

# Assessment of Ground Water Quality Parameter in Allahabad (Prayagraj) City

Kunwar Abhishek Singh<sup>1</sup> Anurag Kumar Srivastava<sup>2</sup>

<sup>1</sup>M. Tech. Student <sup>2</sup>Assistant Professor

<sup>1,2</sup>Department of Civil Engineering

<sup>1</sup>SIIT, Gorakhpur, India <sup>2</sup>ITM, Gida, Gorakhpur, India

**Abstract**— An investigation on evaluation of water nature of Allahabad District was led for 400 nos. of tests which were gathered from 40 homes (5 zones) of twenty squares (two residences from every square). The 20 water quality parameters (physical and chemical), including pH, Turbidity, iron, fluoride, hardness, absolute alkalinity, and calcium, were investigated in the wake of bringing tests under controlled conditions from different, remotely set residences in the ecological building lab of the structural designing division. The outcomes were contrasted and the attractive furthest reach of specific parameters as prescribed by IS:10500 (2012). The outcomes demonstrated that the vast majority of the sources were observed to be polluted by pathogenic living beings according to MPN test. Normal observing of different area water quality is important to have a keep an eye on surface water contamination for solid living of human. Relationship coefficients were determined between various sets of parameters to distinguish the profoundly connected and interrelated water quality parameters.

**Keywords:** Physicochemical Properties, Groundwater and Water Quality Index

## I. INTRODUCTION

As water is an all-inclusive dissolvable it is hard to get unadulterated common water. The water present underneath the water table is called groundwater and in Allahabad ground water is one of the significant wellsprings of consumable water. Be that as it may because of monstrous human exercises this wellspring of common water has turned out to be polluted and it in this manner builds the need to study water quality. When the base (ground) water is defiled, its quality can't be remodeled back effectively, and to gadget approaches to watch it, Water quality list is one among the chief viable devices to talk information on the standard of water to the included voters and approach makers. It in this way, winds up pivotal parameter for the appraisal and the executives of bore well water. Presently a-day, water quality issues have become a huge worry because of the development of populace, urban extension and innovative advancement.

The amount and piece of the broke up minerals in normal water relies on the kind of shake or soil with which it has been in contact, or through which it has passed, and the span of time it has been in contact with these stones. Improvement of groundwater additionally gives chances to consummate its quality. Nature of groundwater may fluctuate from spot to put and from stratum to stratum. It additionally differs from season to season. The assurance of appropriateness of groundwater would along these lines include a portrayal of the event of the different constituents and their connection to the use. Water quality in the

provincial drinking water supply has risen as a noteworthy issue which needs legitimate consideration.

## II. STUDY AREA AND METHODOLOGY

Allahabad is situated in the southern piece of the province of Uttar Pradesh, at 25°27'N 81°50'E 25.45°N 81.84°E, it is an old and exceptional city in India where two major streams of the nation in particular Ganga and Yamuna conveying different modern effluents have a juncture. Various businesses and urban communities in India are situated on the two sides of these waterways.

The water of collected deferent sites has parameters was examined for pH, Alkalinity, Dissolved Oxygen, Copper, Total Dissolve Solid, Chloride, Turbidity, Total Hardness, and Electrical Conductivity etc. According to the standard methodology by IS:10500 (2012).

## III. WQI EQUATION

### A. Calculation of Sub Index of Quality rating (qn):

The estimation of qn is determined utilizing the following articulation.

$$qn = 100[(Vn - Vio) / (Sn - Vio)]$$

Where: qn = quality rating for the nth water quality parameter.  
Vn = estimated estimation of the nth parameter at a given inspecting station.

Sn = standard allowable estimation of the nth parameter.  
Vio = perfect estimation of the nth parameter in unadulterated water.

### B. Calculation of Unit Weight (Wn):

Calculation of unit weight (Wn) for different water quality Parameters are conversely relative to the prescribed principles for the comparing parameters.

$$Wn = K / Sn$$

Where: Wn = unit weight for the nth parameters.

Sn = standard incentive for the nth parameters.

K = constant for proportionality.

The general water quality record was determined by conglomerating the quality rating with the unit weight straightly.

$$WQI = \sum qn Wn / \sum Wn$$

### C. Classification of WQI values for human consumption

WQI Range	Water Quality Type	Possible Usages
0-25	Excellent Water Quality	Drinking, Irrigation and Industrial
26-50	Good Water Quality	Drinking, Irrigation and Industrial
51-75	Fair Water Quality	Irrigation and Industrial

76-100	Poor Water Quality	Irrigation
101-150	Very Poor Water Quality	Restricted use for Irrigation
Above 150	Unfit For Drinking	Proper treatment required before use.

**D. Water Quality Parameters & Units According to IS: 10500**

Sr. No.	Parameters	Units	Limits as per IS:10500
1	pH at 25°C	-	6.5-8.5
2	Electrical Conductivity	µs/cm	Not Specified
3	Turbidity	NTU	5
4	Total Dissolved Solids	mg/l	500
5	Total Hardness as CaCO <sub>3</sub>	mg/l	300
6	Total Alkalinity as CaCO <sub>3</sub>	mg/l	200
7	Chloride as Cl	mg/l	250
8	Sulphate as SO <sub>4</sub>	mg/l	200
9	Fluoride as F	mg/l	1
10	Nitrate as NO <sub>3</sub>	mg/l	45
11	Iron as Fe	mg/l	0.3
12	Ammonia as NH <sub>3</sub>	mg/l	0.5
13	Phosphate as PO <sub>4</sub>	mg/l	Not Specified
14	Sodium as Na	mg/l	Not Specified
15	Potassium as K	mg/l	Not Specified
16	Calcium as Ca	mg/l	75
17	Magnesium as Mg	mg/l	30
18	Hexavalent chromium as Cr <sup>6+</sup>	mg/l	0.05
19	Copper as Cu	mg/l	0.05
20	Dissolved Oxygen (D.O.)	mg/l	Not Specified

1	pH at 25°C	-	6.5-8.5	7.87	7.43
2	Electrical Conductivity	µs/cm	Not Specified	345	359
3	Turbidity	NTU	5	1.7	0.9
4	Total Dissolved Solids	mg/l	500	287	332
5	Total Hardness as CaCO <sub>3</sub>	mg/l	300	163	176
6	Total Alkalinity as CaCO <sub>3</sub>	mg/l	200	127	112
7	Chloride as Cl	mg/l	250	122	134
8	Sulphate as SO <sub>4</sub>	mg/l	200	65	46
9	Fluoride as F	mg/l	1	0.34	0.5
10	Nitrate as NO <sub>3</sub>	mg/l	45	23	17
11	Ammonia as NH <sub>3</sub>	mg/l	Not Specified	<0.05	<0.05
12	Phosphate as PO <sub>4</sub>	-	Not Specified	0.04	0.04
13	Sodium as Na	mg/l	Not Specified	12	28
14	Potassium as K	mg/l	Not Specified	1.9	1.6
15	Calcium as Ca	mg/l	75	42.41	33.45
16	Magnesium as Mg	mg/l	30	17.12	10.43
17	Iron as Fe	mg/l	0.3	0.05	0.11
18	Hexavalent chromium as Cr <sup>6+</sup>	mg/l	0.05	< 0.05	< 0.05
19	Copper as Cu	mg/l	0.05	< 0.05	< 0.05
20	Dissolved Oxygen (D.O.)	mg/l	Not Specified	4.7	5.1

**IV. RESULTS**

**A. Water Quality Parameter Testing**

**1) Rajapur (S1) & Kaushambi (S2) Water Sample**

Sr. No.	Parameters	Units	Limits as per IS:10500	S1	S2
---------	------------	-------	------------------------	----	----

**2) WQI Calculation for Water Sample-1 & 2**

Parameters	Observed value (S1)	Observed value (S2)	Standard value (S <sub>n</sub> )	q <sub>n</sub> (S1)	q <sub>n</sub> (S2)	K <sub>n</sub> (S1 & S2)	W <sub>n</sub> =K <sub>n</sub> /S <sub>n</sub> (S1)	W <sub>n</sub> =K <sub>n</sub> /S <sub>n</sub> (S2)	q <sub>n</sub> ·W <sub>n</sub> (S1)	q <sub>n</sub> ·W <sub>n</sub> (S2)
pH at 25°C	7.87	7.43	6.5-8.5	32.45	47.44	0.027654	0.00368	0.00368	0.11942	0.17457
Electrical Conductivity	345	359	Not Specified	-	-	0.027654	-	-	-	-
Turbidity	1.7	0.9	5	34	18	0.027654	0.00553	0.00553	0.18802	0.09954
Total Dissolved Solids	287	332	500	57.4	66.4	0.027654	0.000055	0.000055	0.00316	0.00365
Total Hardness as CaCO <sub>3</sub>	163	176	300	54.33	58.67	0.027654	0.000092	0.000092	0.00499	0.00539

Total Alkalinity as CaCO <sub>3</sub>	127	112	200	63.5	56	0.027654	0.000138	0.000138	0.00876	0.0077
Chloride as Cl	122	134	250	48.8	53.6	0.027654	0.000111	0.000111	0.00541	0.00595
Sulphate as SO <sub>4</sub>	65	46	200	32.5	26	0.027654	0.000138	0.000138	0.00448	0.00358
Fluoride as F	0.34	0.5	1	34	5	0.027654	0.027654	0.027654	0.9402	0.1383
Nitrate as NO <sub>3</sub>	23	17	45	51.1	37.7	0.027654	0.000614	0.000614	0.03138	0.02319
Iron as Fe	<0.05	<0.05	0.3	-	-	0.027654	0.09218	0.09218	-	-
Ammonia	0.04	0.04	0.5	-	-	0.027654	0.05531	0.05531	-	-
Phosphate	12	28	Not Specified	-	-	0.027654	-	-	-	-
Sodium	1.9	1.6	Not Specified	-	-	0.027654	-	-	-	-
Potassium	42.41	33.45	Not Specified	-	-	0.027654	-	-	-	-
Calcium	17.12	10.43	75	22.8	13.9	0.027654	0.000369	0.000369	0.00842	0.00513
Magnesium	0.05	0.11	30	0.16	0.36	0.027654	0.0009218	0.0009218	0.00015	0.00033
Hexavalent chromium	< 0.05	< 0.05	0.05	-	-	0.027654	0.55308	0.55308	-	-
Copper	< 0.05	< 0.05	0.05	-	-	0.027654	0.55308	0.55308	-	-
D.O.	4.7	5.1	Not Specified	-	-	0.027654	-	-	-	-
							$\sum W_n=1.293$	$\sum W_n=1.293$	$\sum q_n W_n=0.3144$	$\sum q_n W_n=0.4673$

$$WQI (S1) = \sum q_n W_n / \sum W_n = 24.31, WQI (S2) = \sum q_n W_n / \sum W_n = 36.14$$

#### V. CONCLUSION

The pH remained slightly alkaline in nature in every site and the values were ranged between 7.87 to 7.43. The electrical conductivity and TDS were also found high. Sample wise it is high during any season. The present investigation indicates that the concentration of Dissolved oxygen fluctuated in between 4.3 mg/l and 4.1 mg/l.

Descriptive statistics for all water quality parameters examined are shown in Table. It was observed from the computed WQI that the average value is 24.31 & 36.14 for sample 1 & sample 2 and therefore can be categorized into – Excellent water quality & Good water quality as per Table.

#### REFERENCES

- [1] S.K.Pathak, Shambhu Prasad, Tanmay Pathak, Govt. College Sanwer, Indore (M.P.) Assistant Manager (Civil) Larsen & Toubro Limited, WDFC CTP 1&2, Jaipur, determination of water quality index river bhagirathi in Uttarakashi, Uttarakhand, India
- [2] K. Yogendra and E.T. Puttaiah Department of P.G. Studies and Research in Environmental science, Jnana sahyadri, Kuvempu University, Shankaraghatta-577451, Shimoga, Karnataka, India, Determine of water quality index and suitability of an Urban waterbody in Shimoga town, Karnataka
- [3] Joyanta pal & Dr. Manish Pal, Assistant Professor, Civil Engineering Department, National Institute of Technology Agartala, India. Dr.Pankaj Kr. Roy and Dr. Asis Mazumdar, Associate Professor, School of Water Resource Engineering, Jadavpur University, India. Water Quality Index for Assessment of Rudrasagar Lake Ecosystem, India
- [4] M. B. Chougule, A. I. Wasif and V. R. Naik,—Assessment of Water Quality Index (WQI) for Monitoring Pollution of River Panchganga at Ichalkaranji, Proceedings of International Conference on Energy and Environment, Chandigarh, March 2009, pp. 122-127.
- [5] N. Karakaya and F. Evrendilek, —Water Quality Time Series for Big Melen Stream (Turkey): Its Decomposition Analysis and Comparison to Upstream, Environmental Monitoring and Assessment, Vol. 165, No. 1-4, 2009, pp. 125-136.
- [6] C. R. Ramakrishnaiah, C. Sadashivaiah and G. Ranganna,—Assessment of Water Quality Index for the Ground Water in Tumkur Taluk, E-Journal of Chemistry, Vol. 6, No. 2, 2009, pp. 523-530.
- [7] Abdul Hameed M. Jawad Alobaidy, Haider S. Abid, Bahram K. Maulood(2010), —Application of Water

Quality Index for Assessment of Dokan Lake Ecosystem,  
Kurdistan Region, Iraq, Journal of Water Resource and  
Protection, 2010, 2, 792-798.

