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EFFECT OF CONSTRUCTION WORK ON ADJACENT SURFACE WATER QUALITY IN COASTAL DACOPE UPAZILA BANGLADESH

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ABSTRACT

The coastal people have to sustain facing severe natural disasters, which are very frequent and caused by enormous natural and manmade events. The Government of Bangladesh (GOB) has undertaken the implementation of the Coastal Embankment Improvement Project with the loan assistance of World Bank (WB) and grant assistance of the Climate Investment Fund's Pilot Program for Climate Resilience (PPCR). The project is likely to involve significant adverse environmental impacts that are sensitive, diverse, or unprecedented, which may affect an area broader than the facilities subject to physical works. The aim of the present research study was to know the quality of water for aquatic and irrigation purposes. So, the study was conducted with the water samples from adjacent surface water sources, where Polder up-gradation work is being implemented by Bangladesh water development board (BWDB). Water samples collected from adjacent rivers and khals (cannels) were analyzed against National/International permissible limits for aquatic and irrigation water quality. Water pH, Turbidity, Total dissolved solids (TDS), Dissolved oxygen (DO) and Biochemical Oxygen demand (BOD_5). The results revealed that in most cases water bodies of Polder areas had the pH range within the standards of Department of Environment Bangladesh (DoE), The Environment Conservation Rules-1997 (ECR) and World Health Organization (WHO) for irrigation purposes. In most cases, the value of Turbidity was less than 25 Nephelometric Turbidity Unit (NTU), indicating that the water sample was not harmful for irrigation purposes. The TDS values of the water samples in the study area ranged from 1502.40 to 2630.40 mg/l, with an average value of 2044.27 mg/l. The levels of BOD_5 ranged from 2.30 to 14.98 mg/l with an average value of 7.39 mg/l, which meets the ECR standards. It is well known that if the dissolved oxygen levels in the water bodies decreased by less than 6.00 mg/l life in the water bodies around the research area can come under pressure for aquatic ecosystem according to the standard from ECR (1997) (but secure according DoE, 1997).

Key words: water quality, coastal, construction work, polder.

Introduction

The coastal area of Bangladesh is composed of the plain sea part of the Ganges Delta, which is shrunk by large tidal rivers flowing into the Bay of Bengal. The alluvial and aquatic river systems of the coastal region are formed by long periodic deltaic recognition that was transformed into the Ganga and Brahmaputra or historical patterns. The main estuarial rivers in the south-central region are connected and fed by numerous small channels. The coastal region has an estimated population of 40 million and they are very much vulnerable to the natural disaster along with an area of about 720 km coastline. The people of coastal region have to sustain their livelihood facing severe natural disasters which are very frequent and cause d enormous damages. As a result, the livelihoods of coastal people become uncertain as they have to struggle with nature throughout the whole year. They cannot lead a happy and peaceful life since frequent natural disasters tend to sweep away their means of living and other properties (Akter, 2009). Water logging condition in coastal area are becoming a regular dilemma day by day, so many people cannot afford to cultivate crops in a major portion of land every year. Most of the phenomenons are vulnerable with the changing conditions, but climatic circumstances are sets of difficulties that cannot be controlled through a program (Ferdousi, 2010; Yesmin *et al.*, 2013). The cultivable lands in these coastal areas are being affected with varying degrees of soil salinity and other natural hazards. To combat the worst situations, Polderization began in the early sixties to protect land and other human resources from the tidal floods. It also provides to control the salinity infiltration and sedimentation. Due to lack of proper

maintenance, recent damages and pollution from cyclone/storm (Sidr and Aila in 2007 and 2009, respectively) in adjacent rivers required Coastal Embankment Improvement Project (CEIP) adoption. Increasing storm severity and storm height are the outcomes of global warming in the recent world. To maintain a safe environment and to protect the livelihood from natural hazards/disasters, Coastal Embankment Improvement Project implementation with the loan assistance of World Bank has been undertaken by The Government of Bangladesh through grant assistance of the Climate Investment Fund's Pilot Program for Climate Resilience. Significant adverse environmental effects which are sensitive, diverse, or unprecedented, and may affect an area broader than the facilities subject to physical works were expected to be involved in this particular project. Hence the monitoring of the adjacent river and khal (cannel) water quality is a perquisite to be assessed to know the impact of construction work on the quality of surface water. But there is lack of sufficient interest of the researchers for conducting the present study in the extremely remote coastal areas of Bangladesh. Considering the above phenomena this research study work was conducted at Polder 32 in Dacope Upazila of Khulna district. In this area Bangladesh Water Development Board is implementing the Polder up-gradation work under coastal embankment improvement activities as the pilot program for all over the coastal areas of Bangladesh. Recognizing that new approaches are obligatory to overcome the damages of climate change through the implementation of sustainable management of environment is necessary. In this circumstance we wish to frame the concept on which our aim of the study can follow to fit into the overall concept.

Materials and Methods

The study was conducted at Polder 32, the unions of Kamarkhula and Sutarkhali at Dacope Upazial in Khulna district, from January to April 2019. In this study area BWDB is performing 13 different tasks with the support of the Henan Water Conservancy (HWC) Company in China, mentioned as follows: resection of embankment (45.30 km), construction of retired embankment (3.50 km), construction of front embankment (0.70 km), construction of drainage sluice (number 11), construction of drainage sluice (number 7), flushing inlet (number 2) Repair of flushing inlet (No. 21), demolition of drainage sluice (number 3), demolition of flushing inlet (number 3), re- excavation of drainage channel (17.50 km), bank revetment / protection work (1.50 km), slope protection of embankment (4.30 km) and closure (number 1). These tasks have been ongoing since 2016 and may cause runoff in adjacent rivers and khals. Some construction materials are transported across waterways. Therefore, after three years of construction activity, water samples from adjacent rivers and khals were collected and analyzed against National/International permissible limits for irrigation water quality. Twenty-one water samples were collected from seven sources (rivers and khals), and finally seven composite water samples were created for the detection of water quality parameters. The analysis (pH, Turbidity, TDS, DO and BOD_5) was performed from Consultancy Research & Testing Services (CRTS), Khulna University of Engineering & Technology (KUET), Khulna-9203. Finally, the analyzed data was combined, presented as a table, and included in the manuscript.

Results and Discussion

The surface water quality in Polder 32 is affected by internal hydrological connections around the Polder. Table 1 is values of water quality parameters measured at selected locations in Polder 32. The standard values of these indicators set by DoE, ECR and WHO is shown in Table 2.

The hydrogen ion concentration of water is expressed by its pH value. The pH value of 7 is Neutral solution that is neither alkaline nor acidic. In most Polder bodies of water, the pH range well found within DoE, ECR and WHO standards in respect of irrigation purposes (Tables 1-2).

The average turbidity of the waters in the Polder area was about 13.54-67.20 NTU. In most cases, the value was less than 25 NTU, indicating that the water sample was not harmful for irrigation purposes (accordingly different established standards in the world).

Table 1. Water qualities in adjacent river and khal at Polder 32 in Dacope upazila of Khulna district

Sl No.	Sampling site	pH	Turbidity (NTU)	TDS (mg/l)	DO (mg/l)	BOD_5 (mg/l)
1	Chunkuri river	7.91	20.75	2161.15	6.45	8.17
2	Dakhi river	8.07	21.17	2204.38	6.58	8.33
3	Bhadra river	7.99	20.96	2182.76	6.52	8.25
4	Bera khal	7.06	17.09	1699.20	6.24	2.40
5	Khalinagar khal	7.01	67.20	2630.40	6.14	2.30
6	Karyratoli khal	7.07	18.53	1929.60	5.76	7.30
7	Nalian river	7.18	13.54	1502.40	4.51	14.98
	Mean =	-	25.60	2044.27	6.03	7.39

Table 2. National/International permissible limits for irrigation water quality

Parameter	DoE (1997)	ECR (1997)	WHO (1983)
pH	6.5-8.5	6.5-8.5	6.5-8.5
TDS (mg/l)	0-2100	-	0-1000
Turbidity (NTU)	-	-	-
DO (mg/l)	4.5-8	≥5	-
BOD_5 (mg/l)	-	≤6-10	-

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The TDS values of the water samples in the study area ranged from 1502.40 to 2630.40 mg/l, with an average value of 2044.27 mg/l. DoE standard range of TDS for long-term irrigation practices from 0 to 2100 mg/l. Considering this value as standard, three water samples were within the limit, and four were above the limit with minor objections (Tables 1-2). However, the value of TDS is high found in the Polder region due to salt water intrusion. Livestock and wildlife can be harmed when drinking this water contains excess dissolved solids. TDS can influence the toxicity of heavy metals and organic compounds to fish and other aquatic life. Continued use of such water can cause general losses such as weakness, scouring, reduced production, bone degeneration, and eventually death. Quantity and the quality of dissolved solids often determine the type and abundance of aquatic plants and animals in a specific area (EIA, 2013).

The amount of dissolved oxygen (DO) of water in the study area was within the range of 4.51-6.58 mg/l, with an average value of 6.03 mg/l (Table 1). Because dissolved oxygen levels in water decreased by less than 6.00 mg/l, life in the water in the research area can come under pressure according to standard from ECR (1997) but secure accordingly DoE (1997).

The values of BOD_5 in the Polder ranged from 2.30 to 14.98 mg/l with an average value of 7.39 mg/l (Table 1), which meets the ECR standard (Table 2) for irrigation and for fishing and aquatic life except the water of Nalian River.

Conclusion

The water quality of the adjacent river and khal is more or less suitable for aquatic organisms and irrigation purposes. The water quality parameters analyzed were within the standard level except TDS. However, environmental pollution is as old as civilization itself. It has become a major concern in recent decades. So intensive monitoring and great care must be reserved for safe surface water while the construction work in Polder and other parts of Bangladesh is continuing.

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