Assessment of Ground Water Quality in Udupi District, Karnataka

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***Abstract*— Water is an essential natural resource for sustaining life and environment, but over the last few decades the water quality is deteriorating due to it's over exploitation. Water quality is essential parameter to be studied when the overall focus is sustainable development keeping mankind at focal point. In the present study ground water quality analysis has been done in pre-monsoon period for 106 water samples collected at various locations of Udupi district considering industrial areas and sea shores. The analysis was done for the parameters such as pH, chlorides, calcium, magnesium, nitrates, sulphates, fluorides, iron, potassium, sodium, Total Dissolved solids, Bicarbonates, Turbidity ,Conductivity, Total Hardness,etc., The Bureau of Indian Standards for drinking water 10,500: 2012 has been used for Assesment.**

***IndexTerms*—geographical information system, Water quality index, Physico-chemical parameters**

I. INTRODUCTION

Water is the most valuable and vital resource for sustenance of ecosystem, agriculture and human settlements. Ground water is one among the Nation's most important natural resources. Very large volumes of ground water are pumped each day for industrial, agricultural and commercial use. Also, ground water is a drinking water source for about one-half of the Nation's population, including almost all residents in rural areas. Ground water is important as a drinking water supply in every State. They are usually of excellent quality. Being naturally filtered in their passage through the ground, they are usually clear, colorless, and free from microbial contamination and require minimal treatment.

It seems that we can no longer take high quality groundwater for granted. A threat is now posed by an ever-increasing number of soluble chemicals from urban, industrial and modern agricultural activities. Nevertheless, environmental processes such as climate change may also impact the quality of groundwater by directly affecting aquifer recharge and indirectly increasing demand and posing stress over available resources in some regions. The chemical composition of groundwater is a measure of its suitability as a source of water for human and animal consumption, irrigation and for industrial and other uses. The definition of water quality is therefore not objective but is socially defined depending on the desired use of water. The chemistry (quality) of groundwater reflects inputs from the atmosphere, from soil and water-rock reactions (weathering) as well as from previously mentioned pollution sources. Groundwater is a long-term reservoir of the natural water cycle, as opposed to short-term water reservoirs like the atmosphere and fresh surface water. Groundwater makes up about twenty percent of the world's fresh water supply, which is about 0.61% of the entire world's water, including oceans and permanent ice. Global groundwater storage is roughly equal to the total amount of freshwater stored in the snow and ice park, including the north and south poles. This makes it an important resource which can act as a natural storage that can buffer against shortages of surface water, as in during times of drought.

II. OBJECTIVES OF THE STUDY

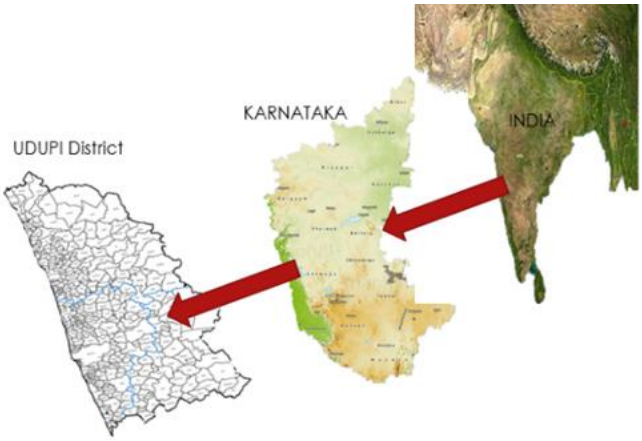
The objectives of our study include:

- To analyse the physico-chemical characteristics of ground water.
- To locate the sample points using GIS
- To determine the water quality index.
- To prioritize the area based on water quality index.

III. STUDY AREA

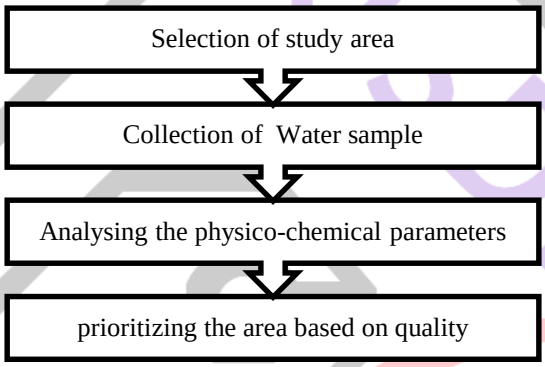
The coastal district Udupi of Karnataka state falls along the west coast of peninsular India and is separated from the rest of peninsula by towering high Western Ghats. The district lies between 13º 04' and 13 º59' North latitude and 74 º 35' and 75 º 12' East longitude covering an area of 3575 sq km. It is about 88 km in length and about 80 km in widest part and is bounded by Uttara Kannada district in the North, by Shimoga and Chickmaglur district in the East and by Dakshina Kannada district in the South. The district is carved out of South Canara District during 1991. The district comprises administrative subdivisions Kundapura, Udupi and Karkala Taluks. This coastal district of Karnataka is blessed with various endowments of Nature. Ground water is the major source of irrigation in the district along with few tanks and lift irrigation schemes. Paddy and Ragi are the major crops

grown in the district along with other subsidiary crops such as Maize, Cereals and Groundnut. Ground water is important source of water in coastal region analysing water is very much required for the above area



IV. METHODOLOGY

Udupi district was selected as the study area Udupi district was selected as the study area. 106 Water sample were collected throught the area. The Samples were tested for different water quality parameters such as pH, Total Dissolved Solids, Total Hardness, Fluoride, Chloride, Nitrate, Iron, Sulphate and Bicarbonate etc., of and prioritizing the area based on quality.



V. PROBLEM DEFINITION

GROUND WATER QUALITY

The groundwater resource should be evaluated thoroughly, carefully and reliably on a real time basis to meet the ever growing needs. Information on the quality and quantity of ground water is important because of the Nation's increasing population and dependency on this resource. The population dependent on public water systems that used ground water for drinking-water supplies increased between 1950 and 2000, and the estimated withdrawal increased about five-fold during that time period. The quality and availability of ground water will continue to be an important environmental issue for the Nation's citizens. Long-term conservation, prudent development, and management of this natural resource are critical for preserving and protecting this priceless national asset. Water has become scarce in many parts of the world due to its increased needs. The situation is aggravated by the problem of water pollution or contamination. Generally the quality of the ground water is affected in two ways:

- Water-soluble substances that are dumped, spilled, spread, or stored on the land surface eventually may infiltrate.
- Substances that are deposited or stored in the ground above the water table.
- Material that is stored, disposed of, or extracted from below the water table. Many of the contamination problems related to these activities are highly complex, and some are not well understood. As an example, the quality of groundwater is affected by waste disposal and land use. One major source of contamination is the storage of waste materials in excavations, such as pits or mines and landfills.
- Groundwater also can become contaminated by the disposal of fluids through wells and, in limestone terrains, through sinkholes directly into aquifers. Likewise, infiltration of contaminated surface water has caused groundwater contamination in several places. Irrigation tends to increase the mineral content of both surface and groundwater. The degree of severity in cases such as these is related to the hydrologic properties of the aquifers, the type and amount of waste, disposal techniques, and climate.

- Pumping is another cause of groundwater quality deterioration, which may precipitate the migration of more mineralized water from surrounding strata to the well. In coastal areas pumping has caused seawater to invade fresh-water aquifers. In parts of coastal west Florida, wild-flowing, abandoned artesian wells have salted, and consequently ruined, large areas of formerly fresh or slightly brackish aquifers.

VI. Analysis

Each and every ground water samples that are collected in the study area are tested for many different parameters the minimum, maximum and mean values of each parameter is listed bellow.

PARAMETER	MINIMUM	MAXIMUM	MEAN	PERCENTILE VARIATION	BIS 10500:2012
pH	5.01	7.6	6.305	81.132	6.5-8.5
TH (mg/l)	12	220	116	0.94	200
Ca^{2+}(mg/l)	7	88	47.5	0.94	75
Mg^{+}(mg/l)	0	132	66	7.547	30
HCO_3(mg/l)	40	300	170	3.773	200
Cl^{-}(mg/l)	0	99.95	49.75	0	250
TDS(mg/l)	126.17	586.98	356.57	0.94	500
F^{-}(mg/l)	0.2	2.35	1.275	31.13	1
Mn^{+}(mg/l)	1	14	7.5	100	0.1
NO_3^{-}(mg/l)	0	9	4.5	0	45
Fe^{2+}(mg/l)	0	4.2	2.1	54.71	0.3
SO_4^{-}(mg/l)	2	25	13.5	0	200
Turbidity (NTU)	1.2	13.6	7.4	100	1
Conductivity	253.16	1196.8	725.2	0	-
K	1	16	8.5	0	-
Na^{+}	3	110	56.5	0	-

Table 1 analysis statistics

VII. Water Quality Index :

- A Water Quality Index (WQI) is a means by which water quality data is summarized by it's Physico-chemical parameter in a consistent manner.This calculation produces a score between 0 and ,<200. lower the score the better the quality of water.

- **Excellent:** (WQI Value 0-50) - Water quality is protected with a virtual absence of impairment, conditions are very close to pristine levels.

- **Very Good:** (WQI Value 50-75) - Water quality is protected with a slight presence of impairment, conditions are close to pristine levels.

- **Good:** (WQI Value 75-100) - Water quality is protected with only a minor degree of impairment, conditions rarely differ from desirable levels.

- **Poor:** (WQI Value 100-200) - Water quality is usually protected but occasionally impaired, conditions sometimes differ from desirable levels.

- **Very poor:** (WQI Value 200-300) - Water quality is frequently impaired, conditions often differ from desirable levels.

- **Unfit for Drinking:** (WQI Value >300) - Water quality is almost always impaired, conditions usually differ from desirable levels.

PARAMETER	MINIMUM	MAXIMUM	MEAN
pH	7.526	11.524	9.525
TH	0.338	6.189	3.263
Ca^{2+}	0.5258	6.610	3.5679
Mg^{+}	0	24.78	12.39
HCO_3	1.67	12.63	7.15
Cl^{-}	0	3.37	1.685
TDS	2.843	13.227	8.035
F^{-}	2.253	26.487	14.37
Mn^{+}	14.084	197.181	105.63
NO_3^{-}	0	2.81	1.405
Fe^{2+}	0	157.74	78.87
SO_4^{-}	0.0563	0.704	0.380

Table 2 Water Quality Index

Final outcome after analysis :

WQI Value	Water Quality	Percentage of water samples
<50	Excellent	0.94%
50-100	Good	45.29%
100-200	poor	50.94%
200-300	Very Poor water	2.83%
>300	Unfit fo drinking	0%

Table 3. Final Outcome

VIII. Conclusion

The physico-chemical parameters of the all well water samples were analysed for all the parameters , most of the samples in this location are found acidic in nature. The located samples points from the GIS shows that most of the portion from the study area are covered.The WQI of 106 samples ranges from 44 to 266. The higher value of WQI is mainly because of higher concentration of iron, chlorides and hardness in ground water in some of the places in Udupi Dist. About 50.94 percent of area falls under poor, 2.83 percent falls under very poor condition and 0 percent unsuitable for drinking. In this part, the groundwater quality may improve due to inflow of freshwater of good quality during rainy season. The determination of water quality index is very helpful to prioritize the area based on quality. This Water Quality Index acts as a decision support system to take up preventive and mitigation measures in the areas of poor quality.

IX. Acknowledgment

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