Influence of Jamuna Bridge on The Jamuna River Morphology

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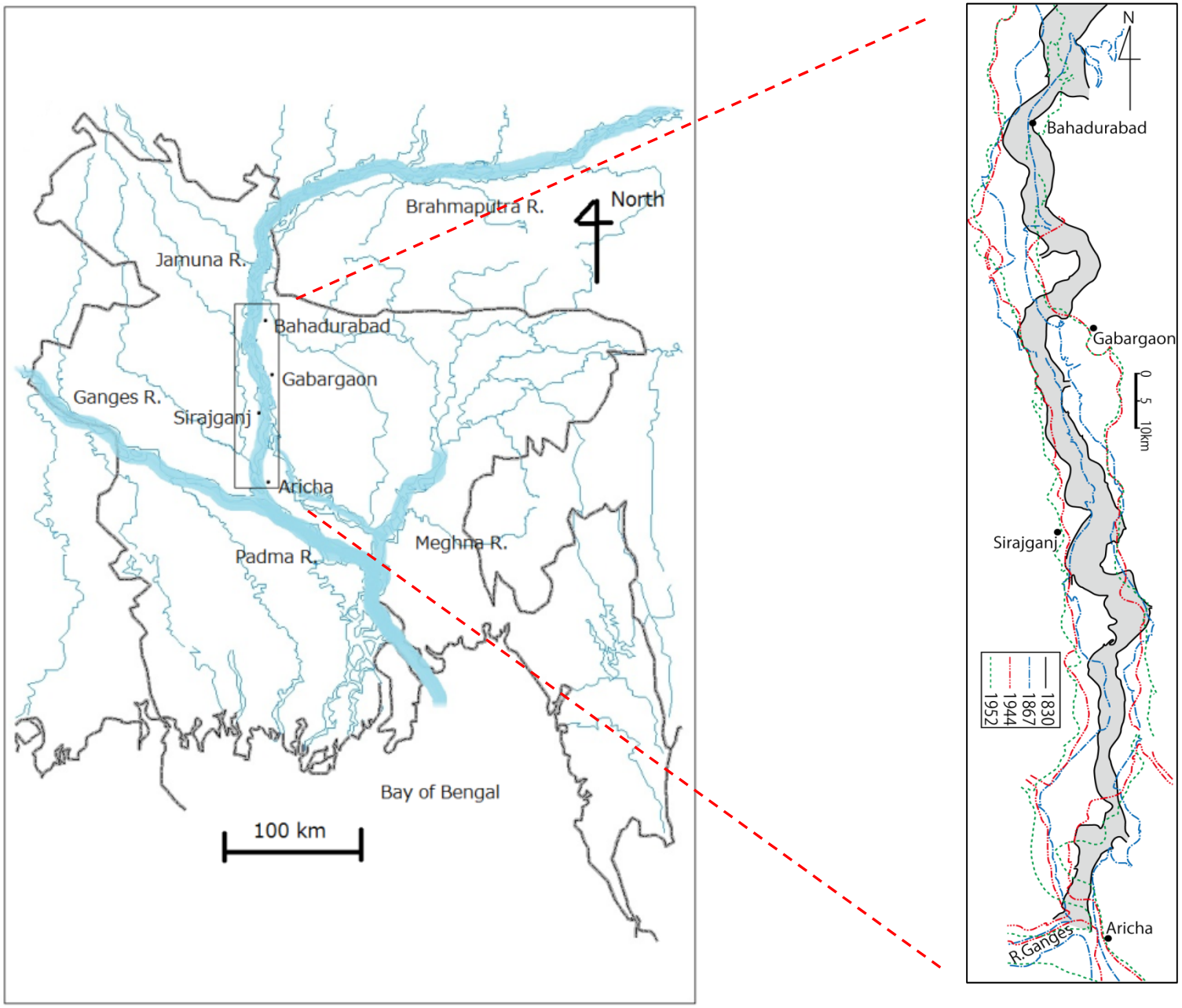
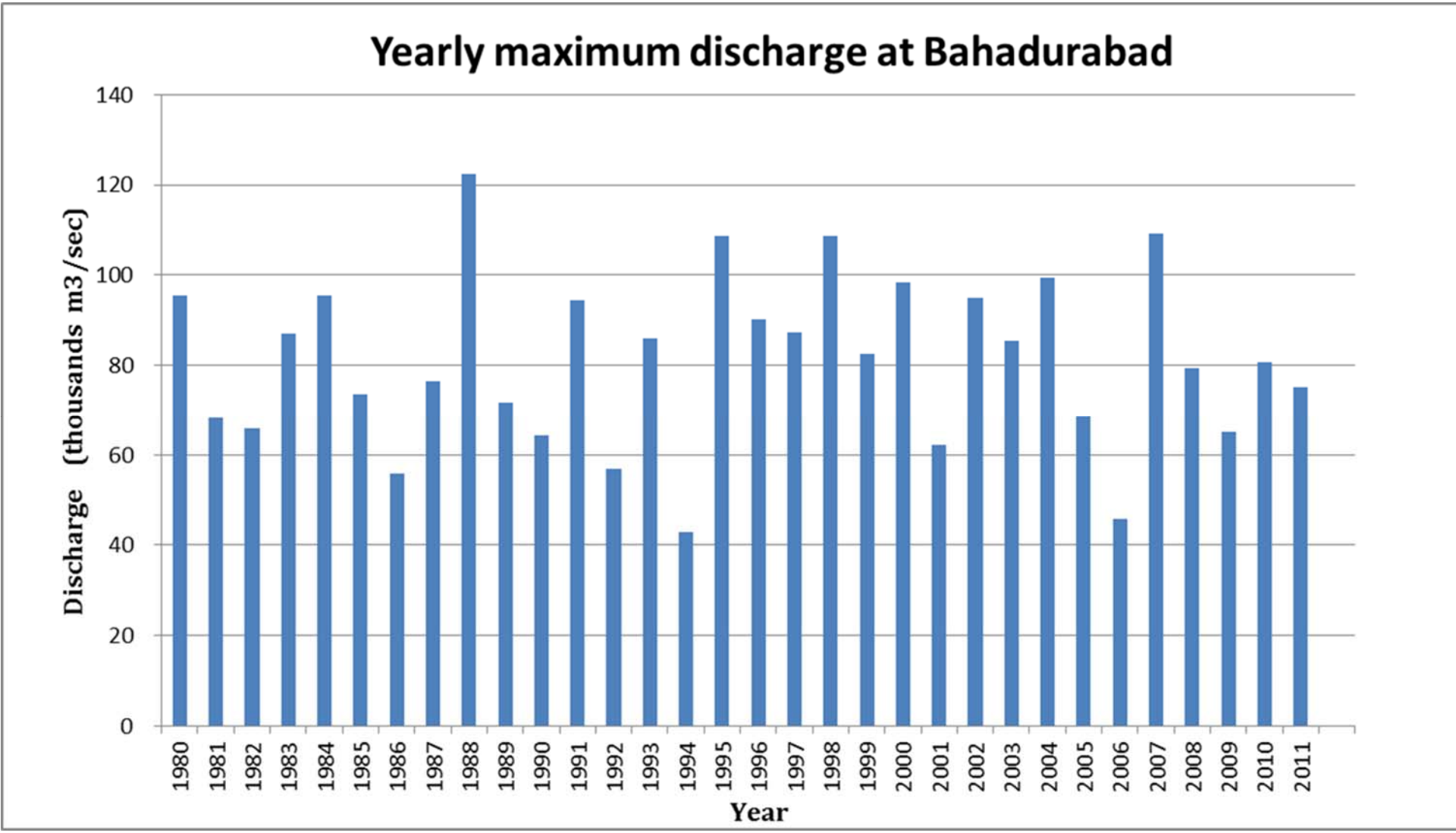

Brahmaputra R.
North
Jamuna R.
Bahadurabad
Gabargaon
Ganges R.
Sirajganj
Aricha
Padma R.
Meghna R.
Bay of Bengal
100 km
N
Bahadurabad
Gabargaon
0 5 10km
Sirajganj
1830
1867
1944
1952
Aricha
R.Ganges

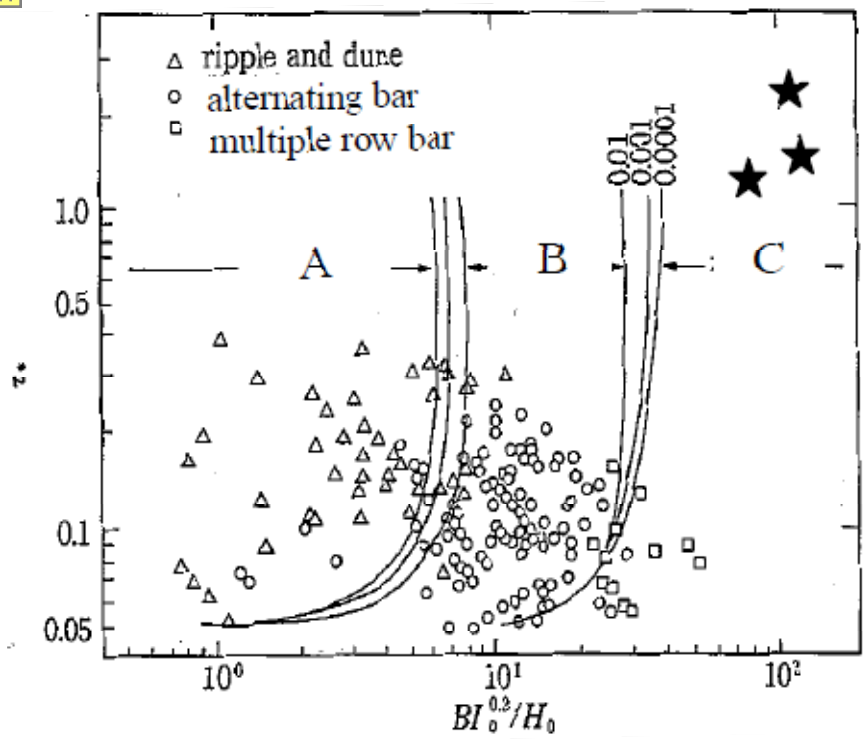

Yearly maximum discharge at Bahadurabad
Discharge (thousands m3/sec)
140
120
100
80
60
40
20
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Year

Major floods in Bangladesh

Flood year	Flood–affected area (km^2)	As % of total area of country	Rank
1955	50,500	35.37	6
1974	52,600	36.84	5
1987	57,300	40.13	3
1988	89,970	63.01	2
1998	100,250	67.93	1
2004	55,000	37.27	4

Area of Bangladesh: 147,570 km^2

Source: Thomas Hofer & Bruno Messerli, Floods in Bangladesh, 2006



Formation region of meso-scale bed form by Kuroki and Kishi (1984)

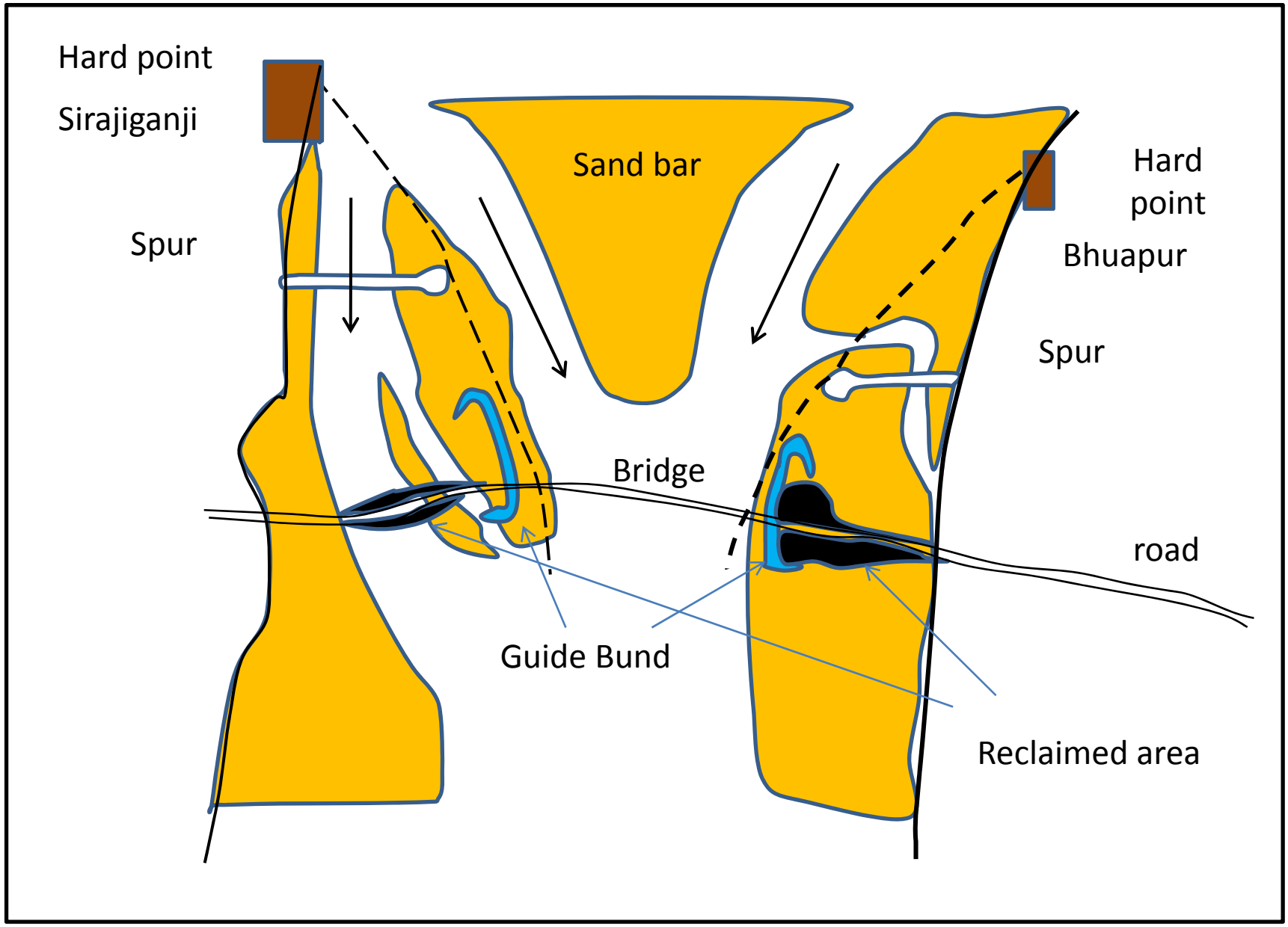
Actual values of formation region of meso-scale bed form by Kuroki and Kishi (1984)

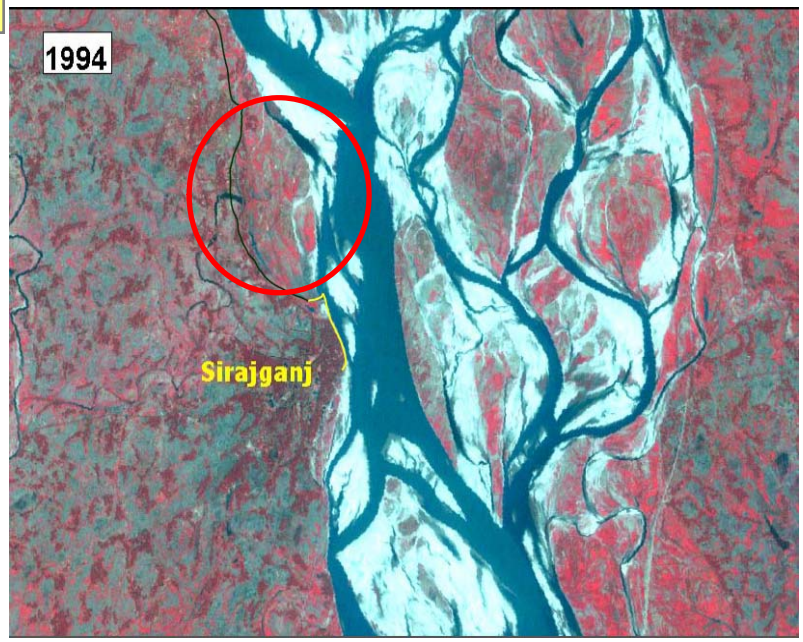
Q, m^3/s	B,m	H_0, m	$BI_0^{0.2}/H_0$	τ_*	Region*1
65,600.0	13,800	11.19	186	1.98	MRB*2
83,485.0	14,500	11.19	182	2.12	MRB*2
16,750.0	11,000	8.60	192	1.52	MRB*2

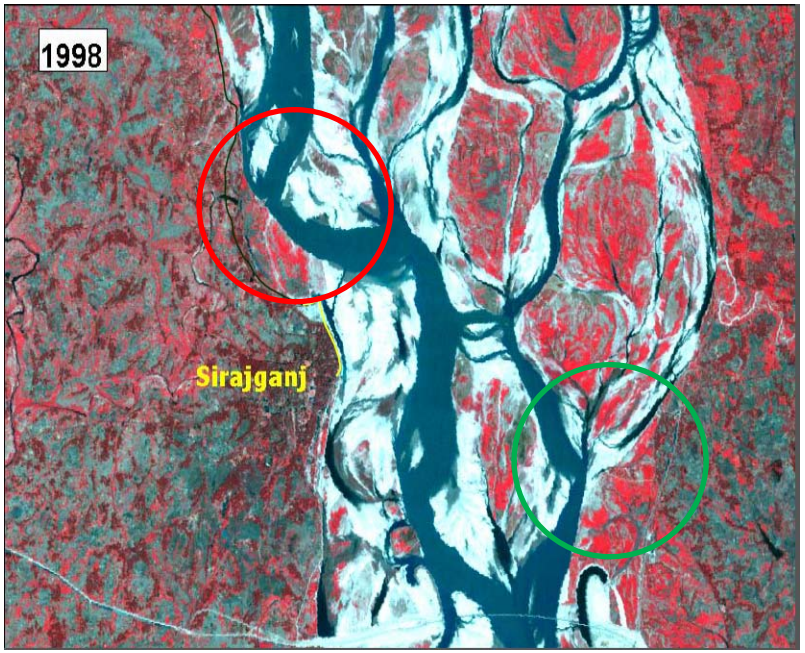
*1: Region of bed form, *2: Multiple row bar

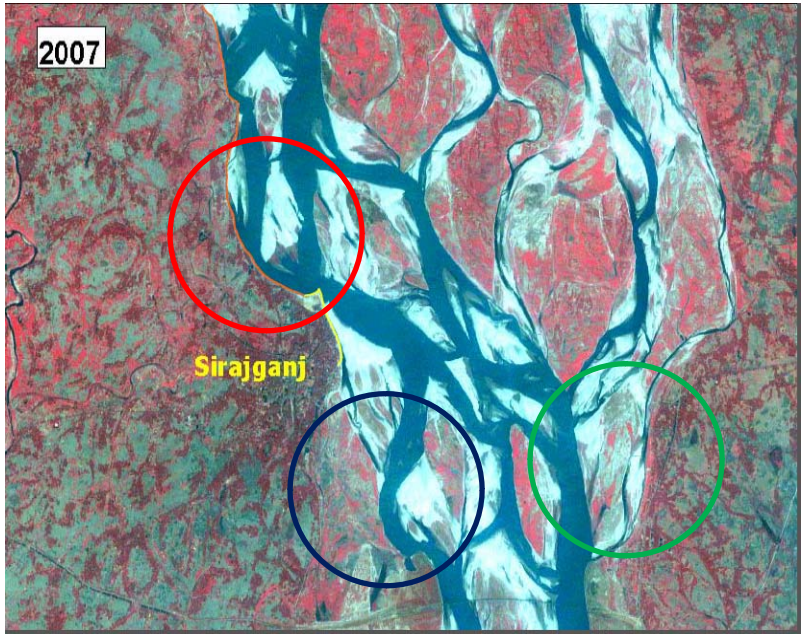
JICA, 1976,

Proposed sites	Stability of the River		Cost of construction Grand total: River width (Crore TK)		Estimated traffic volume		Evaluation of Priority
	Geomor-phology	River – mor-phology			Passenger Trip: 10,000 persons/year, Commodity flow: 1,000 tons/year		
			4.2 km	5.2-5.6 km	Passenger trips	Commodity flow	
Bahadurabad	B	A’	457	499	4,324	2,442 (3,655)	B
Gabargaon	A’	A	474	497	4,324	2,442 (3,655)	A’
Sirajganj	A	A’	433	477	4,452	3,506 (4,419)	A
Nagarbari	C	C	471	488	5,056	3,848 (4,666)	B


Hard point
Sirajiganji
Sand bar
Hard
point
Bhuapur
Spur
Spur
Bridge
road
Guide Bund
Reclaimed area


1994
Sirajganj


1998
Sirajganj


2007
Sirajganj

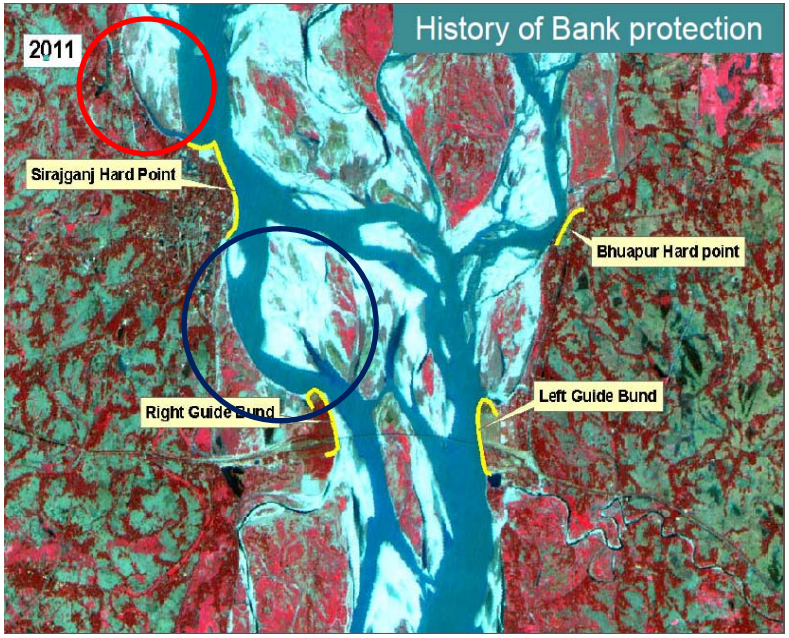

History of Bank protection
2011
Sirajganj Hard Point
Bhuapur Hard point
Right Guide Bund
Left Guide Bund

Photo-1: Sirajganj Hard Point revetment on Jamuna River. reinforcement of toe (visible during low flow) with concrete blocks placed during floods at time of structure failure. (2013 Feb.)

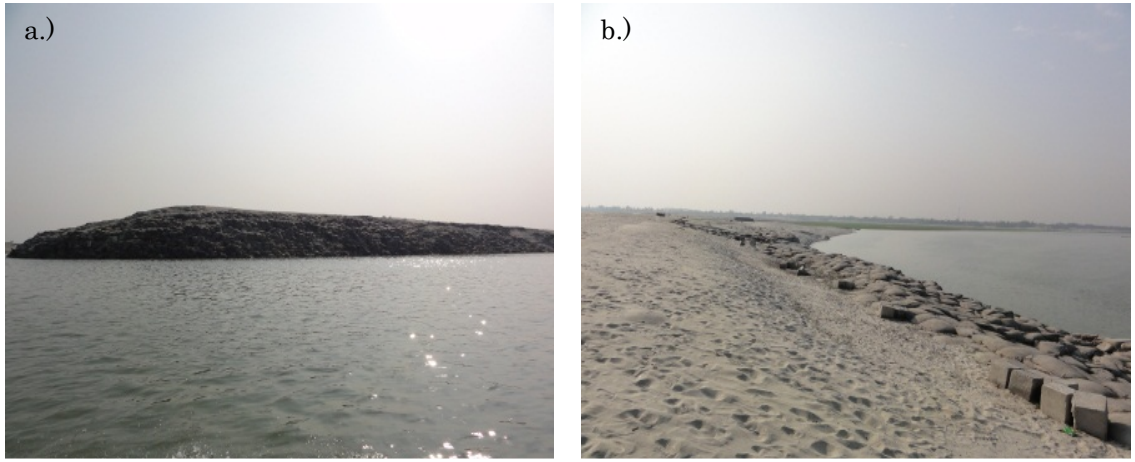
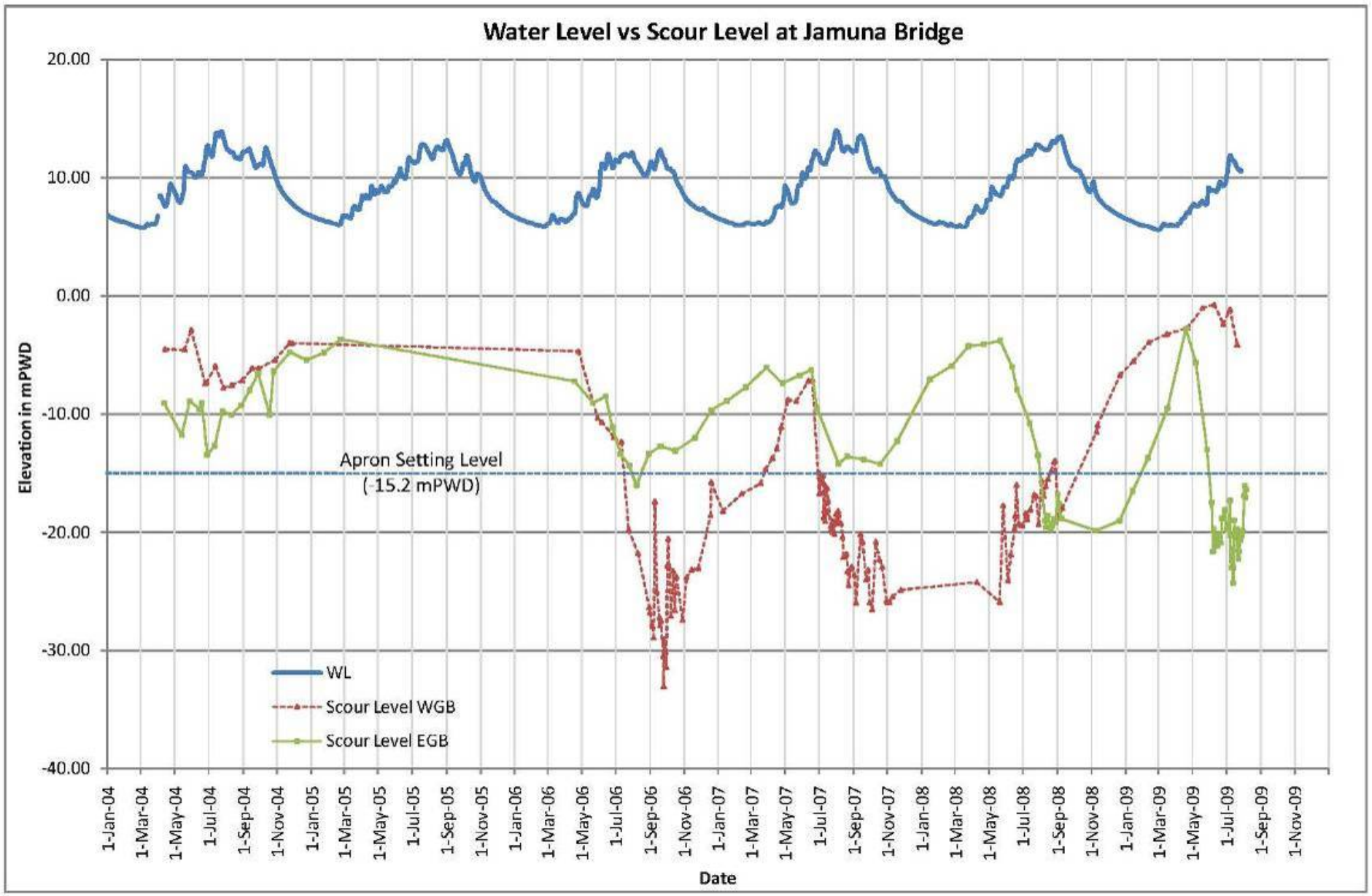
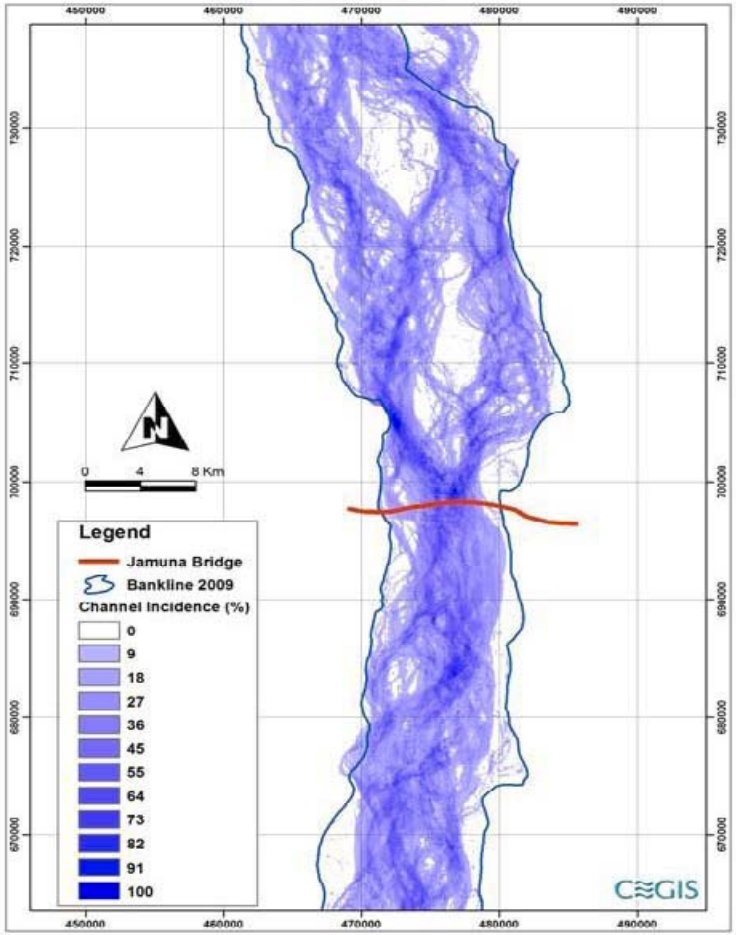


Photo-2 : Mollabari Cross-bar on Jamuna River, as seen a) from Jamuna River (looking downstream), and b) from apex of structure, looking upstream. (2013 Feb.)


Water Level vs Scour Level at Jamuna Bridge
Elevation in mPWD
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
Apron Setting Level
(-15.2 mPWD)
WL
Scour Level WGB
Scour Level EGB
1-Jan-04
1-Mar-04
1-May-04
1-Jul-04
1-Sep-04
1-Nov-04
1-Jan-05
1-Mar-05
1-May-05
1-Jul-05
1-Sep-05
1-Nov-05
1-Jan-06
1-Mar-06
1-May-06
1-Jul-06
1-Sep-06
1-Nov-06
1-Jan-07
1-Mar-07
1-May-07
1-Jul-07
1-Sep-07
1-Nov-07
1-Jan-08
1-Mar-08
1-May-08
1-Jul-08
1-Sep-08
1-Nov-08
1-Jan-09
1-Mar-09
1-May-09
1-Jul-09
1-Sep-09
1-Nov-09
Date

Channel Incidence Map
1973 - 1996



Channel Incidence Map
2000 - 2009

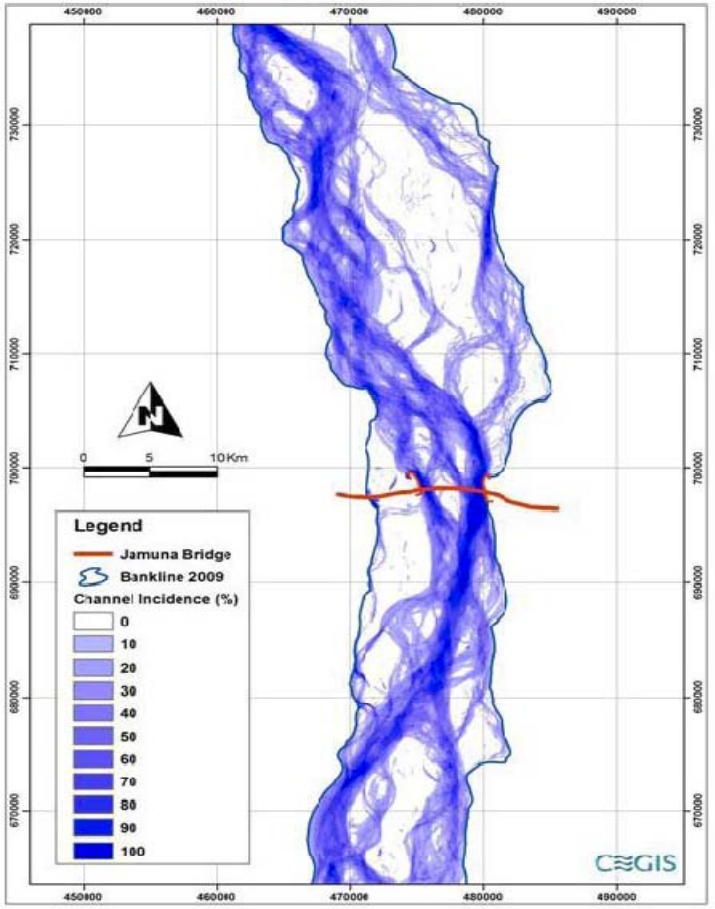


Photo 3c

2012. Feb. by Mr. Ota

Photo 3a

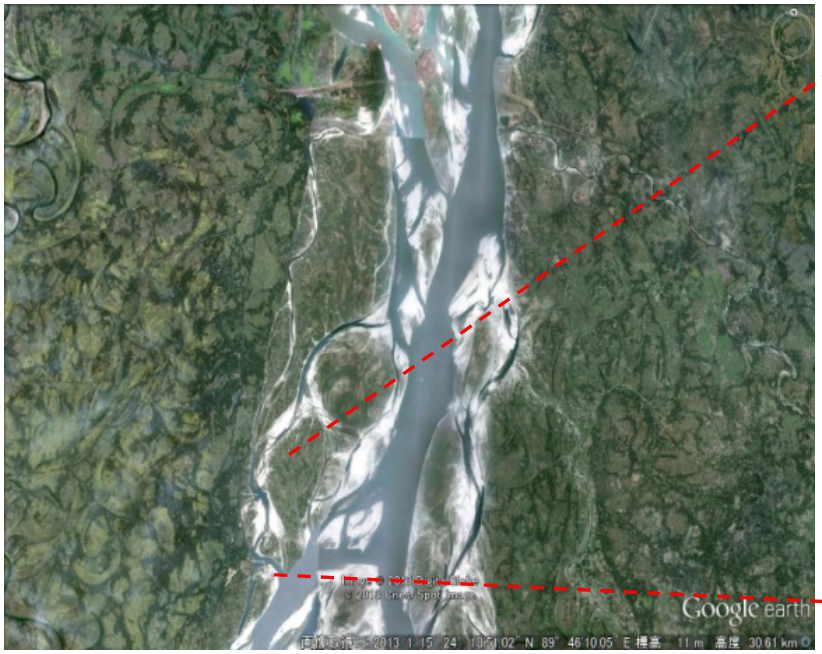


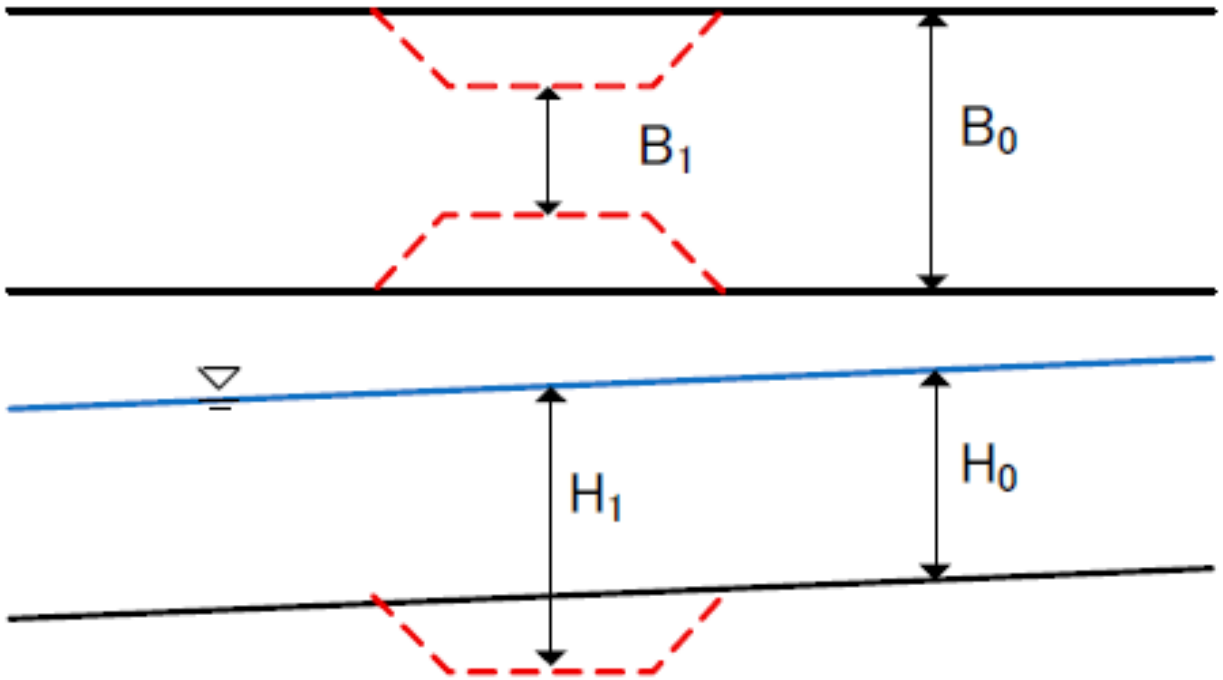
Photo 3b

Enayetpur Spur

a.)

b.)

Photo 4a) Enayetpur Spur on Jamuna River, 4b) geobag reinforcement around pilings of semi-permeable spur dike.



$$v = \frac{1}{n} I^{\frac{1}{2}} H^{\frac{2}{3}} \qquad (1)$$

$$\frac{B_1}{B_0} = \left(\frac{H_0}{H_1}\right)^{\frac{5}{3}} \left(\frac{I_0}{I_1}\right)^{\frac{1}{2}} \left(\frac{n_1}{n_0}\right) \qquad (2)$$

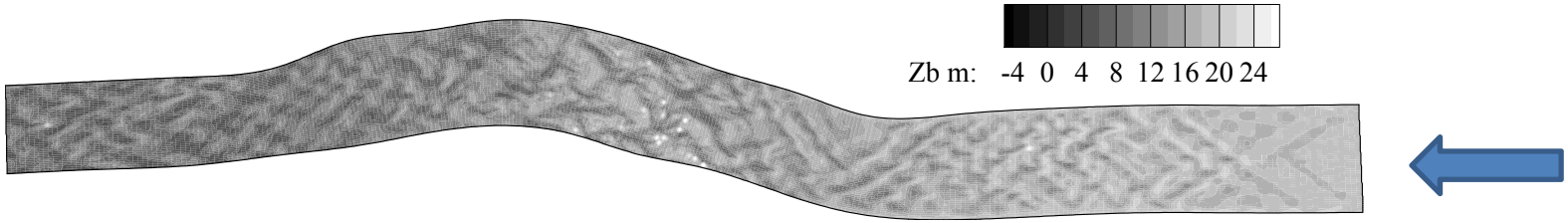
$$\frac{q_b}{\sqrt{(\sigma/\rho - 1)gd^3}} = a\tau_*{}^m \qquad (3)$$

$$\frac{B_1}{B_0} = \left(\frac{H_0}{H_1}\right)^m \left(\frac{I_0}{I_1}\right)^m \left(\frac{d_0}{d_1}\right)^{\frac{3}{2}-m} \qquad (4)$$

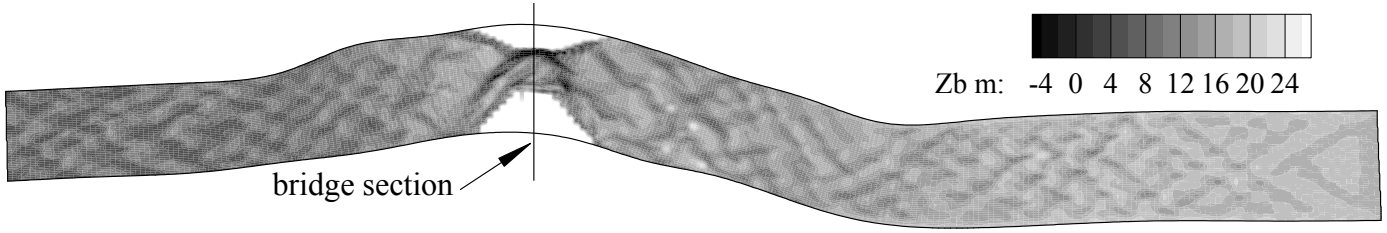
Assuming m=5/2

$$\frac{H_1}{H_0} = \left(\frac{n_1}{n_0}\right)^{\frac{6}{7}} \left(\frac{d_1}{d_0}\right)^{-\frac{6}{35}} \left(\frac{B_1}{B_0}\right)^{-\frac{24}{35}} \quad (5)$$

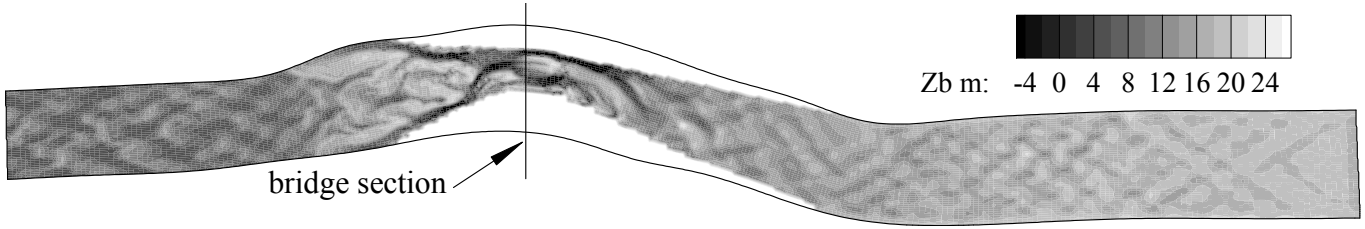
$$\frac{H_1}{H_0} = \left(\frac{B_1}{B_0}\right)^{-\frac{24}{35}} = \left(\frac{5022}{16440}\right)^{-\frac{24}{35}} = 2.25 \quad (6)$$



(1). Calculation results showing the bathymetry starting from flat bed at 90 days from initial condition



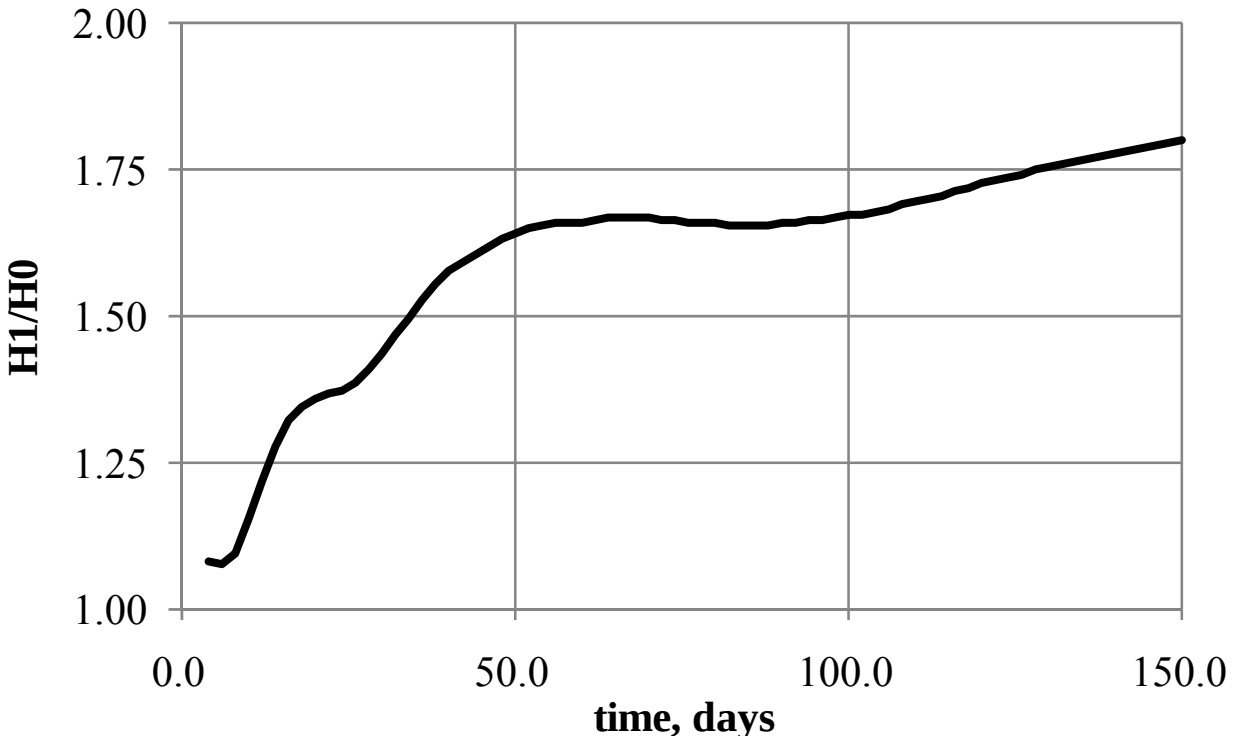
(2). Calculation results with bathymetry at 152 days after installing the guide bund.



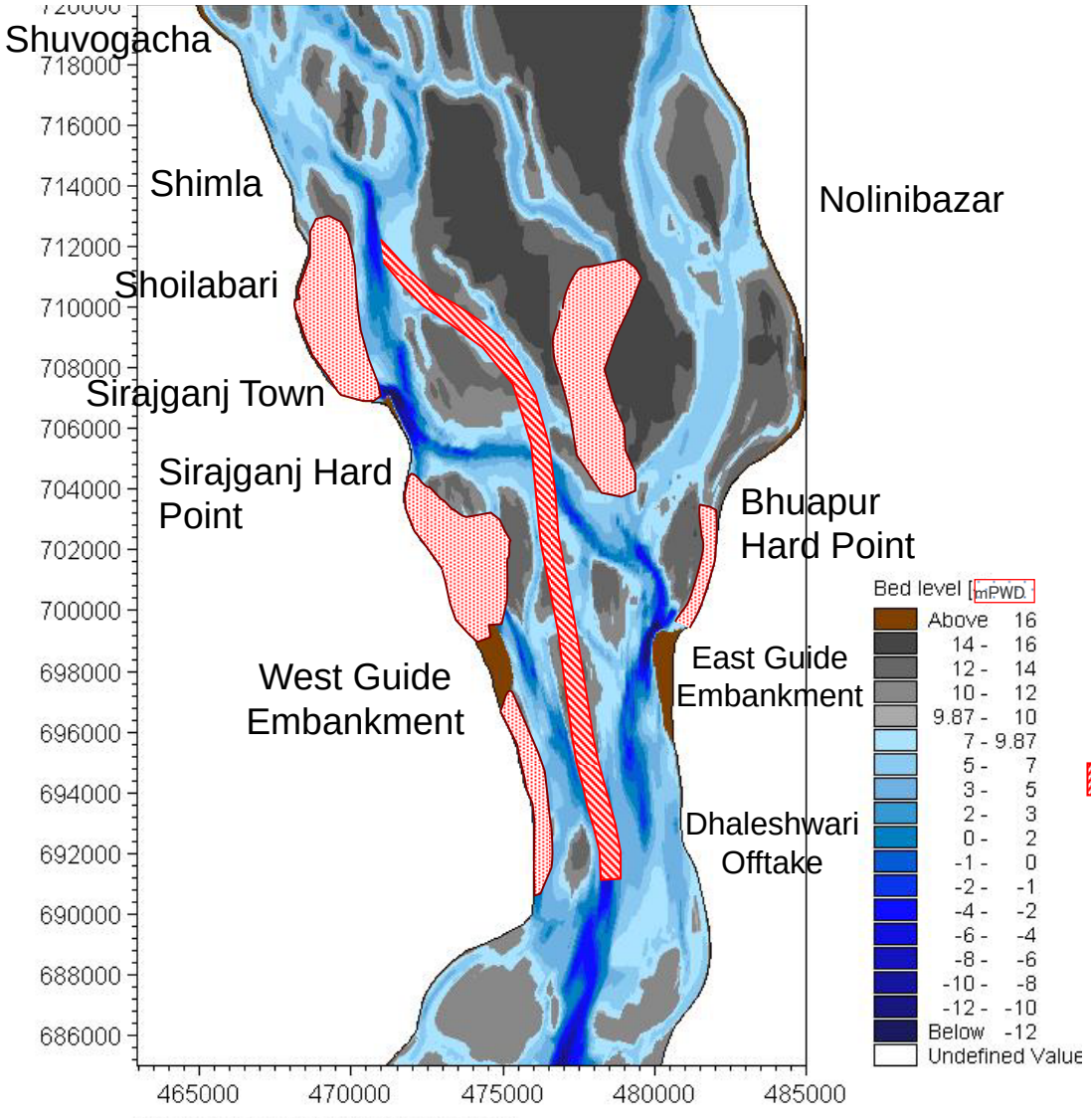
(3). Calculation results with counter measure showing the bathymetry at 156 days after installing series of spur dykes

By Yorozuya

Timely change of H1/H0 calculating with results of Figure 2



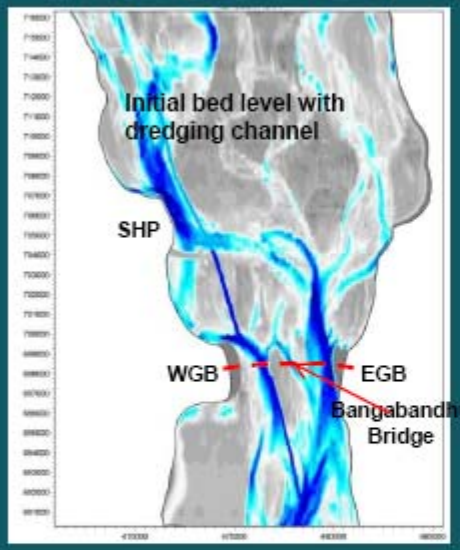
Capital (Pilot) Dredging Plan by Bangladesh Gov.



Dredged Channel

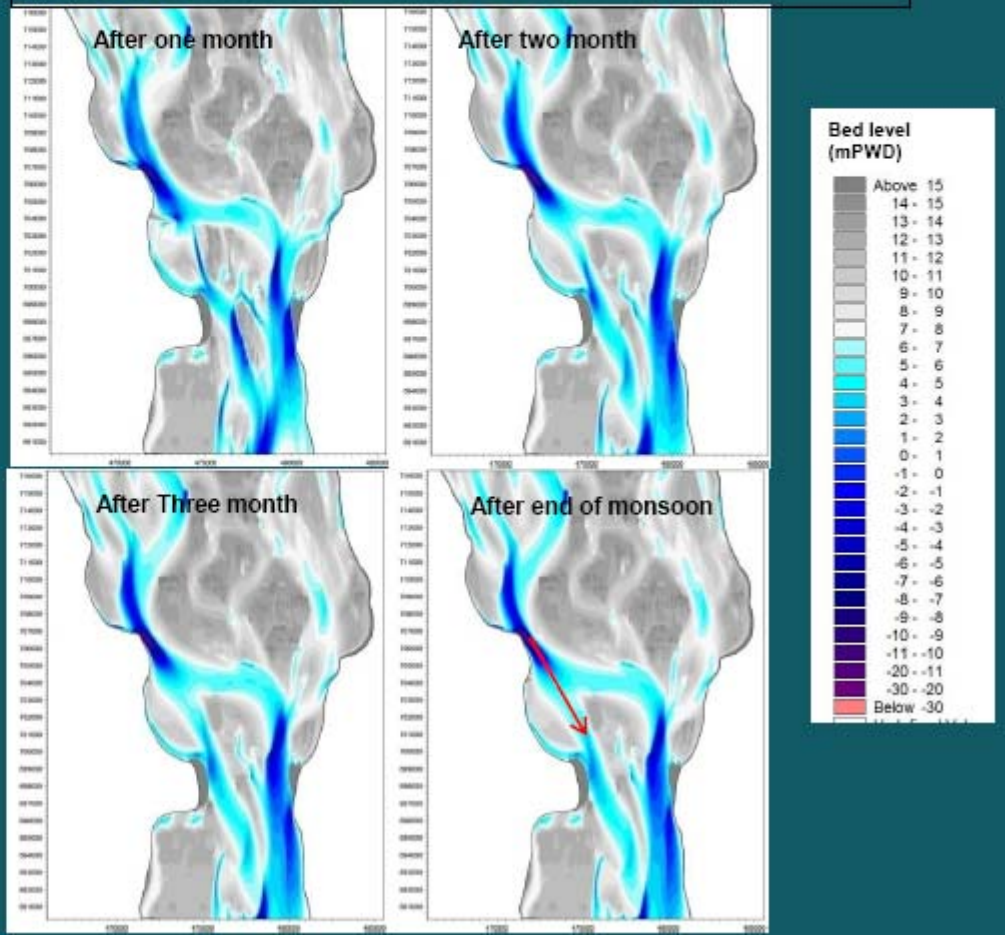
Dumping place of dredged spoil

Model prediction incorporating dredging before execution of dredging work



At the end of monsoon the west channel moves toward the dredging alignment

Simulated Bed Level for each month interval

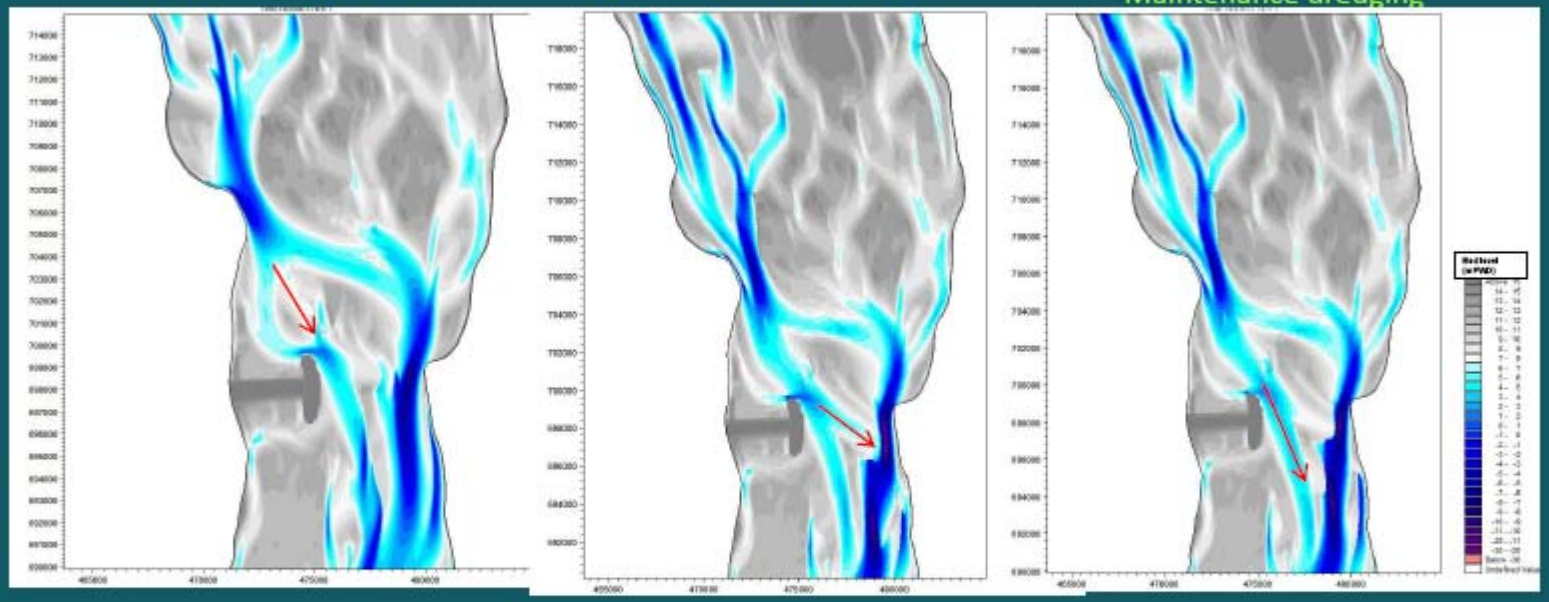


Model prediction incorporating dredging before execution of dredging work

After 1in 10 year Flood

After 2nd 1in 10 year Flood

After 2nd 1in 10 year Flood with Maintenance dredging



After 1 in 10 year flood, a shallow channel would be developed through the char

After 2 consecutive 1 in 10 year flood, the shallow channel would become deeper and moves toward Dhaleswari off take

After 2 consecutive 1 in 10 year flood, incorporating maintenance dredging the shallow channel would become deeper but left anabranch will not form

Jamuna Bridge in Bangaledesh

Main Bridge	4.8 km
East Guide Bund	3.07 km
West Guide Bund	3.26 km

Taunsa Barrage in Pakistan

Completed 1958,
Rehabilitation work started 2003
Irrigation water for 8000km2 area
65 gates with rock, width is about 1325m

Thank you for your attention