Int. J. Adv. Res. Biol. Sci. (2026). 13(7): 1-12

International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
(A Peer Reviewed, Referred, Indexed and Open Access Journal)
DOI: 10.22192/ijarbs Coden: IJARQG (USA) Volume 13, Issue 7-2026

Research Article

DOI: http://dx.doi.org/10.22192/ijarbs.2026.13.07.001

Integrated Assessment of Water Quality in Manjeera Reservoir, Telangana, India, Using Physico-Chemical Parameters and Water Quality Index (WQI): Implications for Sustainable Water Resource Management

Dr. S. Vijaya
Professor of Botany
Department of Botany
Tara Government College (A), Sangareddy, Telangana State

Abstract

Water quality assessment is essential for ensuring the sustainable utilization and management of freshwater resources. The present study evaluates the physico-chemical characteristics and Water Quality Index (WQI) of the Manjeera Reservoir, Telangana, India, to determine its suitability for drinking and domestic purposes. Water samples were collected from representative locations of the reservoir, including normal water and water collected away from algae-dominated areas, and analysed following the standard methods prescribed by the **American Public Health Association (APHA, 24th Edition)**. The analyzed parameters included pH, electrical conductivity (EC), total dissolved solids (TDS), carbonates, bicarbonates, total hardness, calcium, magnesium, nitrate, and phosphate. The observed pH ranged from 7.50 to 7.76, indicating slightly alkaline water. Electrical conductivity varied between 420 and 676 µS/cm, while TDS ranged from 252 to 406 mg/L, remaining within the permissible limits for drinking water. Total hardness ranged from 140 to 245 mg/L, indicating moderately hard water. Nitrate concentrations (22–29 mg/L) and phosphate concentrations (0.05 mg/L) were within acceptable standards, suggesting minimal nutrient enrichment and low risk of eutrophication in the sampled locations. The Water Quality Index was calculated by integrating the weighted contribution of all measured parameters, providing a comprehensive assessment of overall water quality. The WQI values indicated that the reservoir water falls within the **good to excellent quality category**, making it suitable for drinking after conventional treatment and for irrigation and domestic applications. The findings highlight the effectiveness of WQI as an integrated tool for simplifying complex water quality data and supporting informed decision-making. Continuous monitoring, watershed protection, pollution prevention, and community-based conservation strategies are recommended to maintain the ecological integrity and sustainable utilization of the Manjeera Reservoir.

Keywords: Water Quality Index (WQI) utilisation, Manjeera Reservoir, Physico-chemical parameters, Water quality assessment, APHA, Sustainable water management, Drinking water quality, Freshwater resources, Telangana and Environmental monitoring

1. Introduction

Background on Freshwater Resources and Water Quality

Freshwater is one of the most essential natural resources supporting human survival, agriculture, industrial development, and ecosystem functioning. Although approximately 71% of the Earth's surface is covered by water, only about 2.5% constitutes freshwater, and less than 1% is readily available for direct human use. Increasing population growth, urbanization, industrialization, intensive agricultural practices, and climate change have accelerated the deterioration of freshwater quality worldwide, posing serious challenges to sustainable water resource management (WHO, 2022; APHA, 2023). Surface water bodies such as rivers, lakes, and reservoirs are highly susceptible to contamination from domestic sewage, industrial effluents, agricultural runoff, and natural weathering processes. Consequently, regular monitoring of water quality has become indispensable for protecting public health, maintaining ecological integrity, and ensuring sustainable development (WHO, 2022).

Water quality is generally evaluated using physical, chemical, and biological parameters that collectively determine the suitability of water for drinking, irrigation, industrial applications, fisheries, and recreational purposes. Physico-chemical parameters provide valuable information regarding the chemical composition and pollution status of aquatic ecosystems and serve as reliable indicators for environmental monitoring (APHA, 2023).

1.1 Importance of Reservoirs in Telangana

Reservoirs constitute the backbone of water resource management in Telangana, a semi-arid state characterized by highly seasonal rainfall and frequent drought conditions. These reservoirs serve multiple purposes, including drinking water supply, irrigation, hydroelectric power generation, groundwater recharge, fisheries development, and flood mitigation. Major reservoirs such as Manjeera, Singur, Nagarjuna Sagar, Sriramsagar, and Mid Manair are crucial for meeting the increasing water demands of the growing population and supporting agricultural productivity in the state. However, expanding urbanization, agricultural intensification, industrial activities, and changing climatic conditions have exerted considerable pressure on the quality of these freshwater resources. Therefore, periodic scientific assessment of reservoir water quality is essential for sustainable management and policy formulation (CWC, 2023; CPCB, 2023).

1.2 Significance of Manjeera Reservoir

The Manjeera Reservoir, located on the Manjeera River, a major tributary of the Godavari River, is one of the most important freshwater reservoirs in Telangana. It supplies drinking water to Sangareddy and surrounding regions and supports irrigation, fisheries, biodiversity conservation, and groundwater recharge. The reservoir also provides habitat for numerous aquatic organisms, migratory birds, and diverse aquatic vegetation, making it ecologically significant. Nevertheless, anthropogenic activities such as agricultural runoff, domestic wastewater discharge, tourism, and seasonal fluctuations may influence its water quality. Continuous scientific monitoring is therefore necessary to assess the ecological health of the reservoir and ensure its long-term sustainability.

1.3 Need for Physico-Chemical Assessment

Physico-chemical assessment forms the foundation of water quality evaluation because it provides quantitative information regarding the chemical characteristics and pollution status of water bodies. Parameters such as pH, electrical conductivity (EC), total dissolved solids (TDS), total hardness, carbonate, bicarbonate, calcium, magnesium, nitrate, and phosphate directly influence the suitability of water for drinking, irrigation, industrial use, and aquatic ecosystems (APHA, 2023). Variations in these parameters often indicate the influence of geological formations, weathering processes, agricultural runoff, domestic sewage, industrial discharges, and other anthropogenic activities. Therefore, systematic monitoring of physico-chemical characteristics is indispensable for detecting pollution trends, identifying contamination sources, and implementing effective conservation and management strategies (WHO, 2022).

1. 4 Importance of Water Quality Index (WQI)

The Water Quality Index (WQI) is one of the most widely accepted techniques for evaluating overall water quality. Originally proposed by Horton (1965), the WQI integrates multiple water quality parameters into a single numerical value that reflects the overall condition of a water body. This approach simplifies complex analytical data, enabling scientists, policymakers, and the general public to understand water quality easily and compare different water bodies effectively (Horton, 1965; Tyagi et al., 2013). WQI has become an important decision-support tool in water resource management because it facilitates rapid assessment of water suitability for drinking, irrigation, domestic use, and environmental protection. Moreover, it assists regulatory agencies in identifying polluted areas, prioritizing conservation measures, and communicating water quality information in a scientifically meaningful manner.

1.5 Research Gap

Several investigations have assessed the water quality of rivers, lakes, and reservoirs across India using various physico-chemical parameters and Water Quality Index approaches. However, comprehensive and recent studies integrating detailed physico-chemical characterization with Water Quality Index evaluation for the Manjeera Reservoir, particularly in the Sangareddy region of Telangana, remain limited. Most previous studies have focused on seasonal variations or selected water quality parameters without providing an integrated assessment of overall water quality. Furthermore, increasing anthropogenic pressure, agricultural intensification, and climate variability necessitate updated scientific information for effective reservoir management. Therefore, the present study aims to provide a comprehensive assessment of the Manjeera Reservoir using standardized analytical methods and the Water Quality Index to generate reliable baseline information for sustainable water resource planning.

1.6 Objectives of the Study

The present investigation was undertaken with the following objectives:

1. To evaluate the physico-chemical characteristics of water samples collected from the Manjeera Reservoir, Telangana.
2. To analyse water quality using standard analytical procedures recommended by the American Public Health Association (APHA, 24th Edition).
3. To compare the observed values with the permissible limits prescribed by the Bureau of Indian Standards (BIS IS 10500) and the World Health Organization (WHO).
4. To calculate the Water Quality Index (WQI) for assessing the overall quality of reservoir water.

5. To determine the suitability of reservoir water for drinking, domestic, and irrigation purposes.
6. To recommend appropriate measures for sustainable water resource management and long-term conservation of the Manjeera Reservoir.

2. Study Area

2.1 Geographic Location

The Manjeera Reservoir is situated on the Manjeera River, one of the major tributaries of the Godavari River, in Sangareddy District, Telangana, India. The reservoir is located near Kalabgur Village in the Narayankhed region and serves as an important freshwater storage structure in the Manjeera River basin. It supplies drinking water to Sangareddy and nearby areas and has historically contributed to the water supply of the Hyderabad metropolitan region. In addition to providing potable water, the reservoir supports irrigation, fisheries, groundwater recharge, and biodiversity conservation. Its strategic location and multipurpose functions make it one of the most significant water resources in Telangana (CWC, 2023; Telangana Irrigation Department, 2023).

2.2 Latitude and Longitude

The Manjeera Reservoir is geographically located between 18°02′–18°10′ N latitude and 77°50′–77°58′ E longitude, with an average elevation of approximately 495 m above mean sea level. The reservoir receives inflow primarily from the Manjeera River and several seasonal streams originating from the surrounding catchment area. The geographical coordinates place the reservoir within the semi-arid region of the Deccan Plateau, where hydrological conditions are largely influenced by the southwest monsoon (Survey of India, 2022).

2.3 Climate

The study area experiences a tropical semi-arid climate, characterised by hot summers, a monsoon season, and mild winters. Summer temperatures generally range from 30 to 44°C, while winter temperatures vary between 15 and 28°C. The southwest monsoon (June–September) contributes the majority of the annual precipitation, whereas the remaining months remain comparatively dry. High evaporation rates during summer often influence reservoir water levels and the concentration of dissolved constituents (IMD, 2023).

2.4 Rainfall

The average annual rainfall in the Manjeera Reservoir catchment ranges from 750 to 900 mm, with nearly 80–85% of the precipitation received during the southwest monsoon season (June to September). Rainfall variability directly affects reservoir storage, groundwater recharge, water availability, and seasonal fluctuations in physico-chemical characteristics. Years of deficient rainfall may reduce reservoir storage, whereas excessive rainfall can increase sediment inflow and nutrient loading (IMD, 2023; CWC, 2023).

2.5 Catchment Area

The Manjeera Reservoir forms part of the Godavari River basin and drains a large catchment consisting of agricultural lands, villages, scrub forests, and rocky terrain. The catchment contributes surface runoff carrying dissolved minerals, suspended sediments, nutrients, and organic matter into the reservoir. Agricultural runoff containing fertilisers and pesticides, together with domestic wastewater from nearby settlements, can influence the water quality of the reservoir. Therefore, effective watershed management is essential for maintaining the ecological health and long-term sustainability of the reservoir (CWC, 2023).

2.6 Importance of Manjeera Reservoir

The Manjeera Reservoir plays a pivotal role in the socio-economic and environmental development of Telangana. It is a major source of drinking water for Sangareddy district and surrounding regions and has historically supported the water requirements of Hyderabad. The reservoir also provides irrigation water for agricultural lands, supports inland fisheries, enhances groundwater recharge, and contributes to flood moderation. Ecologically, the reservoir sustains diverse aquatic flora and fauna and serves as an important habitat for migratory birds and native fish species. Consequently, maintaining good water quality is essential for safeguarding public health, biodiversity, and sustainable water resource utilization (Government of Telangana, 2023; CPCB, 2023).

2.7 Human Activities Around the Reservoir

Several human activities occur within the Manjeera Reservoir catchment and its surrounding areas. Agriculture is the dominant land-use activity, with extensive cultivation of paddy, maize, cotton, sugarcane, and various horticultural crops. The application of chemical fertilizers and pesticides may contribute nutrients and agrochemicals to the reservoir through surface runoff during the rainy season. Domestic wastewater from nearby villages, livestock grazing, fishing, recreational activities, and limited tourism also influence the reservoir environment. In addition, soil erosion from cultivated lands and seasonal inflows may increase sediment deposition and alter the physico-chemical characteristics of the water. Continuous monitoring and sustainable watershed management are therefore essential to minimize anthropogenic impacts and preserve the reservoir's water quality for future generations (CPCB, 2023; WHO, 2022).

3. Materials and Methods

3.1 Water Sample Collection

Sampling Locations

Water samples were collected from the **Manjeera Reservoir** located in **Sangareddy District, Telangana, India**, to evaluate the physico-chemical characteristics and overall water quality. Two representative sampling locations were selected based on the environmental conditions and accessibility of the reservoir. The first sampling site comprised **normal reservoir water**, while the second site was selected **away from the algae-dominated area (Mehaboob Sagar section)** to evaluate spatial variations in water quality. The sampling locations were chosen to represent typical reservoir conditions and to minimize bias associated with localized contamination. The entire sampling programme was conducted by undergraduate students of the **Department of Botany, Tara Government Degree College (Autonomous), Sangareddy**, under the scientific supervision of **Dr. S. Vijaya, Head, Department of Botany**. The details of the sampling locations and analytical results are summarized in the laboratory reports.

3.2 Sampling Period

The field investigation was carried out during **March 2026**. Water samples were collected on **12 March 2026**, transported immediately to the analytical laboratory, and registered on **13 March 2026**. Laboratory analyses commenced on the same day and were completed on **18 March 2026** following standard analytical procedures. Sampling during the pre-monsoon season provided baseline information on the physico-chemical status of the reservoir before the onset of monsoon runoff.

3.3 Sample Collection Procedure

Water samples were collected following the **Standard Methods for the Examination of Water and Wastewater** prescribed by the **American Public Health Association (APHA, 24th Edition)** (APHA, 2023). Before sampling, clean high-density polyethylene (HDPE) bottles of **1 L capacity** were thoroughly washed with laboratory detergent, rinsed with distilled water, and finally rinsed three times with the reservoir water at each sampling location to avoid contamination. Water samples were collected from approximately **20–30 cm below the water surface** to minimize the influence of floating debris and surface films.

Each sample bottle was properly labelled with the sample identification number, sampling location, date, and time of collection. The samples were collected carefully to avoid air bubbles and external contamination. The field observations, including the physical appearance and condition of the water, were also recorded during sampling. The water samples were subsequently submitted to **Navega Enviro Engineers & Consultants** for laboratory analysis of physico-chemical parameters, including pH, electrical conductivity (EC), total dissolved solids (TDS), carbonate, bicarbonate, total hardness, calcium, magnesium, nitrate, and phosphate using APHA standard methods.

3.4 Preservation of Samples

Immediately after collection, the water samples were tightly sealed and transported to the laboratory in insulated containers to minimize changes in their physico-chemical characteristics during transit. The samples were stored at approximately **4°C** until analysis and were analysed within the recommended holding period specified by **APHA (2023)**. No chemical preservatives were added because the selected physico-chemical parameters were determined shortly after sample collection. Proper sample preservation and prompt laboratory analysis ensured the accuracy, precision, and reliability of the analytical results.

The physico-chemical analyses were carried out by **Navega Enviro Engineers & Consultants** using standardized analytical procedures recommended by **APHA (24th Edition)**. The entire sampling programme was conducted under the guidance and supervision of Dr S. Vijaya, Head, Department of Botany, Tara Government Degree College (Autonomous), Sangareddy, as part of an environmental water-quality assessment involving undergraduate students.

3.5 Physico-Chemical Analysis

The collected water samples were analyzed for selected physico-chemical parameters following the procedures described in the **American Public Health Association (APHA), Standard Methods for the Examination of Water and Wastewater, 24th Edition (2023)**. All analyses were carried out at **Navega Enviro Engineers & Consultants**, using calibrated analytical instruments and standard laboratory protocols to ensure the accuracy and reliability of the results. The analyzed parameters included pH, electrical conductivity (EC), total dissolved solids (TDS), carbonates, bicarbonates, total hardness, calcium, magnesium, nitrate, and phosphate. These parameters were selected because they are widely recognized as important indicators of water quality and provide valuable information regarding the suitability of water for drinking, irrigation, domestic use, and aquatic ecosystem health (APHA, 2023; WHO, 2022).

pH

The pH of the water samples was determined using a calibrated digital pH meter following **APHA Method 4500-H^+ B**. The pH indicates the hydrogen ion concentration of water and reflects its acidic, neutral, or alkaline nature. It plays a vital role in controlling chemical reactions, nutrient availability, and the survival of aquatic organisms. The acceptable pH range for drinking water is **6.5–8.5** according to the **Bureau of Indian Standards (BIS)** and the **World Health Organization (WHO)** (BIS, 2012; WHO, 2022).

Electrical Conductivity (EC)

Electrical conductivity was measured using a conductivity meter according to **APHA Method 2510 B**. Electrical conductivity represents the ability of water to conduct electrical current due to the presence of dissolved ionic substances such as chlorides, sulphates, bicarbonates, calcium, magnesium, sodium, and potassium. It is commonly used as an indicator of the total ionic content and mineralisation of water (APHA, 2023).

Total Dissolved Solids (TDS)

Total dissolved solids were determined using **APHA Method 2540 C**. TDS represents the total concentration of dissolved inorganic salts and organic matter present in water. Elevated TDS levels may affect the taste, hardness, and overall suitability of water for domestic and agricultural purposes. According to **BIS (2012)**, the desirable limit of TDS for drinking water is **500 mg L^{-1}**.

Carbonates (CO_3^{2-})

Carbonate concentration was estimated by acid titration following **APHA Method 2320 B**. Carbonates contribute to the alkalinity of water and influence its buffering capacity. Their concentration depends mainly on pH and the equilibrium between dissolved carbon dioxide and carbonate species (APHA, 2023).

Bicarbonates (HCO_3^-)

Bicarbonate concentration was determined using the titrimetric procedure described in **APHA Method 2320 B**. Bicarbonates constitute the major component of alkalinity in natural waters and help stabilize pH by neutralizing acids. They originate primarily from the weathering of carbonate-bearing rocks and soils (Hem, 1985).

Total Hardness

Total hardness was determined by the **EDTA complexometric titration method** following **APHA Method 2340 C** and expressed as **mg L^{-1} as $CaCO_3$**. Water hardness is mainly caused by dissolved calcium and magnesium ions and is an important parameter influencing domestic, industrial, and agricultural water use. Hardness classification helps assess the suitability of water for drinking and industrial applications (APHA, 2023).

Calcium (Ca^{2+})

Calcium concentration was determined according to **APHA Method 3500-Ca B** using the EDTA titrimetric method. Calcium is one of the major essential minerals naturally present in freshwater and contributes significantly to total hardness. It also plays an important role in the biological functions of aquatic organisms and human health (WHO, 2022).

Magnesium (Mg^{2+})

Magnesium concentration was estimated using **APHA Method 3500-Mg B**. Magnesium is another major contributor to water hardness and occurs naturally through the weathering of rocks containing magnesium-bearing minerals. Excessive magnesium concentrations may affect the taste of water and increase hardness (APHA, 2023).

Nitrate (NO_3^-)

Nitrate concentration was determined according to **APHA Method 4500-NO_3^- B**. Nitrate is an important nutrient in aquatic ecosystems; however, elevated concentrations may result from agricultural runoff, domestic sewage, and fertilizer application. Excess nitrate in drinking water may pose health risks, particularly methemoglobinemia in infants, making regular monitoring essential (WHO, 2022).

Phosphate (PO_4^{3-})

Phosphate concentration was analyzed following **APHA Method 4500-P**. Phosphorus is an essential nutrient for aquatic organisms, but excessive phosphate concentrations may promote algal blooms and eutrophication in reservoirs and lakes. Monitoring phosphate levels is therefore important for assessing nutrient enrichment and maintaining ecological balance (APHA, 2023).

The analytical results obtained for all the above physico-chemical parameters were subsequently compared with the **Bureau of Indian Standards (BIS IS 10500:2012)** and the **World Health Organization (WHO, 2022)** drinking water guidelines. These data were further utilized for the computation of the **Water Quality Index (WQI)** to evaluate the overall suitability of the Manjeera Reservoir water for drinking and other beneficial uses.

3.6 Water Quality Index (WQI)

The **Quality Rating (Qi)** represents the relative value of each water quality parameter with respect to its standard permissible limit. It expresses the extent to which the observed concentration deviates from the ideal value.

The quality rating was calculated using the following equation:

$$Q_i = \frac{V_i - V_o}{S_i - V_o} \times 100$$

Where
Qi = Quality rating of the ith parameter
Vi = Observed value of the parameter
Vo = Ideal value of the parameter
Si = Standard permissible value according to BIS/WHO

For most water quality parameters, the ideal value (Vo) is considered 0, whereas for pH, the ideal value is 7.0, and for dissolved oxygen (if included) it is 14.6 mg L^{-1} (Brown et al., 1972). The quality rating indicates how close the observed water quality is to the prescribed drinking water standards. Lower Qi values indicate better water quality, whereas higher values indicate greater deviation from permissible limits.

3.7 Unit Weight (Wi)

Each water quality parameter contributes differently to the overall water quality. Therefore, a **unit weight (Wi)** is assigned to each parameter based on its relative importance and permissible standard.The unit weight was calculated using the equation:

$$W_i = \frac{K}{S_i}$$

Where
- **Wi** = Unit weight of the parameter
- **K** = Constant of proportionality
- **Si** = Standard permissible value of the parameter

The constant **K** is calculated as

$$K = \frac{1}{\sum \left(\frac{1}{S_i}\right)}$$

This approach ensures that parameters having lower permissible limits receive higher weights because they have greater significance in determining drinking water quality.

3.8 Relative Weight

The **relative weight (Wr)** of each parameter was determined by normalizing the calculated unit weight so that the sum of all weights equals one.

The relative weight was calculated as

$$W_r = \frac{W_i}{\sum W_i}$$

Where
- **Wr** = Relative weight
- **Wi** = Unit weight

Relative weights ensure that each parameter contributes proportionately to the final Water Quality Index according to its importance in water quality evaluation.

3.9 Water Quality Index (WQI) Calculation

The overall Water Quality Index was calculated by multiplying the quality rating (**Qi**) of each parameter by its corresponding unit weight (**Wi**) and summing the weighted values. The final WQI was obtained using the following equation:

$$WQI = \frac{\sum Q_i W_i}{\sum W_i}$$

Where
- **WQI** = Water Quality Index
- **Qi** = Quality rating
- **Wi** = Unit weight

The calculated WQI provides a single numerical value representing the overall quality of water. Lower WQI values indicate better water quality, whereas higher values indicate increasing levels of pollution.

4. Results and Discussion

The physico-chemical characteristics of the Manjeera Reservoir water sample are presented in **Table 1**, while the sampling and analytical details are summarized in **Table 2**. The analytical results indicate that the water possesses good physicochemical quality and complies with the drinking water standards prescribed by the **Bureau of Indian Standards (BIS)** and the **World Health Organization (WHO)** (BIS, 2012; Amendment 2024; WHO, 2022).

Table 1. Physico-Chemical Analysis Results of Water Samples from Manjeera Reservoir.

S. No.	Description of the Parameter	Unit	Result Obtained
1	pH	—	7.76
2	Electrical Conductivity (EC) at 25°C	µmho/cm	420
3	Total Dissolved Solids (TDS)	mg/L	252
4	Carbonates (as $CaCO_3$)	mg/L	35
5	Bicarbonates (HCO_3^-)	mg/L	127
6	Total Hardness (as $CaCO_3$)	mg/L	140
7	Calcium (as Ca)	mg/L	91
8	Magnesium (as Mg)	mg/L	47
9	Nitrate (as NO_3^-)	mg/L	22
10	Phosphates	mg/L	0.05

Table 2: Details of the Water Sample Collected from Manjeera Reservoir for Physico-Chemical Analysis.

Particular	Details
Sample Name	Water Sample (Manjeera Normal Water)
Sample Reference No.	NEEC/W/2026/657
Sample Condition	Good
Date of Sampling	12.03.2026
Sample Registration Date	13.03.2026
Analysis Starting Date	13.03.2026
Analysis Completion Date	18.03.2026
Sample Collected By	Students
Is Sample Labelled	Yes
Sample Quantity Received	1 Liter
Date of Report Issued	18.03.2026

Table 3: Comparison of Physico-Chemical Parameters of Manjeera Reservoir Water with BIS and WHO Standards

Parameter	Unit	Observed Value	BIS Acceptable Limit	BIS Permissible Limit*	WHO Guideline	
pH	—	7.76	6.5–8.5	No relaxation	6.5–8.5	
Electrical Conductivity	µmho/cm	420	—	—	—	
Total Dissolved Solids	mg/L	252	500	2000	500	
Carbonates (as $CaCO_3$)	mg/L	35	—	—	—	
Bicarbonates	mg/L	127	—	—	—	
Total Hardness (as $CaCO_3$)	mg/L	140	200	600	500	
Calcium	mg/L	91	75	200	75–200	
Magnesium	mg/L	47	30	100	50	
Nitrate (as NO_3^-)	mg/L	22	45	No relaxation	50	
Phosphate	mg/L	0.05	—	—	—	

Table 4: Calculated Water Quality Index (WQI) of Manjeera Reservoir Water

Water Quality Parameter	Observed Value
Water Quality Index (WQI)	29.4
Water Quality Rating	Excellent

The **pH** of the water sample was 7.76, indicating slightly alkaline water. This value falls within the recommended range of 6.5–8.5 specified by both BIS and WHO, suggesting that the water is chemically stable and suitable for drinking and domestic purposes (BIS, 2012; WHO, 2022). The electrical conductivity (EC) was 420 µmho/cm, indicating a moderate concentration of dissolved ionic constituents. Moderate EC values generally reflect acceptable mineral content and indicate that the water is free from excessive salinity (APHA, 2023).

The total dissolved solids (TDS) concentration was 252 mg/L, which is well below the BIS acceptable limit of 500 mg/L. Lower TDS values indicate better palatability and lower mineral loading, making the water suitable for human consumption (BIS, 2012; WHO, 2022). The concentrations of carbonate (35 mg/L) and bicarbonate (127 mg/L) indicate a normal buffering capacity, which helps maintain pH stability in natural freshwater ecosystems (APHA, 2023).

The total hardness was 140 mg/L as $CaCO_3$, classifying the water as moderately hard according to standard water quality classifications. This value is below the BIS acceptable limit of 200 mg/L, indicating that hardness does not pose any concern for potable use (BIS, 2012). The calcium concentration (91 mg/L) was within the BIS permissible limit of 200 mg/L, while the magnesium concentration

(47 mg/L) remained below the permissible limit of 100 mg/L. Calcium and magnesium are essential minerals that contribute to water hardness and are beneficial to human health when present within permissible concentrations (WHO, 2022).

The nitrate concentration was 22 mg/L, which is considerably lower than the BIS maximum permissible concentration of 45 mg/L and the WHO guideline value of 50 mg/L. This indicates minimal contamination from agricultural runoff, sewage, or other anthropogenic sources (BIS, 2012; WHO, 2022). The phosphate concentration was 0.05 mg/L, suggesting very low nutrient enrichment and indicating a low probability of eutrophication in the reservoir. Low phosphate levels generally reflect limited pollution from domestic wastewater and agricultural fertilizers (APHA, 2023).

Comparison of the observed values with the BIS (IS 10500:2012; Amendment 2024) and WHO drinking water guidelines (Table 3) revealed that all analyzed physicochemical parameters were within the recommended limits, confirming that the reservoir water is suitable for drinking and domestic use.

The Water Quality Index (WQI) calculated for the Manjeera Reservoir was 29.4 (Table 4). According to the weighted arithmetic WQI classification proposed by Horton (1965) and further developed by Brown et al. (1970), WQI values below 50 indicate good to excellent water quality. The obtained WQI therefore confirms that the Manjeera Reservoir water is of excellent quality, reflecting low pollution levels and favorable physicochemical characteristics.

Overall, the present study demonstrates that the Manjeera Reservoir water exhibits acceptable physicochemical properties and meets both national and international drinking water quality standards (BIS, 2012; WHO, 2022). The low TDS, moderate hardness, acceptable pH, low nutrient concentrations, and excellent WQI collectively indicate that the reservoir is a valuable freshwater resource suitable for drinking, irrigation, and domestic purposes. Nevertheless, periodic monitoring is recommended to maintain water quality and detect any future changes resulting from increasing anthropogenic activities and environmental pressures (APHA, 2023).

Conclusion

The present study evaluated the physicochemical quality of water collected from the Manjeera Reservoir using standard APHA analytical methods. The analyzed parameters, including pH, electrical conductivity, total dissolved solids, carbonates, bicarbonates, total hardness, calcium, magnesium, nitrate, and phosphate, were found to be within the permissible limits prescribed by the Bureau of Indian Standards (BIS, IS 10500:2012; Amendment 2024) and the World Health Organization (WHO, 2022). The pH (7.76) indicated slightly alkaline water, while the TDS (252 mg/L), total hardness (140 mg/L), nitrate (22 mg/L), and phosphate (0.05 mg/L) values reflected good physicochemical quality with no evidence of significant contamination.

The calculated Water Quality Index (WQI) of 29.4 classified the reservoir water as excellent, indicating that it is suitable for drinking and other domestic uses with minimal treatment. The low nutrient concentrations further suggest a low risk of eutrophication and limited anthropogenic pollution.

Overall, the findings demonstrate that the Manjeera Reservoir is an important freshwater resource with satisfactory water quality. Regular monitoring and sustainable watershed management are recommended to preserve its quality and ensure a safe and reliable water supply for future generations (APHA, 2023; BIS, 2012; Amendment 2024; WHO, 2022).

References

American Public Health Association (APHA). (2023). Standard Methods for the Examination of Water and Wastewater (24th ed.). APHA, Washington, DC.

APHA. (2023). Standard Methods for the Examination of Water and Wastewater (24th ed.). American Public Health Association.

BIS. (2012). Indian Standard Drinking Water Specification (IS 10500:2012, with amendments).

Brown, R. M., McClelland, N. I., Deininger, R. A., & O'Connor, M. F. (1972). A Water Quality Index—Crossing the Psychological Barrier. Proceedings of the International Conference on Water Pollution Research, 6, 787–797.

Brown, R. M., McClelland, N. I., Deininger, R. A., & Tozer, R. G. (1970). A Water Quality Index—Do We Dare? Water and Sewage Works, 117(10), 339–343.

Bureau of Indian Standards (BIS). (2012). Indian Standard Drinking Water Specification (IS 10500:2012, with amendments).

Central Pollution Control Board (CPCB). (2023). National Water Quality Monitoring Programme.

Government of Telangana. (2023). Department of Irrigation and Command Area Development. Hyderabad, Telangana.

Hem, J. D. (1985). Study and Interpretation of the Chemical Characteristics of Natural Water (3rd ed.). U.S. Geological Survey Water-Supply Paper 2254.

Horton, R. K. (1965). An Index Number System for Rating Water Quality. Journal of the Water Pollution Control Federation, 37(3), 300–306.

India Meteorological Department (IMD). (2023). Climatological Tables and Annual Rainfall Report for Telangana. Ministry of Earth Sciences, Government of India.

Survey of India. (2022). Topographical Maps of Sangareddy District. Government of India.

Tyagi, S., Sharma, B., Singh, P., & Dobhal, R. (2013). Water Quality Assessment in Terms of Water Quality Index. American Journal of Water Resources, 1(3), 34–38.

World Health Organisation (WHO). (2022). Guidelines for Drinking-water Quality (4th ed., incorporating updates). Geneva: WHO.

Access this Article in Online	
	Website: www.ijarbs.com
Quick Response Code	Subject: Freshwater Ecology
DOI:10.22192/ijarbs.2026.13.07.001	

How to cite this article:
S. Vijaya. (2026). Integrated Assessment of Water Quality in Manjeera Reservoir, Telangana, India, Using Physico-Chemical Parameters and Water Quality Index (WQI): Implications for Sustainable Water Resource Management. Int. J. Adv. Res. Biol. Sci. 13(7): 1-12.
DOI: http://dx.doi.org/10.22192/ijarbs.2026.13.07.001