

ASSESSMENT OF GROUND WATER QUALITY INDEX: MEHSANA DISTRICT, GUJARAT AS A CASE STUDY

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Abstract: *ater Quality Index is a helpful portrayal of general nature of water for open or for any required use and in addition in the contamination obliteration programs and in water quality administration. There are different parameters which influences the utilization and pertinence of water for a specific reason. This specialized paper speaks to with the investigation of physio-compound parameters, for example, pH, BOD, Color, COD, Total Alkalinity and TDS in water tests gathered from various wells and in addition bore wells from various towns close-by the examination territory. The result of this examination shows that the groundwater of a few districts in the investigation region needs separate level of value change by the most practical approach like Artificial Groundwater Recharging while a few locales have great water quality. Research paper shows the examination did on the investigation of the impact of natural parameters on the ground water quality. The improvement of water quality file and checking of ground water is improved the situation Mehsana district, Gujarat. In this sort of multifaceted investigation, the accentuate ought to be centered around relative weightage of concern parameters aligned with issue instead of conventional indistinguishable weightage framework. The present examination is planned with comparative kind of multifaceted way to deal with decide the Groundwater Quality Index (GWQI) for the Mehsana locale and adjacent territories arranged in Gujarat state-India. Under this investigation the different occasional groundwater tests were gathered for the same continuous. **Keywords:** Water Quality Index, ground water, pH, BOD, Artificial Recharge.*

INTRODUCTION

Water quality alludes to the compound, physical, organic, and radiological attributes of water. It is a measure of the state of water in respect to the necessities of at least one biotic animal groups as well as to any human need or reason. It is most as often as possible utilized by reference to an arrangement of benchmarks against which consistence can be surveyed. The most widely recognized guidelines used to evaluate water quality identify with wellbeing of environments, security of human contact and drinking water. Groundwater is a characteristic asset for drinking water. Like other normal assets, it ought to be surveyed consistently and individuals ought to be made mindful of the nature of drinking water. The present examination is gone for surveying the water quality file (WQI) for the groundwater of Mehsana city. This has been controlled by gathering different groundwater tests from 6 nearby zones of Mehsana and subjecting the specimens to a far reaching physicochemical examination. For ascertaining the WQI, the accompanying parameters have been viewed as: pH, BOD, Color, COD, TDS, Total Alkalinity.

Around one billion individuals are specifically reliant upon groundwater assets in Asia alone, and In India, the majority of the populace is subject to groundwater as the main wellspring of drinking water supply. The groundwater is accepted to be relatively much perfect and free from contamination than ground water. Water isn't basic for the lives of creatures and plants, yet in addition possesses an interesting position in enterprises. Work in the zone of water quality has a tendency to be centered around water that is dealt with for human utilization, mechanical utilize, or in the earth. Ecological researchers work to see how these frameworks work, which thusly distinguishes the sources and destinies of contaminants. Environmental legal counselors and policymakers work to characterize enactment with the goal that water is kept up at a fitting quality for its recognized utilize.

In the setting of benchmarks, organizations make political and specialized/logical choices about how the water will be used. In the instance of normal water bodies, they likewise make some sensible gauge of flawless conditions. Distinctive utilizations raise diverse concerns and subsequently unique guidelines are considered. Normal water bodies and in addition ground water sources will change in light of ecological conditions. Despite the fact that ground water source may not pollute much quickly.

Present study aims to ascertain and determine the minimum Water Quality Index (WQI) which will be sufficient and acceptable by the local community of Mehsana District and Town..

LITERATURE REVIEW

The target of the present work is to examine the appropriateness of groundwater for human utilization in view of figured water quality list values. To think about up to which degree the physical and organic parameters have been impacted and occurring from the new water line to groundwater aquifer of that region. This investigation requires the drinking water parameter of groundwater for contemplating water quality record. A Review of Literature has been done before the begin of work.

Quality Characterization of Groundwater utilizing Water Quality Index in Surat city, Gujarat, India was finished by Mangukiya Rupal et al. (2012). The goal of the work was to talk about the appropriateness of groundwater for human utilization in light of processed water quality list esteems. Salt water interruption happening at seaside area of Surat was additionally considered for the investigation. The investigation up to which degree the salt water interruption occurring from the beach front line of Surat to groundwater aquifer of that region was likewise done. Ultimately the drinking water parameter of groundwater for concentrate salt water interruption was finished. Appraisal of ground water quality can be an unpredictable procedure undertaking different parameters fit for causing different weights on general water quality. The assessment of water quality from countless, each containing focuses for some, parameters is troublesome (Almeida et al. 2007). Analysis of water quality utilizing distinctive methodologies like factual investigations of individual parameter, multi-stressors water quality files, and so forth have been considered by Venkatesharaju et al. 2010. Lakes and tanks are known to be biological gauges of the strength of a city as they direct the smaller scale atmosphere of any urban focus (Benjamin et al. 1996), in this manner influ-encing the life of the general population neighboring it. The nature of ground water in an inland water bodies profoundly affect the ground water table and ground water nature of the adjacent aquifers because of presence of direct association amongst ground and ground water. Lakes have an incredible significance ecologically because of reasons, for example, (a) wellsprings of water: ground and groundwater energize and release, for drinking and water

system, (b) underpins liveli-hoods, lung space of clear and cool air, (c) nourishment and sustenance, (d) go about as flood control and stream flow mainte-nance, (e) diversion— instruction, sailing, swimming, strolling and running on the lake bund, (f) lakes are regular framework for environmental change adjustment and biogeo-intelligent cycles, (g) pisciculture, (h) untamed life territory, espe-cially fishes and flying creatures, (I) rain water collecting and, (j) crisis water supply for firefighting. For computing the WQI, 14 parameters to be specific, pH, electrical conductivity, add up to dis-fathomed solids, add up to hardness, alkalinity, calcium, magne-sium, sodium, potassium, chloride, sulfate, nitrate, fluorides and press were considered.

STUDY AREA

Study area includes 6 prime locations of Mehsana city. Mehsana is situated in north Gujarat region, Unjha is situated nearly 100 kms from Ahmedabad and is a part of Mehsana Sub-district. Unjha is well known for Asia’s biggest Industrial APMC. The villages considered in the study are as follows: Aithor, Laxmipura, Pratapgadh, Sinhi, Unava, Sunak, Karli and Unjha itself.

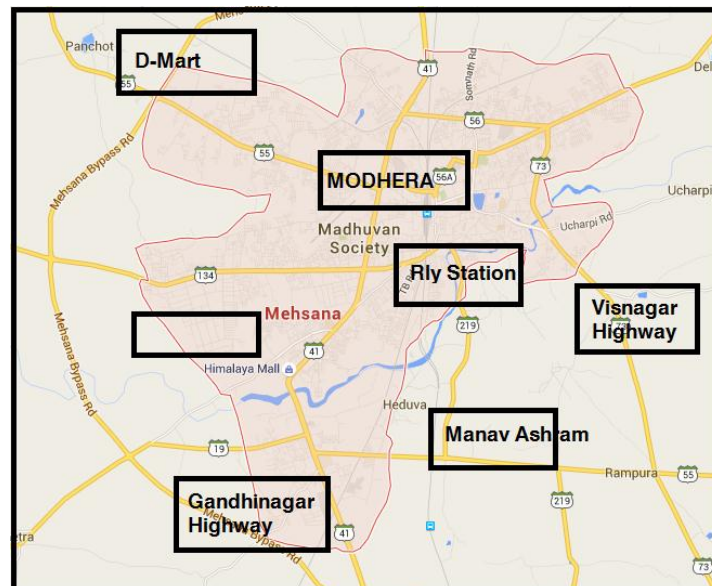


Fig.1: Mehsana and nearby villages

WATER SAMPLING AND METHODOLOGY

In an effort to compare water quality, eight locations were chosen for sampling purpose. These locations were at the eight villages considered for the study. While sampling plastic bottle, BOD bottle, Solution of MnSo4 and KI was always kept. The investigation and lab testing of parameters were done therefore after information gathering. These parameters are clarified as takes after:

3.1 Biochemical Oxygen Demand: B.O.D. is a measure of the measure of sustenance for microscopic organisms that is found in water. Microorganisms use natural issue in their breath and expel oxygen from the water. The BOD test gives the unpleasant thought of organic waste present in the water. Biodegradable waste is normally made out of natural squanders, including leaves, grass clippings and fertilizer.

3.2 Dissolved Oxygen: DO test measures the measure of life maintaining oxygen broke up in the water. This is the oxygen that is accessible ti angle, invertibrates, and every single other creature living in the water. Low levels of disintegrated oxygen in water is an indication of conceivable contamination.

3.3. pH: The pH level is a measure of corrosive substance of the water. Water with a pH of 7 is viewed as nonpartisan. On the off chance that pH is beneath 7, it is named acidic, while the pH more prominent than 7 is said to be basic. The pH of faucet water in India lies between 6.5 to 8.5.

3.4 Total Dissolved Solids: TDS is a measure of strong materials broke down in the water. This incorporates salts, some natural issue and an extensive variety of different things from supplements to harmful materials. Centralizations of TDS that are high or low may restrain the development and prompt demise of numerous sea-going living things.

3.5 Turbidity: Turbidity is a measure of scattering of light in a section of water because of suspended issue. The higher the turbidity, the cloudier the water shows up. On the off chance that water turns out to be excessively turbid, it loses the capacity, making it impossible to help a wide assortment of plants and other sea-going living beings.

3.6 Color: Color would enable us to recognize the quality of contamination to stack. The shading additionally implements us to consider the vegetation and amphibian life.

3.7 Chemical Oxygen Demand: The release of natural and inorganic loads and squanders may influence the tainting of ground water. This may influence even the most purest type of water accessible i.e. ground water. The concoction stack prompts increment the contamination of water bodies. Due to this reason just this parameter is resolved.

3.8 Total Alkalinity: The family unit exercises like dairy cattle cultivating, showering, washing and so forth increment the carbonates and bi-carbonates content. This expands the inorganic load. Hence it is necessary to decide Total Alkalinity.

WATER QUALITY INDEX DETERMINATION

The Water Quality Index utilizes a particular scale to rate the nature of the water. Once the Water Quality Index (WQI) score is resolved, it can be contrasted against standard scale with decide how sound water is accessible around us. The Mehsana city was isolated into 6 districts which are the principle and prime areas of the city as well. What's more, time to time examining has been done prevailing by testing of the water tests. Additionally the information of Mehsana Municipality and tried outcomes were likewise looked at.

4.1 Introduction of GWQI:Ground Water Quality Index (GWQI) is a unit less number that depicts a quality incentive to an amassed set of measure synthetic, physical and microbiological parameters. Essentially a WQI endeavors to give a system to introducing an in total determined numerical articulation to characterize a specific level of water quality.

WQI is a system for displaying an in total determined numerical articulation characterizing finds out level of water quality. Water quality records go for giving a solitary incentive to the water nature of a source diminishing an extraordinary measure of parameters into less difficult articulation and empowering simple translation of checking information.

Water Quality Index is a component for displaying an in total determined numerical articulation characterizing a specific level of water quality. As it were, WQI compresses expansive measure of water quality information into less difficult terms (e.g. great, terrible) for answering to open in steady way. Different looks into have advanced which purchased the progressions to the procedure relying upon the use and parameters under thought.

Facilitate advancement and figuring of WQI incorporates thought of various parameters, for example, pH, BOS, COD, TDS, SS, Temperature, Chloride, Heavy metals, Sulfate and so on. To dissect, decide and test every one of the parameters is long and repetitive process. So just couple of picked parameters have been considered and these are pH, BOD, COD, Total Dissolved Solids (TDS), Total Alkalinity, Color, DO and so forth.

4.2 Calculation of WQI: The Water Quality Index (WQI) has been calculated using Weighted Arithmetic Index method.

Weighing: The word weighing implies relative significance of each of the factor in the overall water quality and it depends on the permissible level of waste water discharge, as suggested by GPCB (Gujarat Pollution Control Board). Factors which have higher permissible limits are less harmful and have low weights while the factors having low permissible limits are more harmful. Therefore

$$W_i = K/S_n$$

Where, W_i = Unit weight of chemical factor, K = constant of proportionality and is given by,

$$K = 1/ [(1/V_{s1})+(1/V_{s2})+(1/V_{s3})+...+(1/V_{sn})]$$

S_n = Standard value of i_{th} parameter.

Rating scale: Each chemical factor has been assigned a water quality rating to calculate WQI.

$$Q_i = 100[(V_a - V_i)/(V_s - V_i)]$$

Where V_a = average measured values in the water sampole for three months at a place

V_s = Standard value of i_{th} parameter (0 for all, exceptions: pH and DO)

$$\text{Water Quality Index (WQI)} = [\Sigma(Q_i W_i)/\Sigma W_i]$$

Where $\Sigma(Q_i W_i)$ = Summation of $(Q_i * W_i)$ of all the parameters considered.

ΣW_i = Total unit weights of all chemical factors.

Using the Water Quality Index, all the samples were categorized into the following five classes.

Table 1: Range of GWQI Scale

Excellent	0-50
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Good	50-100
Poor water quality	100-200
Very poor water quality	200-300
Unsuitable water for human consumption	>300

For the most part WQI are considered for a particular utilization of water. In this examination the WQI for human utilization is considered and allowable WQI for the waste water is taken as 100. A water supply with a low quality rating would not regularly be viewed as satisfactory for exercises including direct contact with the water.

Table 2: Collection and sampling of data (Sample)

Sr. No.	Date/ Tested Parameter	pH	Turbidity (NTU)	Elec. Conductivity	Dissolved Oxygen (mg/l)
1	1 Aug. 2015	6.7	7	733	22
2	16 Aug. 2015	6.9	8	644	42
3	1 Sept. 2015	6.9	5	780	17
4	17 Sept. 2015	7.1	8	702	19
5	3 Oct. 2015	6.8	7	623	52

RESULTS AND DISCUSSION

Water Quality List (WQI) has been evaluated for every one of the districts of Mehsana considered under investigation region. Table 2, Table 3, Table 4 and Table 5 abridges the WQI counts for Mehsana city for four specimens taken at various time interim. Fig. 2 demonstrates the variety of parameters as for area.

Table 3: WQI calculation, sample 1: Railway Station nearby area

Parameter	Mean test Results	Unit	Standard permissible value	Relative Weight	Quality Rating	Weighted value
pH	7.91	Units	7.0	0.67	60.66	40.46
BOD	8.74	mg/l	30	0.19	29.13	5.51
COD	52	mg/l	100	0.06	52	2.95
Colour	42.7	PTU	100	0.06	42.7	2.42
TDS	320	mg/l	2100	0.002	15.23	0.04
Total Alkalinity	188	mg/l	200	0.03	94	2.67
			SUM	1		54.04
			K=5.67			
			WQI=54.02	54.02		

Table 4: WQI calculation, sample 2: Modhera Chokdi area

Parameter	Mean test Results	Unit	Standard permissible value	Relative Weight	Quality Rating	Weighted value
pH	7.78	Units	7.0	0.67	52	34.69
BOD	9.93	mg/l	30	0.19	33.1	6.26
COD	40.2	mg/l	100	0.06	40.2	2.28
Colour	36	PTU	100	0.06	36	2.04
TDS	432	mg/l	2100	0.002	20.57	0.06
Total Alkalinity	200	mg/l	200	0.03	100	2.83
			SUM	1		48.15
			K=5.67			
			WQI=48.15	48.15		

Table 5: WQI calculation, sample 3: D-Mart area

Parameter	Mean test Results	Unit	Standard permissible value	Relative Weight	Quality Rating	Weighted value
pH	7.96	Units	7.0	0.67	64	42.69
BOD	5.77	mg/l	30	0.19	19.23	3.64
COD	32	mg/l	100	0.06	32	1.81
Colour	48.3	PTU	100	0.06	48.3	2.73
TDS	508	mg/l	2100	0.002	24.19	0.066
Total Alkalinity	160	mg/l	200	0.03	80	2.27
			SUM	1		53.21
			K=5.67			
			WQI=53.21	53.21		

Table 6: WQI calculation, sample 4: Manav Ashram Chokdi area

Parameter	Mean test Results	Unit	Standard permissible value	Relative Weight	Quality Rating	Weighted value
pH	8.04	Units	7.0	0.67	71.33	47.58
BOD	8.88	mg/l	30	0.19	29.6	5.59
COD	48	mg/l	100	0.06	48	2.72
Colour	43.8	PTU	100	0.06	8.9	0.50
TDS	480	mg/l	2100	0.002	22.86	0.06
Total Alkalinity	120	mg/l	200	0.03	60	1.701
			SUM	1		48.16
			K=5.67			
			WQI=48.16	48.16		

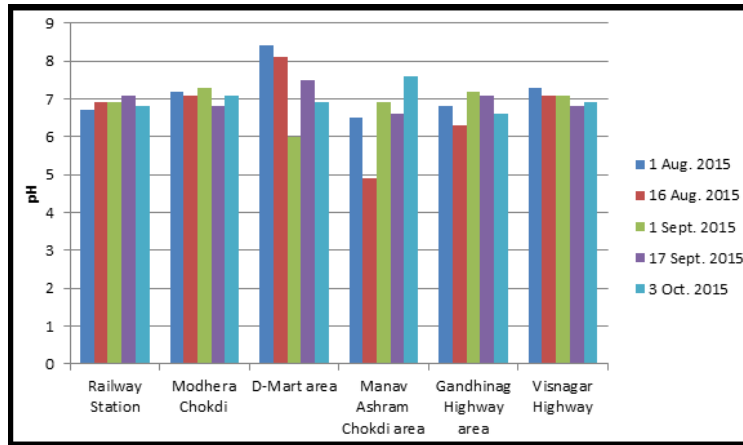


Fig. 2: pH representation region (area) wise

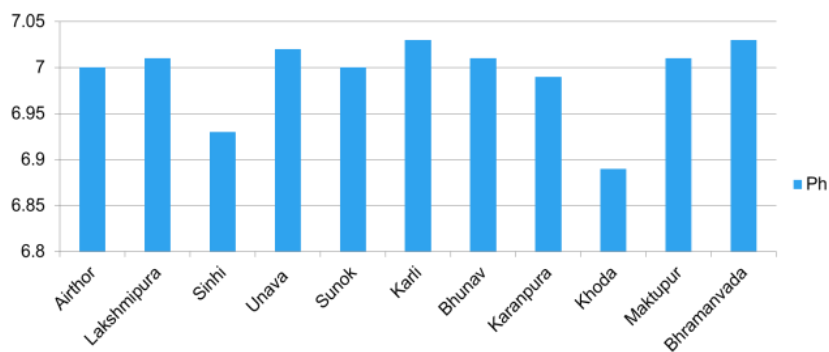


Fig.2: Region wise Variation of Average pH

Similar procedure was adopted for other regions such as Modhera Chokdi area, D-Mart area, Manav Ashram Chokdi area, Gandhinagar highway area and Visnagar Highway area to obtain WQI values. Table 6 shows the WQI parameters and the WQI status of the regions. This summarises the results of obtained WQI study.

Table 7: Average WQI: Region wise

Sr. No.	Name of the Sampled Area	Average WQI	Predominant Parameters	Status of Water
1	Railway Station Area	48.14	pH	Good
2	Modhera Chokdi Area	47.65	pH	Good
3	D-Mart Area	42.31	BOD	Good
4	Manav Ashram Chokdi Area	47.18	TDS	Good
5	Gandhinagar Highway Area	43.78	TDS	Good
6	Visnagar Highway Area	47.44	Total Alkalinity	Good

CONCLUSIONS

The investigation of various substance and physical parameters uncovers that the water is fit for drinking according to figured Water Quality Record Scale. These qualities are contrasted and the given esteems by Gujarat Pollution Control Board (GPCB) and World Wellbeing Association (WHO) limits. The predominance of certain parameter has been found and moves might be made to relieve the issue. Research paper compresses the investigation improved the situation evaluating the Water Nature of ground water and in addition accessible ground water.

The obtained GWQI from representative samples of study area shows the groundwater quality lies in the range of poor to tolerable good but the temporally analysis indicates that such quality fluctuates in its own and even in some of the area it has been found within the range of very poor water . This needs the attention towards the improvement of groundwater quality before further degradation. Literature indicates that artificial recharging of groundwater by recharge well is one of best method confirmed across the world for the improvement of underground water quality in urban region. Therefore, as a future scope of this study the recharge phenomena can be explored to study area and on the base of available data of rainfall, land use pattern ,topography- (1) Runoff in the study area can be worked out and with the consideration of individual recharge well's recharge rate capacity numbers of well can be computed and proposed . (2) Effect of recharging on groundwater quality can be predicted and the effect of recharging can be correlated with GWQI.

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