

# PHYSICO-CHEMICAL PROPERTIES OF WATER IN WULAR LAKE, JAMMU & KASHMIR

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*Abstract:* The Present study was aimed to estimate and investigate some physico-chemical parameters of Wular Lake of Kashmir, India. During the present study six water samples from four accessible areas of Wular Lake were collected and analyzed for the physicochemical properties. Analysis showed a great variation in water quality among the different basins. The incoming flow channel i.e., river Jhelum and the entire catchment are having deteriorated water qualities and possible reason for this could be the increasing eutrophication resulting from agricultural practices in the nearby catchment area or tourism activity.

*Index Terms - Dal lake, BOD, COD, coliform, plastic debris, Urbanization, sewage*

## 1. INTRODUCTION

Clean water bodies are considered as one of the most useful and important god gifted resources for the sustainability and survivability of all the living organisms of the universe. The continuous rate of water quality degradation and pollution of clean water bodies like lakes, rivers, ponds etc is now problem of concern in the whole universe. Over-exploitation and pollution of water are responsible for making it distinct and unfit for consumption.

For effective use of water resources continuous examination and on-times management is necessary for the conservation of green ecosystem. Thus the present study which has been conducted in span of six months is completely related to water quality such as to check physico-chemical parameters of Wular Lake, the largest freshwater lake in Indian subcontinent.

## 2. STUDY AREA

The valley of Kashmir is located on the northern fringe of Indian sub-continent and Wular Lake is located in the north-west of Kashmir about 35 km from Srinagar city, it is formed by the twisting of River Jhelum. In earlier ages, Wular Lake was also called Mahapadmasar. Wular Lake is one of largest wetlands of the Asia and also one of the largest fresh water lakes in the world. It is situated at an elevation of 1,580 m and its coordinates are 34°16'–34°20'N latitudes and 74°33'–74°44'E longitudes. Besides other lakes it is one of the man catering lakes. It plays a vital role in the hydrography of the Kashmir valley its does not only absorbs water basins and control floodwater also its maintains the water quantity needed for power generation ,agriculture use and some sports activates as well. The immense wetland around the lake is the main habitat for the aquatic life if the lakes 60% of the fish production of Jammu and Kashmir are done by this area. The lake has a maximum depth of 5.8 m. The lake's area varies seasonally from 12 to 100 square miles (30 to 260 square kilometers) Wular Lake is one of the important fish habitats, the main species found in this lake is common carp, rosy barb etc. this lake is the mean of support for more than eight thousand fishermen it is one of the main source of income for them by primarily fishing for the endemic non-native carp. Their catch contains about 60 percent of the total yield of fish in Kashmir. The Lake is drained by the only single outlet in the River Jhelum. Wular Lake contains large number of the drains from different directions of the city. Of all the streams Jhelum River is most important and it enters the lake on the eastern side at Banyar, in Hajan block. However it faces environmental threats like the large catchment area is converted into agriculture land or it is polluted by fertilizers and animal waste and the weed growth its self covers the large area of lake.The lake was finally designated as wetland of national importance under the Indian Governments Wetlands Program and in 1990; it was enlisted as A Wetland of International Importance under the Ramsar Convention.

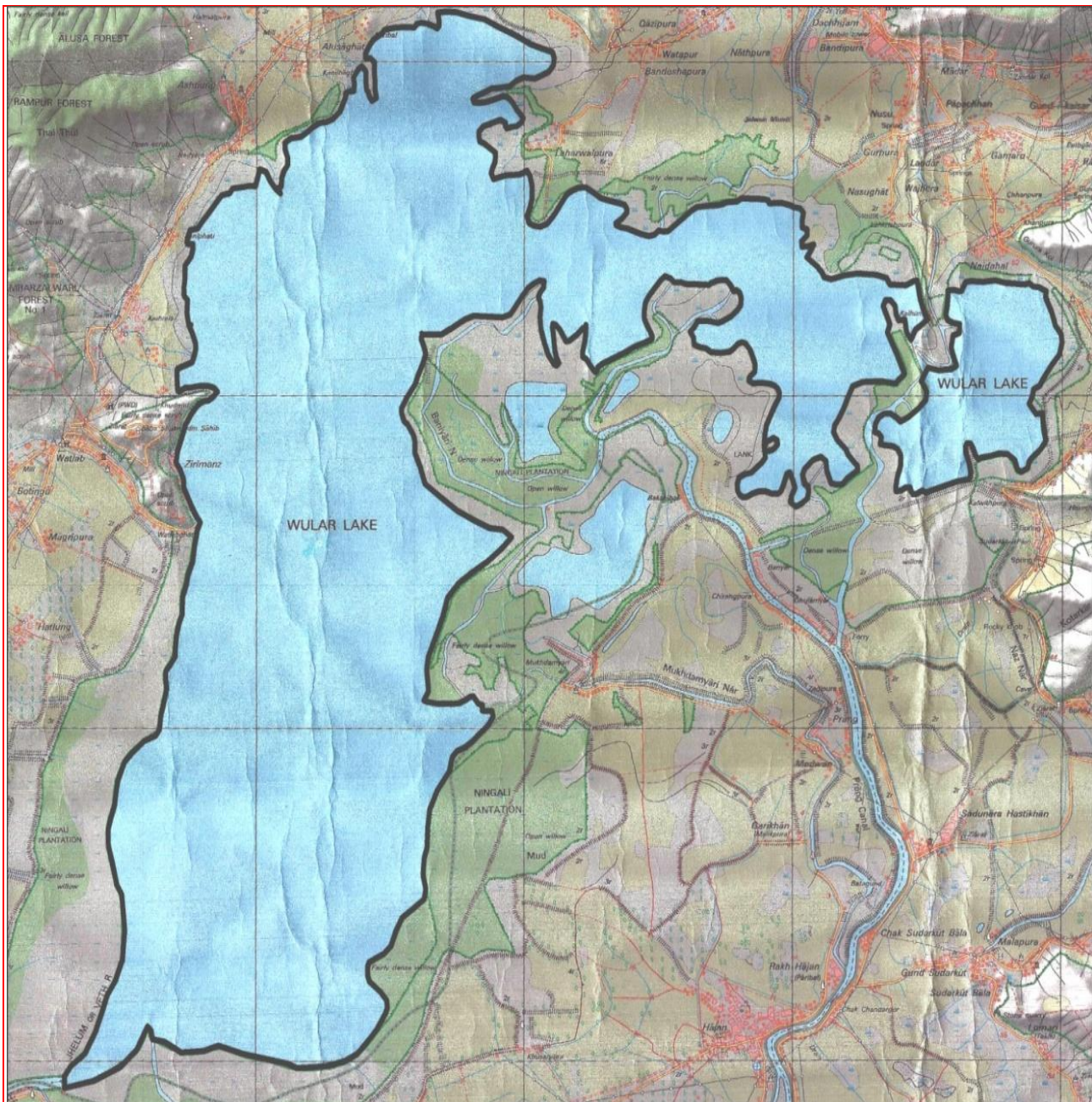


Figure-1 blue area represents the Wular lake catchment area & study site

### 3. METHODOLOGY

Four sites in the whole Wular catchment were selected for water sampling and six water samples were collected in 2 liter plastic cans. The B.O.D samples were collected in separate 3 bottles with 300 ml capacity and sterilized with alcohol 10% with proper care was taken to protect them from sunrays and oxidation by immediately covering them & send all the collecting samples to PHED Zanikote Srinagar laboratory. A total number of 22 parameters were analyzed and observed with standard values. The results were analysed also in GIS to understand the effect of important parameters observed. The following are the various parameters checked with their corresponding methods adopted.

**Table-1 shows the various parameters checked and corresponding method**

Parameters	Methods Adopted
Total iron	Iron MR
Nitrate	Phenol disulfonic method
Fluorides	Ion selective electrode method
Chlorides	Argentometric method
T.D.S	Gravimetric method
Total Alkanity	Titrimetric method
Calcium	EDTA Titrimetric method
Aluminum	Spectorphometric Method
Magnesium	EDTA Titrimetric method
Resd.chlorine	Iodometric titration method
Sulphate	Spectorphometric Method
Ph	Ph meter
Turbidity	Turbidimetric test
Total Hardness	EDTA Titrimetric method
Total Coliform	Membrane filtration
Conductivity	Conductivity meter
Total Acidity	Titration Method
Phosphate	Stannous Chloride Method
Ammonia	Nesslerization Method
Carbon Dioxide	Gas Sensing Electrode
COD	Titrimetric ,mid level
BOD	Standard method 5210 b(5 day BOD test)

## 4. RESULTS AND DISCUSSION

### 4.1 Results

Twenty two parameters were checked for Dal Lake in the PHED laboratory Zainkote Srinagar j&k and the water samples for BOD, COD were put under incubation for 6 days. The results getting after testing are given below in table no 2.

Table-2 water testing results of Wular Lake

Sr. No.	Parameter	Units	Sample w1	Sample w2	Sample w3	Sample w4	Sample w5	Sample w6	MEAN
1	Total Iron	mg/l	0.35	0.4	0.25	0.25	0.2	0.4	<b>0.31±0.09</b>
2	Nitrate	mg/l	25	20	20	25	23	25	<b>23±2.45</b>
3	Fluorides	mg/l	ND	ND	ND	ND	ND	ND	
4	Chlorides	mg/l	16.2	17	16	17	16	15	<b>16.2±0.75</b>
5	T.D.S	mg/l	116	116	112	123	112	110	<b>114.83±4.67</b>
6	Total alkalinity	mg/l	140	144	147	162	144	146	<b>147.7±7.65</b>
7	Calcium	mg/l	30.4	35.2	30	32.8	31.04	32	<b>31.91±1.91</b>
8	Aluminum	mg/l	ND	ND	ND	ND	ND	ND	
9	Magnesium	mg/l	6.832	5.856	6.588	6.832	5.465	5.514	<b>6.18±0.64</b>
10	Resd Chlorine	mg/l	RAW WATER	RAW WATER	RAW WATER	RAW WATER	RAW WATER	RAW WATER	
11	Sulphate	mg/l	ND	ND	ND	ND	ND	ND	
12	Ph		7.43	7.59	7.6	7.64	7.02	7.42	<b>7.45±0.23</b>
13	Turbidity	N.T.U	14.4	18.62	15.65	17.8	13.82	14.56	<b>15.81±1.97</b>
14	Total Hardness	mg/l	112	102	110	110	110	110	<b>109±3.52</b>
15	Total coliform	MPN	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE	
16	Conductivity	µs/cm	237	237	232	251	228	232	<b>236.17±8.04</b>
17	Total Acidity	mg/l	1.1	1.3	1.2	1	1	1.2	<b>1.13±0.12</b>
18	Phosphate	mg/l	0.01	0.01	0.013	0.012	0.015	0.013	<b>0.01±0.0</b>
19	Ammonia	mg/l	0.1	0.12	0.1	.08	0.09	0.1	<b>0.10±1.01</b>
20	Carbon Dioxide	mg/l	1.25	1.12	1.1	1.1	1.6	1.4	<b>1.26±0.2</b>
21	COD	mg/l	293	296	292	300	289	290	<b>293.33±4.08</b>
22	BOD	mg/l	202.17	193.8	195.6	198	184.96	192.51	<b>194.51±5.79</b>

## 4.2. DISCUSSION

The five most important parameters were observed and analyzed in Gis. As per our observations and conclusion, the Dal catchment is now fully loaded with nitrate and phosphorous. Every year tons of nitrate and phosphate from the inflows channels and 15 major drains of the city were drained into the lake which causes serious ill effects to Dal ecosystem and water quality. Due to the excessive presence of nitrate and phosphate the unwanted weeds like azolla have covered the maximum area of dal lake water which leads to eutrophication of lake.

Bio-Chemical oxygen demand is a parameter to assess the organic load in waterbody. Many researchers has recorded higher BOD values in polluted water. The BOD concentration ranged between 28 mg/l to 33 mg/l indicating that the water body is eutrophic. The test results gives the indication that dal lake water is having higher value of BOD which directly hamper the aquatic life. The higher amount of organic compounds in water which demands higher COD and as a result the lower quality of water for fish and other aquatic life.

From the foregoing observations of the physic-chemical parameters, it can be concluded that the waterbody shows the characters of eutrophication. Low dissolved oxygen, high bio-chemical oxygen demand and high nitrate concentrations indicate the eutrophic status of the water body

The results also shows the higher values of Turbidity ranges from (13-18 NTU) which is higher than the permissible limit(>5 NTU). Due to the high turbidity in lake which causes color changes ,odour, resistance to light penetration inside lake for photosynthesis to produce more dissolved oxygen. Directly or indirectly it leads to threat to lake ecosystem.

Chloride is an indication of salinity in water. Surface water containing significant amount of chloride also tend to have high amount of Na ions indicating the possibility of contacts with water of marine origin. From an environmental standpoint, chloride is basically a conservative parameter and may serve as an index of pollution occurring in natural freshwater from primary sources such as industrial and municipal outlets.

Oxygen is the single most important gas for most aquatic organisms; free oxygen or DO is needed for respiration. The DO levels below 1 ppm will not support fish; levels of 5 to 6 ppm are usually required for most of the fish population. The average value of DO levels (6.5mg/l) indicates the average quality of river water.

The results were explained using GIS to represent the data results of important parameters focused.

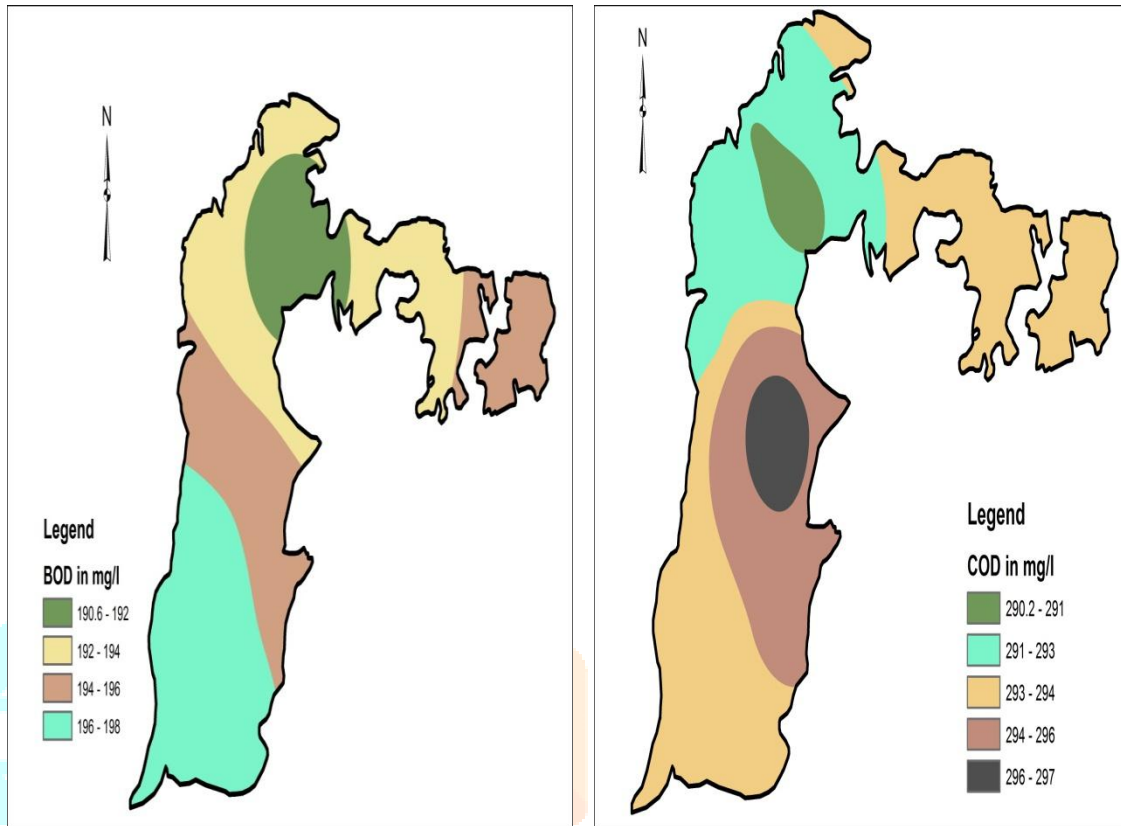


Figure shows the variation of BOD across wular Lake    Figure shows COD demand in Wular lake

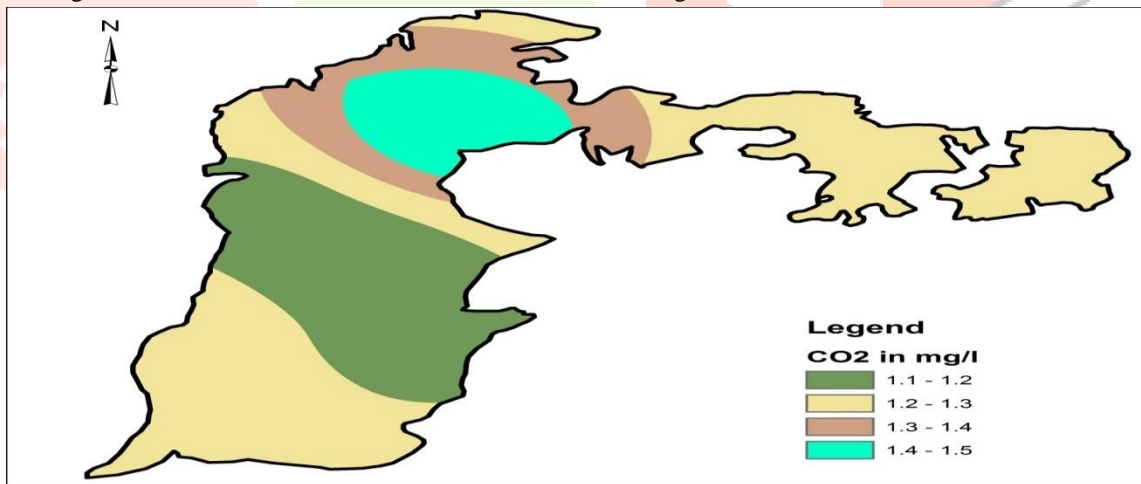


Figure shows the variation of Co2 level in Wular Lake

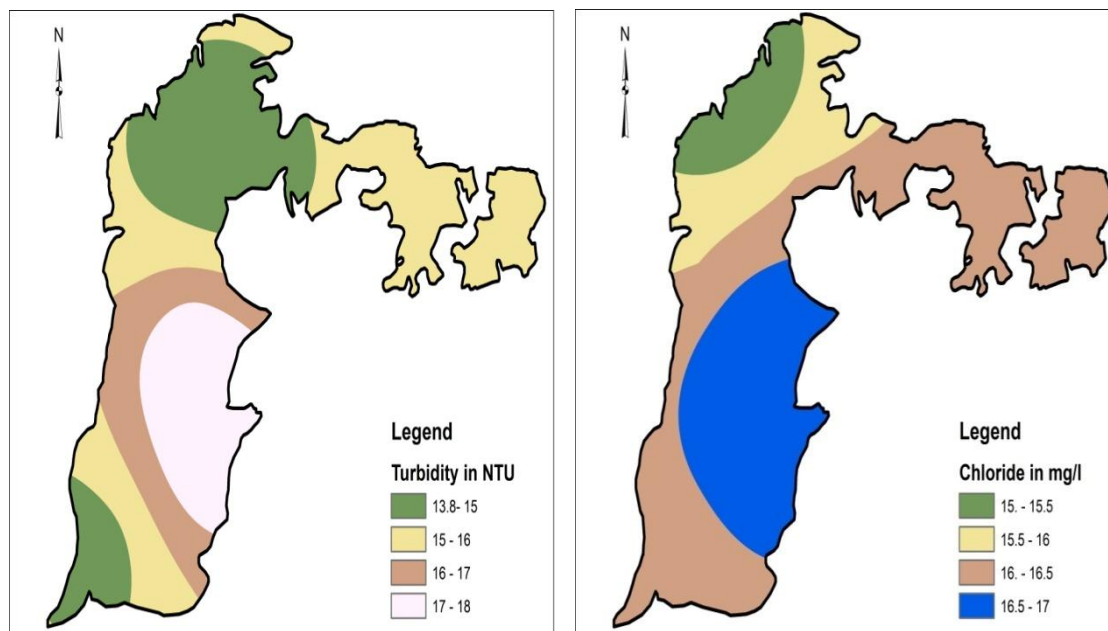


Figure shows turbidity across wular Lake      Figure shows the chloride content across wular lake

Use of GIS simply helps us to visualize the effects of various parameters and their concentration effects across catchment very simply. It's very simpler than graphical methods. Almost all the basins of Dal Lake show same character and from above figures it indicates that every basin is highly polluted with nitrate and phosphate. Every year BOD is increasing very fast rate .the water surface is almost covered with azolla weeds which hampers the lake ecosystem. The increase of nitrate and phosphate load in the lake causes siltation hence depth of lake every year affected. The 15 major drains of city are the main culprit behind the dal lake pollution. The coliform shows MPN (most probable value) positive which means the lake is highly contaminated with organic matter or sewage. So the present report reveals that nutrient loading and maximum weed cover across the whole lake has exceeded the eutrophic condition leading to a hyper eutrophic status.

## 5. CONCLUSION

The study in this report indicates clearly the degradation of water quality and quantity of Wular Lake. Lake parameters have been identified in our project which shows the variation in the ecological behavior of the lake. Due to higher turbidity content, the color of the lake has changed from bluish green to Hazel color which has caused the declined in tourist attraction as per the aesthetic view. The study also reveals that the increase in impurities due to pollution, which also accelerates the value of BOD and COD as tested in the certain location which reduces the dissolved oxygen present in water and due to this kind of changes would affect the aquatic environment as an increase in nitrogen content would result in eutrophication that stimulates aquatic plants and also affect aquatic life because of depletion of oxygen demand in water it creates difficulty to survive. The lake water is unfit from the purpose of drinking and the general water quality is not even "GOOD". So all in all the conclusion is quite straightforward that the lake is about to see it's near death unless and until government, local bodies and most importantly the people who live in and around the lake do something for its savior.

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