Integrating Remote Sensing and GIS Techniques for Effective Groundwater Quality Assessment

A Project Report

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by

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1. INTRODUCTION

Groundwater assumes a significant part in the water supply and ecology of arid and semiarid locales. The quality of groundwater is significant to help life Groundwater is con-savaged by regular and anthropogenic elements, for example, geological structure, arrangement of precipitation geochemical process, the association between the groundwater and spring minerals and human exercises[1]. These factors interact to form a variety of water types Different hydrogeochemical processes that the groundwater goes through over space and time affect the chemistry of the groundwater. Groundwater is the water living in the interstices of rock arrangements under immersed conditions, and it is one of the main normal assets of the earth. It is an important part of the natural environment and is necessary for the earth's survival and growth[2]. Physical characteristics like pH, TDS, ORP, DO, Temperature, and Salinity as well as chemical components like major cations and anions serve as indicators of groundwater quality.

2. MATERIALS AND METHODS

2.1. Description of the Study Area

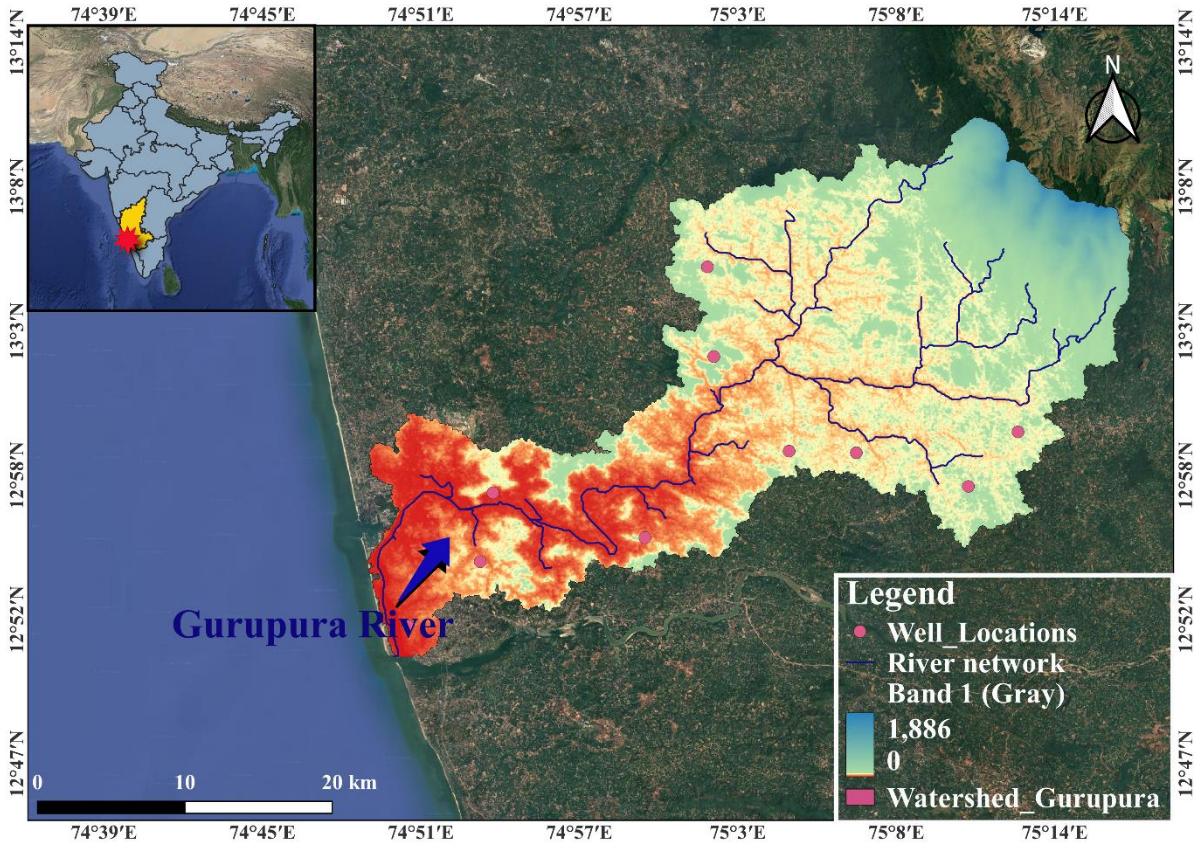

Figure 1. Location of the Study area

The Gurupura River, also known as the Pachamagaru River, the Phalguni River, or the Kulur River, is a river in the Indian state of Karnataka. It comes from the Western Ghats and is a tributary of the Netravati River, which flows south of Mangalore into the Arabian Sea. It gets its name from the town Gurupura, arranged close to Mangalore. The Addoor CWC gauging station, which drains an area of approximately 840 km2 (Figure 1), was chosen for this investigation. The west coast is made up of a coastal plain with agricultural cropland.[3].

2.2. Water Quality Sampling

Groundwater samples from the Gurupur River basin were taken for the post-monsoon season (2021) at ten sampling sites. The groundwater samples were obtained using open wells and hand pumps. Open wells that are routinely utilised were selected for sampling. A polythene bucket was used to elevate the water in the instance of sampling from a dug well in order to obtain the samples. The water surface was slightly stirred before lifting to prevent the chemistry from being changed by evaporation.

Table 1. Water Quality Sampling Assessment

Sl. No	Water Quality Parameter	Unit	Min	Max	Mean	Std. Dev.	BIS Std. 2012
1	GWL (m)	meter	1.8	9.3	4.82	2.43	
2	pH	pH-unit	4.88	7.44	6.213	0.73	8.5
3	ORP	millivolts (mV)	-0.3	19.5	8.29	6.52	0-300
4	DO	mg/l	0.38	0.76	0.62	0.11	6.5-8
5	EC	mS/cm	44	491	234.5	120.46	400
6	TDS	mg/l	22	245	117.2	60.19	500
7	Temp (C°)	^{0}C	27.06	32.55	29.64	1.45	12
8	Salinity	ppm	0	1	0.4	0.51	0.5
9	Calcium (Ca)	Caco3	280	840	548	210.01	250
10	TH	Caco3	80	560	328	140.85	300
11	Chloride (Cl)	mg/l	39.97	99.94	61.97	17.50	75
12	Na	mg/l	0	55.25	19.23	14.91	12
13	K	mg/l	0	18.99	7.39	5.77	80
14	HCo3	mg/l	28	136	66.4	38.14	45
15	SO4	mg/l	0	0.072	0.03	0.03	200

2.3. Water Quality Indexing (WQI)

The index's application provides a precise and easy-to-understand unit of measurement that can adapt to changes in water quality [4]. In the United States, Horton (1965) selected 10 of the most frequently used water quality variables, such as pH, coliforms, explicit conductance, alkalinity, and chloride, to create WQI. and is widely used and accepted throughout Europe, Africa, and Asia. The index is significantly influenced by the allocated weight, which reflects a parameter's significance for a particular application. In 1970, the Brown group also produced a second WQI that was comparable to Horton's file. Index Formulation: a weighted mean index was decided upon with the form [5]

$$QWI = \sum_{i=1}^{n} w_i \ q_i$$

WQI = The water quality index, a number between 0 and 100
q_i= the quality of the ith parameter, a number between 0 and 100
w_i = the unit weight of the ith parameter, a number between 0 and

3. RESULT AND DISCUSSION

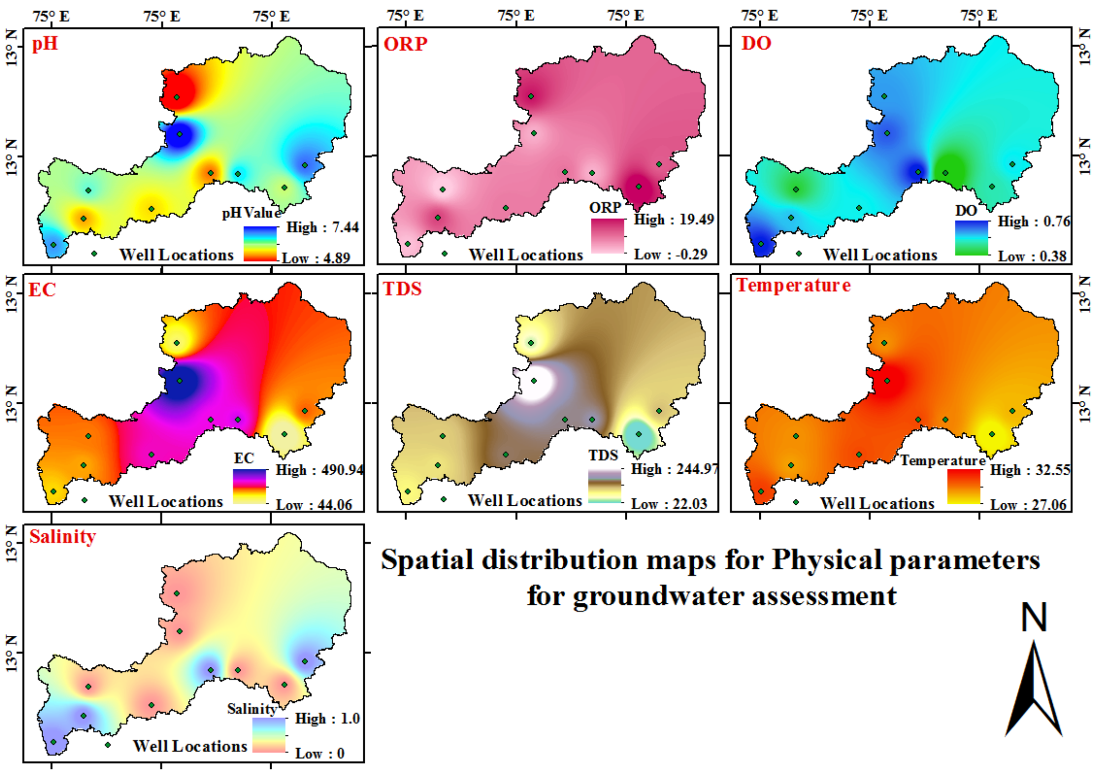

Figure 1. Spatial map representation of physical parameters of groundwater assessment.

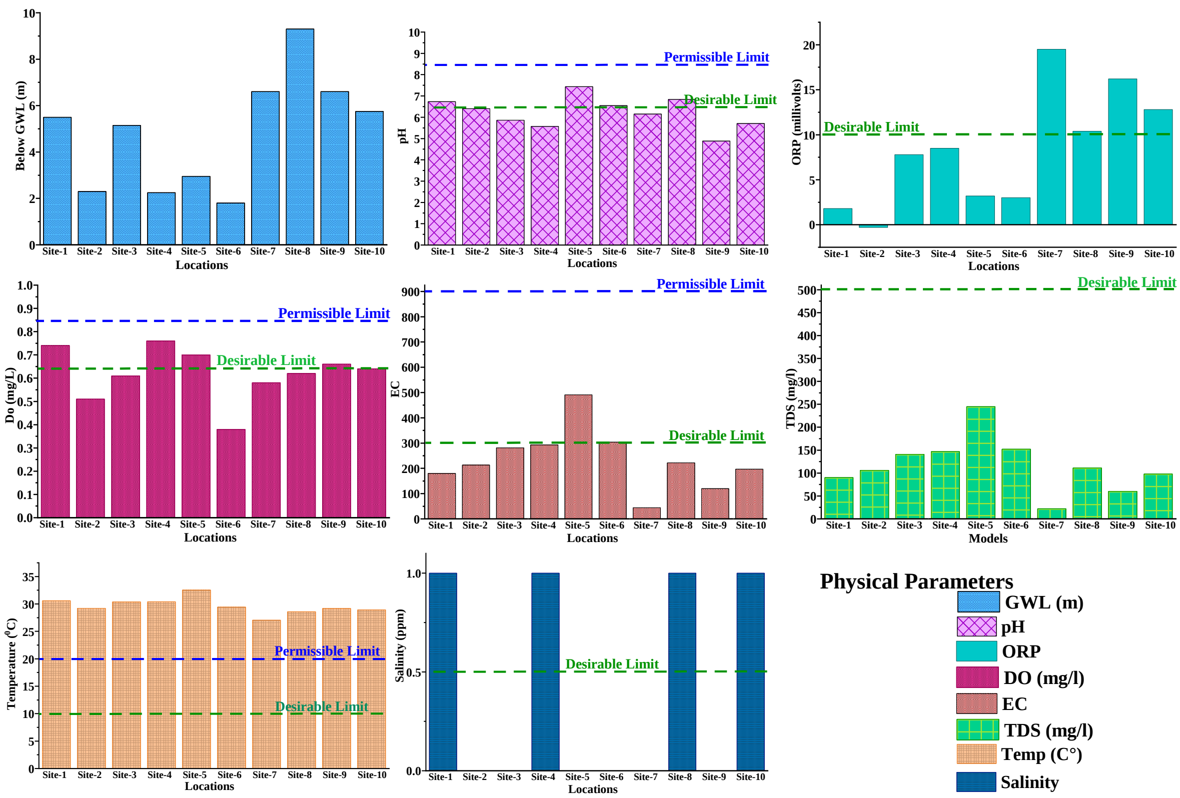

Figure 2. Bar chart representation of physical parameters of groundwater assessment.

Table 1 displays the major ion composition of groundwater samples at various sampling times. The pH of the shallow groundwater tests is somewhat corrosive, while the pH of the open well siphon water tests is somewhat corrosive to antacid, at various inspecting times. Post-monsoonal samples have very similar average pH values (avg. 6.213). At various sampling locations, the electrical conductivity (EC) of the open well water samples range from 44 to 491 lScm-1, with an average conductivity value of 234 lScm-1 and higher conductivity values in October and Novemb

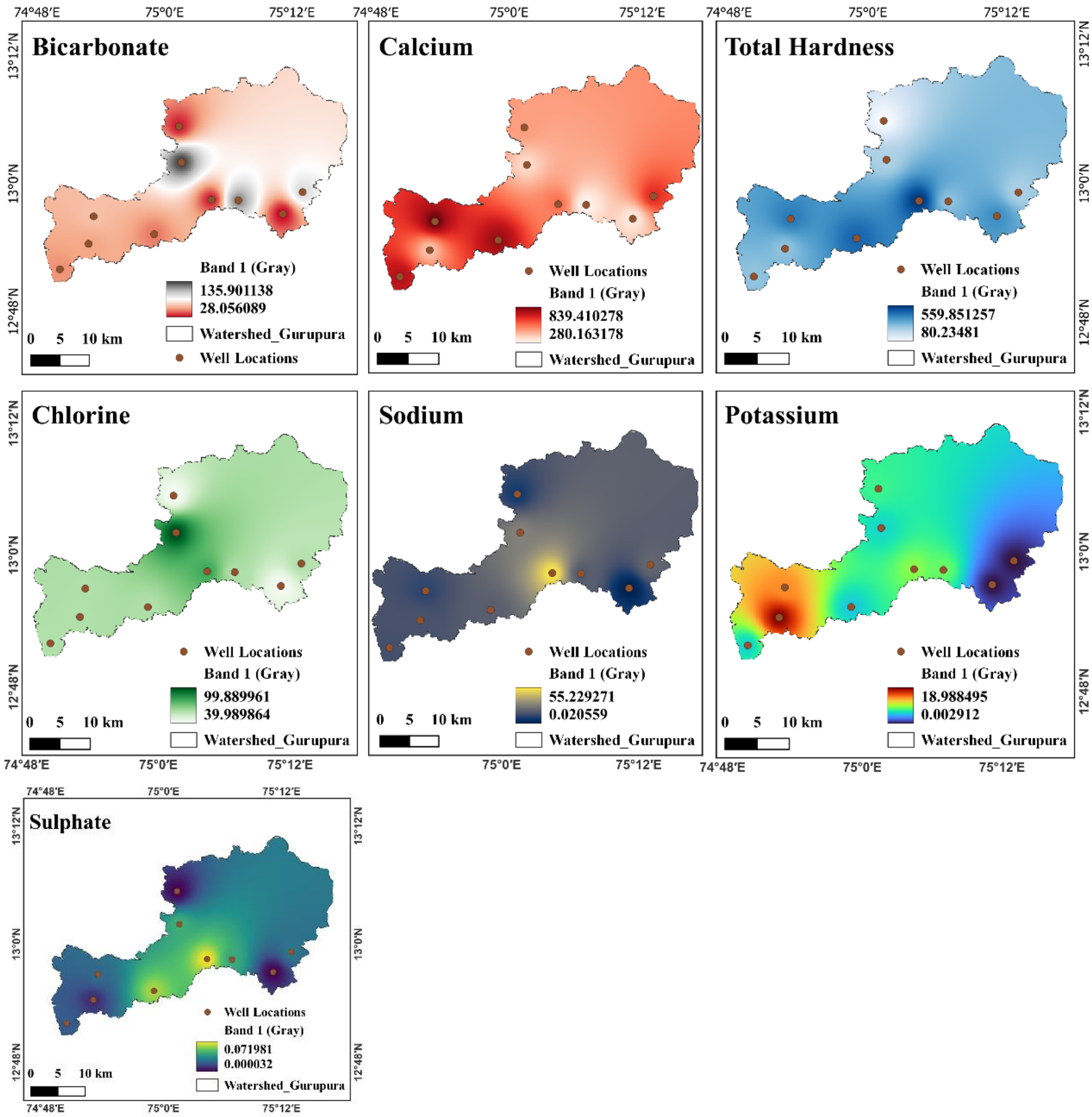

Figure 3. Spatial map representation of chemical parameters of groundwater assessment.

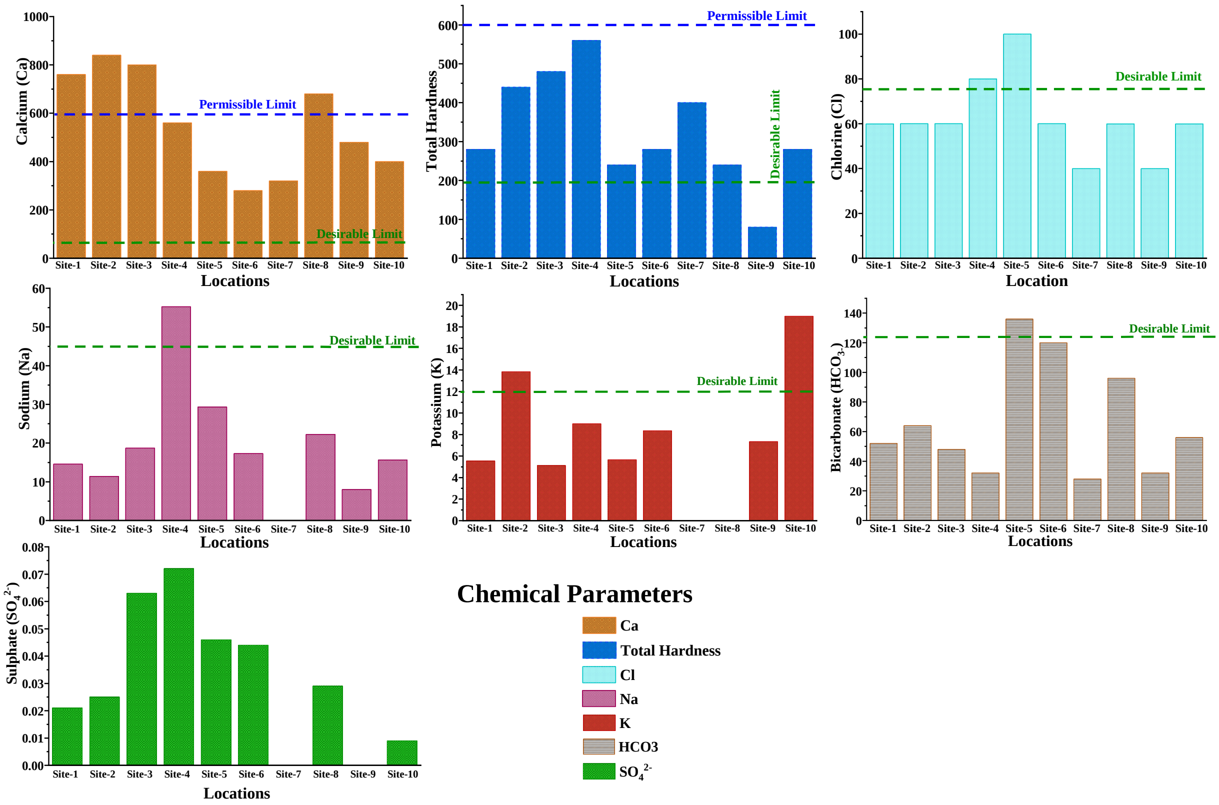

Figure 4. Bar chart representation of Chemical parameters of groundwater assessment.

The relationship between pH and TDS in the watershed varies from region to region. For instance, as the pH rises, the TDS content in the middle catchment water climbs exponentially. The average TDS concentration the open site samples differ from the other samples because to their high TDS content and slightly acidic pH (average of 117 2 mg L-1). 6.213). As a result of anthropogenic sources, notably agricultural activity, the well water may have increased TDS levels.

Water Quality Indexing of the ten sampling locations are analysed using Hortons Equation, Table 2 represents the WQI ranges and respective water quality status throughout the Gurupura river basin has been prepared as per the recommendation of Brown 1970 as shown in table 3. 50 percentage of the Gurupura River basin water quality is falling under Excellent water quality which ranges from (91-100), 40 percentage good water quality and 10 percentage poor water quality as shown in Table 3. Overall water quality of the gurupura river basin is excellent water quality in the post monsoon season of 2021.

Table 2. Water Quality Indexing and Water Quality Status using Hortons Equation

Sl. No	Site Location	Coordinates		WQI Value	Water Quality Status
1	Site -1	Latitude	Longitude	101.56	Excellent Water Quality
2	Site -2	12.949	74.889	95.32	Excellent Water Quality
3	Site -3	12.921	74.984	86.44	Good Water Quality
4	Site -4	12.975	75.074	85.07	Good Water Quality

5	Site -5	13.034	75.027	120.53	Excellent Water Quality
6	Site -6	12.974	75.116	99.29	Excellent Water Quality
7	Site -7	12.953	75.186	85.421	Good Water Quality
8	Site -8	12.987	75.217	103.06	Excellent Water Quality
9	Site -9	13.09	75.023	61.24	Poor Water Quality
10	Site -10	12.906	74.881	80.13	Good Water Quality

WQI Range	Water Quality	% water sample
91 - 100	Excellent Water Quality	50
71-90	Good Water Quality	40
51-70	Poor Water Quality	10
31-50	Bad Water Quality	Nil
0-30	Unsuitable for drinking water	Nil

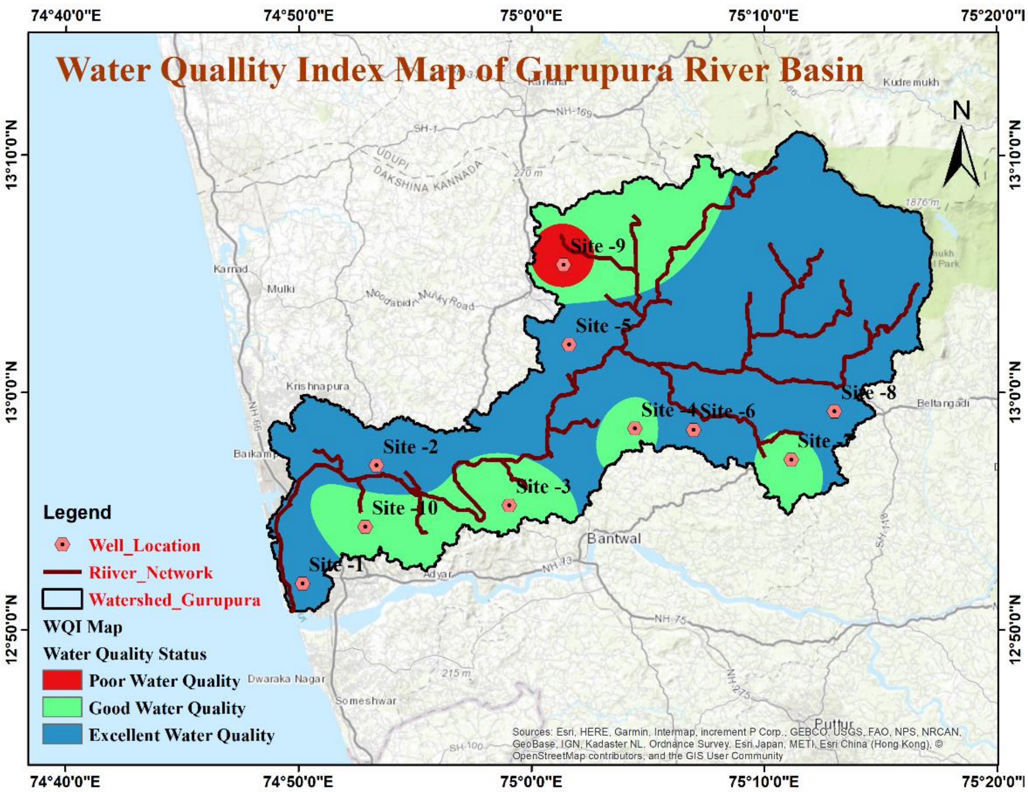

Figure 5. Water Quality Index Map of Gurupura River Basin

4. CONCLUSION

The physical and chemical water quality factors and processes impacting the chemical composition of groundwater have been examined using the integration of remote sensing and GIS techniques. The hydrogeochemistry of groundwater 10 samples collected along the Gurupur catchment has been studied, and the results show that extensive weathering of the source rock is the main source of chemical elements for the river and groundwater, with agrarian and barometric constituents serving as additional sources of synthetic elements. The

Water Quality index values are ranging from 61.24 to 120.50 which represents poor water quality and excellent water quality respectively. The finding of the study is declaring that groundwater quality of Gurupura river basin in post monsoon season is in excellent condition with 50 percentage well location is falling under excellent water quality conditions and only 10 percentage of well location is in poor quality, where as in the coastal region groundwater quality is detreating and need to be continuous monitoring.

5. REFERENCE

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