PHYSICO-CHEMICAL ASSESSMENT OF PRE & POST MONSOON GROUND WATER QUALITY IN SOME SPECIFIC AREAS OF SHEKHAWATI REGION

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Abstract

Groundwater, the water stored beneath the Earth's surface, serves as a vital source of drinking water for a significant portion of the global population. Its quality not only impacts human health but also plays a pivotal role in maintaining the ecological balance of our planet. This topic encompasses a wide range of factors and considerations, including natural processes, human activities, contamination risks, and monitoring techniques. A comprehensive understanding of groundwater quality is crucial in ensuring its sustainability and safeguarding the health and well-being of communities that rely on this invaluable resource. In this exploration, we will delve into the multifaceted dimensions of groundwater quality, shedding light on the challenges, solutions, and the importance of preserving this hidden treasure beneath our feet.

Keywords: Groundwater, WHO, hazardous, polluted, Water pollution, Sustainability.

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INTRODUCTION

The groundwater in urban and industrial regions is particularly vulnerable to contamination. Both human activities and natural processes contribute to the contamination of groundwater. The reaction of solid waste and discharged effluents from industrial facilities, which infiltrate via precipitation, contaminate the groundwater. This groundwater is tainted because percolating water takes up several heavy metals on its way to the aquifer system. It has been estimated that eighty percent of human ailments in underdeveloped nations are caused by polluted groundwater. According to the World Health Organization, drinking water pollution is responsible for roughly 5 million annual fatalities worldwide. Water pollution prevention has risen to the forefront of environmental protection agendas in both industrialized and a growing number of developing nations. Successful policies for preventing, controlling, and reducing inputs of hazardous substances, nutrients, and other water pollutants from point source into aquatic environment have incorporated the prevention of pollution at the source, the precautionary principle, and the prior licensing of waste water discharges by competent authorities.[1]

Only 2.5% of the entire stock in the hydrosphere is fresh water, with a total of 35 million km^3. The ice and permafrost of the Arctic and Antarctic areas hold vast quantities of freshwater. Vapor and cloud water in the atmosphere have a volume of around 12,900 km^3, or 0.04 percent of all available freshwater. In 2020, when the global population is expected to reach roughly 7.5 billion, there will be enough freshwater on Earth to provide each person with about 12,000 liters.[2]

However, natural and anthropogenic causes have led to a worldwide shortage of fresh water and widespread water contamination. Water is deemed polluted when it contains enough contaminants to render it unsafe for consumption or other purposes. Increased population, better standards of life, and expanding economies have all contributed to a surge in the need for high-quality water.

Water use has increased six fold during the last century. Human activities have resulted in the loss of between 64 and 71 percent of the world's natural wetland habitat since 1900. Sixty percent of the world's population, or roughly 4 billion people, lives in areas with almost permanent water stress. Three billion people worldwide do not have access to safe, clean water at home.[3]

By 2025, half of the world's population may face water scarcity. By 2030, global water demand is expected to exceed availability by 40 percent, and by 2050, as many as 6 billion people may confront water scarcity.

One billion people still practice open defecation in 2016, and over 600 million do not have access to even minimal levels of drinking water, according to UNICEF's report Strategy for Water, Sanitation, and Hygiene 2016-2030. The first discovery, related to water contamination, is of grave concern, as is the second finding, related to public health.

As surface water resources dwindle and pollution rises in many regions of the globe, there has been a frantic hunt for new, clean water sources, and this has forced people to turn to groundwater.[4]

Groundwater

The term "groundwater" is used to describe the aqueous substance that fills all subterranean voids and flows only because of gravity. It's the water that collects in the cracks and crevices of rocks and soil due to infiltration of rainwater or the water that flows into these areas from rivers, lakes, and other bodies of water.[5]

Aquifers are underground water reserves that may be found in either rock formations or unconsolidated deposits. The water table is the depth at which water completely fills all of the spaces in the ground, including soil pores, rock cracks, and rock voids. The chemical make-up of groundwater is "a result of where the water has been and what sort of substance it has washed over or through" (www.env.gov.html).

The groundwater regime is an intricate ecosystem in which water is always on the move thanks to the processes of recharge (water entry) and discharge (water exit), both of which may happen naturally or be influenced by human activity. Water may be extracted from impermeable rocks like granite that contain an abundance of sand or gravel when the regular sources of groundwater supplies are depleted. Recharge of a basin's aquifers is influenced by a number of factors, including precipitation, solar radiation, groundwater usage, ground qualities, and the depth to which aquifers are buried under the surface.[6]

With a capacity of around 5.0 1024 L, ground water pools of earth contain more than 2,000 times the amount of water in all the rivers of the world and 30 times more water than all the freshwater reservoirs in the world combined. Nearly one-third of the world's population relies on groundwater for their daily water needs, making this renewable resource critically vital. The high initial cost and ongoing upkeep of producing surface water via dams means that groundwater is increasingly being used as a source for residential, urban, agricultural, and industrial operations, particularly in developing nations.

It's vital to remember that in rural India's arid and semiarid areas, groundwater is used for both drinking and irrigation. Hand-dug wells, shallow wells with a hand pump, and deep wells or boreholes with a submersible pump are all used to draw water from the ground.

Multiple factors, both natural and man-made, contribute to ground water's overall quality. This includes things like geological formation, mineral dissolution and precipitation, groundwater velocity, infiltration rate, recharge water quality and relationship with other water aquifer types, and redox conditions in the soil and water phases.[7]

Arsenic, other heavy metals, fluoride, nitrates, and polyaromatic hydrocarbons are just some of the toxic substances that have made their way into groundwater as a result of human activities like rapid industrialization, urbanization, and mining.

Domestic and industrial wastes pose the greatest threat to groundwater safety, alongside agricultural composts and pesticides. In the absence of treatment, eighty percent of wastewater is released into the environment. These pollutants may pollute aquifers after they've made their way into them from the stream. Ground water in coastal areas is also contaminated by saltwater intrusion. Most modern horticulture practices call for massive amounts of fertilizers, leading to unclean and potentially hazardous circumstances for human health.[8]

Due to the slowness of natural through-flushing processes, a polluted groundwater body may stay thus for decades, if not centuries. Second, water and the contained material are chemically and physico chemically dependent on one another to a large extent. When working with groundwater, it is important to consider the qualities of both the soil and the water, since there is much room for altering the water's content via interaction with the two.[9]

The "Shastras" define the five elements necessary for life, and water is one of them. Finding habitable water is the first step in the quest for alien life. Water is essential to life on Earth and plays a crucial role in our everyday routines. There is now a global water problem because of skyrocketing demand from households, farms, and factories. The water cycle includes processes such as evaporation, condensation, precipitation, deposition, runoff, infiltration, transpiration, and groundwater movement, which all contribute to the transfer of water from one reservoir to another. Most of the water in the atmosphere comes from oceanic evaporation. Only 91% of this evaporated water is replenished in the ocean basins by precipitation. The remaining nine percent is shuttled to locations over land masses where climate-related variables cause precipitation to occur. Runoff and groundwater flow to the seas balance out the disparity between the rates of evaporation and precipitation over land and ocean. The oceans provide the vast majority of the water on Earth. The oceans contain over 97% of the world's total water supply. The remaining three percent exists as freshwater in sources such as glaciers and icecaps, groundwater, lakes, soil, the atmosphere, and living organisms.[10]

1. MATERIAL AND METHODS

Shekhawati, which includes the districts of Jhunjhunu, Sikar, and Churu, is situated in North Rajasthan. It’s borders are the Bikaner, Hanumangarh, Haryana, Alwar, Jaipur, the southeast, Ajmer, and the Nagaur on the northwest, northeast, east, and southwest, respectively. It has an area of 13784 km^2.

Sample Collection

In the Shekhawati area (Sikar, Churu, and Jhunjhunu), a survey was undertaken. In this location, samples were taken from tube wells. Before the samples are analyzed in the lab, they are collected in brand-new, transparent 500 ml plastic bottles and washed five to eight times with water samples. All the glassware, pots, and pans were first thoroughly cleaned with tap water before being rinsed with deionized distilled water. These parameters were examined using the devices known as a pH meter, conductivity meter, spectrophotometer, and flame photometer. Standard procedures were used to compute physical and chemical parameters such as pH, TDS, EC, Cl, NO_3^- and F. For the analysis, certain chemicals are employed, and paraffin wax is used to seal the container.

2. RESULTS

Sample Details

From the study area (Sikar, Churu and Jhunjhunu) tube well water samples were obtained. All these water samples were collected from different sites. Details of the water samples are given in the table 3.1

Table 3.1: Sample Details

Sample area	Sample site	Sample code pre monsoon	Sample code Post monsoon
Jhunjhunu city	Jhunjhunu city	J1A	J1a
	Nawalgarh	J2A	J2a
	Chirawa	J3A	J3a
	Pilani	J4A	J4a
	khetri	J5A	J5a
	Bisau	J6A	J6a
Sikar	Sikar city	S1A	S1a
	Reengus	S2A	S2a
	Laxmangarh	S3A	S3a
	Neem ka thana	S4A	S4a
	Losal	S5A	S5a
Churu	Churu city	C1A	C1a
	Ratangarh	C2A	C2a
	Sardar sahar	C3A	C3a
	Rajgarh	C4A	C4a
	Taranagar	C5A	C5a

Water Quality assessment of water samples in Pre-Post monsoon Period

Results for Water Quality assessment of water samples in pre and post-monsoon period are shown in Tables 3.2,3.3 and 3.4.

Table 3.2: Water Quality assessment of Jhunjhunu water samples in Pre-and post-Monsoon Period

Parameters	J1A	J2A	J3A	J4A	J5A	J6A	J1a	J2a	J3a	J4a	J5a	J6a
Ca^{2+}	48.0	72.0	36.8	62.3	74.8	71	62.0	74.0	74.0	84.0	58.7	72.3
Mg^{2+}	40.80	16.80	9.12	10.24	15.5	16.7	44.88	18.96	35.04	38.71	45.52	69.32
Na^{+}	136	156	75	146	154	80	136	158	98	101	127	138
K^{+}	3	2	1	1	2	1	4	1	5	2	3	4
HCO_3^-(mg/)	126	268	278	285	269	295	198	300	298	350	326	246
Cl(mg/L)	289.00	184.00	135.00	136.00	279.00	269.00	248.00	198.00	140.00	154.00	165.00	125.00
SO_4^{2-}(mg/L)	63.0	24.0	51.0	25.1	22.1	25.21	90.0	35.0	50.0	60.2	56.9	57.1
NO_3^-(mg/L)	12	40	92	54	21	23	44	58	69	56	42	51
PO_4^{3-}(mg/L)	0.038	0.032	0.023	0.027	0.029	0.028	0.039	0.033	0.022	0.024	0.025	0.026
CO_3^{2-}(mg/L)	28	24	20	21	25	26	35	55	48	42	51	46

In pre-monsoon period,Ca^{2+} ranged from 36.8 mg/L to 74.8 mg/L. The minimum $Ca^{2+}$was recorded at J3A and maximum Ca^{2+} was recorded at J5A sample and in post monsoon period, Ca^{2+} ranged from 58.7 mg/L to 74.0 mg/L. The minimum $Ca^{2+}$was recorded at J5a and maximum Ca^{2+} was recorded at J3a and J4a sample. In pre-monsoon period,Mg^{2+} ranged from 9.12 mg/L to 40.80mg/L. Minimum Mg^{2+} was found at J3A and maximum was recorded at J1A sampling site. In post monsoon period, Mg^{2+} ranged from 18.96 mg/L to 69.32mg/L. Minimum Mg^{2+}which was 18.96 mg/L, found at J2a and maximum 69.32mg/L was recorded at J6a sampling site.

In pre-monsoon period, Na^{+} ranged from 75 mg/L to 156 mg/L. Minimum and maximum Na^{+} was found at J3A and J2A sampling sites respectively.

In post monsoon period, Na^{+} ranged from 98 mg/L to 158 mg/L. Minimum and maximum Na^{+} was found at J3a and J2a sampling sites respectively. In pre monsoon period, K^{+} ranged from 1 mg/L to 3 mg/L whereas in post monsoon period, K^{+} ranged from 1 mg/L to 5 mg/L. In pre-monsoon period,HCO_3^- ranged from 126 mg/L to 295 mg/L, where minimum and maximum HCO_3^- was found at J1A and J6A sampling sites respectively.

In post monsoon period, HCO_3^- ranged from 198 mg/L to 350 mg/L, where minimum and maximum HCO_3^- was found at J1a and J4a sampling sites respectively. In pre-monsoon period, the results for Cl^- ranged from 135 mg/L to 289 mg/L. In present finding maximum chloride concentration was recorded at J1A and minimum at J3A.

In post monsoon period, Cl^- ranged from 140 mg/L to 248 mg/L. In present finding maximum chloride concentration was recorded at J1a and minimum at J3a. The values of chloride are below the permissible limit according to W.H.O. In pre-monsoon period, SO_4^{2-} ranged from 22 mg/L to 63 mg/L. Many sulphate compounds are readily soluble in water.

In post monsoon period, SO_4^{2-} ranged from 35 mg/L to 90 mg/L. The minimum sulphate in water samples was 35 mg/L recorded at J2a, and maximum 90 at J1a. Sulphate values in the most water samples of the study area are within the permissible limit of W.H.O. and BIS (< 250 mg/L).In pre-monsoon period,NO_3^- ranged from 12 mg/L to92 mg/L. Maximum nitrate 92 mg/L was recorded at J3A whereas 12 mg/L minimum nitrate was recorded at J1A. However, the nitrate of J3A and J4A were recorded above the permissible limit prescribed by W.H.O [45 mg/L].

In post-monsoon period, NO_3^- ranged from 44 mg/L to 69 mg/L. Maximum nitrate 69 mg/L was recorded at J3a whereas 44 mg/L minimum nitrate was recorded at J1a. However, the nitrate of J2a, J3a, J4a and J6awere recorded above the permissible limit prescribed by W.H.O [45mg/L].In pre-monsoon period,PO_4^{3-} ranged from 0.023 mg/L (at J3A sampling site) to 0.038 mg/L (J1A sampling site).In post monsoon period, PO_4^{3-} ranged from 0.022mg/L (at J3a sampling site) to 0.039 mg/L (J1a sampling site).In pre-monsoon period,CO_3^{2-} ranged from 20 mg/L (at J3A) to 28 mg/L (at J1A sampling site) while in post- monsoon period, CO_3^{2-} ranged from 35 mg/L (at J1a sampling sites) to 55 mg/L (at J2a sampling site).

Table 3.3: Water Quality assessment of Sikar water samples in Pre and post-Monsoon Period

Parameters	S1A	S2A	S3A	S4A	S5A	S1a	S2a	S3a	S4a	S5a
Ca^{2+}	63.0	84.0	22.8	52.3	45.8	62.0	12.0	14.0	15.0	45.7
Mg^{2+}	42.32	15.30	25.12	9.24	52.5	36.30	69.3	38.7	45.2	44.8
Na^{+}	165	154	165	136	165	154	101	152	139	136
K^{+}	2	1	4	5	3	2	1	3	4	1
HCO_3^-(mg/L)	126	268	410	552	278	285	292	299	124	313
Cl^-(mg/L)	260.00	301.3	298.2	284.9	315.2	310.3	355.4	381.2	377.6	56.3
SO_4^{2-}(mg/L)	48.2	58.9	55.3	44.1	53.7	50.8	37.8	49.9	45.3	8.4
NO_3^-(mg/L)	21.6	32.9	28.5	37.7	49.1	46.2	21.2	35.5	29.5	9.8
PO_4^{3-}(mg/L)	0.032	0.038	0.023	0.035	0.063	0.021	0.025	0.032	0.036	0.025
CO_3^{2-}(mg/L)	25	26	26	29	45	63	21	21	32	65

In pre-monsoon period,Ca^{2+} ranged from 22.8 mg/L to 84.0 mg/L. The minimum $Ca^{2+}$was recorded at S3A and maximum Ca^{2+} was recorded at S2A sample and in post-monsoon period, Ca^{2+} ranged from 12.0 mg/L to 62.0 mg/L. The minimum $Ca^{2+}$was recorded at S2a and maximum Ca^{2+} was recorded at S1a sample.

In pre-monsoon period,Mg^{2+} ranged from 9.4mg/L to 52.5 mg/L. Minimum Mg^{2+} was found at S4A and maximum was recorded at S5A sampling site. In post-monsoon period, Mg^{2+} ranged from 36.30mg/L to 69.3mg/L. Minimum Mg^{2+}which was 36.30mg/L, found at S1a and maximum 69.3mg/L was recorded at S2a sampling site. In pre-monsoon period, Na^+ ranged from 136 mg/L to 165 mg/L. Minimum Na^+ was found at S4A and maximum Na^+ was found at S1A, S3A & S5A sampling sites respectively.

In post monsoon period, Na^+ ranged from 101 mg/L to 154 mg/L. Minimum and maximum Na^+ was found at S2a and S1a sampling sites respectively. In pre-monsoon period, K^+ ranged from 1 mg/L to 5 mg/L whereas in post-monsoon period, K^+ ranged from 1 mg/L to 4 mg/L. In pre-monsoon period, HCO_3^- ranged from 126 mg/L to 552 mg/L, where minimum and maximum HCO_3^- was found at S1A and S4A sampling sites respectively.

In post monsoon period, HCO_3^- ranged from 124 mg/L to 313 mg/L, where minimum and maximum HCO_3^- was found at S4a and S5a sampling sites respectively. In pre-monsoon period, the results for Cl^- ranged from 260 mg/L to 315.2 mg/L. In present finding maximum chloride concentration was recorded at S5A and minimum at S1A. In post-monsoon period, Cl^- ranged from 56.3 mg/L to 381.2 mg/L. In present finding maximum chloride concentration was recorded at S3a and minimum at S5a. The values of chloride are below the permissible limit according to W.H.O.

In pre-monsoon period,SO_4^{2-} ranged from 48.2 mg/L to 58.9 mg/L. Many sulphate compounds are readily soluble in water. In post monsoon period, SO_4^{2-} ranged from 8.4 mg/L to 50.8 mg/L. The minimum sulphate in water samples was 8.4 mg/L recorded at S5a, and maximum 50.8 at S1a. Sulphate values in the mostly water samples of the study area are within the permissible limit of W.H.Oand BIS (< 250 mg/L).In pre-monsoon period,NO_3^- ranged from 21.6 mg/L to 49.1 mg/L. Maximum nitrate 49.1 mg/L was recorded at S5A whereas 21.6 mg/L minimum nitrate was recorded at S1A. However, the nitrate of S5A were recorded above the permissible limit prescribed by W.H.O. [45 mg/L].

In post monsoon period, NO_3^- ranged from 9.8 mg/L to 45.2 mg/L. Maximum nitrate 46.2 mg/L was recorded at S1a whereas 9.8 mg/L minimum nitrate was recorded at S5a. However, the nitrate of S1a were recorded above the permissible limit prescribed by W.H.O. [45mg/L].

In pre-monsoon period,PO_4^{3-} ranged from 0.023 mg/L (at S3A sampling site) to 0.063 mg/L (S5A sampling site).In post monsoon period, PO_4^{3-} ranged from 0.021 mg/L (at S1a sampling site) to 0.036 mg/L (S4a sampling site).In pre-monsoon period,CO_3^{2-} ranged from 25 mg/L (at S1A) to 45 mg/L (at S5A sampling site) while in post monsoon period, CO_3^{2-} ranged from 21 mg/L (at S2a &S3a sampling sites) to 62 mg/L (at S5a sampling site).

Table 3.4: Water Quality assessment of Churu water samples in Pre and post-Monsoon Period

Parameters	C1A	C2A	C3A	C4A	C5A	C1a	C2a	C3a	C4a	C5a
Ca^{2+}	63.0	85.0	56.0	16.0	15.0	45.7	63.3	16.0	47.5	63.0
Mg^{2+}	45.63	12.60	16.30	14.0	69.30	44.80	96.00	38.9	36.0	48.3
Na^{+}	54.67	65.33	60.34	50.97	59.22	54.57	35.11	49.82	41.33	51.55
K^{+}	4	5	4	4	5	4	4	5	4	5
HCO_3^-(mg/L)	126	263	420	552	523	451	123	563	123	153
Cl^-(mg/L)	230.00	210.00	310.00	210.00	563.00	452.00	250.00	156.00	148.00	156.00
SO_4^{2-}(mg/L)	46.2	57.8	54.3	41.4	53.5	49.9	35.3	48.2	41.5	17.3
NO_3^-(mg/L)	6.8	10.1	7.5	65.1	77.8	72.2	58.9	72.4	67.2	44.8
PO_4^{3-}(mg/L)	56.2	56.3	54.3	44.1	59.3	4.60	8.43	56.3	45.0	56.2
CO_3^{2-}(mg/L)	26.1	36.3	37.7	44.1	49.9	58.5	63.2	45.6	45.2	95.1

In pre-monsoon period,Ca^{2+} ranged from 15.0 mg/L to 63.0 mg/L. The minimum $Ca^{2+}$was recorded at C5A and maximum Ca^{2+} was recorded at C2A sample and in post monsoon period, Ca^{2+} ranged from 16.0 mg/L to 63.3 mg/L.The minimum $Ca^{2+}$was recorded at C3a and maximum Ca^{2+} was recorded at C2a sample. In pre-monsoon period,Mg^{2+} ranged from 14.0mg/L to 69.30 mg/L. Minimum Mg^{2+} was found at C4A and maximum was recorded at C5A sampling site. In post monsoon period, Mg^{2+} ranged from 36.0mg/L to 96mg/L. Minimum Mg^{2+}which was 36.0mg/L, found at C4a and maximum 96mg/L was recorded at C2a sampling site.

In pre-monsoon period, Na^{+} ranged from 50.97 mg/L to 65.33 mg/L. Minimum Na^{+} was found at C4A and maximum Na^{+} was found at C2A sampling sites respectively. In post-monsoon period, Na^{+} ranged from 35.11 mg/L to 154.57 mg/L. Minimum and maximum Na^{+} was found at C2a and C1a sampling sites respectively. Inpre-monsoon period, K^{+} ranged from 4 mg/L to 5 mg/L whereas in post-monsoon period, K^{+} ranged from 4 mg/L to 5 mg/L. In pre-monsoon period,HCO_3^{-} ranged from 126 mg/L to 552 mg/L, where minimum and maximum HCO_3^{-} was found at C1A and C4A sampling sites respectively. In post monsoon period, HCO_3^{-} ranged from 123 mg/L to 563 mg/L, where minimum HCO_3^{-} was found at C2a & C4a and maximum HCO_3^{-} was found atC3a sampling sites respectively. In pre-monsoon period, the results for Cl^{-} ranged from 210 mg/L to 563 mg/L. In present finding maximum chloride concentration was recorded at C5A and minimum at C2A. In post-monsoon period, Cl^{-} ranged from 148 mg/L to 452 mg/L. In present finding maximum chloride concentration was recorded at C1a and minimum at C4a. The values of chloride are below the permissible limit according to W.H.O. In pre-monsoon period,SO_4^{2-} ranged from 41.4 mg/L to 57.8 mg/L. Many sulphate compounds are readily soluble in water. In post monsoon period, SO_4^{2-} ranged from 17.3 mg/L to 49.9 mg/L. The minimum sulphate in water samples was 17.3 mg/L recorded at C5a, and maximum 49.9 at C1a. Sulphate values in the mostly water samples of the study area are within the permissible limit of W.H.O. and BIS (< 250 mg/L).

In pre-monsoon period,NO_3^{-} ranged from 6.8 mg/L to 77.8 mg/L. Maximum nitrate 77.8 mg/L was recorded at C5A whereas 6.8 mg/L minimum nitrate was recorded at C1A. However, the nitrate of C4A & C5A were recorded above the permissible limit prescribed by W.H.O. [45 mg/L].In post monsoon period, NO_3^{-} ranged from 44.8 mg/L to 72.4 mg/L. Maximum nitrate 72.4 mg/L was recorded at C3a whereas 44.8 mg/L minimum nitrate was recorded at C5a. However, the nitrate of all samples were recorded above the permissible limit prescribed by W.H.O. [45mg/L] except C5a.In pre-monsoon period,PO_4^{3-} ranged from 44.1 mg/L (at C4A sampling site) to 59.3 mg/L (C5A sampling site).In post monsoon period, PO_4^{3-} ranged from 8.43 mg/L (at C2a sampling site) to 56.3 mg/L (C3a sampling site).In pre monsoon period,CO_3^{2-} ranged from 26.1 mg/L (at C1A) to 49.9 mg/L (at C5A sampling site) while in post monsoon period, CO_3^{2-} ranged from 45.2 mg/L (at C4a sampling sites) to 95.1 mg/L (at C5a sampling site).

3. CONCLUSION

Good water quality is essential for ensuring people live long, healthy lives as well as the social and economic growth of any country. One of the crucial natural resources that contributes to the success of our country is water. Groundwater is one of the easily available sources that serves as our country's primary source of drinking water as well as being essential to our existence. The issue of groundwater quality is very serious in India, where the vast majority of the population depends on groundwater for drinking water supplies. Additionally,groundwater contamination brought on by the ongoing discharge of household sewage, industrial effluents, and solid waste dumps leads to health problems. Groundwater quality has been further deteriorated as a result of excessive resource consumption and improper waste disposal practices brought on by urban regions' rapid expansion.

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