

CHAPTER – VII

Ministry of Water Resources

7.1 Maintenance of Farakka Barrage and its ancillaries

Maintenance of the Farakka Barrage constructed by Government of India during the 1970s was inadequate. Consequently, there were major gate failures on six occasions from 1985 to 2011, major systems such as remote control systems for the gates and navigational lock of the barrage remained inoperative for nearly three decades. The project management did not have enough spare gates as prescribed by the Central Water Commission norms. Bed protection works and maintenance works on the feeder canal were not undertaken. No action for preventive maintenance of the barrage structures was taken.

7.1.1 Introduction

7.1.1.1 Government of India commissioned a barrage on the river Ganga at Farakka in West Bengal in 1974. The river splits into Bhagirathi-Hooghly on the right (south) and Padma on the left (west) that enters Bangladesh 20 km downstream from Farakka barrage. For the next 90 km flowing south-west, Padma is treated as the Indo-Bangladesh boundary.



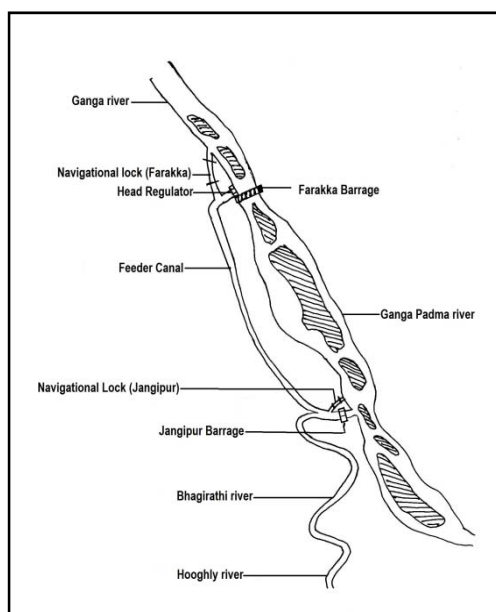
The main objective of the Farakka barrage was to regulate the flow of water to the Bhagirathi-Hooghly through the feeder canal to maintain navigability of the Kolkata Port. The barrage was also meant to facilitate river transport in the National Waterway No.1 between Allahabad and Kolkata (Haldia) Port and plays an important role in providing water supply to Kolkata, its surroundings and to the 2000 MW thermal power plant at Farakka.

The barrage along with its ancillary structures was constructed at an approximate cost of ₹156 crore and commissioned in 1974. The barrage comprises of the following three main structures:

a) Main barrage: The main barrage on the river Ganga at Farakka regulates the flow of water from India to Bangladesh. It is 2245 m long and has 112 gates. It was designed for maximum discharge of 27 lakh cusecs.

b) Head regulator: It is constructed at the origin of the feeder canal to regulate the inflow of water into the river Bhagirathi-Hooghly through a feeder canal from the river Ganga.

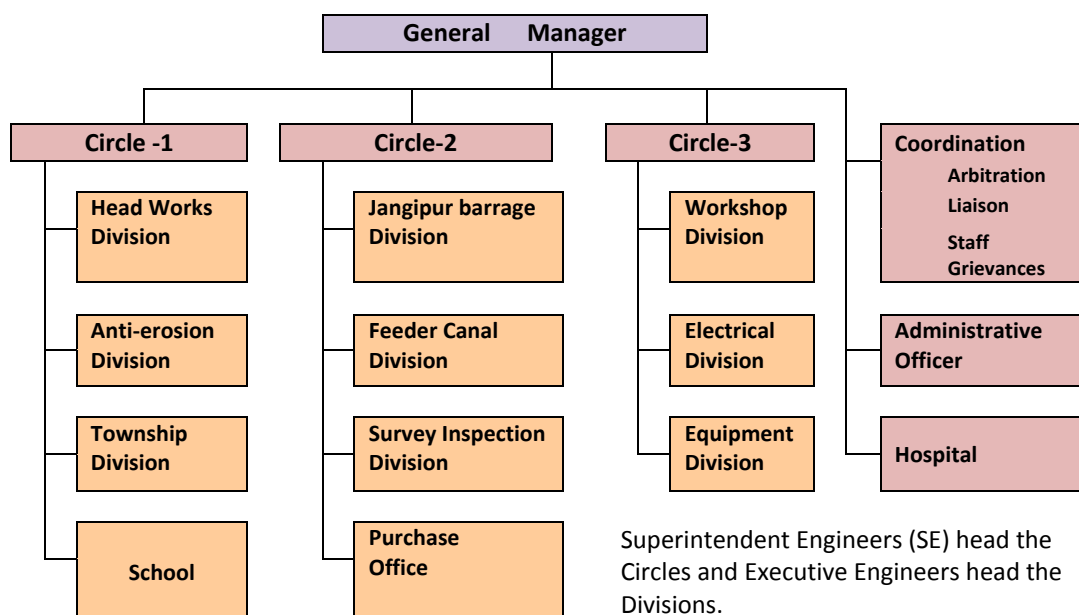
c) Jangipur barrage: Jangipur barrage was constructed at the off take point of the Bhagirathi-Hooghly to regulate flow of water from the Ganga and vice versa. A 38.38 km long feeder canal connects Bhagirathi-Hooghly and Ganga.



There is a pair of railway tracks and pre-reinforced concrete road bridge on the downside running parallel to the main barrage. They serve as the direct surface communication link between the south and north in West Bengal and thereafter the north-eastern part of India.

7.1.1.2 The operation and maintenance of the Farakka Barrage Project (FBP) is entrusted to the Farakka Barrage Authority (FBA) under the Ministry of Water Resources (MoWR), Government of India (GOI). The General Manager is the Chief Executive Officer of the FBP and is responsible for operations and maintenance. He is assisted by four Superintending Engineers who in turn are assisted by Executive, Assistant and Junior Engineers and

other support staff. Total manpower at the end of March 2012 was 1,259. The organisational chart of the FBP is given below. The Central Water Commission (CWC), an attached office of MoWR provides overall guidance through Technical Advisory Committee (TAC), Gate Regulation Committee (GRC) and Canal Study Group (CSG).



7.1.1.3 The budget allocation and actual expenditure during the last six years is shown below.

(₹in crore)

Table 11- Budget allocation and Expenditure

Year	Budget allocation		Actual expenditure		Total Expenditure
	Plan	Non-Plan	Plan	Non-Plan	
2006-07	61.00	23.67	58.74	24.29	83.03
2007-08	33.00	24.99	31.45	24.41	55.86
2008-09	76.61	27.95	54.03	32.57	86.60
2009-10	70.00	39.45	68.93	39.65	108.58
2010-11	82.00	40.63	43.99	41.59	85.58
2011-12	71.40	42.80	69.46	41.81	111.27
Total	394.01	199.49	326.60	204.32	530.92

7.1.1.4 Audit commenced in June 2011 and the audit objectives and the scope of audit were explained to the management of FBP. The audit was completed in March 2012 and discussed with the management of the FBP in July 2012. The audit of the FBP was conducted with a view to see whether maintenance of barrages and its ancillaries and navigation channels was being carried out economically and efficiently and whether utilisation of funds for maintenance was commensurate with the budget allocation.

7.1.2 Maintenance of main barrage, head regulator and Jangipur barrage

The Head Works Division-I (HWD-I) of the FBP is responsible for operation and maintenance of the Main Barrage and Head Regulator, while the Jangipur Barrage Division (JBD) is responsible for the Jangipur Barrage. The job of HWD-I and JBD inter alia includes maintenance of:

- (i) gates,
- (ii) control systems,
- (iii) ancillary parts,
- (iv) pre-reinforced concrete road, and
- (v) hydrographic survey and bed protection works.

Audit noticed that the FBP had failed to ensure timely and proper repair and maintenance of the Main Barrage, Head Regulator and Jangipur Barrage. The deficiencies are discussed in the following paragraphs:

7.1.2.1 Gates

(a) Gates in use

Timely repair of the gates is very important. A failure of the gates can lead to uncontrolled discharge of water to the neighbouring country, consequential depletion of Pond level⁷⁶ and less inflow of water to river Bhagirathi through the feeder canal. Further, uncontrolled discharge of water for a considerable time creates deep scours in the river bed adjacent to the barrage, which can damage the barrage structure. On the other hand, reduced discharge to the feeder canal will negatively impact the availability of water for power generation at NTPC⁷⁷, increase the salinity of the water due to reduced flushing out of tidal sea water, thereby endangering ecological balance and also induce scarcity of drinking water downstream of Farakka Barrage.

The main barrage has 112 gates while the Head Regulator has 11 three tier gates. As the gates constantly withstand severe water pressure, it is important that they remain suitably thick. The gates also need to be regularly inspected and tested to detect corrosions and holes, so that necessary corrective measures can be taken in time. As per norms of the CWC and recommendations of the GRC, gates are to be painted at intervals of four to six years⁷⁸ to avoid rusting.

⁷⁶ The level of water at near vicinity of the main barrage in the upstream

⁷⁷ National Thermal Power Corporation

⁷⁸ FBP has no manual of its own and follows CWC's manual.

Audit observed that the FBP did not fix any norms for periodical painting of gates. Further, in spite of several recommendations⁷⁹ of the GRC and TAC, the FBP showed scant regard to these recommendations and the gates of the main barrage were not painted for many years.

Number of gates	Not painted for
69	> 5 years
26	> 15 years
17	> 20 years

Similarly, gates of the Head Regulator and Jangipur Barrage were also not painted for more than 10-15 years.

Audit observed that inadequate repair and maintenance of gates led to gate failures on six occasions from 1985 to 2011, as discussed below:

- (i) Gate number 17 and 74 of the Main Barrage were totally damaged in February 2007 and in June 2008 respectively but were not replaced as of June 2012. Further, FBP identified (January 2010) four other damaged gates⁸⁰ of the Main Barrage for undertaking special repairs. In January 2011, after a lapse of one year, the FBP awarded the work to a firm for ₹47.52 lakh with stipulated time of 180 days (i.e ending on 30 July 2011) for completion of the work. The work was however, yet to be completed as of June 2012 after 30 months from date of identification.
- (ii) There was profuse leakage through the side and bottom rubber seals of most of the gates even though these gates were lowered to the river bed (sills). Some gates could not even be lowered to the sills due to mechanical problem. In two gates, the gap between the sill and the gates was 21-30 inches. This resulted in excess discharge of water to the neighbouring country. Besides, excess discharge of water through the gaps reduced the pond level. In order to maintain the desired pond level of the barrage, water discharge in the feeder canal was restricted thereby affecting the navigability of the Kolkata Port.

The FBP Management stated (July 2012) that the gates were in continuous operation for the last 36 years and had outlived their economical life. As the gates were exposed to extreme natural vagaries, prolonged damages had occurred to the gates and they were due for replacement. Management further stated that a joint inspection with an expert agency (Texmaco) was carried out (July 2011) following which it was concluded that the gates were in dilapidated condition and that an action plan had been formalised for

⁷⁹ Meetings held on December 2005, November 2006 and February 2010 during the course of audit.

⁸⁰ Gate Nos. 14, 15, 90 and 91

replacement of the gates in a phased manner during the Twelfth Five Year Plan (FYP) period (2012-2017).

(b) Spare gates

As per the CWC guidelines, 10 *per cent* of the total gates are required to be kept as spare gates for replacement in case of emergency. Accordingly, 11 gates for the Main Barrage, three gates for the Head Regulator and two gates for the Jangipur Barrage should be kept as spare. Against this, there were only three spare gates for the Main Barrage and no spare gate for the Head Regulator and Jangipur Barrage.

Expenditure Finance Committee (EFC) during XI FYP proposed for procurement of four spare gates at a cost of ₹2.60 crore. Audit scrutiny, however, revealed that FBP did not procure any spare gate during the Plan period. Inaction of FBP to procure adequate spare gates may lead to significant reduction in disaster management capacity of the barrage.

The FBP Management stated (July 2011) that keeping 10 *per cent* spare gates was not techno-economically viable. A spare of three to four gates was sufficient to meet emergent situations as by the time the spare gates are erected, additional gates could be fabricated. Moreover to meet any exigency, sufficient stop logs were kept available.

The reply contradicts the existing norm set by CWC for keeping a minimum 10 *per cent* of spare gates as reserve for emergency, as also the fact that the procurement of four spare gates was approved by the EFC during XI FYP.

7.1.2.2 Control System

(a) Remote Control System

The gates of the Main Barrage were designed for remote control operation of all gates from a single point (Remote Control Desk), because sometimes 30 to 35 gates are required to be operated simultaneously. Manual operation of gates during rain and storm and at night is difficult and beset by the possibility of human errors.

Audit noted that the remote control system was out of



order since 1985. The existing operating system of Farakka Barrage had also become obsolete, resulting in errors in operation of the gates. In order to remedy the situation FBP carried out consultations (between 1990 and 2003) with two agencies viz., Central Water Power Research Station, Pune (CWPRS) and Electronics Research and Development Corporation of India, Kolkata (ER&DCI) for rectification of the system. Both agencies suggested replacement of the system with a new system with latest technology. The TAC, however, declined (99th Meeting in 2003) the proposal as it would entail huge cost and recommended rectification instead. The projected cost of replacement suggested by the consultants or worked out by the FBP was not found on record. However, the TAC decided (101st Meeting in 2005) to opt for up-gradation as no agency was found for undertaking rectification as earlier recommended by TAC.

Though the EFC provided ₹1.50 crore during Eleventh FYP Period (2007-2012) for completing the first phase of installation of the new operating system, no work was done till April 2012. Consequently, the gates continued to be operated without the remote control system for more than 25 years and no action for rectification/up-gradation of the existing system was initiated in over 20 years since the first consultation was undertaken for the purpose.

(b) Local Control System

In addition to the remote control system, local control system (electrical and manual) is provided on the gates for operation of the gates. The local control system comprises of Electrical Control Panels and Sub-Distribution boxes and in case of malfunctioning of the electrical system the gates are operated manually.



Audit observed that the local system remained intermittently inoperative due to poor maintenance work which consequently led to frequent manual operation of the gates.

FBP Management stated (July 2011) that replacement of the remote control system would be undertaken only after all the gates were replaced because phased replacement of remote control system would be technologically problematic and cost ineffective. Regarding local control system Management stated that efforts to repair the system were futile and as the

system had outlived its useful life, action for its replacement along with the respective gates had been initiated.

7.1.2.3 Hoist ropes

The heavy gates⁸¹ of the barrage are suspended to the hoists by steel ropes. As the hoists have to bear such heavy loads, it is necessary to undertake periodical check-up to detect deterioration of the ropes, so as to avoid any untoward incident. The GRC recommended (January and December 2005) the inspection of the wire ropes by an expert agency to work out the schedule for repair/replacement.

FBP informed (January 2006) TAC that the work would be completed within March 2006. FBP approached (September 2008) Central Institute of Mining and Fuel Research, Dhanbad (CIMFR) for conducting a non-destructive testing of the hoist ropes and it was decided by the TAC that action for replacement of the ropes would be taken on the basis of its report.



There was no further development in this regard as of June 2012 even though the EFC had provided ₹ one crore for replacement of hoist ropes and stay wires during the XI FYP period (2007-2012) on account of deterioration through prolonged use.

It is evident from the above that the FBP paid no heed to the advice of different expert committees (GRC and TAC) for repair and maintenance of the steel ropes. Non-adherence to the experts' advice regarding repair/replacement, coupled with absence of periodical inspection, is fraught with the risk of the gates collapsing and thereby creating an avoidable crisis.

The FBP Management stated (July 2011) that CIMFR could not perform the testing work of hoist ropes as the technology was not commensurate with the operational characteristics of the hoist ropes and stated that as the ropes were in use for more than 35 years, it was decided to replace the hoist ropes also along with the gates, as envisaged in the action plan.

⁸¹ Weight of one steel crest gate is about 29 MT and 39 MT for an under sluice gate.

Reply of the FBP Management corroborates the fact that the hoist ropes along with the gates need immediate replacement in the absence of regular maintenance.

7.1.2.4 Survey and bed protection work

Floods cause scour pockets in the river bed which leads to deviation of contours. Bed protection works like dumping of boulders in crates are necessary to restore these scours and contours. The FBP carries out pond level surveys of the river during the post-flood period at close interval in the reach from 300 meter upstream to 300 meter downstream of the Main Barrage. The GRC recommended (December 2005 and again in November 2006) to dump sand bags and boulders on the contours to save the barrage structures by preventing undermining of the barrage foundation. Further the EFC during the XI FYP mentioned the necessity of undertaking the protection work of flexible apron along with submerged spurs and three damaged bays (16, 17 and 18) and provided ₹7.50 crore. However, the FBP did not spend any amount as of September 2011 thereby compromising on the safety of the entire barrage structure.

7.1.2.5 Navigation Lock

The main components of the navigational lock at Farakka are Mitre Gates, Caisson Gates (Stop Logs), Radial Valve Gates, Bulkhead Gates, Mooring Bits, Control Rooms and Electrical rooms.

Audit observed that the FBP failed to carry out routine maintenance of the different components of the Navigation Lock in spite of having a maintenance manual. Besides, the FBP took no initiative to repair/restore the machinery/equipment lying inoperative



since long. Even the security of the assets was inadequate. The position is detailed in the following paragraphs.

- a) There was displacement in different parts of the gear system of Mitre and Radial valve gates' hoisting devices. Consequently, the gates of the navigation lock had to be operated with great difficulty and there was considerable leakage of water through the rubber seals at most times. As such, the possibility of the gate operating system becoming totally non-functional at any point of time cannot be ruled out.

- b) The remote control system was inoperative since inception and the gates were being operated locally.
- c) Periodical insulation tests of the electrical wirings of hoisting mechanisms of Mitre Gates and Radial Valve Gates, overhead lines of East and West Bank of the lock as well as pumping mechanism, ventilation and physical checking were not carried out.
- d) Most of the electrical operating panels of the Lock Gate at Farakka were operated without any switches, the electrical wirings of the machines and other different structures were in a very bad and unsafe condition and civil structure housing electrical components was dilapidated. Such hazardous conditions might cause a serious accident at any point of time during gate operation.
- e) Caisson Gates (Stop logs), meant for servicing and maintenance of Mitre Gates, were not positioned in proper place in the lock channel and remained non-functional since inception. This resulted in non-maintenance of Mitre gates.



Electrical Panels of the Lock Gate



Caisson Gates

- f) The barbed wire fencing was very old and absent in most of the places. Hence, important parts of locks lying haphazardly inside the lock gate complex were susceptible to damage/theft by miscreants.

FBP Management stated (July 2011) that provisions were made in the XII FYP for repair and maintenance of the navigational lock and its appurtenant structures and efforts were being made for modernisation of the navigational lock.

7.1.2.6 Maintenance of Feeder Canal

The feeder canal has several cross drainage structures for communication, irrigation and removal of drainage congestion. It has 17 jetties for ferry service, two road cum rail bridges and two road bridges.

During the Eleventh FYP (2007-2012), MoWR allotted ₹15.10 crore for “Operation and Maintenance of Feeder Canal” from Farakka Barrage to river Bhagirathi (38 Km). Of this, the FBP could utilise only 4.6 *per cent* (₹0.70 crore) till September 2011. Audit observed that despite specific recommendations by the TAC, FBP did not undertake protection works of the canal, viz. filling up the scour pockets in two reaches with sand filled HDPE⁸² bags, de-silting of Bagmari siphon, bank protection measures and construction of roads and bridges.

The alignment of Feeder Canal intersects various villages, path, roads etc. for which ferry services have been provided to maintain connectivity. With a view to discontinue ferry service at two points⁸³ FBP in February 1974 conceived a project of building road bridges across the feeder canal. Work on the road bridge was awarded (September 1977) to a contractor which was rescinded in January 1988. After a lapse of nearly five years, in October 1992, the rescinded work was awarded to another contractor at a cost of ₹1.07 crore. The bridge was to be completed by November 1994. The contractor completed the civil work in May 2001 after delay of 78 months. The FBP paid the contractor ₹1.27 crore upto 41st running account bill. FBP stopped further payment and the bridge was not taken over due to not conducting mandatory load bearing test by the contractor. The dispute was ultimately resolved (December 2008) by the Supreme Court and as per the order, FBP further paid ₹27.69 lakh to the contractor. Audit observed that FBP failed to prevail upon the contractor to conduct the mandatory load bearing test as of May 2012.

Since the FBP did not use the bridge it continued to operate free ferry service at the two locations across the length of Feeder Canal. During the period from 2006-12 the FBP authority had incurred an expenditure of ₹2.08 crore towards maintenance of free ferry service. Audit scrutiny revealed that apathy of the FBP to construct roads and bridges resulted in avoidable expenditure on free ferry service.

⁸² High Density Polyethylene

⁸³ RD 23 & 34

Recommendation 6:

Concerted efforts may to be taken to adhere to the milestones in the action plan formulated by FBP to meet the objective of replacement of gates and other structures by the end of Twelfth Five Year Plan period.

Recommendation 7:

FBP may identify and fix the responsibility centres, deliverables and deadlines to achieve the above milestones.

7.1.3 Utilisation of funds for maintenance

The following is the break-up of expenditure incurred on salary/ establishment costs, anti-erosion etc. during the last six years:

(₹ in crore)

Table 12 - Break up of expenditure incurred under FBP

Year	Salary/ establishment	Anti-erosion works	Maintenance works	Professional services*	Other activities	Total
2006-07	15.47	34.71	5.58	8.73	18.54	83.03
2007-08	17.39	16.17	3.98	8.98	9.34	55.86
2008-09	24.78	32.11	5.88	11.99	11.84	86.60
2009-10	29.90	44.66	5.61	15.98	12.43	108.58
2010-11	28.01	19.72	6.07	15.00	16.78	85.58
2011-12	30.16	38.33	9.56	15.00	18.22	111.27
Total	145.71	185.70	36.68	75.68	87.15	530.92
Percentage of total expenditure	28%	35%	7%	14%	16%	

* Substantial part of expenditure under professional services was payment to CISF

It is evident that expenditure on maintenance works was only seven *per cent* of the total expenditure, whereas expenditure on anti-erosion works was the highest at 35 *per cent*.

In 2005, responsibility of Farakka for anti-erosion works was extended from 12 km to 40 km upstream and seven km to 80 km downstream of the barrage. The FBP through its four divisions⁸⁴ took up anti-erosion works on a regular basis in the left bank upstream and the right bank downstream of the barrage. An amount of ₹185 crore was incurred on anti-erosion works during 2006-07 to 2011-12 by diverting substantial manpower for these works from

⁸⁴ Anti Erosion Division, Survey & Investigation Division, Feeder Canal Division, Equipment Division

their regular duties. Audit is of the view that it was one of the reasons for neglect of the required maintenance of FBP.

FBP Management stated (July 2011) that higher authorities were requested to fill up large number of vacant posts in Head Works Division. It also stated that a few maintenance works could be implemented through outsourcing.

The reply supports the audit contention that the maintenance of Farakka Barrage was not given priority by the FBP Management.

7.1.4 Inspection by Central Water Commission

The CWC conducted (July 2011) inspection and concluded that most of the gates of main barrage and head regulator were in precarious condition and unless some urgent measures were adopted, their collapse seemed inevitable any time. All the gates were corroded beyond repairs and had lost their design strength to withstand hydro dynamic pressure.

The CWC suggested (July 2011) a comprehensive solution of replacing gates in a phased manner during the XII FYP period (2012-2017). It justified the proposal stating that the gates had already outlived their economic life and any future special repairs could only postpone the disaster in waiting for a couple of years. Therefore instead of tackling the problem in a solitary piecemeal basis it was suggested to go for a comprehensive overhaul i.e., to replace all the gates. It advised the Management to convene TAC meeting at the earliest for consideration and acceptance of this proposal. The TAC met in November 2011 and approved the proposal for replacement of gates and some other structures in phased manner during the XII FYP period.

Audit is of the view that protocol for preventive maintenance vetted by the CWC in June 2012 should have been in place much prior to their inspection. No system existed for periodic inspection and maintenance. No records in the form of log books or registers were maintained. Painting of gates and their special repair jobs awarded to the National Projects Construction Corporation (NPCC) and Jessop in 1996 continued till 2005 but remained unfinished.

The FBP Management offered no comments on the issue.

Recommendation 8:

Management should ensure adherence to protocol for preventive maintenance adopted in June 2012 and ensure availability of adequate Tools and Plants items and instruments, requisite and mandatory spares in the inventory and maintenance of records of inspection.

7.1.5 Conclusion

It was seen that maintenance of the Farakka Barrage and its ancillaries was lax. Several critical structures such as gates, gate operating system, navigational lock etc. were not maintained and repaired, resulting in a situation where some of these structures were in disuse for several years. The FBP Management, CWC and MoWR neglected the inspection and maintenance aspects of the FBP structures for last three decades. Bed protection works to restore the scours and contours in the river bed to save the barrage structures in order to prevent undermining of the barrage foundation were not undertaken. FBP also did not undertake protection works of the feeder canal in spite of the recommendations of the TAC. No action for preventive maintenance of the Barrage structures was taken. The budget allocation of the project was biased in favour of anti-erosion works. Expenditure on maintenance works was only seven *per cent* of the total expenditure, whereas expenditure on anti-erosion works was the highest at 35 *per cent*.

The FBP Management accepted most of the audit observations and stated that action plans had been initiated for repair and replacement of the dilapidated structures in a phased manner during the Twelfth Five Year Plan period (2012-17).

The issues mentioned in the above paragraphs were referred to MoWR in July 2012, however, reply was not received as of July 2013.