

## CHAPTER - VI

### Nature of Intervention

#### 6.1 General Discussion

As we know that up to 1931, the reach was more or less straight between Rajmahal and Farakka. The strategy to build up structural measures took attention from 1963. The chances of incipient gully formations along the bank developed after spur installations during late 1960 onwards. For example the possibility to spate the blocks of Kaliachak I & II, Manikchak and Englishbazar was found through Gopalpur Khari (incipient gully) in 1998 (Rupantarer Pathe, 1998). It has been witnessed that as much embankments have constructed, natural attacks by the river increased by many times compared to 1930 – 1960 periods. For instance, after construction of 5<sup>th</sup> retired embankment from 1991 to 1998 further erosion engulfed more than 2 km width of bank line for a distance of 10.00 km from Domhat to Panchanandapur up to 1998 and it increased an additional area of more than 11 kms. The necessary measures that were

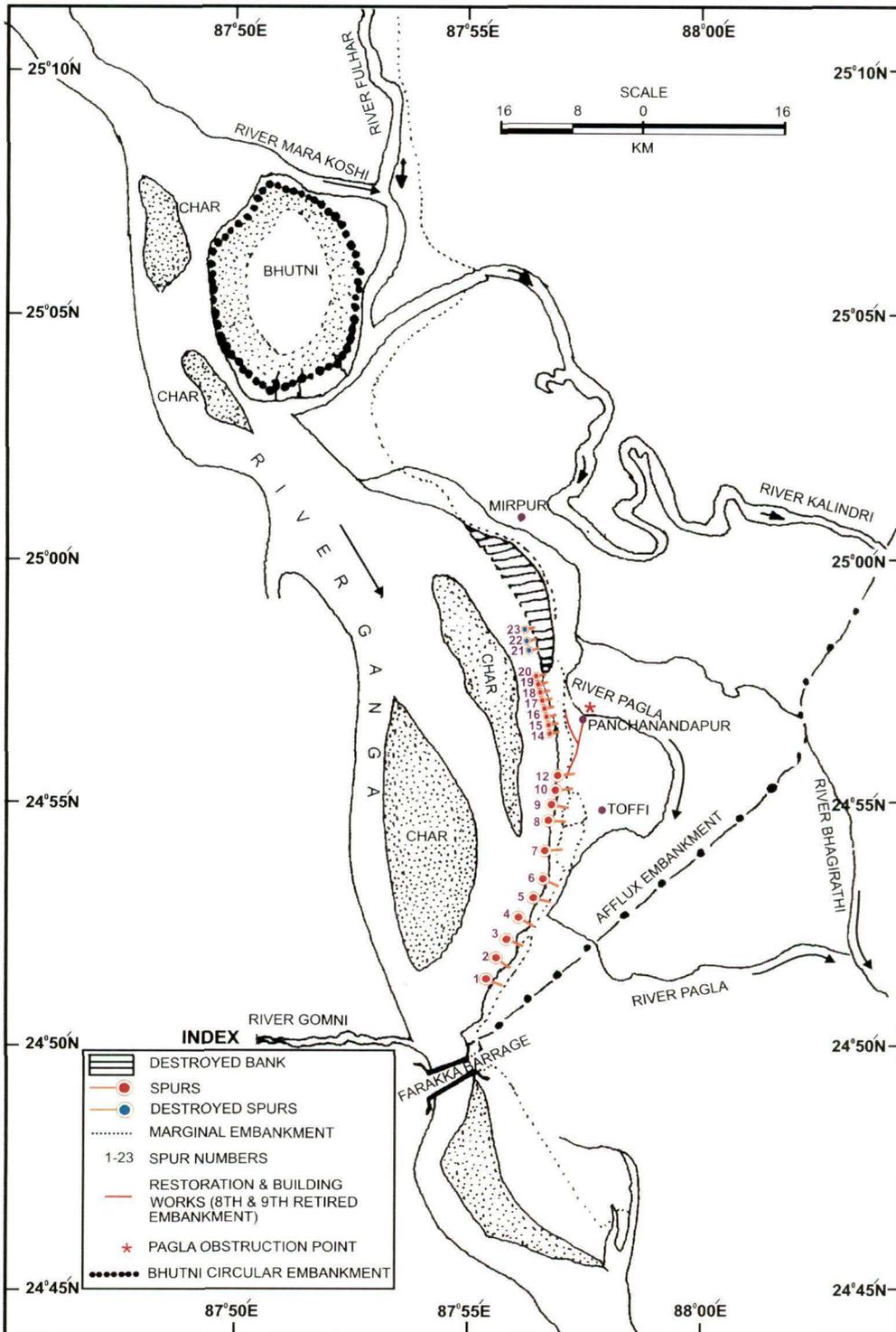
**Table 6.1** Year wise statement of installation of Spurs.

Sl. No.	Year	Identity of Embankment / Spur
1.	1996	Spur 24
2.	1997	5 <sup>th</sup> retired embankment and spur no. 24
3.	1998	Restoration of spur 24
4.	1999	New spur near Kaliachak II
5.	1990	Spur no. 20 and 10
6.	1991	Restoration of spur no. 20 and 10
7.	1992 to 1995	Strengthening of spur no. 10, 18 & 20.
8.	1990	Restoration of spur no. 10
9.	1998	Strengthening of spur no. 10 & 20
10.	1999	Construction of 6 <sup>th</sup> retired embankment near Khaskol and strengthening of spur no. 20
11.	2000	Restoration of 6 <sup>th</sup> retired embankment near Khaskol and Daulatola in Manikchak and Englishbazar
12.	2000	Repairing of spur no. 19
13.	2000	Reconstruction of spur no. 20 (upstream of Farakka Barrage, P.S. Kaliachak)
14.	2000	Construction of 7 <sup>th</sup> retired embankment on the left bank of river Ganga
15.	2001	Construction of 8 <sup>th</sup> retired embankment (upstream of Farakka Barrage) P.S. Englishbazar & Kaliachak
16.	2001	Remodeling of marginal embankment (Bull headed 'D') P.S. Kaliachak
17.	2001	Protection of spur no. 18 (P.S. Kaliachak)
18.	2001	Protection over 8 <sup>th</sup> retired embankment for 1.5 km from the tagging point of Panchanandapur (P.S. Kaliachak)
19.	2002	Construction of bed bars with the falling apron and revetment along 8 <sup>th</sup> retired embankment (P.S. Kaliachak)
20.	2002	Construction of bed bars with revetment and falling apron from tagging point of spur no. 18 & 17 at Panchanandapur

Source: I & W, West Bengal, 2003.

To make out the scenario more prominently the location of the spurs with their identity numbers may thus be presented as in *Fig.6.1*

**SPURS ALONG THE LEFT BANK OF RIVER GANGA**



Source: Based on the Map of Irrigation and Waterways Department, Govt. of West Bengal, 1999 & Field Survey 2011-2012

**Figure 6.1** Location of Left Bank Line Spurs of River Ganga in Malda District.

In the following discussion, the measures taken so far are being discussed :

### 6.1.1 Spurs

From time to time and year to year different spurs had been installed.

#### 6.1.1.1. During 1970 – 1980

After 1963, actually making of spurs became very much important. In 1972 – 1973, ten (10) number of bull headed spurs were installed near Jhowbona, Panchanandapur and Laskartola. These four (4) spurs wiped out readily and the other six (6) could only save their existence after 1973 flood. During 1973 – 74, eight (8) number of modified bull headed spurs were set along the left bank near Charbabupur and Dhelpara and they existed till 1974 up to their outflanking in heavy erosion. In 1975, the heavier Sahebganj *dhap* spur was totally wiped out. To restrict the heavier wasting of bank 29 bed bars were installed of submersible type from Jhowbona to Charbabupur covering Panchanandapur, Laskartola and Dhelpara but the dawn of making became history up to 1975 flood season. The period from 1975–1976 nine (9) number of spurs were constructed at Charbabupur, Rajnagar, Toffi and Sahebganj *Dhap* reach. Damage and breakage of these nine (9) spurs were repaired after post floods of 1979. During the flood period of 1978 spur numbers 2, 4, 7, 8 and 9 were seriously attacked and spur numbers 3, 5 and 6 totally out flaked though they were restored after 1978.

#### 6.1.1.2 During 1980 –1990

Actually 12 km of immediately upstream of Farakka barrage received prominent severity of erosion in this period. On the other hand the later phase was characterized by similar severity along Manikchak–Moynapur sub reach. From 1980–1985 mainly repairing, restoration, maintenance and renovation of spur no. 07, 08 and 09 were carried out. Construction of bed bars and their maintenance were also taken up. During 1985–1990, Moynapur bar was made up. Spurs with numbers 12 and 24 were maintained. The need to fill up the breaching part of the afflux embankment was a serious task and the restoration of the left marginal embankment (Roy, 2000).

#### 6.1.1.3 During 1990 – 2005

Panchanandapur to Moynapur was the main reach in this period. Near Moynapur spur no. 25 and 26 were prepared. Similarly reconstruction & restoration was done for spur numbers 20, 24, 25, and 26 as well spur no.18 and 10. In 2002, bed bars were constructed near Panchanandapur with revetment and falling apron from spur

numbers 17 to 18 to save the Ganga Bhawan. By the end of 2003 – 2005, Sakullapur, Dharampur and Khaskol attracted attention. During 1993 flood situation and 1994 erosion three spurs numbered 25, 26, 26A were out flanked. Up to 2004-2005 most of the spurs were seriously wounded almost mainly in areal collapse and cavity attacks. Up to 1996 in Manikchak Gram Panchayet only about 1,350 acre land was found untouched from erosion compared to 2,300 acre eroded land in case of 08 mouzas (Sarkar, 1998).

### 6.1.2 Embankments

A Number of embankments have built up in Malda from time to time to save the bank from erosion of the shifting river. But in most of the times the marginal embankments having been breached, has touched the back lying retired embankment and has transformed into retired one in real sense. Actually the major erosion protective embankments in Malda are:

- i. Eastern marginal embankment from south of Bhutni Diara to Farakka.
- ii. Fulahar embankment for old Koshi & Fulahar.
- iii. Likhhal Khal embankment at the back of Kalindri and parallel to Fulahar.
- iv. Sambalpur Bundh, Kidney shaped and further east of Likhhal embankment
- v. Bhutni circuit embankment along the Marginal belt of Bhutni Diara
- vi. Afflux embankment almost perpendicularly located to Farakka Barrage.
- vii. Spill channel embankment below Farakka Barrage was made up along the left bank of the river and was of prime importance for flood protection.
- viii. Protection and Restoration of Bhutni-Diara circuit embankment, Afflux embankment was taken up during the 1998-1999 economic year (I &W, 1999).

Actually the main embankment here is the eastern Diara Marginal one and the associated retired embankments (*Fig. 6.2*). These are discussed below:

SPURS AND EMBANKMENTS

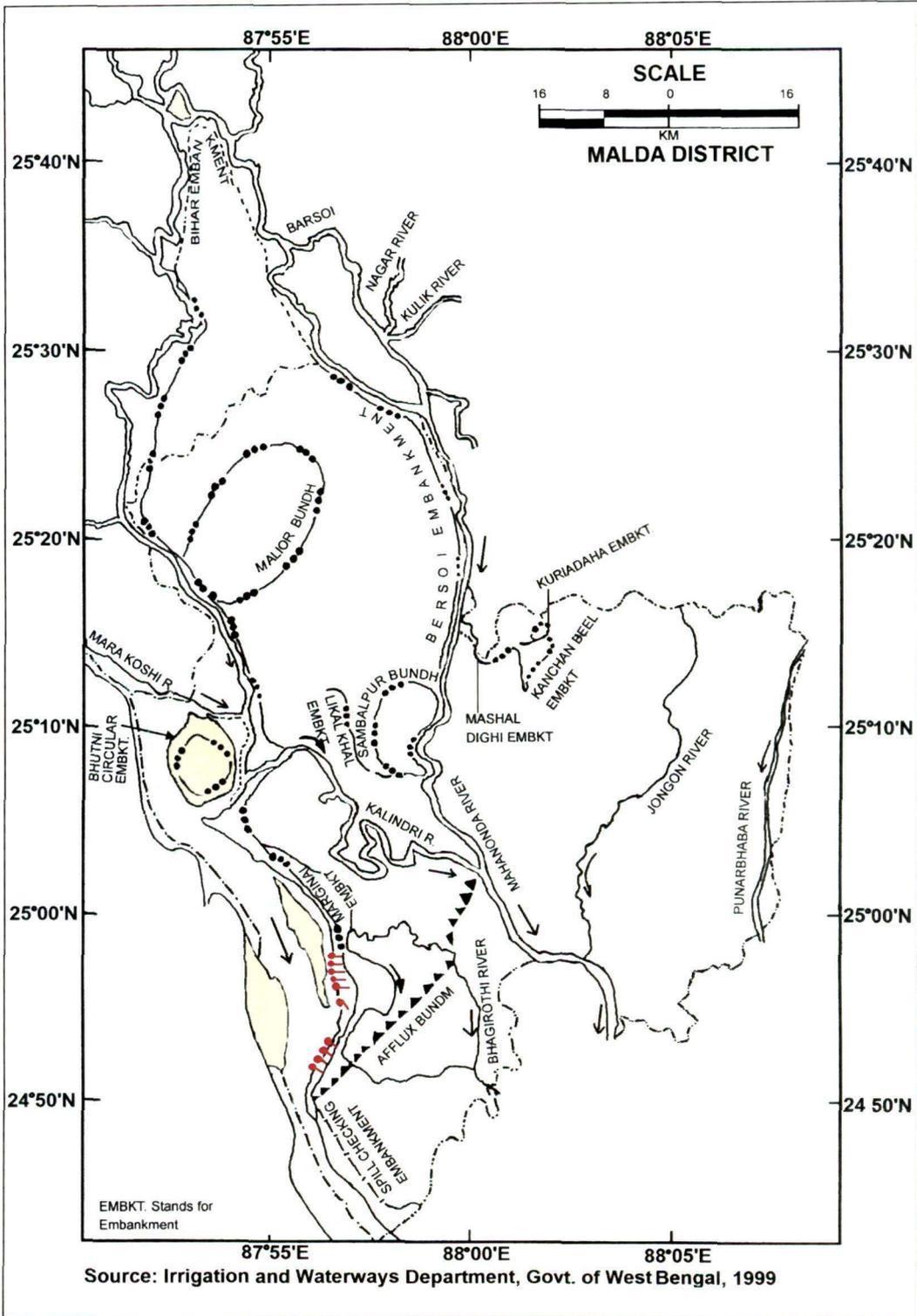


Figure 6.2 Locations of Main Embankments along Left Bank Line of River Ganga in Malda District.

### 6.1.2.1 1980 – 1990

During this phase special attention had been provided to the making of embankments and their maintenance plus further repairing. From 1980 to 1985 reconstruction of existing marginal embankments and spill checking embankment was taken up. Restoration of Farakka tagging embankment of afflux type with that of the marginal one was also given importance. During 1985–1990, the construction of the Moynapur retired embankment was done. In this period construction of ring bund and closing the breach in the forward embankment and the strengthening of marginal embankment was seriously completed.

### 6.1.2.2 1990 – 2003

This phase was very important regarding the activities of preservation, maintenance and restoration of the embankments. Construction and maintenance of the embankments though did not control any ferocity of the river attacks. This works done in this phase have been listed below:

- i. Making of 3<sup>rd</sup> retired embankment
- ii. Raising and consolidation of 3<sup>rd</sup> retired embankment
- iii. Construction of retired embankment at Aswinitola (Domhat to Goloktola).
- iv. Construction of 6<sup>th</sup> retired embankment
- v. Protection and renovation works on 6<sup>th</sup> retired embankment at Khaskol & Daulatola.
- vi. Construction of 7<sup>th</sup> retired embankment
- vii. Construction of 8<sup>th</sup> retired embankment
- viii. Remodeling of eastern marginal (Diara) embankment
- ix. Protection of 8<sup>th</sup> retired embankment
- x. After flood 1997, 4<sup>th</sup> retired embankment was seriously attacked 5<sup>th</sup> retired embankment was strengthened near Aswinitola and the marginal embankment was engulfed at places.
- xi. 9<sup>th</sup> retired one is still alive and was consolidated in 2003 –2004.
- xii. 8<sup>th</sup> retired embankment was seriously attacked in 2003 from Khaskol to Pagla ghat and almost destroyed.
- xiii. Land acquisition between Sakullapur – Panchanandapur reach during 2005, to protect the area near spur 17 and protection plus build up of the 9<sup>th</sup> retired embankment.

- xiv. Near Jotkasturi and Sakullapur the alternative embankment was washed away for 70% of its total length and 8<sup>th</sup> retired embankment was fully eroded up to Bhagirathi point covering parts of Jot Kasturi to Jot Ananta.
- xv. 7<sup>th</sup> retired embankment was attacked in 2001 seriously from Jhowbona (Jl.No.03) to upstream of Jot Ananta of Kaliachak II.
- xvi. During 2007–2008 and post 2008 periods till now, the 9<sup>th</sup> retired embankment is the only safeguard of extreme type after the 60% engulfment of the 8<sup>th</sup> retired embankment.

The working group on Flood Control Programme for 10<sup>th</sup> five year plan has said in its report that, the financial outlay required for the Tenth Five Year Plan has been worked out on the basis of the projections made by the states with international border and having serious flood and erosional problems. These funds are, however, to be provided fully by the central Government due to international implications (Basu,2004).

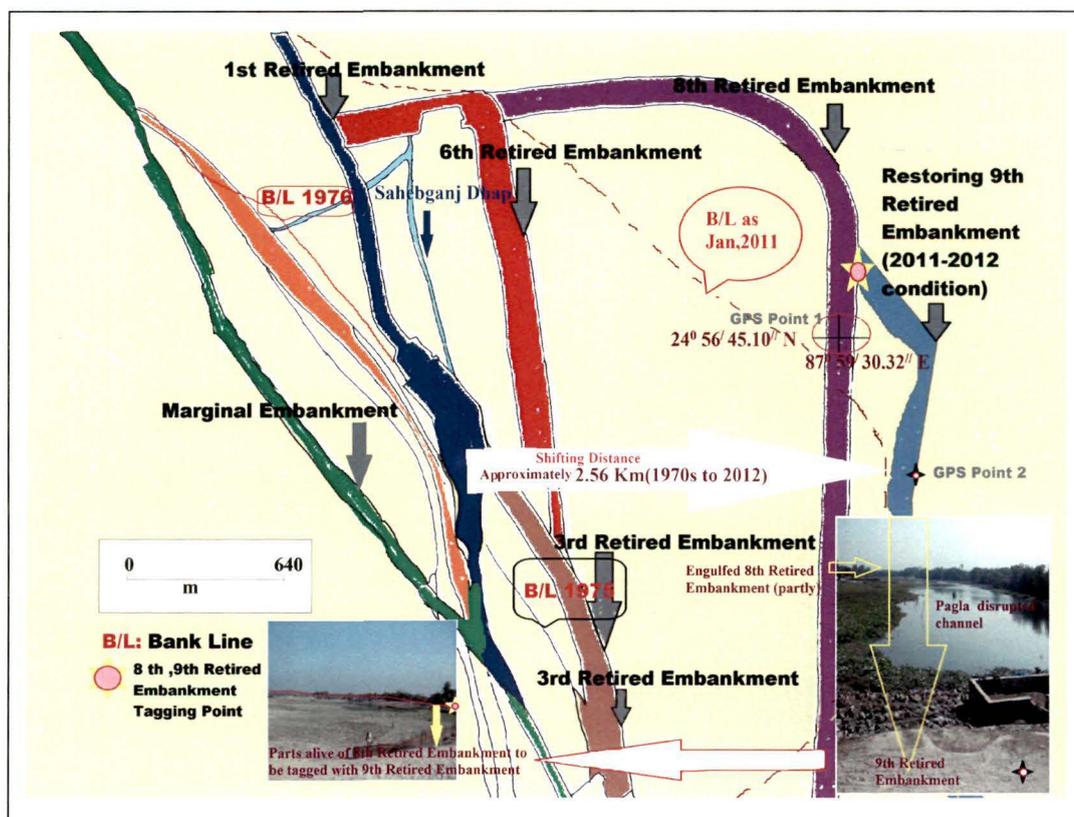
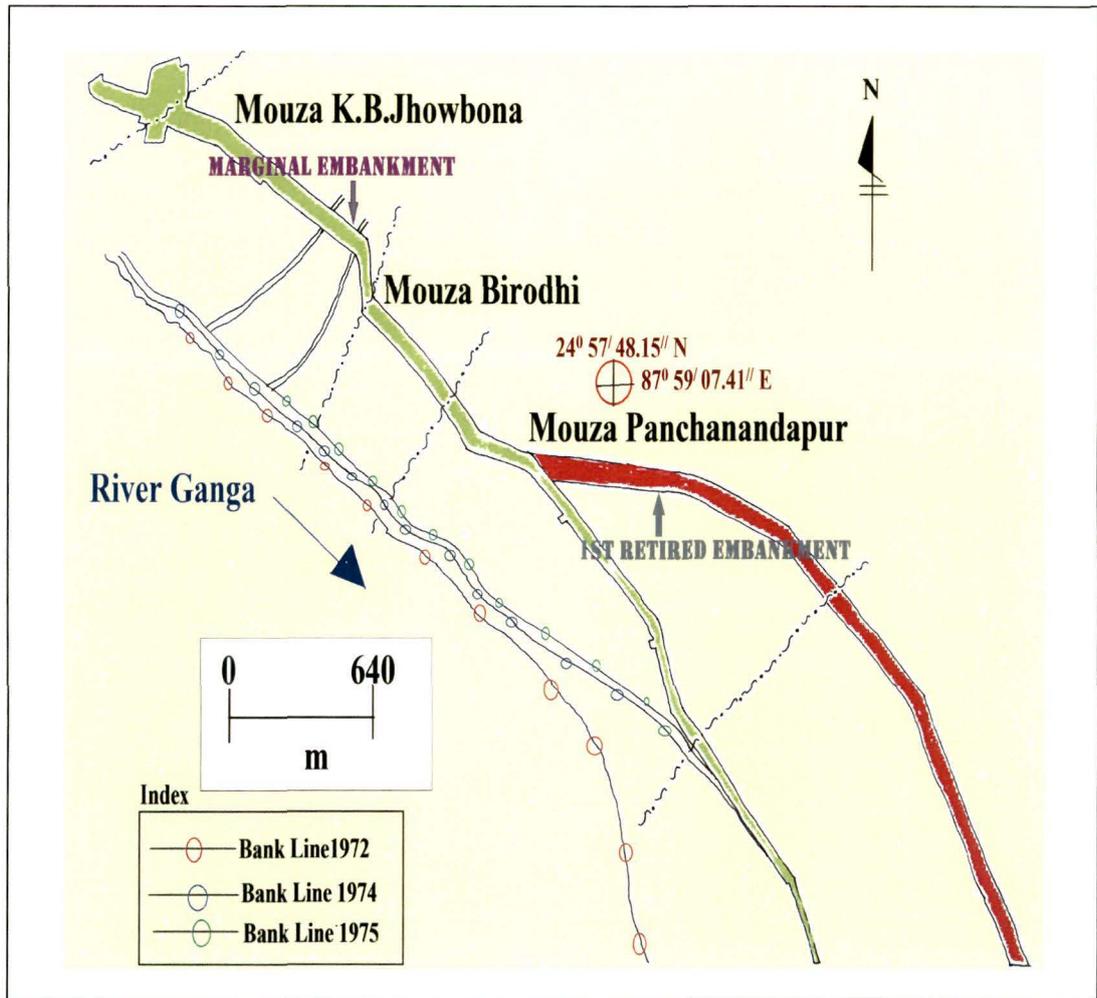


Figure 6.3 a Embankments near Panchanandapur Area.

The location of the last few retired embankments in a comprehensive manner is has been presented latest upto January 2012 in the *fig.6.3 a and b*.



**Figure 6.3 b** Embankments near Panchanandapur Area.

## 6.2 Impact Assessment and Usefulness analysis of interventions

To solve the problem of Ganga erosion, the need is to be very cautious about the measures to be taken up from ecological point of view. Many a time making of structural measures in dry season is problematic without knowing proper information of in-channel water table. Upstream of Farakka Barrage the pond level at the Barrage is maintained purposefully to regulate water to Bhagirathi River through feeder canal. Upstream of Farakka the water table is kept at such a level so that to regulate steady flow of water to Bhagirathi and for which near Farakka, building up of launching apron from within the channel bed and pitching of boulders along the bank is a serious attempt against stream dynamics. For which repelling spurs are really needful to direct and train the water purposefully taken as short term measure. For which

actually bank protection measures are less important at marginal parts of bank line rather making of repelling (attracting and deflecting spurs) spur may be a short term protection. Actually wherever we are at the close to the real menace especially in case of rivers; river dynamics play its own role and man is at the grant of that. Up to 1998, repeated attempts of spur making were a continuous action. In case of any river regime mainly meandering rivers construction of deflecting spurs at the upper part of the meander curve near Manikchak Domhat area before 1993 – 1994 period was a futile action. For which impinging flow attacks came to Panchanandapur part vigorously and the meander apex shifted more downward from Khaskol to few kms down of Panchanandapur. After 1995 most of the downstream spurs were engulfed because of such action. Spurs should be properly winged with boulder pitching along both the upstream and downstream part of bank line taking at least 250 to 300 m of bank line. The misfortune is that in most of the cases though the spurs are installed as deflecting spurs but unmanaged installation turns them to an attracting spur. Winged spurs are not installed in many a time due to scarcity of financial infrastructure. Actually maintenance is not properly done at a regular basis. Back erosion of the spurs(incipient gully forms) has engulfed them seriously for which upstream of Farakka Barrage, the spur at distance of 26 km, 24 km, 20 km, 12 km, and 18 km have totally ruined as stated by P.Basu in 2004. Bull headed spurs have played rather negative role as the bull shaped heads response much in gravitational attraction than its tail part and fall of the head leads to steady engulfment of the remaining tail part automatically. Long repelling and deflecting spurs still are not in reality in Malda due to less cost – benefit ratio. Any long repelling spur should be reached to the river bed having at least 200 – 300 m of length. Improper execution sometimes becomes the reason of unwanted reactions in channel hydrology(plate:6.1). Discontinuous spurs aggravate the formation of incipient gully(table 6.2) and sudden collapse of the spurs.

**Table 6.2** Inter-spur Distance(m) along the Left Bankline of River Ganga.

Sl No.	Spurs	Inter spur Distance m	Av. Distance
1	1-2	830	544m
2	2-3	660	
3	3-4	670	
4	4-5	840	
5	9-10	500	
6	14-15	160	
7	20-21	150	

Source: Compiled from map and Field measurement, 1999.

Installation of Manikchak spurs could have placed at least 10 km downstream of Aswinitola to achieve the most possible utility to act as deflecting spur. If the ground pitching of the individual spur is not at a depth at least 20 m, the longevity reduces about 2 to 4 years. Aproning of the sand beds along the bank by iron sheets is needed but which was really a dreamlike plan in Malda in respect of effluences of money. Deflecting spurs should have at best more than  $90^\circ$  in respect of attacking currents. Submersible cameras should be used to view the down pouring of boulder barges. If the launching aproning is inadequate, down pressure will lead to the sub surface undermining more and more, which is a very precise ground reality in Malda.



Plate 6.1 Inter spur spacing between Sakullapur-Panchanandapur.

Spurs should have multi-layered pitching from ground level keeping in view hierarchy of layering as per the size of the boulders. Wipe holes are to be opened up at about 30 m distance along spur walls, where cemented and concertized spurs are to be set up to reduce down back water and over-saturated water pressure along the spur wall. Geo-synthetic block mattresses can be used for anchored and floating spurs, but that yet not have been possible in Malda.

### Conclusion

The plan can be like this, the spur is placed along the bank line with chains of anchors at distant or far off location from bank (at best 200 – 230 m from bank) and the spur feet will be floating on metal *tarja* mats against the cavity wounded banks. The aim is to drag and bring the spur at desired spots as and when required. Such a measure is

not still possible. In case of submersible bed bars anchoring should have been tagged to the bed and the bank both but actually technology of bed anchoring over loose soil is not possible easily. Articulated concrete mattresses are much superior to normal pitching. Small concrete slabs are joined with each other in this case within an iron panel. A number of adjoining panels will result into a big mesh of desired elasticity. Each sheet is composed of many panels and the sheets are stitched with each other by polymer threads. Spreading of such mattresses should be taken into consideration as urgent and successful measures than spurs and the extent of spread should be 200 m back of the bank top to the foot of the bank estimated in dry periods. The joints and pockets of the mattress are concretized with bank infiltrating liquid cements. Boring of pipes can even strengthen the attachment of the mattress and the bank.

On the basis of such discussion the impact of spurs and embankments with necessary modifications can be summarized as below:

- a) Bull heads have invited excessive acceleration of gravity and failure of the spurs.
- b) Discontinuous spurs lead to incipient gully formations and further cavity attacks in between two successive spurs.
- c) Apron-less pitching at the base of spurs lead to over superincumbent load pressure and slip down of sand beds at faster rates.
- d) 300 – 400 m distance need between the marginal & retired embankment with regulators to gush out trapped rain water and to stop to destroy the lithological saturation through accumulated rainwater.
- e) Anthropogenic digging of soil at the back of the spurs or embankments if not restricted, it may cause instability of the embankments which has found a dam reality in Malda.
- f) Spurs needed to be fenced with palisades in the frontal and the back side parts of the structure to trap down falling silts with runoff water.
- g) Embankments without guide walls and breach repairing can even play the volatile role of unwanted flash flood.

## References

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