

# Water Quality Index for Assessment of Ghoda Pachad Dam, Bhopal (M.P.)

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**Abstract**— The study presents a comprehensive evaluation of water quality in Ghoda Pachad Dam, Bhopal, Madhya Pradesh. There are four internationally recognized water quality index (WQI) methods: National Sanitation Foundation Water Quality Index (NSFWQI), Canadian Council of Ministers of the Environment Water Quality Index (CCMEWQI), Oregon Water Quality Index (OWQI), and Weighted Arithmetic Water Quality Index Method (WAWQI). Analysis conducted for the year 2023-24 indicates a WQI value of 40.77 suggesting unsuitability for drinking purposes according to established criteria. However, variations in index values across locations are attributed to differing physico-chemical characteristics. Despite unsuitability for drinking, the WQI values affirm the water's suitability for purposes like irrigation and aquaculture, ensuring its effective utilization beyond drinking water standards.

**Index Terms**- Aquaculture, Dam, Ghoda Pachad, Physico-Chemical Parameters, Water Quality Index (WQI).

## I. INTRODUCTION

Water is an essential natural resource that holds both social and economic significance for humanity (Kumar et al., 2018). The study area in Ghoda Pachad Dam, Bhopal, Madhya Pradesh, is predominantly covered by water. The quality of water in this region is assessed using the Weighted Arithmetic Water Quality Index Method (WAWQI) (Dendukuri et al., 2017). This method is employed to evaluate and compare the overall water quality based on specific parameters and criteria established by index.

Fresh water is vital for human welfare. Water is one of the most essential urban and rural amenities, and it is indispensable for human activities (Gupta et al., 2021). The quality of water varies greatly due to social,

economic, and environmental factors. Industrialization, urbanization, unsustainable agricultural practices, and population growth have all contributed to the deterioration of freshwater sources (Ali et al., 2023). To address these challenges, it's important to consistently monitor and evaluate the condition of water bodies.

The current study aims to estimate a Water Quality Index (WQI) using the Weighted Arithmetic Water Quality Index (WAWQI) method. Unlike alternative methods, WAWQI incorporates multiple water quality parameters into a mathematical equation that assigns a numerical rating to the overall health of a water body. Furthermore, this method assesses the suitability of surface and groundwater sources for human consumption (Ram et al., 2021).

## II. METHODOLOGY

Study Area – Ghoda Pachad Dam is situated in the Huzur tehsil of Bhopal district, Madhya Pradesh, India. Its coordinates are 23° 16' 0" N 77 ° 31' 15" E.



Fig 1 : Location Map of Ghoda Pachad Dam, Tehsil Huzur, District Bhopal (M.P.)

Water samples were collected from Feb 2023-March 2024 at Ghoda Pachad Dam. To assess water quality, various variables such as water temperature, air temperature, pH, and dissolved oxygen (DO) were measured. Additional parameters including total dissolved solids (TDS), specific conductivity, total alkalinity, total hardness, chlorides, nitrate, and calcium were analyzed according to established protocols and guidelines (APHA, 2005). pH serves as a crucial indicator of aquatic system health (Dewangan et al., 2023).

### III. SAMPLE COLLECTION

Water samples were taken from different sites in a random selection process at Ghoda Pachad Dam (Fig. 1).

Weighted Arithmetic Water Quality Index Method  
Weighted arithmetic water quality index method (Dendukuri et al., 2017) classified the water quality according to the degree of purity by using the most commonly measured water quality variables. The method has been widely used by the various scientists and the calculation of WQI was made by using the following equation:

$$WQI = \frac{\sum Q_n W_n}{\sum W_n}$$

The quality rating scale (Qn) for each parameter is calculated by using this expression:

$$Q_n = 100[(V_n - V_o) / (S_n - V_o)]$$

Where,

Qn = Quality rating scale

Vn = Estimated concentration of ith parameter in the analysed water

Vo = Ideal value of this parameter in pure water Vo = 0 (except pH =7.0 and DO = 14.6 mg/l)

Sn = Recommended standard value of parameter

Wn = Unit weight for each water quality parameter

Wn is calculated by using the following formula:

$$W_n = K / S_n$$

K = proportionality constant and can also be calculated by using the following equation:

$$K = \frac{1}{\sum (\frac{1}{S_n})}$$

Using a formula to find a constant "K" that helps in comparing the values of different parameters. This constant depends on the standards for each parameter. Water Quality Index (WQI) is calculated by combining the quality ratings and unit weights for all

parameters. This gives an overall measure of the water quality, taking into account all the parameters measured.

### IV. RESULT

In this investigation, employing the water quality index (WQI) allows for a comparative assessment of water quality across diverse locations. The variations in index values, observed can be attributed to the differences in physico-chemical characteristics of Ghoda Pachad Dam.

The water quality index (WQI) for the water of Ghoda Pachad Dam was assessed for year 2023-24 is 40.77, as presented in Table 1. These values categorize the water of Ghoda Pachad Dam as unsuitable for drinking purposes, according to the BIS criteria outlined in Table 2 (BIS 2012). Based on the current findings, it is evident that the water quality of Ghoda Pachad Dam is Good and can be used for irrigational and aquacultural activities only.

Table-1. Water quality parameters and observed values.

Parameters	Standard value (Sn)	Observed value (Vn)	Unit weight (Wn)	Quality rating scale (Qn)	Wnlo gQn (WQI)
Atmospheric temp. (°C)	35	33.4	0.00757893	95.4285714	0.72324645
Water temp. (°C)	32	30.2	0.00828945	94.375	0.78231726
pH	7.5	6.9	0.03536834	92	3.25388716
Conductivity	300	264.4	0.00088421	88.1333333	0.07792824
DO (mg/l)	5	5.9	0.05305251	118	6.26019594
Ca (mg/l)	100	28	0.00265263	28	0.07427351
NO3- (mg/l)	0.3	0.1	0.88420847	33.3333333	29.4736156

Chloride (mg/l)	250	40.4	0.00106105	16.16	0.01714657
Total Hardness (mg/l)	300	80.6	0.00088421	26.866667	0.02375573
Total Alkalinity (mg/l)	200	106.5	0.00132631	53.25	0.07062615
TDS (mg/l)	500	178	0.00053053	35.6	0.01888669
				WQI	40.7758793

Table -2. BIS Standard values of WQI.

Range	Water Quality
0-24	Excellent
25-49	Good
50-74	Poor
75-100	Very Poor
Above 100	Unfit for consumption

### CONCLUSION

The analysis of the water quality index (WQI) for Ghoda Pachad Dam during the year 2023-24, which stands at 40.77 as indicated in Table 1, it is evident that the water quality is categorized as unsuitable for drinking purposes according to the criteria outlined in Table 2. However, it's important to note that the variations in index values observed across different locations are likely attributed to differences in physico-chemical characteristics. Despite the categorization of the water as unsuitable for drinking, the WQI values indicate that the water quality at Ghoda Pachad Dam is still within acceptable ranges for other purposes such as irrigation and aquaculture. This suggests that while the water may not meet the standards for drinking directly, it can still be utilized

effectively for other purposes without significant concerns regarding its quality.

These findings suggest that while improvements may be necessary to meet drinking water standards, the water quality at Ghoda Pachad Dam remains relatively good and suitable for various non-drinking purposes such as irrigation and aquaculture. This underscores the importance of ongoing monitoring and management efforts to maintain and improve water quality in the region.

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