APPENDIX 7.
NATURAL ENVIRONMENTAL AND HYDROLOGICAL DATA

1. AMBIENT NATURAL CONDITION SURVEY RESULTS

1.1 Meteorological Survey

In order to design the three bridges, it is necessary to collect and correlate the basic meteorological data such as Rainfall, Humidity and Wind Speed and Direction data listed in Table 1.1.1-Table 1.1.6.

Meteorological data at Dhaka Station and Comilla Met. Station is available at BMD - Bangladesh Meteorological Department- Web site.

1.1.1 Rainfall

According to monthly rainfall data from 2000 to 2009, average annual rainfall is about 2100 - 2200 mm/yr at Dhaka and Comilla Station. Normally rainy season starts from May and ends in October, especially there is heavy rainfall in June and July in comparison to other months, which is about 400 mm/month. Dry season lasts from November to April.

Table 1.1.1 Monthly Total Rainfall Data at Dhaka Station

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
2000	45	52	121	212	554	295	182	319	106	155	3	0	2044
2001	0	13	6	54	300	590	184	312	258	161	72	0	1950
2002	29	0	72	91	344	316	766	223	129	83	83	0	2136
2003	2	50	128	132	141	673	290	131	97	129	3	49	1825
2004	0	4	6	175	186	654	311	183	686	218	1	0	2424
2005	6	2	249	157	193	259	403	410	395	349	0	1	2424
2006	0	0	0	117	607	402	151	226	300	94	1	0	1898
2007	0	20	21	179	153	548	654	221	339	280	82	0	2497
2008	0	0	3	48	295	235	573	427	145	98	0	0	1824
2009	30	11	26	34	282	330	457	375	247	265	0	0	2057
Average	11.2	15.2	63.2	119.9	305.5	430.2	397.1	282.7	270.2	183.2	24.5	5.0	2108
Max.	45	52	249	212	607	673	766	427	686	349	83	49	2497
Min	0	0	0	34	141	235	151	131	97	83	0	0	1824

Source :Bangladesh Meteorological Department WEB site

Table 1.1.2 Monthly Total Rainfall Data at Comilla Met Station

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Dec.
2000	13	44	172	189	471	183	200	363	214	272	0	0	2121
2001	0	1	33	46	402	386	202	205	209	177	18	0	1679
2002	22	4	51	111	272	373	446	272	156	52	116	0	1875
2003	0	25	96	123	140	473	191	202	264	134	0	45	1693
2004	0	0	9	167	162	476	295	191	839	208	0	0	2347
2005	1	3	155	91	291	259	542	361	514	417	3	0	2637
2006	0	0	0	181	185	326	331	167	663	61	5	0	1919
2007	0	30	11	163	185	628	753	505	179	320	111	0	2885
2008	23	56	45	91	205	577	563	319	279	227	0	0	2385
2009	1	1	43	14	168	170	676	482	298	74	4	0	1931
Average	6.0	16.4	61.5	117.6	248.1	385.1	419.9	306.7	361.5	194.2	25.7	4.5	2147
Max.	23	56	172	189	471	628	753	505	839	417	116	45	2885
Min	0	0	0	14	140	170	191	167	156	52	0	0	1679

Source :Bangladesh Meteorological Department WEB site

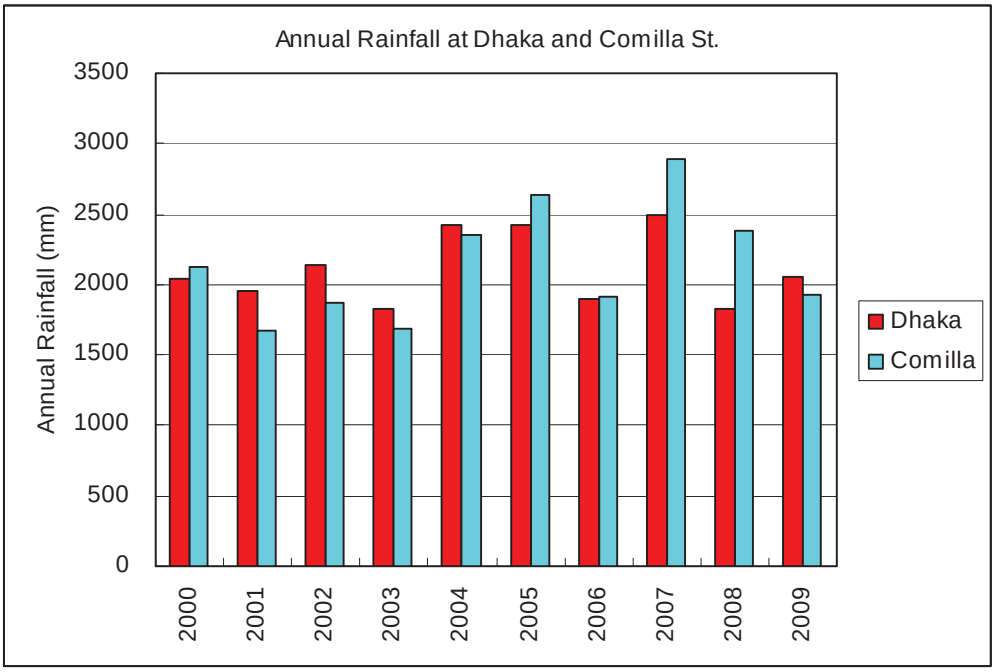


Figure 1.1.1 Annual Rainfall at Dhaka and Comilla Met. Station

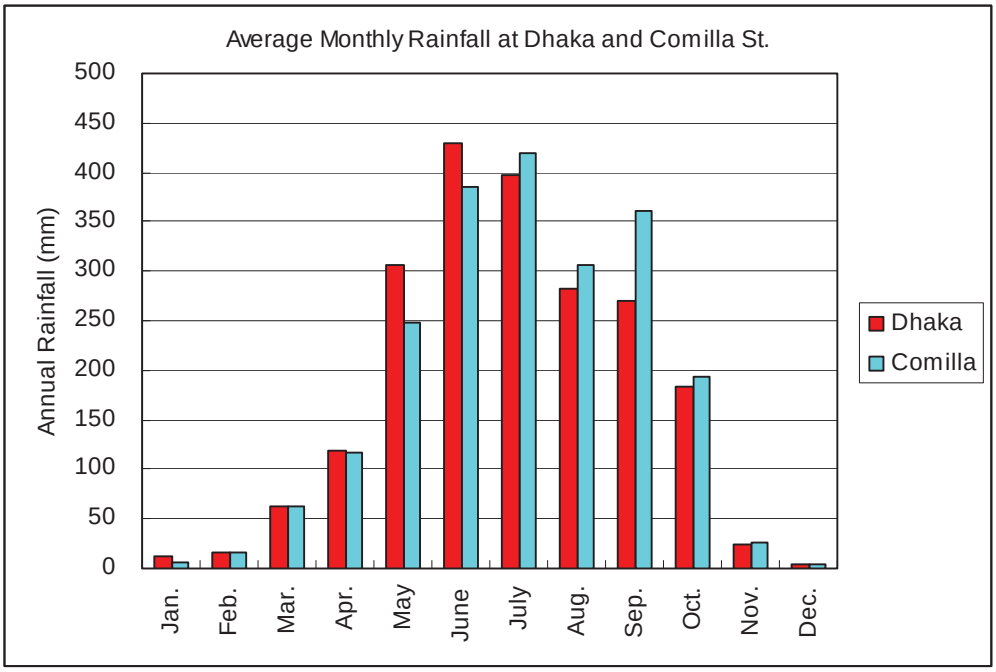


Figure 1.1.2 Average Monthly Rainfall at Dhaka and Comilla Met. Station

1.1.2 Humidity

Table 1.1.3 Monthly Maximum and Minimum Humidity (%) at Dhaka Station

Month	2001		2002		2003		2004		2005		2006		2007		2008	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Jan	99	20	98	26	100	28	100	25	97	28	100	21	100	20	98	25
Feb	99	22	94	18	99	26	97	17	97	17	98	15	100	23	96	13
Mar	96	13	94	16	98	13	98	16	98	18	96	11	96	14	95	28
Apr	96	16	98	35	98	28	98	40	94	27	96	28	95	32	94	23
May	98	51	98	47	98	31	98	15	98	44	98	40	98	33	96	37
Jun	99	55	98	49	98	45	99	50	98	46	99	57	98	52	98	51
Jul	98	54	98	55	98	56	99	54	99	57	98	55	99	55	98	61
Aug	98	59	99	52	99	52	98	52	97	55	95	52	98	50	97	57
Sep	98	51	98	45	98	51	98	58	98	52	99	51	98	42	98	53
Oct	99	38	97	32	98	47	98	32	98	34	98	38	98	31	98	32
Nov	99	36	99	28	96	21	98	27	98	32	95	26	99	35	97	29
Dec	99	30	99	33	100	28	100	25	97	28	100	21	100	20	98	25

Source : BMD

Table 1.1.4 Maximum and Minimum Monthly Humidity (%) at Comilla Met. Station

Month	2001		2002		2003		2004		2005		2006		2007		2008	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Jan	100	24	100	31	100	31	100	31	100	23	100	21	100	23	100	28
Feb	100	29	100	27	100	30	100	24	100	25	100	29	100	31	99	16
Mar	98	23	100	26	100	22	100	34	99	46	100	26	100	25	99	46
Apr	98	33	98	40	98	46	100	44	99	33	100	33	99	42	98	34
May	98	50	99	55	98	45	100	27	99	49	100	44	99	41	97	42
Jun	100	59	100	61	100	50	100	54	98	61	98	55	99	55	97	65
Jul	100	61	100	66	100	58	99	59	99	57	98	61	99	58	98	58
Aug	100	61	100	58	97	55	98	60	98	63	97	60	98	56	98	54
Sep	99	54	100	52	97	57	100	60	99	57	98	57	99	56	97	52
Oct	100	54	100	41	100	56	100	38	100	53	100	55	98	41	99	48
Nov	100	42	100	42	100	35	100	35	100	35	100	33	98	43	98	36
Dec	100	32	100	32	100	35	100	26	100	34	100	32	100	32	100	41

Source : BMD

1.1.3 Wind Speed and Direction

Table 1.1.5 Average Wind Speed (knot) and Direction at Dhaka Station

Year	Jan.		Feb.		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir
1998	1.5	NW	1.7	NW	2.7	W	2.5	S	3.1	S	2.8	S	2.0	S	1.9	S	2.1	SE	2.7	SE	3.6	NE	2.0	NW
1999	2.1	NW	2.2	NW	2.2	S	2.5	S	2.5	S	2.5	S	2.6	SE	2.3	SE	1.9	SE	2.4	SE	1.6	N	1.7	N
2000	1.6	N	2.0	N	2.3	S	3.3	S	2.6	S	2.5	S	2.4	S	2.4	S	2.2	S	3.3	NE	1.5	N	1.6	N
2001	2.2	NW	1.8	NE	3.6	S	4.1	S	3.4	S	3.2	S	3.9	S	2.5	S	3.0	S	2.6	S	1.7	N	2.0	N
2002	2.5	N	2.5	NW	3.9	S	4.2	S	3.5	S	2.8	S	2.7	S	2.8	S	3.0	SE	2.0	N	2.8	N	2.4	N
2003	3.1	NW	3.5	N	3.8	S	5.1	S	4.9	S	4.1	SE	4.1	S	4.3	SE	4.3	SE	3.3	NE	2.8	N	3.1	W
2004	3.5	W	3.9	W	5.6	S	5.9	S	5.5	S	3.6	S	4.3	SE	4.1	SE	6.3	E	4.2	SE	3.2	W	2.5	NW
2005	4.1	NNW	4.3	W	4.6	S	4.5	S	4.4	S	4.4	SE	4.6	SE	3.5	S	4.6	SE	4.8	SE	3.4	NW	3.7	NNW
2006	3.0	N	3.6	S	5.0	NNW	3.8	S	3.8	S	2.1	S	2.2	SE	4.5	SE	5.4	SE	2.3	N	2.0	W	2.4	NW
2007	2.9	NW	3.1	NW	4.2	NW	3.8	S	3.5	S	3.1	S	3.1	S	3.1	S	3.2	S	4.1	NE	5.5	NE	2.9	NW

Source :Bangladesh Meteorological Department WEB site

Table 1.1.6 Average Wind Speed (knot) and Direction at Comilla Met. Station

Year	Jan.		Feb.		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir
1998	3.0	N	3.4	S	4.2	S	3.7	S	5.2	S	5.4	S	3.9	S	4.1	S	3.6	S	2.9	S	2.2	N	2.4	NW
1999	2.6	N	3.1	N	3.7	S	3.6	S	4.5	S	4.0	S	4.3	S	4.0	S	2.9	S	2.8	S	1.8	N	1.8	N
2000	1.8	N	2.4	N	3.3	S	4.7	S	4.0	S	4.5	S	3.8	S	3.4	S	3.9	S	2.5	S	1.8	N	2.4	N
2001	2.7	N	4.3	S	2.7	S	4.9	S	2.6	S	4.1	S	3.6	S	3.1	S	2.7	S	1.9	S	1.8	N	1.8	N
2002	2.3	N	2.9	N	3.5	S	4.5	S	5.1	S	4.6	S	4.1	S	4.1	S	2.7	S	2.1	N	2.6	N	2.9	N
2003	4.2	N	3.9	N	4.2	S	5.0	S	4.9	S	5.2	S	4.9	S	3.9	S	3.2	S	2.9	N	2.7	N	2.7	W
2004	3.3	N	3.8	N	6.5	S	8.5	S	6.0	S	5.1	S	6.4	S	5.2	S	4.1	S	7.1	S	3.8	N	3.4	NW
2005	3.9	N	6.8	S	5.6	S	4.4	S	4.6	S	4.5	S	4.6	S	4.2	S	3.5	S	3.3	S	3.0	N	2.9	NNW
2006	4.0	N	6.0	S	3.2	S	4.7	S	4.7	S	4.9	S	3.6	S	3.0	S	2.8	S	2.2	N	2.3	N	2.4	NW
2007	2.4	N	2.8	S	3.0	NW	4.0	S	3.7	S	3.8	S	3.2	S	2.8	S	2.7	S	3.7	S	2.3	N	2.2	NW

Source :Bangladesh Meteorological Department WEB site

1.2 Hydraulic and Hydrological Survey

1.2.1 Overall

In order to predict the water flow during flood season and scour around existing and new bridge piers, it is necessary to collect and correlate the hydraulic and hydrological properties of the Lahkya (Sitalakhya) River (Kanchpur Bridge), Meghna River and Gumti River. Some of the properties will be directly used in the numerical model as input data or needed to generate by developing the model. Regarding these input data, some of existing hydrological data has been collected from Bangladesh Water Development Board (BWDB), which is enlisted in Table 1.2.1.

Table 1.2.1 Data & information to be collected for hydrological study

Parameter	Survey contents / Description	Progress
(1) Hydrological data		
(i) Daily discharge data at the upstream and downstream section of each bridge.	Available data from 1960 to 2011 (As per previous studies, Bhairab Bazar and Chandpur stations are located at the upstream and downstream of Gumti bridge respectively.)	All data of daily water level and weekly discharge are available from BWDB.
(ii) Daily water level data at above stations (max, min, average).		
(iii) Discharge and water level variations with time (hourly) for major post flood events at the above stations.	Post five flood events.	No hourly data available. Daily water level and weekly discharge data are available.
(iv) Measured discharge and water level during bridge construction.	Data collected while bridge was constructed.	Water Level during bridge construction is predicted from daily water level data.
(v) Stream velocity at bridge site and river flow direction.	During dry and rainy season, stream velocity and river flow at each bridge site-50m interval in the horizontal direction.	Stream velocity survey to be conducted in rainy season, because river flow in dry season is slow and supposed to be no remarkable effect on scouring)
(vi) Interview survey.	10 sites along the river stretch for each bridge.	Interviewed around each bridge site.
(2) Land sat Images.	Before and after bridge construction and considering the major flood events (5 sets).	Land Sat Images collected from Internet.
(3) Survey river bed material and geological profile.	Grain size distribution (D50, D60, D95) for river bed material to be collected during geological survey.	Bed materials collected from 3 points for each bridge.
(4) Miscellaneous data collection from different organizations.	To be borrowed the documents of FAP 9B (left embankment protection for Meghna river), FAP 24 (river research program), and other relevant information and informative data.	FAP 9B collected FAP 24 not collected (because of many hydraulic data are available).

1.2.2 Hydraulic data

Secondary hydraulic data around three bridges are collected in order to develop numerical model, which will be set to as boundary condition. Collected data from BWDB are shown in Table 1.2.2 and Table 1.2.3. Locations of Observation Stations are shown in Figure 1.2.1 and Figure 4.1.4.

Table 1.2.2 Discharge & Water Level Data List around Kanchpur Bridge

Item	Station Name	Station Number	River Name	Location (Dist:Thana:Union:Mouza)	Data Available (Year)	Observation Period	
						From	To
Tidal Water Level	Kalagachia	71	Dhaleswari	Munshiganj, Munshiganj Sadar, Paurashava,	44	1968	2011
	Kalatia (Outfall)	70	Dhaleswari	Dhaka, Keraniganj, Kalatia, Nutan Char	44	1968	2011
	Demra	179	Lakhya	Narayanganj, Rupganj, Tarabo, Taraba	44	1968	2011
Non Tidai Discharge	Demra	7.5	Balu	Narayanganj, Rupganj, Kayet Para, Pubgaon	16	1994	2009
	Demra	179	Lakhya	Narayanganj, Rupganj, Tarabo, Taraba	24	1986	2009

Table 1.2.3 Discharge & Water Level Data List around Meghna Bridge & Gumti Bridge

Item	Station Name	Station Number	River Name	Location (Dist:Thana:Union:Mouza)	Data Available (Year)	Observation Period	
						From	To
Tidal Water Level	Bhairb Bazar	273	Upper Meghna	Kishoreganj, Bhairab, Paurashava,	44	1968	2011
	Narsingdi	274	Upper Meghna	Narsingdi, Narsingdi Sadar, Hajipur, Char Hajipur	44	1968	2011
	Meghna Ferry Ghat	275.5	Upper Meghna	Munshiganj, Gazaria, Baluakandi, Bara Baliakandi	44	1968	2011
	Satnal	276	Upper Meghna	Chandpur, Matlab, Satnal, Char Chariani	44	1968	2011
	Daudkandi	115	Gumti-Burinadi	Comilla, Daudkandi, Dakshin Daudkandi	44	1968	2011
Non Tidal Discharge	Jibanpur(Gumti Br.)	114	Gumti-Burinadi	Comilla,Debidwar,Debidwar,Binoypar	30	1996	2011
Tidai Discharge	Bhairab Bazar	273	Surma-Meghna	Kishoreganj, Bhairab, Paurashava,	28	1981	2011

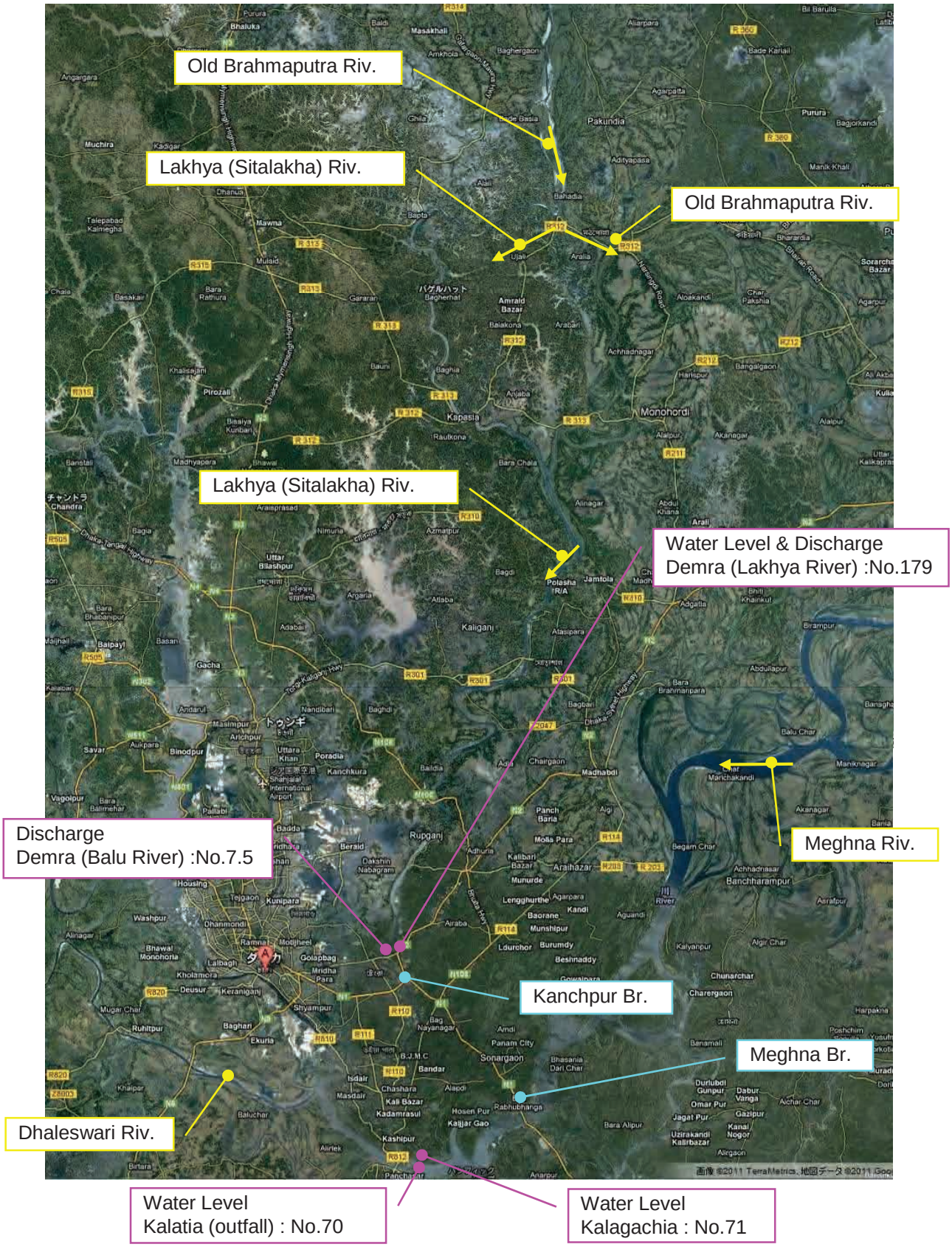


Figure 1.2.1 Water Discharge & Water Level Station around Kanchpur Bridge.

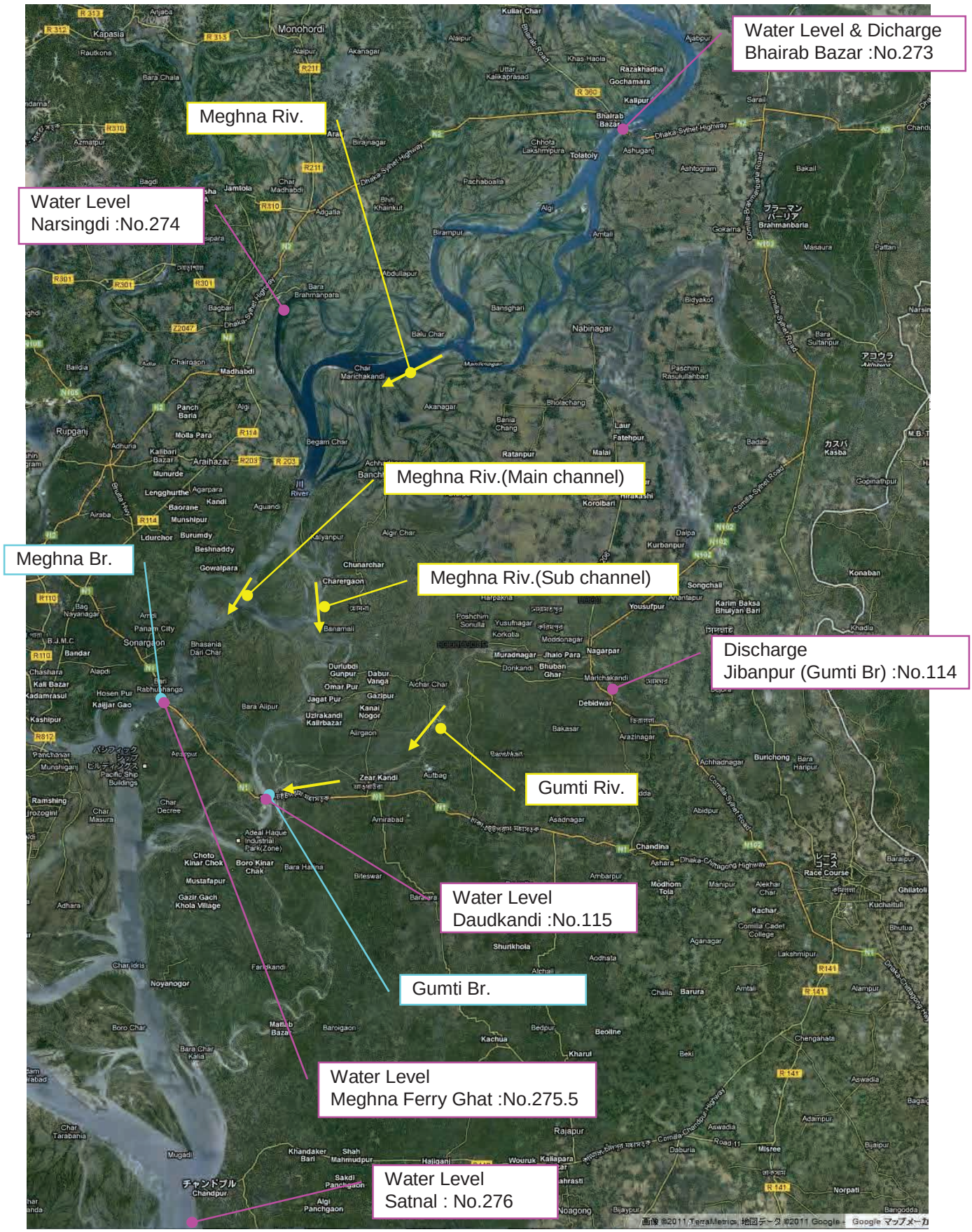
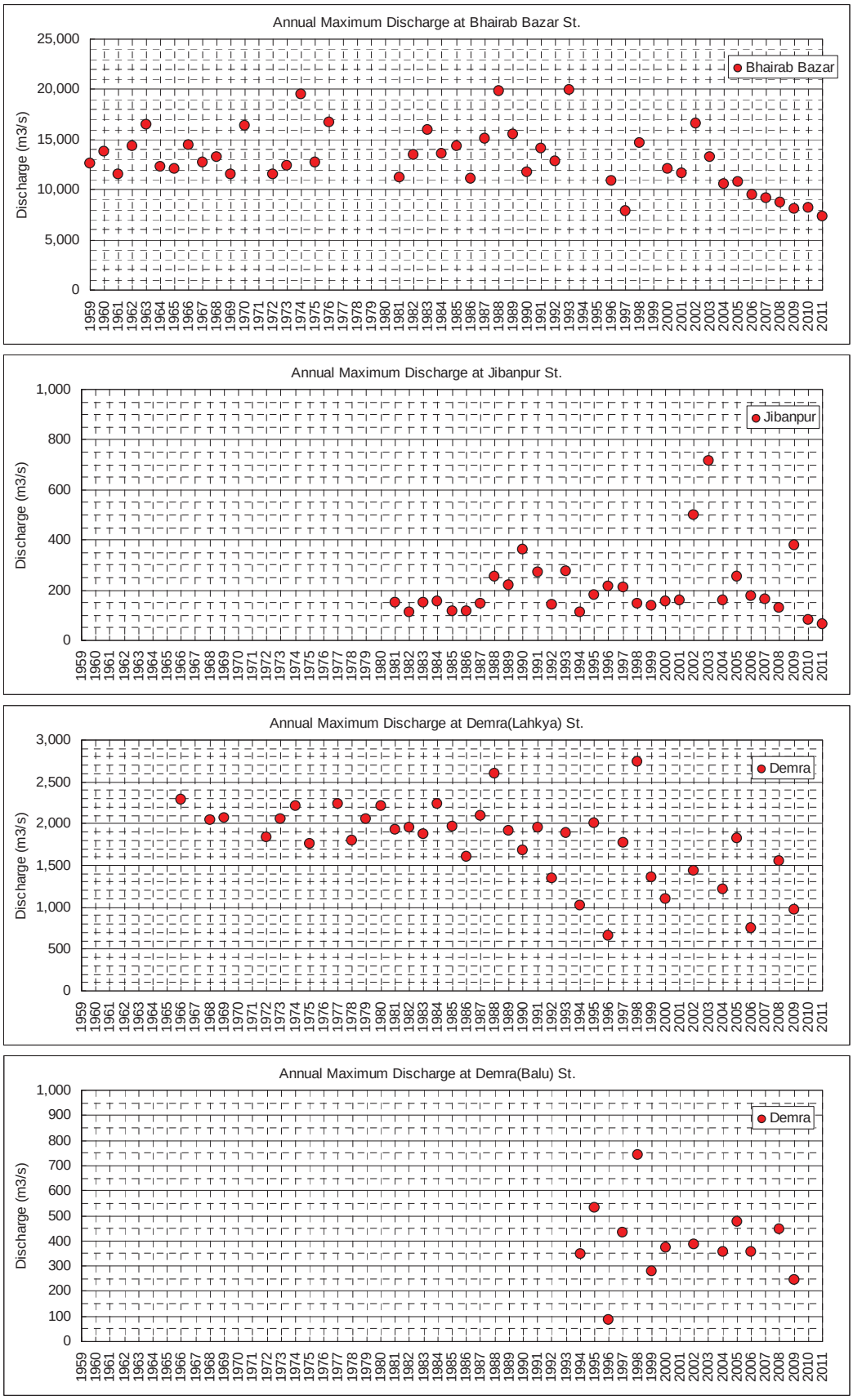


Figure 1.2.2 Water Discharge & Water Level Station around Meghna & Gumti Bridges

Table 1.2.4 Annual Maximum Discharge Observed by BWDB (unit: m3/s)

River	Meghna	Gumti	Lahkya	Balu
Station	Bhairab Bazar	Jibanpur	Demra	Demra
1959	12,600			
1960	13,800			
1961	11,520			
1962	14,320			
1963	16,520			
1964	12,300			
1965	12,100			
1966	14,400		2,290	
1967	12,700			
1968	13,300		2,040	
1969	11,500		2,070	
1970	16,400			
1971				
1972	11,500		1,840	
1973	12,400		2,060	
1974	19,500		2,210	
1975	12,700		1,760	
1976	16,700			
1977			2,240	
1978			1,800	
1979			2,050	
1980			2,210	
1981	11,200	150	1,930	
1982	13,500	112	1,950	
1983	16,000	152	1,880	
1984	13,600	154	2,240	
1985	14,300	117	1,970	
1986	11,100	115	1,600	
1987	15,100	145	2,090	
1988	19,800	256	2,600	
1989	15,500	221	1,910	
1990	11,700	364	1,680	
1991	14,100	273	1,950	
1992	12,800	144	1,340	
1993	19,900	275	1,890	
1994		111	1,020	346
1995		179	2,010	531
1996	10,900	215	657	88
1997	7,825	211	1,766	434
1998	14,670	146	2,742	744
1999		139	1,364	281
2000	12,110	155	1,094	371
2001	11,631	158		
2002	16,558	501	1,430	385
2003	13,229	716		
2004	10,571	161	1,214	355
2005	10,787	256	1,829	477
2006	9,464	176	756	357
2007	9,133	164		
2008	8,727	129	1,557	448
2009	8,032	380	973	244
2010	8,241	80		
2011	7,375	63		
Maximum	19,900	716	2,742	744
Minimum	7,375	63	657	88
Mean	12,936	207	1,784	389

Source :Edited BWDB observation data by JICA Team



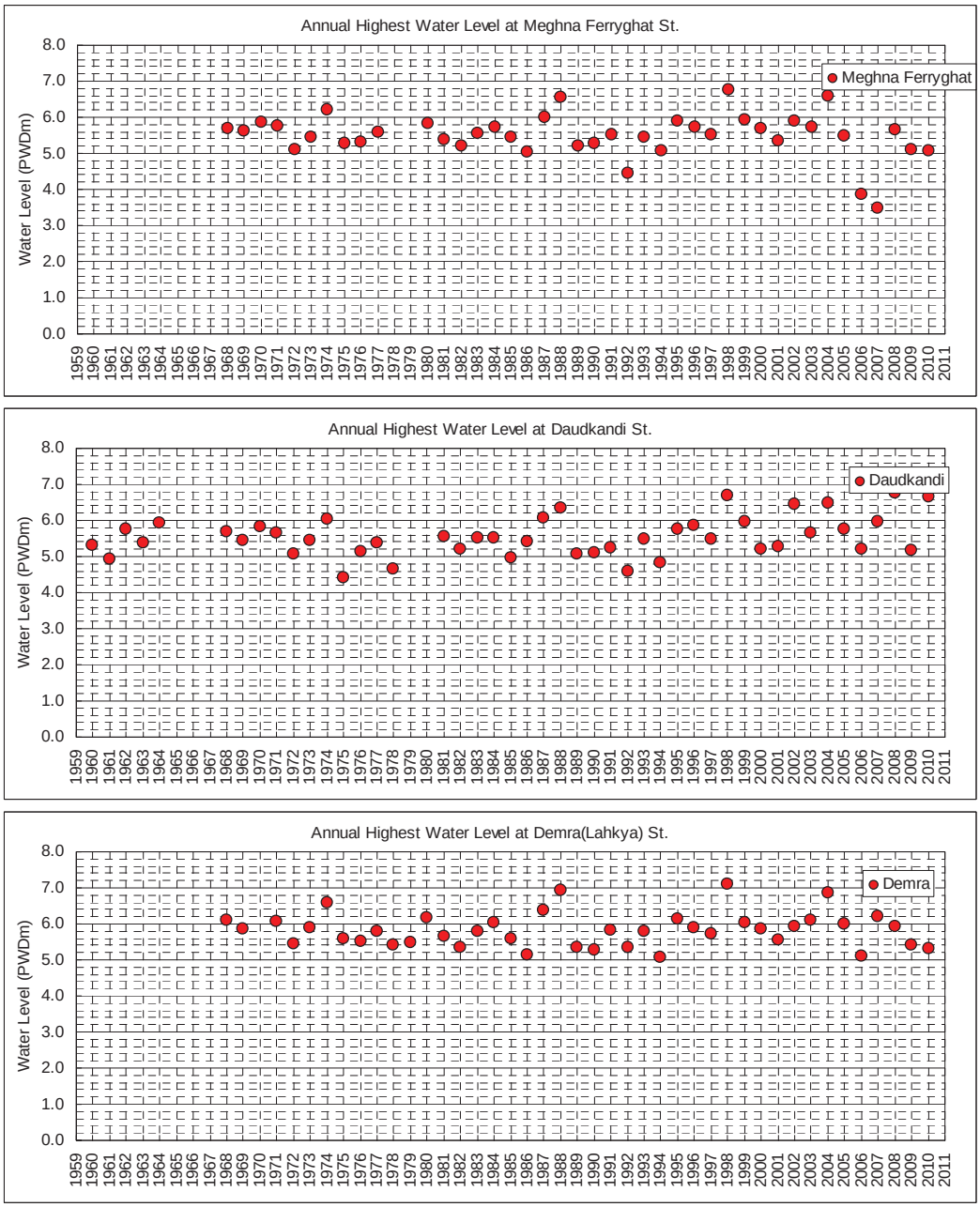
Source :Edited BWDB observation data by JICA Team

Figure 1.2.3 Annual Maximum Discharge Observed by BWDB

Table 1.2.5 Annual Highest Water Level Observed by BWDB (unit: PWD.m)

River	Meghna	Meghna-Gumti	Lahkya
Station	Meghna Ferryghat	Daudkandi	Demra
1959			
1960		5.30	
1961		4.94	
1962		5.76	
1963		5.38	
1964		5.93	
1965			
1966			
1967			
1968	5.68	5.69	6.09
1969	5.63	5.46	5.87
1970	5.87	5.83	
1971	5.76	5.65	6.08
1972	5.11	5.07	5.44
1973	5.44	5.46	5.88
1974	6.19	6.05	6.60
1975	5.29	4.40	5.60
1976	5.32	5.14	5.53
1977	5.59	5.39	5.81
1978		4.66	5.43
1979			5.49
1980	5.82		6.16
1981	5.40	5.55	5.65
1982	5.19	5.20	5.35
1983	5.56	5.53	5.81
1984	5.73	5.52	6.04
1985	5.44	4.95	5.57
1986	5.03	5.40	5.14
1987	5.99	6.06	6.38
1988	6.55	6.34	6.92
1989	5.22	5.08	5.34
1990	5.29	5.10	5.28
1991	5.51	5.23	5.82
1992	4.44	4.60	5.36
1993	5.45	5.47	5.80
1994	5.06	4.82	5.07
1995	5.90	5.77	6.13
1996	5.72	5.85	5.88
1997	5.53	5.50	5.71
1998	6.76	6.68	7.11
1999	5.93	5.96	6.03
2000	5.68	5.22	5.85
2001	5.33	5.26	5.55
2002	5.90	6.45	5.93
2003	5.74	5.65	6.11
2004	6.60	6.49	6.86
2005	5.48	5.75	6.00
2006	3.85	5.21	5.12
2007	3.50	5.96	6.20
2008	5.65	6.77	5.94
2009	5.12	5.17	5.42
2010	5.06	6.67	5.30
2011			
Maximum	6.76	6.77	7.11
Minimum	3.50	4.40	5.07
Mean	5.50	5.55	5.82

Source :Edited BWDB observation data by JICA Team



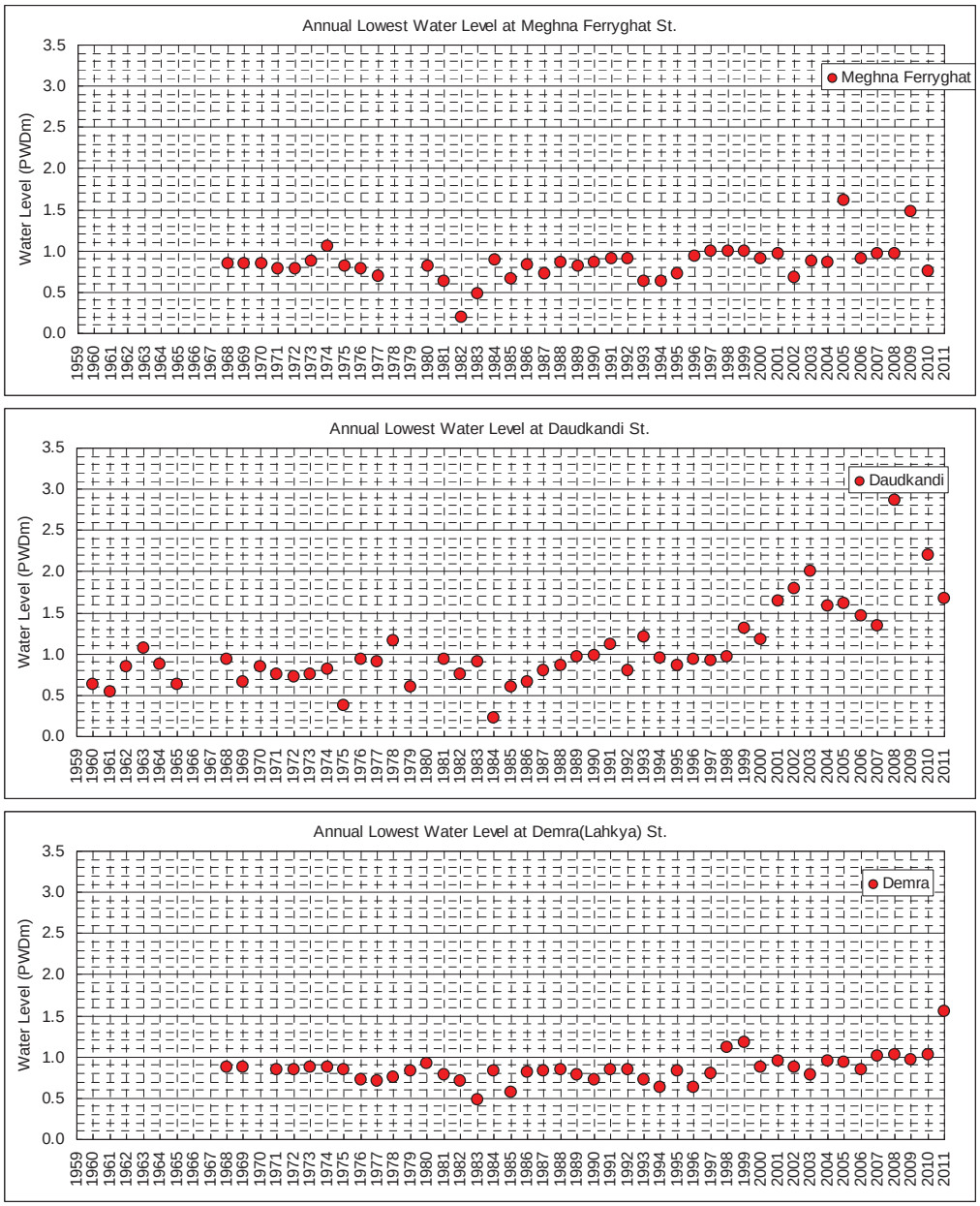
Source :Edited BWDB observation data by JICA Team

Figure 1.2.4 Annual Highest Water Level Observed by BWDB

Table 1.2.6 Annual Lowest Water Level Observed by BWDB (unit: PWD.m)

River	Meghna	Meghna-Gumti	Lahkya
Station	Meghna Ferryghat	Daudkandi	Demra
1959			
1960		0.64	
1961		0.55	
1962		0.85	
1963		1.07	
1964		0.88	
1965		0.64	
1966			
1967			
1968	0.85	0.94	0.87
1969	0.84	0.67	0.87
1970	0.85	0.85	
1971	0.79	0.76	0.85
1972	0.78	0.73	0.85
1973	0.88	0.75	0.88
1974	1.05	0.82	0.88
1975	0.81	0.37	0.85
1976	0.78	0.94	0.73
1977	0.70	0.91	0.72
1978		1.16	0.75
1979		0.61	0.82
1980	0.82		0.92
1981	0.64	0.94	0.79
1982	0.20	0.76	0.71
1983	0.49	0.91	0.48
1984	0.89	0.22	0.83
1985	0.66	0.60	0.58
1986	0.83	0.66	0.81
1987	0.73	0.80	0.83
1988	0.86	0.86	0.85
1989	0.82	0.97	0.79
1990	0.86	0.98	0.73
1991	0.91	1.11	0.85
1992	0.90	0.80	0.84
1993	0.63	1.20	0.73
1994	0.63	0.95	0.63
1995	0.73	0.86	0.83
1996	0.93	0.94	0.63
1997	1.00	0.92	0.80
1998	1.00	0.96	1.11
1999	0.99	1.31	1.17
2000	0.91	1.18	0.88
2001	0.96	1.64	0.95
2002	0.68	1.80	0.87
2003	0.87	2.00	0.78
2004	0.86	1.58	0.95
2005	1.61	1.61	0.94
2006	0.90	1.46	0.84
2007	0.96	1.35	1.01
2008	0.96	2.87	1.02
2009	1.48	3.14	0.97
2010	0.75	2.20	1.03
2011		1.67	1.56
Maximum	1.61	3.14	1.56
Minimum	0.20	0.22	0.48
Mean	0.85	1.09	0.86

Source :Edited BWDB observation data by JICA Team



Source :Edited BWDB observation data by JICA Team

Figure 1.2.5 Annual Lowest Water Level Observed by BWDB

1.2.3 River profile data

River cross section profile data has been collected from BWDB and former reports in order to get to know the historical changes of Meghna and Lakhya river belt.

(1) Cross section profile by BWDB Survey

BWDB's Cross-sectional data that are collected are enlisted in Table 1.2.7, and Cross sectional lines are shown in Figure 1.2.6.

BWDB has been surveyed the cross section river profile about 2-3 years intervals at same measurement line since 1960's. But there is some problems about the BWDB's data like below.

1) There are no measurement line near the three bridges, and these lines are at least 6km longitudinal intervals, so it is difficult to difficult to discuss the stability of the river around bridges

2) It seems that BWDB's survey line is not just same among every survey year, especially Meghna river that channel profile are widely changed by flood, so it is difficult to compare the each cross section on Meghna river.

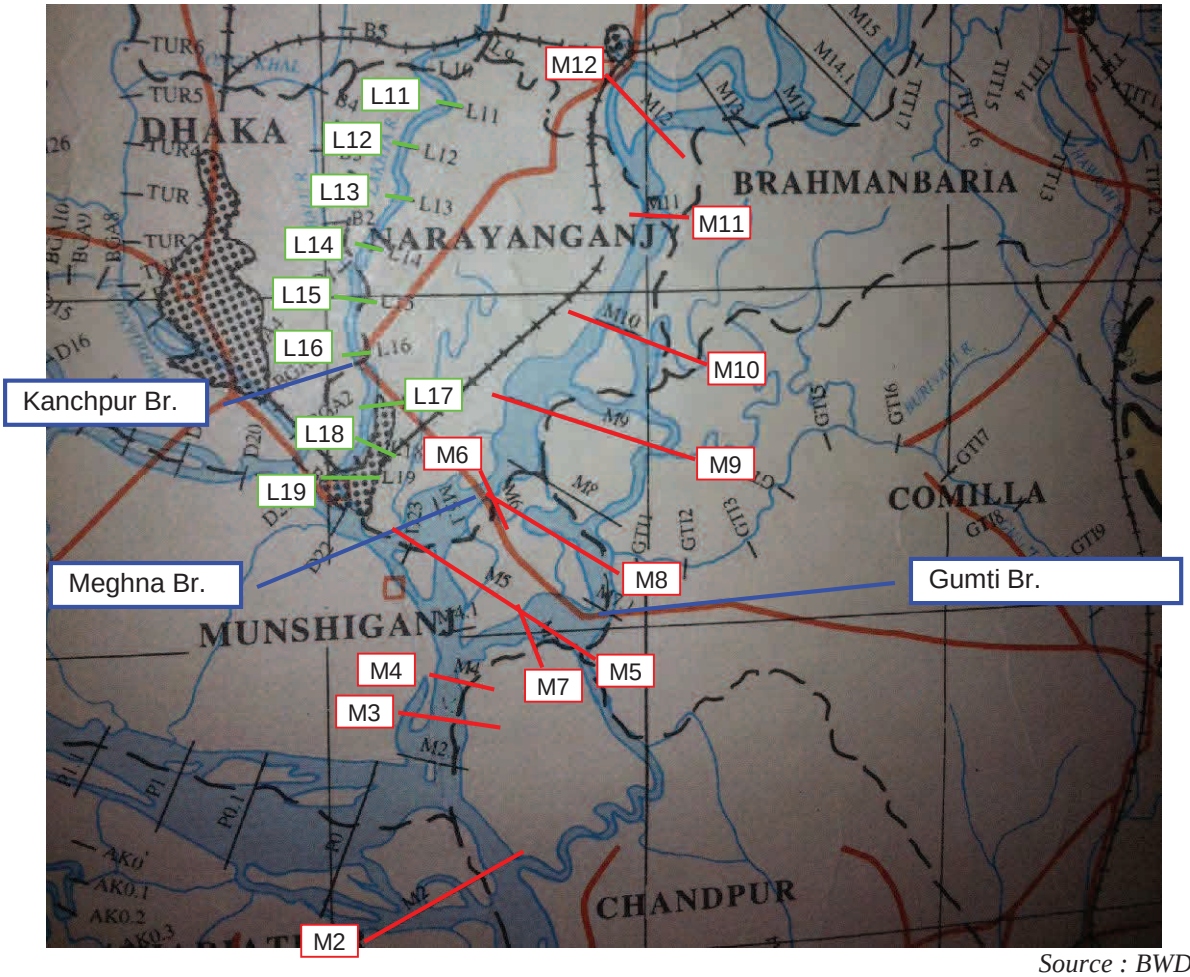
Hence, BWDB's cross section data is used to check and understand the historical river bed height at both river, and cross section profile is only in Lahyka river (Table 1.2.8).

Table 1.2.7 Cross Section Survey Data List (BWDB Survey)

River name	Bridge name	Data Station	Data Period
Meghna River	Meghna Gumti	M2 to M12 (13 Lines)	Now (latest), Oldest, about 5years interval periods.
Lakhya River	Kanchpur	L11 to L19 (9 Lines)	

Table 1.2.8 Cross section data for Morphology Analysis

	Comparison by BWDB's data	
	cross section profile	bed height
Meghna	―	○
Lakhya	○	○

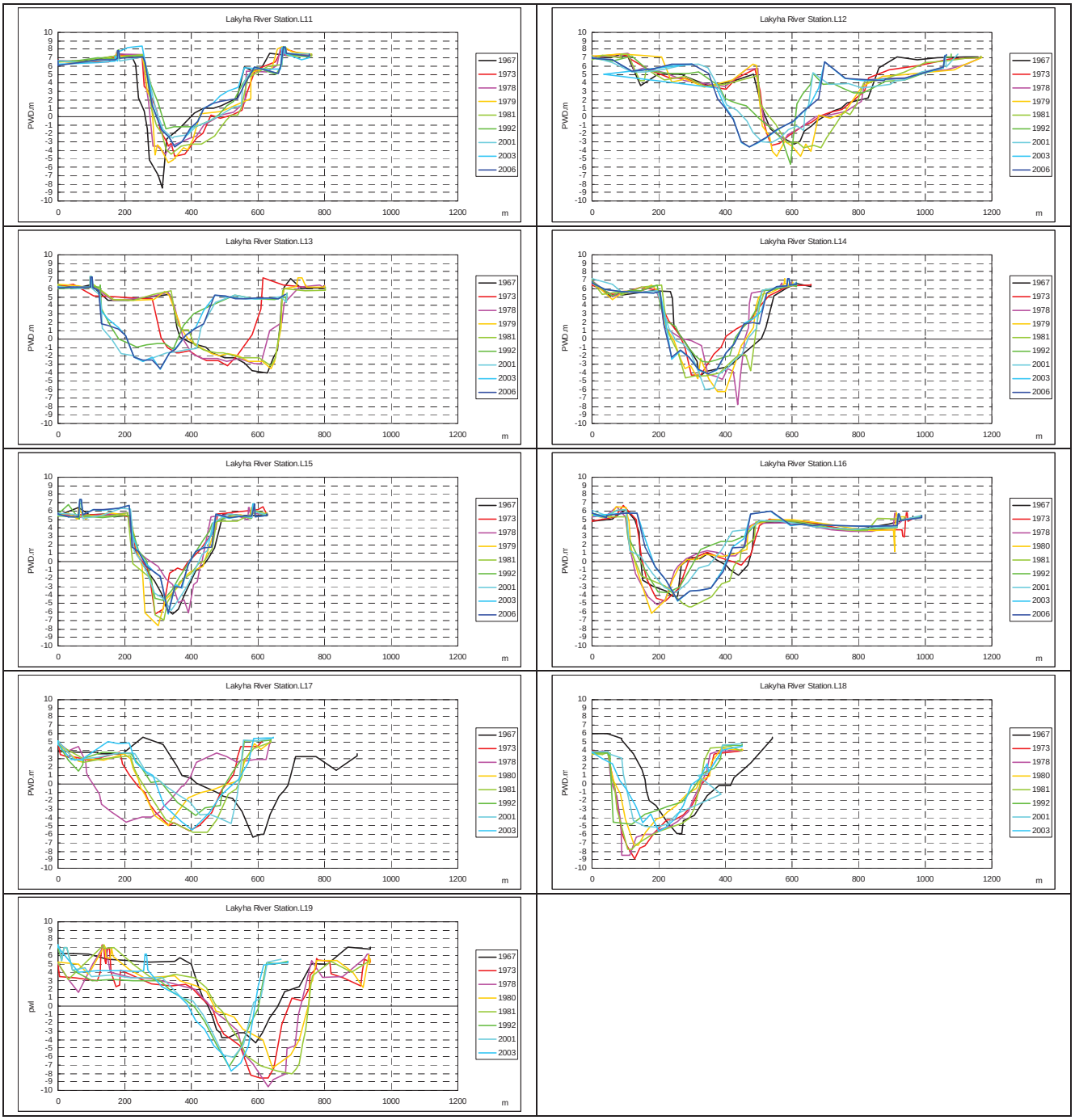


Source : BWDB

Figure 1.2.6 Location Map for Cross Section Survey by BWDB

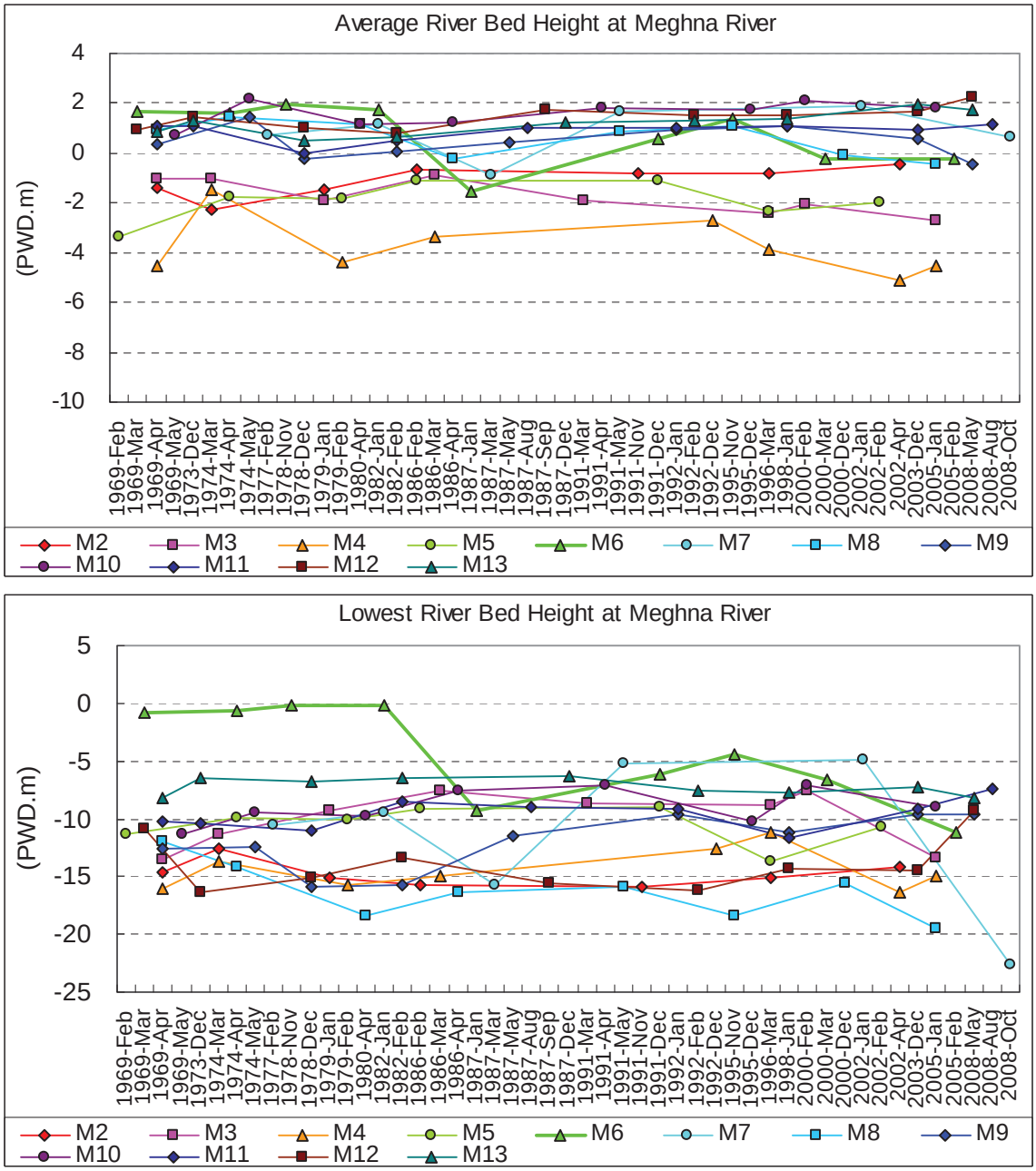
Source :Edited BWDB observation data by JICA Team

Figure 1.2.7 Meghna River Cross Section Profile (Surveyed by BWDB)



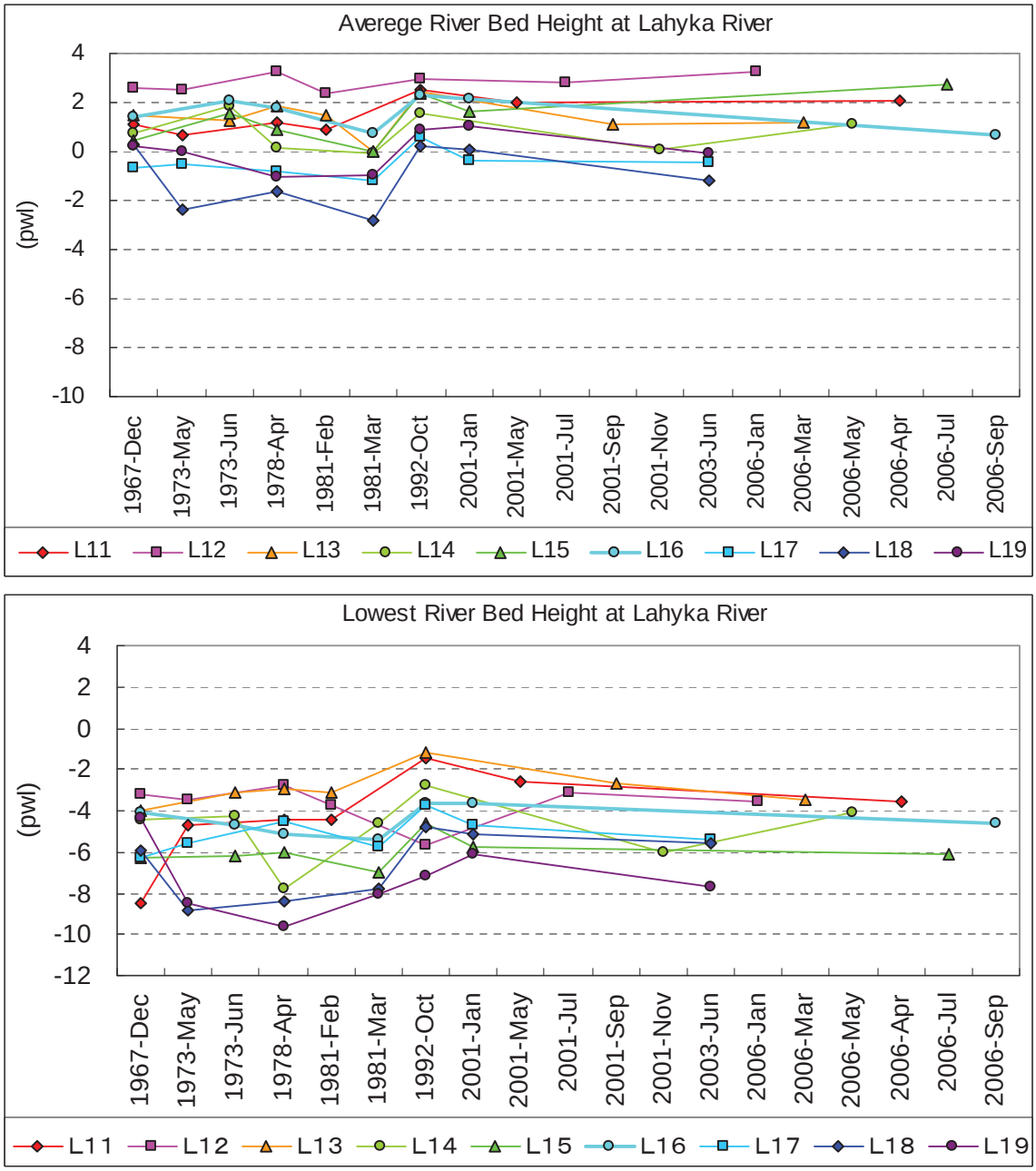
Source :Edited BWDB observation data by JICA Team

Figure 1.2.8 Lahkya River Cross Section Profile (Surveyed by BWDB)



Source :Edited BWDB observation data by JICA Team

Figure 1.2.9 Average and Longitudinal River Bed Height at Meghna River



Source :Edited BWDB observation data by JICA Team

Figure 1.2.10 Average and Longitudinal River Bed Height at Kanchpur River

1.2.4 Interview Survey

Interview survey around three bridges has been already conducted in order to know past major flood information about water level and river flow condition around existing piers.

The field survey result will be used to increase the level of accuracy of numerical model and to analyse the characteristics of these rivers during the peak flow in rainy season. These will be helpful to detect about scouring around bridge piers also.

Table 1.2.9 Interview Survey overview

Bridge site	Interview data	Interview Point
Kanchpur Bridge	25/Jan/2012	4
Gumti Bridge	25/Jan/2012	4
Meghna Bridge	14/Mar/2012	5

Figure 1.2.11 Interview survey around Kanchpur Bridge

Figure 1.2.12 Interview survey around Gumti Bridge

Figure 1.2.13 Interview survey around Meghna Bridge

Table 1.2.10 Interview Result around Kanchpur Bridge

Question		Interview Point.1	Interview Point.2	Interview Point.3	Interview Point.4	Interview Point.5
		Right side of the river (dhaka side)		Left side of the river (chittagon side)		
Q1	Highest water level you have ever seen around bridge in rainy season (flood)	1988: Water Level is up to left river bank (but no overflowed)	2007: overflowed around right side of the river	1988:water depth is about 20cm 1998: 2004:	1988: 1998:	
Q2	How often does the river overflow to the land?	about every 10 years (1988,1998)	-	-	-	
Q3	Historical changes about river around bridge	no changes around bridge	-	no changes around bridge	River width became narrow. P7 was under the water in past time, but now became on the land.	
Q4	Water condition around pier, waves from pier to shoreline	eddy occurs around pier5 to 7, P6's eddy is largest.	eddy occurs around P6	eddy occurs around P5 and P6	eddy occurs around P5 and P6	
Q5	Sediment unload area works in rainy season?	Yes, unload area is shifted to bank side in rainy season.	-	Yes, unload area is shifted to bank side in rainy season.	Yes, unload area is shifted to bank side in rainy season.	
Q6	Have you ever seen the gabages or trees caught between the piers?	Never	-	-		

Table 1.2.11 Interview Result around Gumti Bridge

Question		Interview Point.1	Interview Point.2	Interview Point.3	Interview Point.4	Interview Point.5
		Left side of the river (chittagon side)		Right side of the river (dhaka side)		
Q1	Highest water level you have ever seen around bridge in rainy season (flood)	1988:highest flood, water depth is 15cm on the land 1998: Last Time	1988: highest flood, water level is 20cm over on the land 1998: lower than 1988's about 0.5m	1988:higher than 1998 1998:	1988: 1998:highest in three 2004:lowest in three	
Q2	How often does the river overflow to the land?	-	-	-	-	
Q3	Historical changes about river around bridge	-	No change around bridge	-	No change around bridge	
Q4	Water condition around pier, waves from pier to shoreline	- (never seen before)	some eddy occurred around pier in rainy season	-	eddy around pier in Gumti river is bigger than Meghna river side.	

Table 1.2.12 Interview Result around Meghna Bridge

Question		Interview Point.1	Interview Point.2	Interview Point.3	Interview Point.4	Interview Point.5
		Right side of the river (dhaka side)		Right side, upstream	Left side of the river (chittagon side)	
Q1	Have you ever seen the flood around Meghna bridge in rainy season? When those flood has occurred? How much height is those highest flood level?	1998 is up to 30cm above ground at the location of that tree.	1998 is up to 30cm above ground at the location of that tree. 1988 is up to the ground at the location of that car.	1988 is up to 80cm above ground at the location of that tree.	1988 1998 (most highest).	1998 is up to the ground at the location of that bamboo.
Q2	How often does the river overflow to the land?	1960 1962 1974 1980 1987 1998(most highest).	1988, 1998 (most highest)	1988 (most highest), 1998 2004	No flood at here.	1988 1998 (most highest)
Q3	Was there historical changes about the river around this Meghna bridge? (ex. bank erosion, shoreline Scenery, sand bar rising and falling, land use along river)	-	The sand bar upstream of the bridge, have already collected by the digging contractor 7-8 years ago, and now lost.	Bank erosion of this side is progressing every year. The sand bar upstream of the bridge, have already collected by the digging contractor 7-8 years ago, and now lost. (same as Interview 2.) Cement plant embankments look over there, which was completed in 2008.	-	-
Q4	If know, please teach the river flow condition around piers in summer season (flood) to us. (ex. Eddy or Whirlpool around pier, Waves from pier to shoreline)	-	-	-	I have seen several times the eddy at the downstream of the pier during the flood.	I have seen several times the eddy at the downstream of the pier during the flood.
Q5	Sediment unload area works in rainy season?	-	-	-	-	-

1.2.5 Land Sat Data

Land sat data has already been collected in order to fully understand the historical changes of the river stream line/belt. These data were downloaded from Global Land Cover Facility Earth Science Data Interface (ESDI) Homepage and the accessing link is shown below

http://glcfapp.glcf.umd.edu:8080/esdi/index.jsp

Land Sat Image about 10 years interval after 1970's is shown in *Source :Edited Landsat data by JICA Team*

Figure 1.2.14, and comparison of river stream line traced from 4 pictures is shown in Figure 1.2.15.

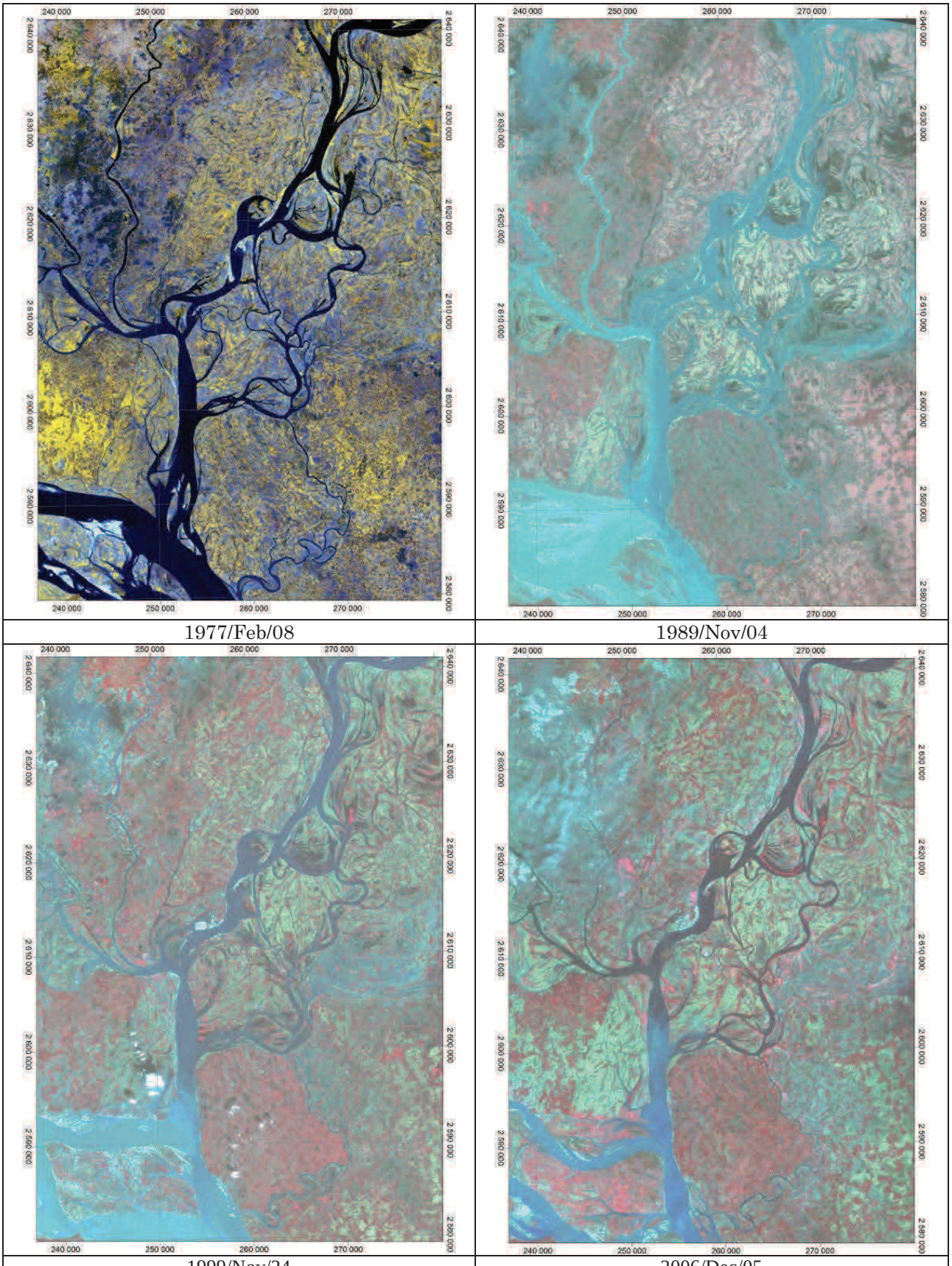
Figure 1.2.15 shows that the cource of Meghna river is morphing by year, and channel width depends on river discharge. It seems that river profile of 1989 is very wider than other years because the piciture in 1989 is taken in flood season (Discharge at Bhairab Bazar is 15.500m3/s)

Especially around Meghna and Gumti Bridge, it seems that stream line is almost same profile. Hence It is supposed that river shore line around Meghna and Gumti Bridge is stable in the view of morphorlogy.

Table 1.2.13 Land sat data list (collected)

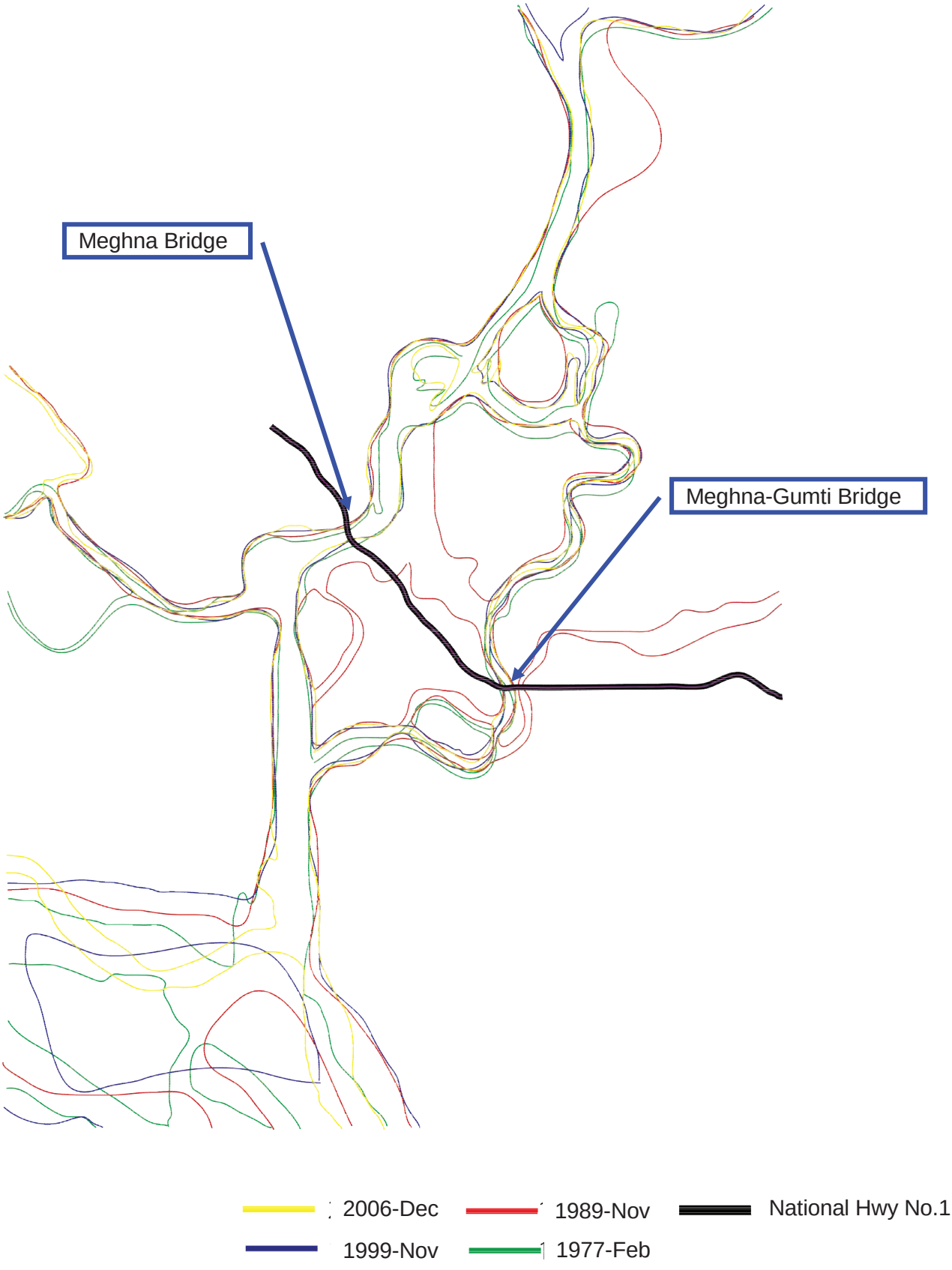
Photo Date	Preference
1972/12/28	ID: LM11470441972363AAA04 Cloud Cover: 10% Qlty: 5
1976/1/27	ID: LM21470441976027AAA01 Cloud Cover: 0% Qlty: 0
1977/2/8	ID: LM21470441977039AAA05 Cloud Cover: 0% Qlty: 5
1980/2/20	ID: LM31470441980051AAA04 Cloud Cover: 10% Qlty: 7
1980/12/4	ID: LM31470441980339AAA03 Cloud Cover: 0% Qlty: 9
Major Flood Event in 1987	
1988/9/14	ID: LT51370441988258BKT00 CC: 53% Qlty: 7 Sensor: TM
1988/11/1	ID: LT51370441988306BKT00 CC: 10% Qlty: 7 Sensor: TM
Major Flood Event in 1988	
1989/1/12	ID: LT41370441989012XXX02 CC: 10% Qlty: 7 Sensor: TM
1989/1/28	ID: LT41370441989028XXX02 CC: 10% Qlty: 9 Sensor: TM
1989/2/13	ID: LT41370441989044XXX06 CC: 0% Qlty: 7 Sensor: TM
Major Flood Event in 1998	
1999/10/7	ID: LE71370441999280SGS01 CC: 12% Qlty: 9 Sensor: ETM+
1999/10/23	ID: LE71370441999296SGS00 CC: 6% Qlty: 9 Sensor: ETM+
1999/11/24	ID: LE71370441999328SGS00 CC: 0% Qlty: 9 Sensor: ETM+
2000/2/28	ID: LE71370442000059SGS00 CC: 0% Qlty: 9 Sensor: ETM+
Major Flood Event in 2007	
2011/11/25	ID: LE71370442011329PFS00 CC: 0% Qlty: 9 Sensor: ETM+ SLC-off
2012/1/12	ID: LE71370442012012PFS00 CC: 15% Qlty: 9 Sensor: ETM+ SLC-off

#1 : http://glcfapp.glcf.umd.edu:8080/esdi/index.jsp



Source :Edited Landsat data by JICA Team

Figure 1.2.14 Land sat image around Meghna River



Source :Edited by JICA Team

Figure 1.2.15 Change of shore line of Meghna River around Meghna & Gumti Br

1.2.6 River bed material and geological survey

Bed materials diameter is important to predict the scouring around piers. Table 1.2.14 is the former survey result by JICA in 1997 around Meghna Bridge. It is shown that almost of the bed material is consisted by Fine sand and Silt (d=0.002 to 0.425mm), and clay that has viscosity is almost nothing. D50 is about 0.1 to 0.2 mm, average of D50 is 0.167mm.

Table 1.2.14 Summery of bed material test around Meghna Bridge (1997 JICA Report)

Sample No.	Grain Size Analysis (%)						D50 (mm)	D60/10
	Clay	Silt	Fine Sand	Medium Sand	Coarse Sand	Gravel		
	-0.002	0.002-0.075	0.075-0.425	0.425-2.0	2.0-4.76	4.76-76.1		
A-1	0	2	98	0	0	0	0.205	1.45
A-2	0	2	98	0	0	0	0.202	1.82
B-3	0	1	99	0	0	0	0.205	1.44
C-3	0	3	97	0	0	0	0.190	2.29
C-4	0	4	96	0	0	0	0.150	2.01
C-5	0	2	98	0	0	0	0.165	2.18
D-1	0	26	73	1	0	0	0.140	4.91
D-2	0	48	49	3	0	0	0.776	5.05
D-3	0	24	75	1	0	0	0.133	4.38
D-4	0	36	64	0	0	0	0.090	5.00
D-5	0	55	45	0	0	0	0.060	6.23
D-6-1	6	85	9	0	0	0	0.031	6.50
D-6-2	0	26	74	0	0	0	0.100	3.64
D-7	0	7	93	0	0	0	0.115	1.56
D-8	0	12	88	0	0	0	0.147	2.75
D-9	0	16	84	0	0	0	0.140	3.20
D-10	0	13	87	0	0	0	0.100	1.92
E-1	0	27	73	0	0	0	0.095	3.55
E-2	0	10	90	0	0	0	0.125	1.87
E-3	0	2	98	0	0	0	0.165	2.16
Average	0.30	20.05	79.40	0.25	0.00	0.00	0.167	3.20

Source :JICA Report[1]

[1] Basic Design StudyReport On The Project For Protection Works For Meghna Bridge In Prople's Republic Of Bangladesh, 1998 Feb