

# Impact of chamravattam regulator cum bridge on Bharathapuzha river and adjacent areas

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## Abstract

**Objective:** The present study deals with the impact of Chamaravattam RCB, Malappuram District, Kerala over Bharathapuzha River with the specific objectives of determining the impact on water quality and quantity.

**Methods:** Water samples are collected from the eight upstream areas of the Bharathapuzha River which are under the influence of Chamaravattam RCB for analyzing the elemental concentration, pH, electrical conductivity, dissolved oxygen, total coliform and *E.coli*. Field survey and personal interactions are conducted in both upstream and downstream areas of Chamaravattam RCB and collected information regarding water quality, crop yield, ground water table, salinity intrusion and socio-economic status.

**Findings:** The main objectives of the RCB are increase in ground water table, increase in agricultural production, improved transportation, prevention of saline water intrusion and communication facilities. The result of the study reveals that even though Chamaravattam RCB has numerous positive impacts, it at the same time negatively affected the quality of water due to the restriction of natural flushing action of the river. A layer of water at upstream of RCB becomes stagnant and pollutants accumulate. Due to this, total coliforms and *E.coli* counts of water are much higher than the desired values and amount of dissolved oxygen in water gets reduced. The elemental concentration of the water samples are also out of range. In downstream area salinity balance is negatively affected and even well water became saline. All this made Bharathapuzha River water out of consumable quality. Bharathapuzha River, a fast becoming source of health hazards for the people of several panchayats and municipalities on its bank and thereby it adversely affect the economy of the people.

**Improvements:** The result of the present study insists the necessity of a thorough study to uptake remedial measures and overcome these negative impacts.

**Keywords:** Bharathapuzha River, Chamaravattam RCB, Water quality, Salt water intrusion

## 1. Introduction

Constructing Regulator Cum Bridge (RCB) is a multipurpose project having the main objective to evolve sufficient storage of water for meeting the drinking water supply and for irrigating the agricultural areas. Another important objective is the effective control of salinity intrusion into the upstream side of regulator. Besides, the river when bridged connecting the two banks, will improve the communication facilities, transportation distance and the employment opportunities in that area. RCB or barrage use radial or sluice gates to control and raise water levels in their upstream reaches of streams and irrigation canals with mild slopes. [1]

The Chamaravattam regulator cum bridge also known as Chamaravattam Palam, is built across Bharathapuzha aka Nila near Chamaravattam. This seems to be the largest of its type in Kerala. The bridge has 978 m length and 10.5 m width. It connects Ponnani and Tirur. The Chamaravattam Bridge was inaugurated by the chief minister of Kerala on 17 may 2012. This is actually a project with dual goals – irrigation and reducing the distance by road between Calicut and Kochi by 38 km. The project was conceptualized as early as 1977 or 1984, but was dormant for some time. The figure 1 shows Chamaravattam Regulator Cum Bridge.

Figure 1. Chamaravattom Regulator Cum Bridge



Bharathapuzha River is the second longest river in Kerala having length of 209 km. It is also called as “Nila”, “Kuttipuram Puzha” and “Ponnaniyar” and considered as the “Nile of Kerala”. This river originates from Anaimalai hills of Western Ghats and flows towards the west direction. On the way many rivers join Bharathapuzha and finally flow into the Arabian Sea. The river spreads across the Palakkad and Malappuram districts of Kerala [2].

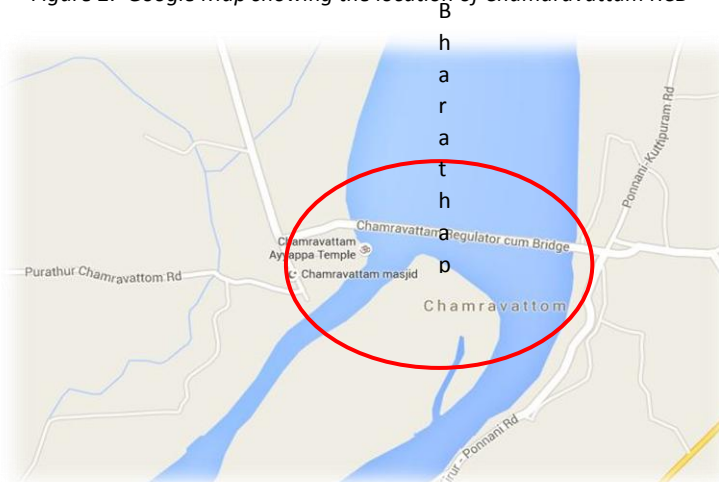
Abdul Hakkim V.M and his students from Kelappaji College of Agricultural Engineering and Technology, Kerala Agricultural University, Tavanur, Kerala, India (2008) had conducted a study on the Koottayi RCB, Tirur, Malappuram district, Kerala. They analyzed the changes brought by the RCB in that area including the pollution in upstream areas, death of fishes in Tirur puzha, increase in irrigation facility and there by an increase in production of 40 % etc.

A study on improvement of paddy cultivation in the command area of Kattampally RCB had conducted by Padma Kumar and Balachandran in 2008. The RCB was constructed in 1996 by the Government of Kerala, at the confluence point of Kattampally tributary with 13 operable shutter lock gates and Road Bridge. After the construction of the RCB the expected results could not be achieved mainly due to the excessive floods during monsoon due to faulty construction and intrusion of saline water through the shutters causing destruction to paddy cultivation, increased salinity of impounded water, hardening of soil, wide spread occurrence of leeches and excessive bushy weed growth[3].

## 2. Materials and Methods

An impact study was conducted in the areas which are under the influence of Chamaravattom RCB, Malappuram District, Kerala. Water quality testing assay, field survey and interactions with locals were conducted to evaluate the positive and negative impacts made by Chamaravattom RCB on Bharathapuzha River and adjacent areas. The figure 2 shows the location of Chamaravattom RCB in google map.

Figure 2. Google Map showing the location of Chamaravattom RCB



## 2.1. Water Quality

On 30 November 2014 the study area was visited. Eight sampling sites were identified on the upstream area of Chamaravattam RCB. (Chamaravattam, Triprangode, Tavanur, Kadakasheri, Thirunavaya, Kuttipuram, Kumbidi, Kudallur). From each sites, water sample is collected in a separate labeled bottles, when all the shutters of the RCB were closed. The water samples were then analyzed in laboratory to determine the elemental concentration, pH, electrical conductivity, dissolved oxygen, total coliform and *E.coli*. [4]

## 2.2. Field survey

In both upstream and downstream areas, field survey were conducted. An interaction with local people living in the surrounding of the sampling sites were also done and gathered information regarding agricultural yield, ground water table, water quality, salinity intrusion and socio-economic status.

## 3. Result and Discussion

### 3.1. Water quality analysis

To get an insight about the quality of the water impounded on the upstream of the RCB, water quality analysis was done.

#### 3.1.1. pH and Elemental concentration of water sample

Table 1. pH and Elemental analysis of the samples

Sl. No	Parameter	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Desirable limit as per BIS
1	pH	7.89	8.03	7.94	7.7	7.8	8.1	7.7	8.19	6.5-8.5
2	Chloride, mg/l	806.5	171.2	1486.8	1603	98.3	74.1	146	1311	250
3	Sulphate, mg/l	15.03	52.7	40.06	25.24	18.4	96.5	48	15.01	200
4	Calcium, mg/l	40	38	11.20	11.9	27.2	28.5	8.5	15.2	75
5	Magnesium, mg/l	2.96	7.7	19.2	35.2	25.2	28.5	9.9	16.6	30
6	Nitrate-N, mg/l	0.97	3.2	1.01	3.21	3.5	0.91	2.2	2.9	10
7	Nitrite, mg/l	ND	ND	ND	0.02	0.24	0.04	ND	0.01	--
8	Phosphate, mg/l	0.16	0.01	0.09	ND	0.05	ND	ND	ND	---
9	Iron, mg/l	0.03	0.25	0.02	0.14	0.2	0.12	0.9	1.02	---

Legend: Sample1 - Chamaravattam, Sample 2 - Triprangode, Sample 3-Tavanur, Sample 4 - Kadakasheri, Sample 5 - Thirunavaya, Sample 6 - Kuttipuram, Sample 7 -Kumbidi, Sample 8-Kudallur  
Source: Primary data.

Table 1 shows pH and elemental analysis of the samples. From the elemental analysis, it is clear that concentration of many of the elements are higher than the desired limit as per BSI. It is due to the restriction of natural flushing action of the river and accumulation of pollutants.[5]

**3.1.2. Electrical Conductivity (EC) of Water Samples**

Electrical conductivity is an index of the amount of minerals present in the water and it varies with temperature. The electrical conductance is a good indication of total dissolved solids which is a measure of salinity that affects the taste of potable water. Depending on the conductivity, water can be classified by excellent, good, permissible, brackish and saline [6].

Table 2. Electrical Conductivity of Water Samples

Sl. No.	Sampling Location	EC ( $\mu\text{mhos/cm}$ )
1	Chamaravattam	190
2	Triprangode	80
3	Tavanur	250
4	Kadakasheri	120
5	Thirunavaya	350
6	Kuttiipuram,	290
7	Kumbidi,	250
8	Kudallur	400

Source: Primary data.

Table 2 shows electrical conductivity of water samples. According to WHO standards for drinking purpose, the desired limit of electrical conductivity (EC) of river water is 50 to 1500  $\mu\text{mhos/cm}$ . From the result of the present study, it is clear that EC of the water samples at various upstream sites of Chamaravattam RCB are in desired limit. Survey conducted in the downstream area revealed that the main problem faced by the people is saline water intrusion and as a result poor quality of drinking water. From this it is clear that Chamaravattam RCB is successful in preventing salinity intrusion in upstream reaches and provides more fresh water for drinking and irrigation in the upstream reaches.

**3.1.3. Dissolved Oxygen (DO)**

Table 3. Dissolved Oxygen (DO) of samples

S.no.	Sampling Location	Amount of DO (mg/l)
1	Chamaravattam	4
2	Triprangode	2.9
3	Tavanur	4.5
4	Kadakasheri	4.6
5	Thirunavaya	3.75
6	Kuttiipuram	4
7	Kumbi	3.8
8	Kudallur	3.45

Source: Primary data

Table 3 shows the dissolved oxygen of samples. The concentration of dissolved oxygen below 5mg/l may adversely affect the functioning and survival of biological communities. If the concentration is below 2mg/l, it can lead to death of fishes and other aquatic life. In all the samples amount of dissolved oxygen is below 5mg/l. From this it is clear that Bharathapuzha River water is highly unfit for the survival of aquatic life.

### 3.1.4. Total Coliforms & E.coli

Total coliforms are a group of bacteria commonly found in the natural environments like vegetation or soil. They are also found in intestines of mammals, including humans. They are not likely to cause any sickness but their presence is the indication of contamination of drinking water by many more harmful microorganism. The only member of total coliform group of bacteria found in the intestines of mammals is *E.coli*. Their presence in water is the indication of recent faecal contamination and also the presence of disease causing pathogens such as bacteria, virus and other parasites.[7]

Table 4. Total coliforms and E.coli counts of Water Samples

Sl. No.	Sampling Location	Total coliforms, MPN/100 ml	<i>E.coli</i> , MPN/100 ml
1	Chamaravattam	500	Absent
2	Triprangode	1500	200
3	Tavanur	1200	100
4	Kadakasheeri	3000	100
5	Thirunavaya	800	80
6	Kuttiapuram,	1800	320
7	Kumbidi,	700	60
8	Kudallur	2900	150

Source: Primary data.

Table 4 shows the total coliforms and *E. coli* counts of water samples. None detectable per 100ml is the maximum acceptable concentration for drinking water. In another words for every 100ml of drinking water tested, no total coliform or *E.coli* should be detected. But from the study it is clear that the count of total coliforms and *E.coli* are much higher than the range, indicating that water is contaminated. Stagnant layers of impounding water in the upstream of RCB is the main reason for high concentration of total coliforms and *E.coli*. The natural flushing action of river is lost due to the closing of shutters and water became stagnant.

## 3.2. Field Survey

### 3.2.1. Water table

The survey conducted at the upstream areas of the RCB shows that availability of water is increased in the well and nearby ponds. From this it is clear that the RCB helped to increase the ground water level in the upstream areas and there by reduced the problem of the drinking water but the quality of water is still a problem since the water collected from the area shows a high concentration of coliform bacteria's. The wells on the bank of the river are the source of disease. [8]

From the survey conducted from the downstream area, it was clear that saline water intrusion is a great problem. The salinity balance of the river is affected negatively and even the well water became saline and thereby drinking water effected.

### 3.2.2. Agriculture

The survey conducted in the upstream areas of the RCM reveals that majority of the farmers are depending Bharathapuzha River for irrigation of their crops. By the establishment of Chamaravattam RCB project, availability of water is increased for irrigation and thereby an increase of 45 percent of production is obtained.[9]

## 4. Conclusion

Bharathapuzha River and the nearby areas are highly affected by the implementation of the Chamaravattam RCB project. From the present study, it is clear that the RCB has both positive and negative sides. The analysis water collected from the upstream area of the RCB reveals that Electrical Conductivity (EC) values are within the desired limit. This shows that the salinity intrusion of the upstream area is successfully prevented by the Chamaravattam RCB. But in the downstream areas, the salinity balance of the river is affected and even the well water became saline and thereby drinking water affected. The salinity intrusion also effect the breeding of fishes negatively. The microbial analysis of water samples collected from the upstream areas shows that total coliforms and E.coli counts of water are much higher than the desired values. The elemental analysis reveals that Calcium, Sulphate and Nitrate-N concentration are much lower than the desired value but the average concentration Chloride in the water samples are much higher than the desired value. Also the presence of trace amount of Iron, phosphate and Nitrate are determined. From this it is clear that water is highly out of the consumable quality. In this situation the people depending this river are drinking this contaminated water. The Dissolved Oxygen (DO) concentration of the sample ranges from 3.2 to 4.5 mg/l, which is lower than the desired limit (5mg/l) which can adversely affect the fish population in the river.

By the establishment of Chamaravattam RCB project, availability of water is increased for irrigation and thereby an increase of 45 percent of agricultural production is obtained. Even though the RCB has many positive impact, we should also focus on the negative impact of the RCB. The result of the present study insists the necessity of a thorough study to uptake remedial measures and to overcome these negative impacts.

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