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Impact Study of Koottayi Regulator Cum Bridge

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Abstract:- Prevention of saline water intrusion, increase in ground water table, increase in agricultural production, improved transportation and communication facilities are the main objectives of regulator cum bridges. Even though regulator cum bridge has number of positive impacts, it has got number of negative effects also, especially on the upstream side of it. The study was undertaken for analyzing the impact of regulator cum bridge at Koottayi in Malappuram District (Kerala, India) with the specific objectives of determining the impact on water quality, agriculture and transportation. The results of the study reveal that Koottayi regulator cum bridge has got many positive impacts including prevention of salt water intrusion and increased fresh water availability. At the same time it adversely affects the quality of water due to the restriction of natural flushing action of the river. It creates stagnant layers of water and also accumulates pollutants in the upstream side of regulator cum bridges. Due to this amount of dissolved oxygen in river water gets reduced. This intrusion adversely affects the aquatic ecosystem.

Key Terms:- Regulator Cum Bridges, Water quality, Salt water intrusion, Soil characteristics, Electrical Conductivity

I. INTRODUCTION

Construction of Regulator Cum Bridge (RCB) is a multipurpose project. The main objective is to evolve sufficient storage for irrigating the gross ayacut area and for meeting the drinking water supply. Another important objective is the effective control of saline water intrusion into the upstream side of regulator. Besides, the river when bridged connecting the two banks, will improve the communication facilities and the employment opportunities in that area. Barrage or RCB use radial or sluice gates to control and raise water levels in their upstream reaches of streams and irrigation canals with mild slopes.

The Viyyam RCB (Malappuram district, Kerala) was constructed as a multipurpose project (1991). The main objective of this project is to prevent the salinity intrusion into the kole lands. It also helps in irrigation of puncha crop in the upstream of kole lands by utilizing the storage created by the intervention. It also functions as a flood control structure by leading the entire flood discharge of the Viyyam kayal to the Kanhiramukku river. In addition to the puncha crop, the impounded salt free water can be used for irrigating cash crops viz coconut, arecanut, pepper etc. The single line bridge could reduce the road distance between Edappal and Kanjiramukku by 8kilometers and between Ponnani and Kanjiramukku by 8 kilometers.

Balachandran and Padmakumar (2008) conducted a study on improvement of paddy cultivation in the command area of Kattampally RCB. 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 following reasons.

i. Excessive floods during monsoon due to faulty construction and intrusion of saline water through the shutters causing destruction to paddy cultivation and increased salinity of impounded water.
ii. Hardening of soil, wide spread occurrence of leeches and excessive bushy weed growth.

II. MATERIALS AND METHODS

The study was conducted in the areas of influence of Koottayi RCB in Malappuram District of Kerala. Water analysis and field survey were conducted for evaluating the effect of RCB on soil characteristic and water quality.

Fig. 1: Koottayi Regulator cum Bridge

A. Water Quality

The study area was visited on 24 November 2012. Nine sampling sites were identified in the Tirur river on the upstream of Koottayi RCB (Koottayi, Melbhagathu, Kattachira, Ettri kadavu, Kanathu kadavu, Thalakkadathur, Vettam, Kondanathu kadavu and Thazhepalam). At each site, water samples were collected in bottles when all the shutters of the Koottayi regulator cum bridge were closed. The water samples were analysed to determine the electrical conductivity, p^H, Dissolved Oxygen and Other quality parameter such as chloride, sulphate, calcium, magnesium, iron, nitrate, nitrite, phosphate, total coliform and E.coli.

B. Field survey

Field surveys were conducted in both upstream and downstream sites of Koottayi RCB. Personal interactions were made with local people living around the sampling sites and gathered information about water quality, crop yield, ground water table, salt water intrusion and socio-economic status

III. RESULTS AND DISCUSSION

Water quality analysis was done to get an insight about the quality of the water impounded on the upstream of the RCB

A. Water Quality

i) Electrical Conductivity (EC)

Desired limit of EC of river water is 50 to1500 µmhos/cm. The result of the study reveals that EC of the water samples at various sites on the upstream of Koottayi RCB are within the desired range. The survey conducted in the downstream reach of Koottayi RCB revealed that the main problem faced by the people is poor quality drinking water due to salt water intrusion. This indicates that salt water intrusion could be successfully prevented by the RCB in the upstream reaches. More fresh water is available for irrigation and drinking in the upstream reaches, hence the RCB is successful in preventing the salt water intrusion.

Table I. Electrical Conductivity of Water Samples

Sl. No.	Site	EC(µmhos/cm)
1	Koottayi	490
2	Thalakkadathur	460
3	Vettam	410
4	Kattachira	60
5	Kanathu kadavu	380
6	Kondanathu kadavu	350
7	Melbhagathu	310
8	Ettri kadavu	190
9	Thazhepalam	140

ii) Other Quality Parameters

The total coliforms and E.Coli counts were much higher than the desired range, indicating that water is polluted. The high count of E.Coli in the water is primarily the indication of possible presence of bacterial pathogen. The high concentration of E.Coli and total coliforms is due to stagnant layers of impounding water in the upstream of RCB. The stagnant layer of water is due to the closing of shutters, which prevents the natural flushing action of river.

Table 2: Water quality parameters

Sl. No.	Parameter	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Desirable limit as per (BIS)
1	p^H	7.96	8.06	8.20	7.95	7.84	7.81	7.84	8.02	7.88	6.5 -8.5
2	Chloride, mg/l	1603.90	1721.20	39.12	82.15	78.24	74.33	1486.56	70.42	35.21	250.00
3	Sulphate, mg/l	174.00	171.60	10.16	14.80	19.44	18.52	54.80	13.56	7.72	200.00
4	Calcium, mg/l	40.00	48.00	80.00	9.60	11.20	11.40	35.20	11.20	8.00	75.00
5	Magnesium, mg/l	96.23	99.14	5.83	7.78	2.92	7.78	69.98	2.92	0.97	30.00
6	Iron, mg/l	0.03	0.09	0.10	1.06	0.03	0.05	0.03	0.01	0.02	0.30
7	Nitrate-N, mg/l	1.23	0.68	0.45	0.95	1.27	0.44	1.24	0.88	0.61	10.00
8	Nitrite, mg/l	ND	ND	ND	0.30	0.10	1.10	ND	ND	ND	…….
9	Phosphate, mg/l	0.03	0.04	ND	0.04	ND	ND	0.05	ND	ND	……..
10	Totalcoliforms, MPN/100 ml	2800	8800	800	6800	2600	4200	1100	3800	1500	10.00
11	E.Coli, MPN/100 ml	100	6600	200	200	Absent	500	100	100	100	Absent

Legend: Sample 1: Koottayi, Sample 2: Melbhagath, Sample 3: Kattachira, Sample 4: Ettrikadavu, Sample 5: Kanathu kadavu, Sample 6: Thalakadathoor, Sample 7: Vettom, Sample 8: Kondanathu kadavu, Sample 9: Thazhepalam.

iii) Dissolved Oxygen

Dissolved Oxygen (DO) concentrations below 5 mg/l may adversely affect the functioning and survival of biological communities and below 2 mg/l can lead to death of most fishes. Amount of Dissolved Oxygen were below 5gm/l in all the samples and at some sampling stations it was 2 mg/l. This may be the reason for the death of fish population reported at the upstream side of RCB.

Table 3: Dissolved Oxygen of samples

Sampling location	Amount of DO (mg/l)
Kattachira	4
Koloopalam	3
Ezhurkadavu	3
Thalakkadathur	2
Kondanathukadavu	3
Kanathukadavu	2
Bot jetty	2
Kakkadavu	2
Ettrikadavu	3
Vettam	3
Koottayi	4

B. Field Survey

i) Water table

Results of the field surveys conducted in the upstream side of Koottayi RCB reveal that ground water table is raised considerably due to impounding of water by closing shutters of the RCB.

ii) Agriculture

Results of the surveys conducted in the upstream side of Koottayi RCB revealed that many people depend on river water for irrigation. The area of production was increased by 40% in Vettom, Mangalam, Purathur and Aliserry panchayaths due to the implementation of Koottayi RCB project.

IV. SUMMARY

Water analysis in the upstream side of the RCB reveals that EC values range from 50 to 1500 µmhos/cm which is within the desired limit. This shows that salinity intrusion in the upstream side of the RCB could be successfully prevented. But in the downstream side of RCB, the adverse effect of salt water intrusion is more prominent. Water quality analysis of the samples reveal that chloride, sulphate, calcium, magnesium, iron, nitrate and phosphate concentrations are much lower than the desired limit, but the total coliforms and E.coli counts are much higher than the desired value. From this it is evident that the water is more polluted due to the restriction of natural flushing out of the river, which leads to foul smell and colour change of water in Tirur River. Water quality analysis was carried out to determine the concentration of Dissolved Oxygen (DO). The DO concentrations in the samples ranged from 2 to 4 mg/l, which is lower than the desirable limit (5 mg/l) which can adversely affect the fish population in the river. This may be the reason for fish death in the Tirur puzha. In Koottayi region especially in the Vettom, Mangalam, Purathoor and Alisheri Panchayaths, the area of production was increased by 40% due to the implementation of Koottayi RCB project. Though RCB has got number of positive impacts in terms of prevention of saline water intrusion, increase in ground water table, increase in area of production, improved transportation and communication facilities, has got number of negative effects also on the upstream side of it. The results of the present study reveals that a thorough Environmental Impact Assessment (EIA) of the regulator cum bridges are to be conducted to assess the negative impacts on the upstream side of it and appropriate corrective / remedial measures are to be taken to overcome these negative impacts. .

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