower most zone (vth, zone) it abruptly increased upto 8.62 (-a zone mean). This abrupt increase in pH clearly suggests an incursion of Tapi river water in Ratnawati basin at its mouth. It means the groundwater of Ratnawati basin is suitable for drinking purpose except fifth zone (lower reach) where pH value crosses the permissible limit. The pH distribution of Ratnawati basin is given.

ELECTRIC CONDUCTANCE :

Suitability of ground water for irrigation have been determined on the basis of electric conductance in Micro-mhos/cm at 25°C. Average E.C. of the Ratnawati basin is beyond the permissible limit and the water is not suitable for irrigation purposes. The mean E.C. of the Ratnawati basin is 854.84 m mhos/cm statistics of the E.C. is also estimated from the Table No.1 It is evident that the second zone i.e. run-off zone reveals a maximum value of

E.C. The mean E.C. of this zone is 1080.89 m. mhos with very high S. D. 736.62 m.mhos. The second largest mean E.C. observed in the fourth 20 NC i.e. 1045 The remaining zone reveals the E.C. below average.

ALKALINITY :

It is an anionic property of groundwater. However even high alkalinity is not hazardous to drinking purpose. The average alkalinity of Ratnawati basin is 232.41 P.P.M. with a wide range and S. D. 125.38. Zone wise distribution of mean value of alkalinity reveals a general trend of decrease from source to the mouth of the Ratnawati basin. The (Ca+Mg) exceeds over (Na+ve)

Clearly indicates alkaline nature of water. The alkaline earth metals (Ca+Mg) exceeds over the alkali metal (Na+k) in the all zones.

ACIDITY :

Acidity of ground water have determined on the basis of weak acids ($\text{HCO}_3 + \text{CO}_3$) and strong acids ($\text{SO}_4 + \text{Cl}$) Weak acids are slightly exceeds over strong acid A striking feature is that zone first, third, fourth and fifth shows excess of weak acids over strong acids and zone second reveals excess of strong acids and zone second reveals excess of strong acids over weak acids. The zone wise statistic of the acidity is given in

The carbonates and bicarbonates ($\text{CO}_3 + \text{HCO}_3$) i.e. weak acids dominates over the strong acids ($\text{Cl} + \text{NO}_3$) in case of upper zones over a Deccan trap formation expect a second zone Sample No.6 (i.e. Aganti Burg). In second zone Aganti Burg is a exceptional case in basin from the anionic and cationic proportion diagrams it is evident that ground water acquires properties according to the gematerial of the geological formation.

TOTAL HARDNESS :

It is a cationic property of groundwater. All the groundwater samples have classified on the basis hardness proposed by Handa (Table No.2)

Classification of water based on hardness and other ionic concentrations proposed by Handa (1964) The table No. 2 it is evident observed in Rathnawati basin. However the maximum sample lie in A1 and A2 categories which is indicate permanently hardness. The mean total hardness of Rathnawati basin is basin is 328 ppm. In the range of 28 to 1832 with S.D. 314.77. The zone wise mean value of total hardness also decreases.

Table No. 2

Categories	Ca+Mg	Ca+Mg	Cl+SO ₄	Sample No.	Hardness
A1	$\text{HCO}_3 >$	Na+K	$< \text{HCO}_3$	2,3,4,7,8,17, 19	Permanent
A2	$\text{HCO}_3 >$	Na+K	$< \text{HCO}_3$	1,5,6,9,11,12, 13,16,18,23	Permanent
A3	$\text{HCO}_3 <$	Na+K	$> \text{HCO}_3$	10, 15	Permanant
B1	$\text{HCO}_3 >$	Na+k	$< \text{HCO}_3$	14	Temporary
B2	$\text{HCO}_3 <$	Na +K	$> \text{HCO}_3$	Nil	Temporary
B3	$\text{HCO}_3 <$	Na + K	$> \text{HCO}_3$	21	Temporary

From second zone to the Fifth zone of the basin. The Ajanti Buzurg in the upper reach of the basin shows extremely high value of hardness i.e. 1832 p.p.m. This extremely high value of the total hardness restricts. Utility of water for all purposes. The minimum hardness is also reported from the second zone i.e. 68 ppm. The zone wise mean hardness of the second zone also highest in the basin. The fifth zone reveals in minimum hardness. The statistics of the total hardness is given in

The spatical distribution of the hardness is.

(Salinity in Rathnawati basin.)

(Handa's 1964 Modified Salinity Method)

Table No. 3

Categories	Salinity	CPM	TSC	Sample No.
C1	Low	<2.5		6, 14, 17
C2	Low-Medium	2.5 -	7.5	1,2,3,4,8,9,12,23
C3	Medium-High	7.5 -	22.5	10,11,13
C4	High-Very High	22.5 -	37.5	5,15,18,20
C5	Extremely High	>37.5		Nil

Table No. 4

Categories	Salinity	CPM	Cation	Anion
C1	Low	< 2.25	Nil	Nil
C2	Low-Medium	2.5 - 7.5	3,2,17,14	14,23
C3	Medium-High	7.5 - 22.5	4,5,8,9,	6,7,8,10,12
			12,16,18,22	
			16,17,22	
C4	High-Very high	22.5 - 37	6, 9	5, 18
C5	Experemently High	>37.5	Nil	Nil

SALINITY :

Salinity is base on T.C.S. in E.P.M. (Hand's 1964 Modified Salinity method) on this basic of salinity basin can be divided into C1, C2, C3, C4 and C5 categories as show in the (Table No. 4) In that table extreme Hand's Categori are absent in Ratnawati basin, Maximum samples lie within medium to high salinity category of Handa.

CLORIDE CARBONATE RATIO :

The chloride coarbonate ratio of the Ratnawati basin ranges in between 0.02 and 3.28 with mean of nearly 0.8 such high value of chloride, carbonate ratio clearly indicates the contaminated category of water. It means that

water in Rathanawati basin is not good quality for all purposes.

Ultimately on the basis of variation in the concentration of dissolved substance and Durum's (1981) orbritary consideration of water containing more than one thousand ppm dissolved substaces with moderate to high salinity, the Ratnawati basin can be divide in three categories. Viz

- i) Highly mineralied water in upper reach
- ii) Alkaline water in middle reach
- iii) Salive water in lower reach

CALCIUM (CA DISTRIBUTION) :

Calcium is important element of alkaline earth metals and predominantly found in the ground water of Ratnawati basin. The Calcium content of the ground water of basin ranges in between 21 PPM (Narvade well sample No. 8 and 652 PPM (Ajana Bzurg well sample No. 6) The value of Ca fluctuates around 80 PPM with Standard deviation 111.67 The distribution Ca is asymmetrical in the basin. The calcium is comparatively more in groundwater side.

Exceptionally very high concentration of Ca (652 PPM) observed on the northern divide in the vicinity of the Ajanti Bzurg. The aridity and the occurence of dyke with higher concentration of Ca might be the main Cause behind this higher concentration of Ca.

MAGNESIUM (Mg DISTRIBUTION) :

Mg is another alkaline earth metal and more soluble in water than Ca. The Mg concentration of ground of Ratnawati basin varies greatly and ranges in between 1.92 ppm (Adgaon well sample No. 9) and 65.B ppm (Angurni Well sample No. 4) The mean Mg Concentration of ground water for Ratnawati basin is 32.03 ppm with standard deviation 18.52 The distribution of Mg is also asymmetrical. However in the part of the basin the Mg Concentration is higher than western and southern side of the basin. On the western side of the basin Mg concentration is minimum becasuse of the removal of the mineral due to high rainfall in the basin.

IRON (Fe DISTRIBUTION) :

Fe concentrartion of the groundwater in Ratnawati basin varies greatly and ranges in between 0.04 ppm to 0.6 ppm in groundwater. The higher concentration of Fe found in two isolated pockets one ins into the vicinity of Ajanti Bzurg (sample No. 6) and another in the vicinity of Gadavadi (Sampel No. 19) in lower reach of the Rathanawati basin. However it is not harmful since it lies below the permissible limit of groundwater as suggested by WHO.

GROUNDWATER QUALITY :

The groundwater qualities have been determined

on the basis of World Health Organization (W.H.O.) Standard table. The zone wise quality of the groundwater in Ratnawati basin have compared with WHO (1963) standard table and given in (Table No. 5.)

CONCLUSION :

Chemical characteristics of ground water represent a set of complex pattern and process in Ratnawati basin. The pH value is well above seven and exess of Ca+Mg aver Na+k clearly indicates alkaline nature. The pH value ranged in between 7.4 and 8.8 . The main electric Conductance is also high and varies greatly zonewise Alkalinity of ground water decreses from first to the fourth zone of the basin there is a dominance of alkaline earth metals (Ca+Mg) over alkali (Na+k) Acidic of ground water also varies greatly in Ratnawati basin The mean hardness of the basin is 328 PPM with very wide range. High Corresivity of the ground water in the Ratnawati basin.

*** REFERNCES :**

- * **Adyalkar, P. G. and Banerjee (1981)** : "Hydrogology and Groundwater Potentials of West Bengal" Everyman's Science, Indian science Congress Association Vol - XVI. (S)Oct. Nov. 1981 P. P. 140-147, 1981
- * **Bhamare S. M. (1985)** : "Hydromorphic Analysis of Panzara Basin" National Geographical Journal of India 311, P. P. 23-27, 1985.
- * **Bhamare S. M. (1991)** : "Calcretes and Groundwater Potentiality in the Panzara Basin". Vol. of selected papers from the 2nd Conference of the Indian Institute of Gemorphologists on Environmental Geomorphology P. P. 115-122. Edt. H. S. Sharma. Concept Publishing Company, New Delhi , 1991.
- * **Bhamare S. M. and Joshi S. G. (1993)** : "Geomorphic Control on Ground-water patterns and apprasial of Burai basin". Unpublished, presented at The First Annual National Conference, The Deccan Geographical Society Pune. 27-29 Nov. 1993.
- * **Handa B. K. (1964)** : "Modified classification procedure for rating irrigation waters". Soil Sci.98 P. P. 264-269, 1964.
- * **Handa B. K. (1964)** : "Modified Hill Piper diagram for presentation of water analysis". Data Curr. Sci. 34 P. P. 313-314, 1965.
- * **Handa B. K. (1966)** : "Agricultural quality of groundwater in Kutch India". Jour Agri. Sci. 36 P. P. 233-238. 1966.
- * **Hem. J. D. (1959)** : "Study and Interpetation of the chemical characteristics of natural water". U. S. Geol Survey water supply paper 1473, P. P. 269, 1959.
- * **Inman D. L. (1952)** : Measures for describing the size distribution of sediments Jour. Sed. Pertol Vol. 22, No. 3, 125-145, 1952.
- * **Kale, Pawar, Gupte** : "Assesment of water quality of perennial stream from semiarid Maharashtra for human consupcion and irrigation". Frontiers in environmental geography, concept publication company New Delhi - 110059, 1993.