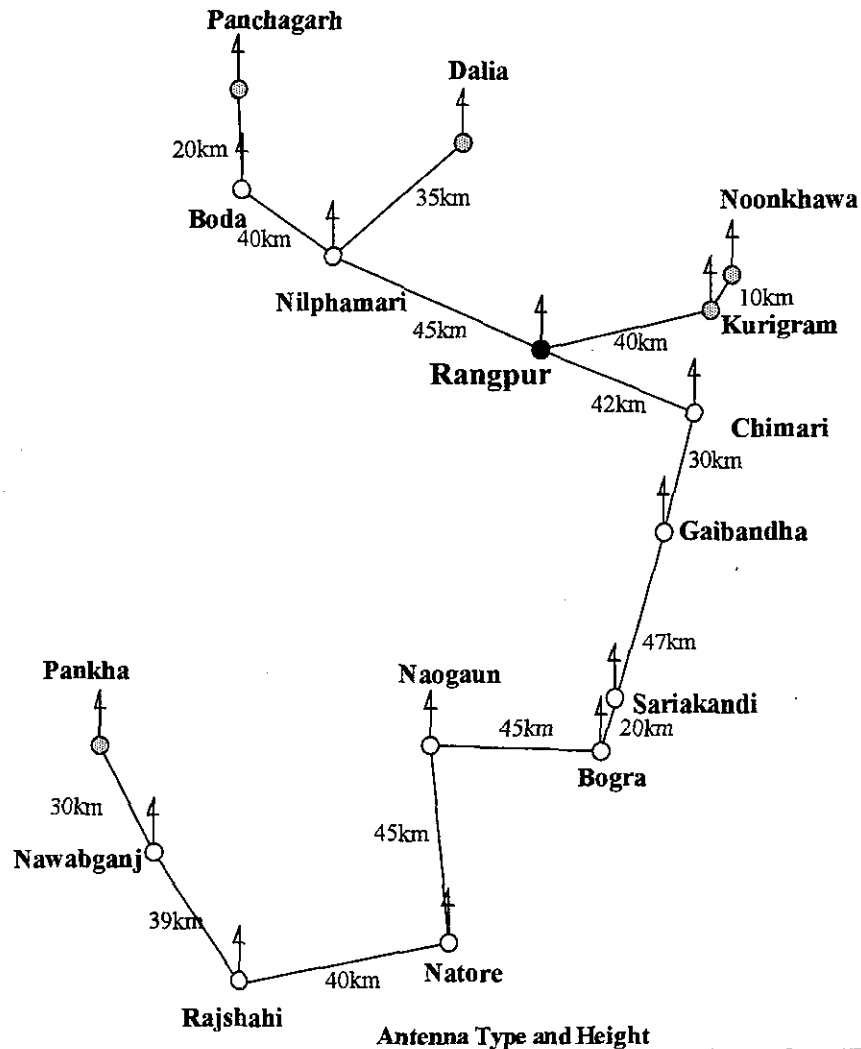
5. REGION –NW (RANGPUR)



Antenna Type and Height

Station	Antenna Type	Height [m]
Boda	3EL colinear	30
Bogra	3EL colinear	30
Chimari	3EL colinear	30
Dalia	5EL Yagi	10
Gaibandha	3EL colinear	40
Kurigram	3EL colinear	30
Natore	3EL colinear	30
Naogaun	3EL colinear	30
Nawabganj	3EL colinear	40
Nilphamari	3EL colinear	30
Noonkhawa	5EL Yagi	10
Panchagarh	5EL Yagi	10
Pankha	5EL Yagi	10
Rajshahi	3EL colinear	40
Rangpur	3EL colinear	30
Sariakandi	3EL colinear	30

Legend

●	Divisional Office
○	Repeater Station (O&M Office)
△	Repeater Station (Upazila)
◍	Telemetric Gauging Station
———	BWDB VHF Link

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

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Figure 5

Telemeter Network Diagram (Region-NW)

Table 5.1: Radio Design Sheet
Panchagarh To Boda

No	Design item		Abb.	Unit	Distance / Design value		Value	Unit	Remark
					Distance		20.0	km	
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-102.8	f	166	MHz	
3	Adds	Diffraction Loss	Lps	dB	0				From Profile (Figure 5.1)
	Loss	Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant.	Feeder Loss(T)	Lft	dB	-0.9		20	m	10D-2V: 0.041dB
	sys.	Feeder Loss(R)	Lfr	dB	-1.7		40	m	10D-2V: 0.041dB
	Loss	Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	9.5				5 elements Yagi
6	Antenna Gain(R)		Gar	dB	5.0				3 elements colinear
7	Receiving Power		Pr	dBm	-65.4				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	47.6				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Prne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	49.8				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	58.9		37.5		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	5.0				
16	**S/N at Fading**		S/Nfd	dB	**53.9**				No.14-15
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	28.9				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	23.9				No.18-15
20	Result				OK				**No.16>34.5dB**

Table 5.2: Radio Design Sheet
Boda to Nilphamari

No	Design item		Abb.	Unit	Distance / Design value		Value	Unit	Remark
					Distance		*40.0*	km	
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		*10*	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-108.8	f	166	MHz	
3	Adds Loss	Diffraction Loss	Lps	dB	*0*				**From Profile (Figure 5.2)**
		Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant. sys. Loss	Feeder Loss(T)	Lft	dB	-1.7		*40*	m	10D-2V: 0.041dB
		Feeder Loss(R)	Lfr	dB	-1.7		*40*	m	10D-2V: 0.041dB
		Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	*5.0*				*3 elements colinear*
6	Antenna Gain(R)		Gar	dB	*5.0*				*3 elements colinear*
7	Receiving Power		Pr	dBm	-76.7				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	36.3				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Prne	dBm			*10*	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	38.5				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	47.6		39.5		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	7.0				
16	**S/N at Fading**		S/Nfd	dB	**40.6**				No.14-15
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	17.6				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	10.6				No.18-15
20	Result				OK				**No.16>34.5dB**

Table 5.3: Radio Design Sheet
Dalia To Nilphamari

No	Design item		Abb.	Unit	Distance 35.0 km Design value		Value	Unit	Remark
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-107.7	f	166	MHz	
3	Adds	Diffraction Loss	Lps	dB	0				**From Profile (Figure 5.3)**
	Loss	Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant.	Feeder Loss(T)	Lft	dB	-0.9		20	m	10D-2V: 0.041dB
	sys.	Feeder Loss(R)	Lfr	dB	-1.7		40	m	10D-2V: 0.041dB
	Loss	Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	9.5				5 elements Yagi
6	Antenna Gain(R)		Gar	dB	5.0				3 elements colinear
7	Receiving Power		Pr	dBm	-70.3				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	42.7				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Prne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	44.9				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	54.0		39.0		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	6.5				
16	**S/N at Fading**		S/Nfd	dB	**47.5**				No.14-15
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	24.0				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	17.5				No.18-15
20	Result				OK				**No.16>34.5dB**

Table 5.4: Radio Design Sheet
Nilphamari To Rangpur

No	Design item		Abb.	Unit	Distance / Design value		Value	Unit	Remark
							45.0	km	
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-109.9	f	166	MHz	
3	Adds	Diffraction Loss	Lps	dB	0				From Profile (Figure 5.4)
	Loss	Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant.	Feeder Loss(T)	Lft	dB	-1.7		40	m	10D-2V: 0.041dB
	sys.	Feeder Loss(R)	Lfr	dB	-1.7		40	m	10D-2V: 0.041dB
	Loss	Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	5.0				3 elements colinear
6	Antenna Gain(R)		Gar	dB	5.0				3 elements colinear
7	Receiving Power		Pr	dBm	-77.8				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	35.2				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Prne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	37.4				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	46.6		40.0		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	7.5				
16	**S/N at Fading**		S/Nfd	dB	**39.1**				No.14-15
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	16.6				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	9.1				No.18-15
20	Result				OK				**No.16>34.5dB**

Table 5.5: Radio Design Sheet
Kurigram to Rangpur

No	Design item		Abb.	Unit	Distance / Design value		Value	Unit	Remark
							40.0	km	
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-108.8	f	166	MHz	
3	Adds	Diffraction Loss	Lps	dB	0				From Profile (Figure 5.5)
	Loss	Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant.	Feeder Loss(T)	Lft	dB	-1.7		40	m	10D-2V: 0.041dB
	sys.	Feeder Loss(R)	Lfr	dB	-1.7		40	m	10D-2V: 0.041dB
	Loss	Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	5.0				3element colinear
6	Antenna Gain(R)		Gar	dB	5.0				3element colinear
7	Receiving Power		Pr	dBm	-76.7				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	36.3				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Prne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	38.5				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	47.6		39.5		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	7.0				
16	**S/N at Fading**		S/Nfd	dB	**40.6**				No.14-15
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	17.6				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	10.6				No.18-15
20	Result				OK				**No.16>34.5dB**

Table 5.6: Radio Design Sheet
Noonkhawa To Kurigram

No	Design item		Abb.	Unit	Distance 10.0 km Design value		Value	Unit	Remark
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-96.8	f	166	MHz	
3	Adds	Diffraction Loss	Lps	dB	0				From Profile (Figure 5.6)
	Loss	Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant.	Feeder Loss(T)	Lft	dB	-0.9		20	m	10D-2V: 0.041dB
	sys.	Feeder Loss(R)	Lfr	dB	-1.7		40	m	10D-2V: 0.041dB
	Loss	Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	9.5				5 elements Yagi
6	Antenna Gain(R)		Gar	dB	5.0				3 element colinear
7	Receiving Power		Pr	dBm	-59.4				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	53.6				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Prne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	55.8				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	64.9		36.5		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	4.0				
16	**S/N at Fading**		S/Nfd	dB	**60.9**				No.14-15
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	34.9				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	30.9				No.18-15
20	Result				OK				No.16>34.5dB

Table 5.7: Radio Design Sheet
Rangpur to Chimari

No	Design item		Abb.	Unit	Distance 42.0 km Design value		Value	Unit	Remark
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-109.3	f	166	MHz	
3	Adds	Diffraction Loss	Lps	dB	0				**From Profile (Figure 5.7)**
	Loss	Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant.	Feeder Loss(T)	Lft	dB	-1.7		40	m	10D-2V: 0.041dB
	sys.	Feeder Loss(R)	Lfr	dB	-1.7		40	m	10D-2V: 0.041dB
	Loss	Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	5.0				3 element colinear
6	Antenna Gain(R)		Gar	dB	5.0				3 element colinear
7	Receiving Power		Pr	dBm	-77.2				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	35.8				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Pmi	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Pne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Pmi)+1/(Pne)		Pm	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	38.0				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	47.2		39.7		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	7.2				
16	**S/N at Fading**		S/Nfd	dB	**40.0**				No.14-15
17	Threshold Level : Pm+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	17.2				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	10.0				No.18-15
20	Result				OK				**No.16>34.5dB**

Table 5.8: Radio Design Sheet
Chimari to Gaibandha

No	Design item		Abb.	Unit	Distance / Design value		Value	Unit	Remark
							30.0	km	
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-106.3	f	166	MHz	
3	Adds Loss	Diffraction Loss	Lps	dB	0				From Profile (Figure 5.8)
		Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant. sys. Loss	Feeder Loss(T)	Lft	dB	-1.7		40	m	10D-2V: 0.041dB
		Feeder Loss(R)	Lfr	dB	-2.1		50	m	10D-2V: 0.041dB
		Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	5.0				3 element colinear
6	Antenna Gain(R)		Gar	dB	5.0				3 element colinear
7	Receiving Power		Pr	dBm	-74.6				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	38.4				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Prne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	40.6				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	49.7		38.5		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	6.0				
16	**S/N at Fading**		S/Nfd	dB	**43.7**				No.14-15
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	19.7				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	13.7				No.18-15
20	Result				OK				**No.16>34.5dB**

Table 5.9: Radio Design Sheet
Gaibandha to Sariakandi

No	Design item		Abb.	Unit	Distance 47.0 km Design value		Value	Unit	Remark
1	*Power Output: 10log"P"(W)+30*		Pt	dBm	40		*10*	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-110.2	f	166	MHz	
3	Adds	Diffraction Loss	Lps	dB	*0*				**From Profile (Figure 5.9)**
	Loss	Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant.	Feeder Loss(T)	Lft	dB	-2.1		*50*	m	10D-2V: 0.041dB
	sys.	Feeder Loss(R)	Lfr	dB	-1.7		*40*	m	10D-2V: 0.041dB
	Loss	*Coaxial Arrester Loss*	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	*5.0*				*3 elements colinear*
6	*Antenna Gain(R)*		Gar	dB	*5.0*				*3 elements colinear*
7	Receiving Power		Pr	dBm	-78.5				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	34.5				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	*8*	dB	
10	External Noise Power: dBμV-113		Prne	dBm			*10*	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	36.7				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	*Max 70% distortion*
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	45.8		40.2		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	7.7				
16	**S/N at Fading**		S/Nfd	dB	**38.1**				*No.14-15*
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	15.8				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	8.1				No.18-15
20	Result				*OK*				***No.16>34.5dB***

Table 5.10: Radio Design Sheet
Sariakandi to Bogra

No	Design item		Abb.	Unit	Distance / Design value		Value	Unit	Remark
					Distance		20.0	km	
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-102.8	f	166	MHz	
3	Adds Loss	Diffraction Loss	Lps	dB	0				**From Profile (Figure 5.10)**
		Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant. sys. Loss	Feeder Loss(T)	Lft	dB	-1.7		40	m	10D-2V: 0.041dB
		Feeder Loss(R)	Lfr	dB	-1.7		40	m	10D-2V: 0.041dB
		Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	5.0				*3 elements colinear*
6	Antenna Gain(R)		Gar	dB	5.0				*3 elements colinear*
7	Receiving Power		Pr	dBm	-70.7				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	42.3				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Pmi	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Pme	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Pmi)+1/(Pme)		Pm	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	44.5				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	53.6		37.5		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	5.0				
16	**S/N at Fading**		S/Nfd	dB	**48.6**				No.14-15
17	Threshold Level : Pm+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	23.6				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	18.6				No.18-15
20	Result				OK				**No.16>34.5dB**

Table 5.11: Radio Design Sheet
Bogra to Naogaun

No	Design item		Abb.	Unit	Distance / Design value		Value	Unit	Remark
							45.0	km	
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-109.9	f	166	MHz	
3	Adds Loss	Diffraction Loss	Lps	dB	0				From Profile (Figure 5.11)
		Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant. sys. Loss	Feeder Loss(T)	Lft	dB	-1.7		40	m	10D-2V: 0.041dB
		Feeder Loss(R)	Lfr	dB	-1.7		40	m	10D-2V: 0.041dB
		Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	5.0				3 elements Yagi
6	Antenna Gain(R)		Gar	dB	5.0				3 elements Yagi
7	Receiving Power		Pr	dBm	-77.8				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	35.2				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Prne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	37.4				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	46.6		40.0		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	7.5				
16	**S/N at Fading**		S/Nfd	dB	**39.1**				No.14-15
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	16.6				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	9.1				No.18-15
20	Result				OK				**No.16>34.5dB**

Table 5.12: Radio Design Sheet
Naogaun to Natore

No	Design item		Abb.	Unit	Distance / Design value		Value	Unit	Remark
							45.0	km	
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-109.9	f	100	MHz	
3	Adds	Diffraction Loss	Lps	dB	0				From Profile (Figure 5.12)
	Loss	Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant.	Feeder Loss(T)	Lft	dB	-1.7		40	m	10D-2V: 0.041dB
	sys.	Feeder Loss(R)	Lfr	dB	-1.7		40	m	10D-2V: 0.041dB
	Loss	Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	5.0				3 elements colinear
6	Antenna Gain(R)		Gar	dB	5.0				3 elements colinear
7	Receiving Power		Pr	dBm	-77.8				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	35.2				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Prne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	37.4				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	46.6		40.0		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	7.5				
16	**S/N at Fading**		S/Nfd	dB	**39.1**				No.14-15
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	16.6				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	9.1				No.18-15
20	Result				OK				**No.16>34.5dB**

Table 5.13: Radio Design Sheet
Pankha to Nawabiganj

No	Design item		Abb.	Unit	Distance / Design value		Value	Unit	Remark
							30.0	km	
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	*Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4*		Lpf	dB	-106.3	f	166	MHz	
3	Adds	Diffraction Loss	Lps	dB	0				**From Profile (Figure 5.13)**
	Loss	Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant.	Feeder Loss(T)	Lft	dB	-0.9		20	m	10D-2V: 0.041dB
	sys.	Feeder Loss(R)	Lfr	dB	-2.1		50	m	10D-2V: 0.041dB
	Loss	Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	9.5				*5 elements Yagi*
6	Antenna Gain(R)		Gar	dB	5.0				*3 element colinear*
7	Receiving Power		Pr	dBm	-69.3				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	43.7				*No.7+113*
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	*External Noise Power: dBμV-113*		Prne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	45.9				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	55.0		38.5		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	6.0				
16	**S/N at Fading**		S/Nfd	dB	**49.0**				No.14-15
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	25.0				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	19.0				No.18-15
20	Result				OK				***No.16>34.5dB***

Table 5.14: Radio Design Sheet
Nawabiganj to Raijsahi

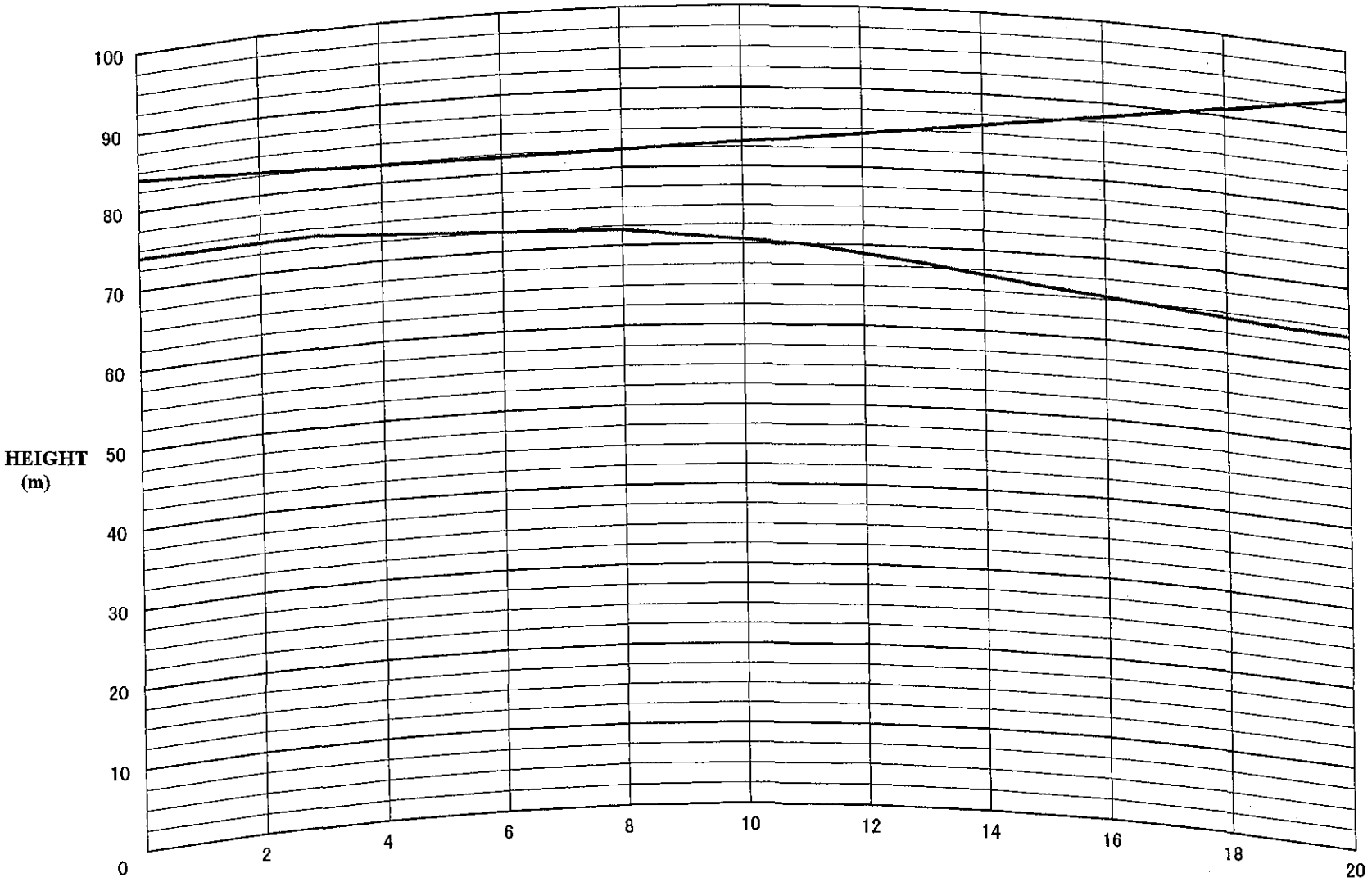
No	Design item		Abb.	Unit	Distance / Design value		Value	Unit	Remark
					Distance		39.0	km	
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-108.6	f	166	MHz	
3	Adds	Diffraction Loss	Lps	dB	0				**From Profile (Figure 5.14)**
	Loss	Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant.	Feeder Loss(T)	Lft	dB	-2.1		50	m	10D-2V: 0.041dB
	sys.	Feeder Loss(R)	Lfr	dB	-2.1		50	m	10D-2V: 0.041dB
	Loss	Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	5.0				3 elements colinear
6	Antenna Gain(R)		Gar	dB	5.0				3 elements colinear
7	Receiving Power		Pr	dBm	-77.3				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	35.7				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Prni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Prne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Prni)+1/(Prne)		Prn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	37.9				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	47.0		39.4		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	6.9				
16	**S/N at Fading**		S/Nfd	dB	**40.1**				No.14-15
17	Threshold Level : Prn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	17.0				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	10.1				No.18-15
20	Result				OK				**No.16>34.5dB**

Table 5.15: Radio Design Sheet
Natore to Raijsahi

No	Design item		Abb.	Unit	Distance 40.0 km Design value		Value	Unit	Remark
1	Power Output: 10log"P"(W)+30		Pt	dBm	40		10	W	
2	Free Space Loss: 20log"f"(MHz)+20log"d"(km)+32.4		Lpf	dB	-108.8	f	166	MHz	
3	Adds	Diffraction Loss	Lps	dB	0				**From Profile (Figure 5.15)**
	Loss	Reflection Loss	LAL	dB					
		Topographic Coefficient	tf	dB	-10.0				Adjusted by the test
		Supplment value by Test	Z	dB					
4	Ant.	Feeder Loss(T)	Lft	dB	-1.7		40	m	10D-2V: 0.041dB
	sys.	Feeder Loss(R)	Lfr	dB	-2.1		50	m	10D-2V: 0.041dB
	Loss	Coaxial Arrester Loss	Lfa	dB	-1.0				0.5 x 2
		Other Loss	Ld	dB	-3.5				Filter, distributor,etc
		Antenna directivity	La	dB					
5	Antenna Gain(T)		Gat	dB	5.0				3 element colinear
6	Antenna Gain(R)		Gar	dB	5.0				3 element colinear
7	Receiving Power		Pr	dBm	-77.1				Sum of No.1 to 6.
8	Receiving Input Voltage (Open end): 0dbμV=-113dBm			dBμV	35.9				No.7+113
9	Internal Noise Power: 10log"B"+NF-144		Pni	dBm	-125.2	B	12	kHz	
						NF	8	dB	
10	External Noise Power: dBμV-113		Pne	dBm			10	dB	Noise deterioration
11	Receiver Noise Power: 1/(Pni)+1/(Pne)		Pn	dBm	-115.2				
12	S/N at High Frequency		C/N	dB	38.1				No.7-11
13	S/N Improvement coefficient: 10log3"fd"^2x B/2"fm"^3		I	dB	9.1	fd:	3.5	kHz	Max 70% distortion
						fm:	3	kHz	
14	S/N at Normal Condition		S/N	dB	47.2		39.5		No12+13
15	Fading Value Presumed: 0.1dB/km+3dB		fd	dB	7.0				
16	**S/N at Fading**		S/Nfd	dB	**40.2**				No.14-15
17	Threshold Level : Pn+(S/NL-I)		PL	dBm	-94.3				No.11+30-9.1
18	Fading margin relative to threhold level: Pr-PL		ML	dB	17.2				No.7-17
19	Magin relative to threshold level while a fading: ML-Lfd		Mf	dB	10.2				No.18-15
20	Result				OK				**No.16>34.5dB**

Project Name : FFWS (Figure 5.1)

TERRAIN PROFILE

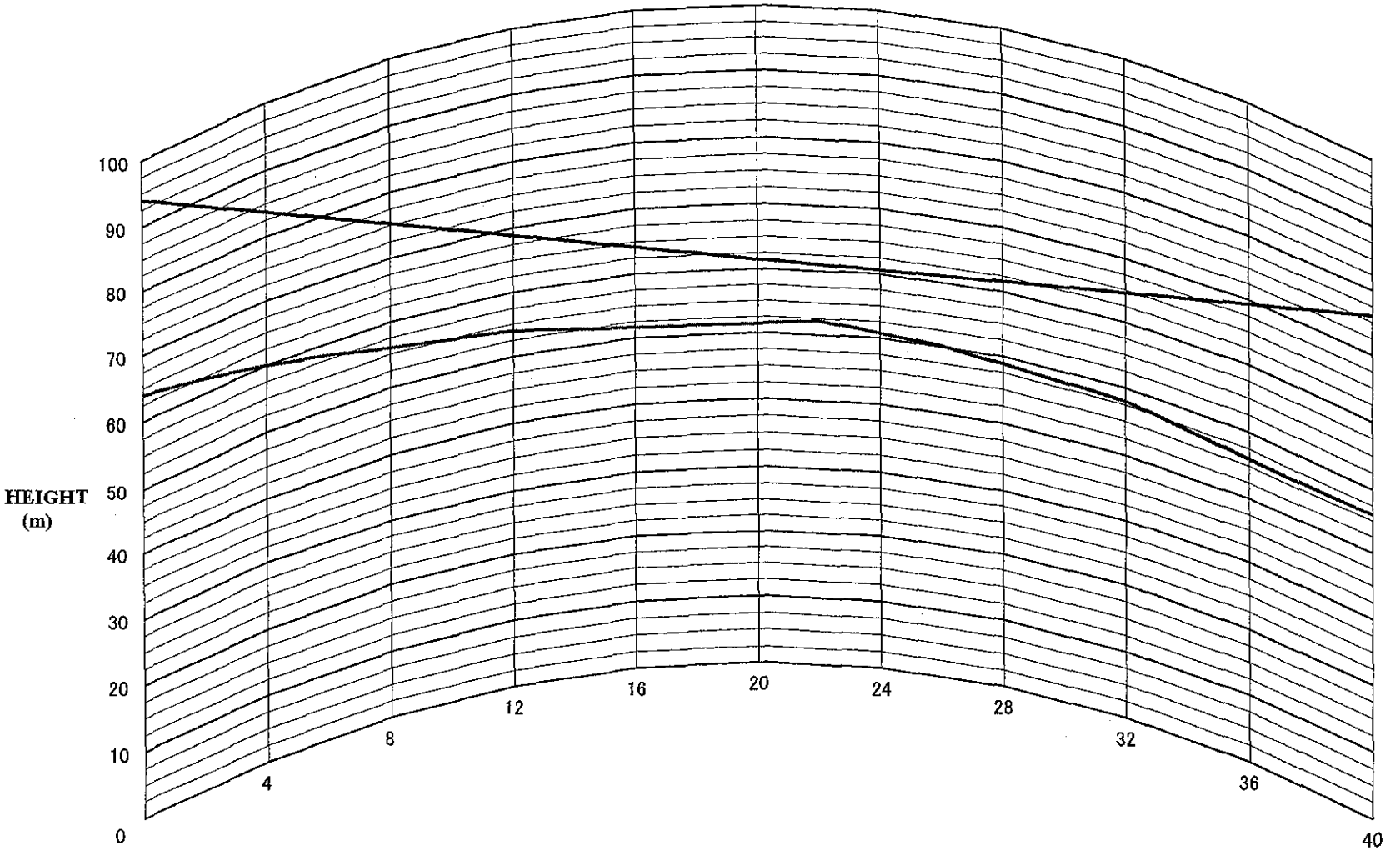


Station Name : Panchagarh
Site Elevation : 74 m
Antenna Height : 10 m

Station Name : Boda
Site Elevation : 64 m
Antenna Height : 30 m

Project Name : FFWS (Figure 5.2)

TERRAIN PROFILE

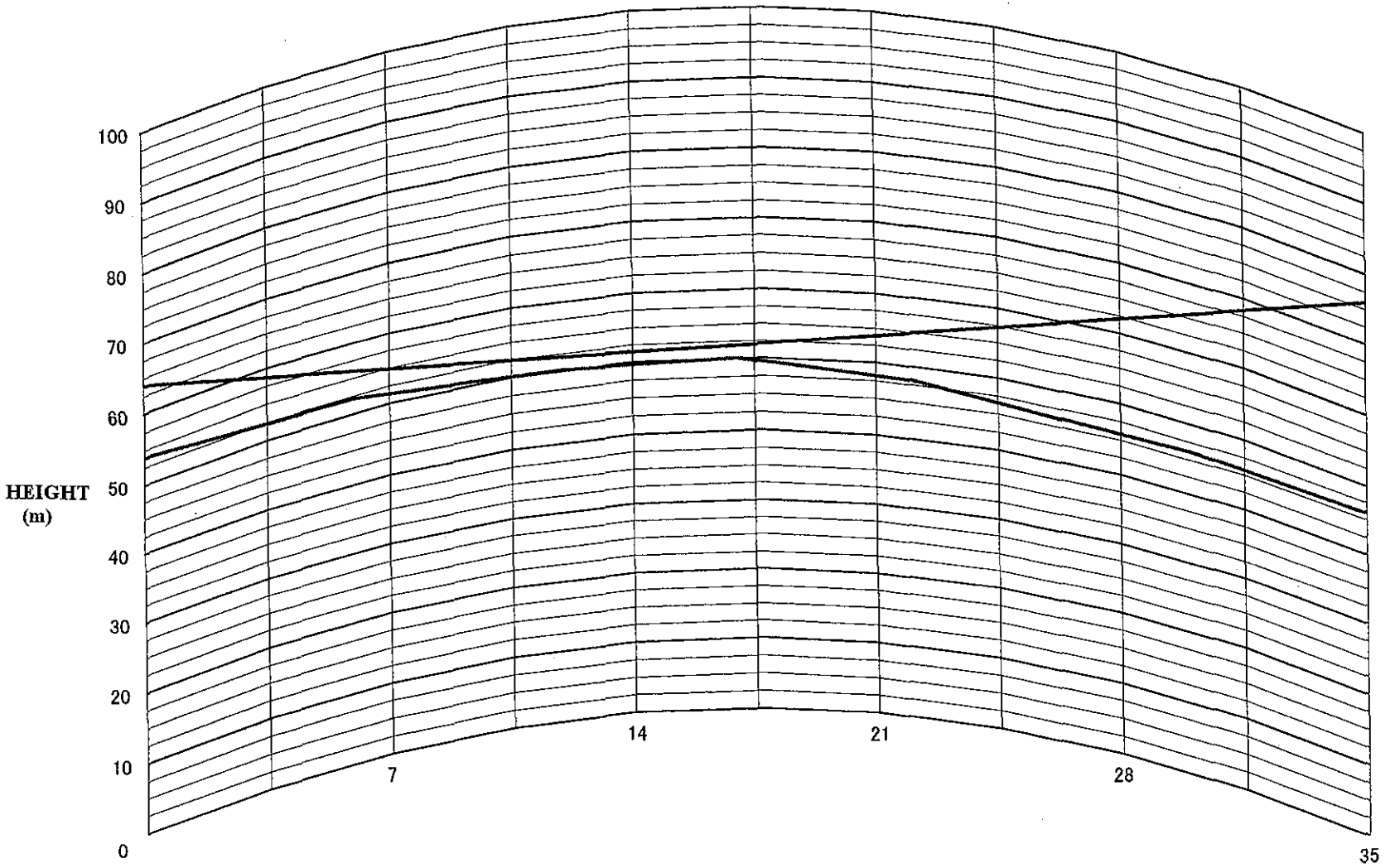


Station Name : Boda
Site Elevation : 64 m
Antenna Height : 30 m

Station Name : Nilphamari
Site Elevation : 46 m
Antenna Height : 30 m

Project Name : FFWS (Figure 5.3)

TERRAIN PROFILE

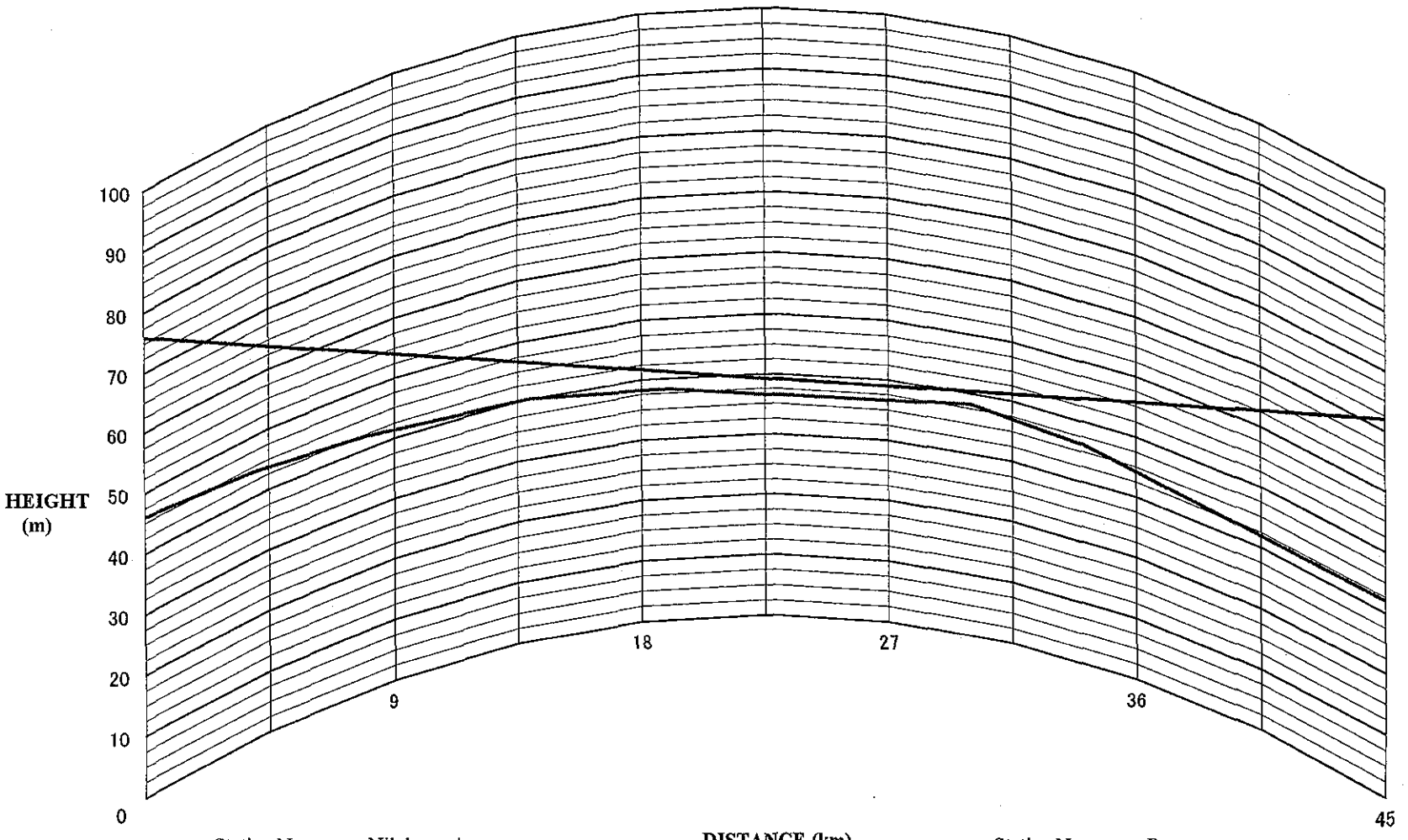


Station Name : Dalia
Site Elevation : 54 m
Antenna Height : 10 m

Station Name : Nilphamari
Site Elevation : 46 m
Antenna Height : 30 m

Project Name : FFWS (Figure 5.4)

TERRAIN PROFILE



Station Name : Nilphamari
Site Elevation : 46 m
Antenna Height : 30 m

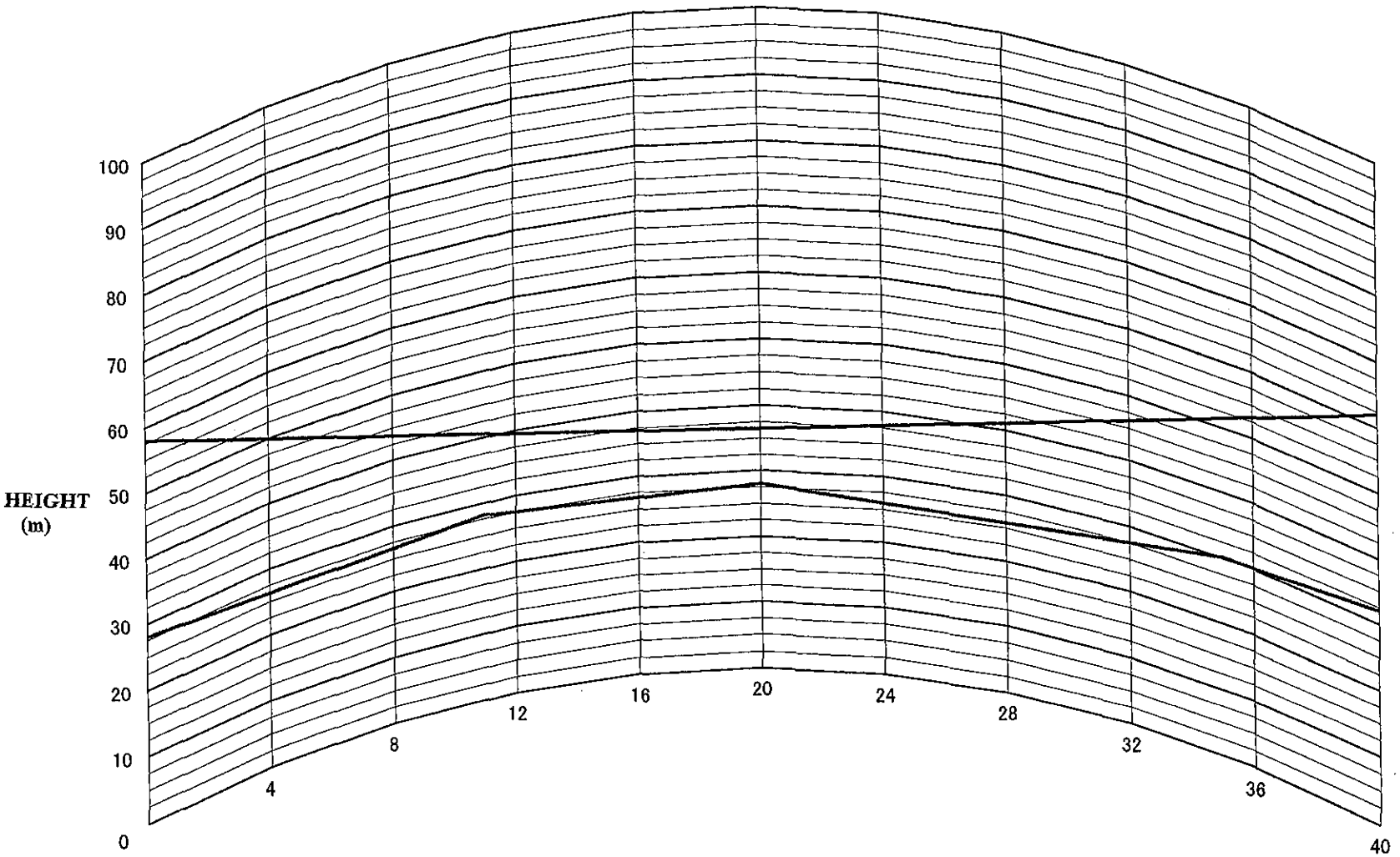
DISTANCE (km)

45 (km)

Station Name : Rangpur
Site Elevation : 32 m
Antenna Height : 30 m

Project Name : FFWS (Figure 5.5)

TERRAIN PROFILE



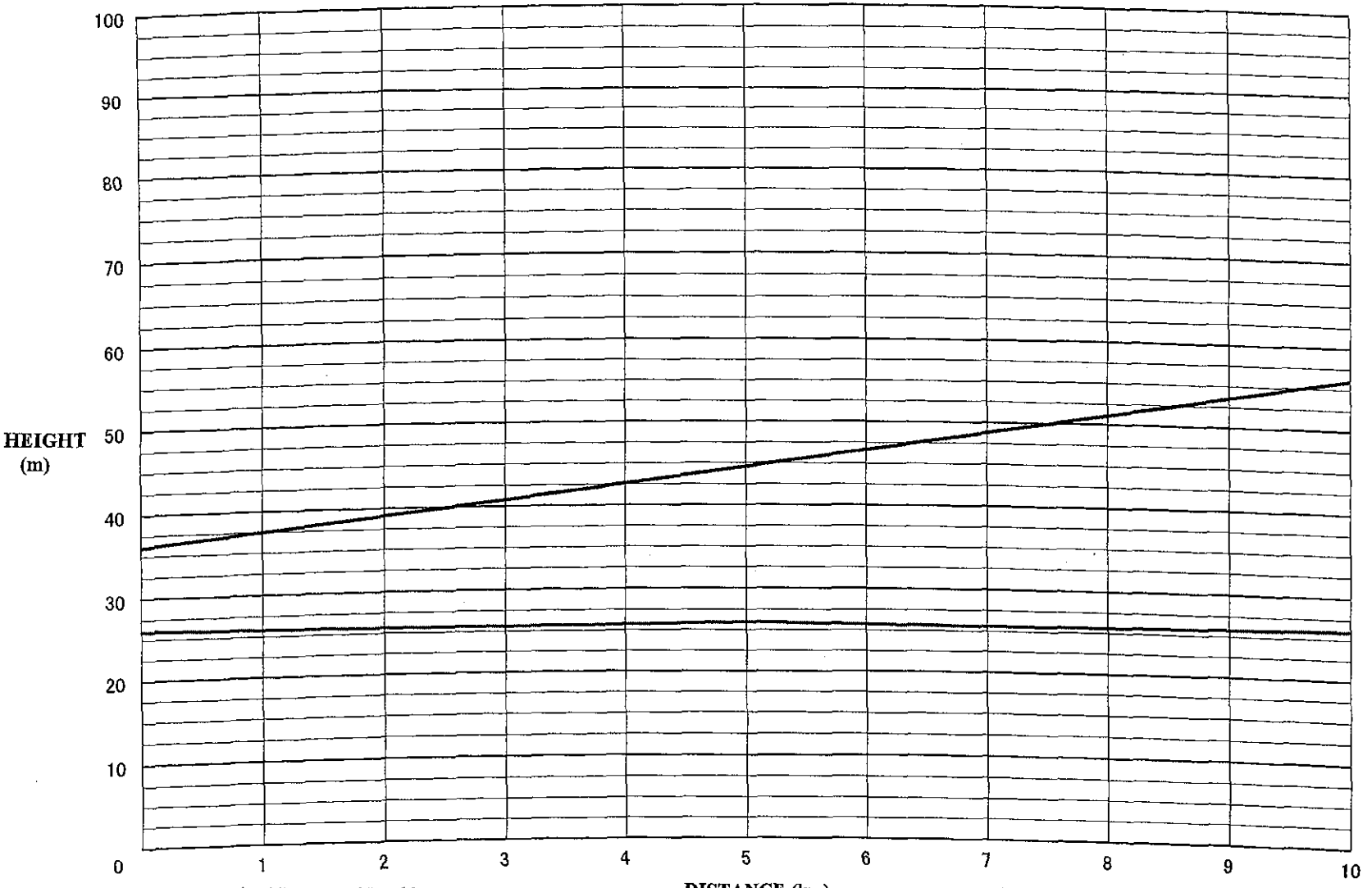
Station Name : Kurigram
Site Elevation : 28 m
Antenna Height : 30 m

40 (km)

Station Name : Rangpur
Site Elevation : 32 m
Antenna Height : 30 m

Project Name : FFWS (Figure 5.6)

TERRAIN PROFILE

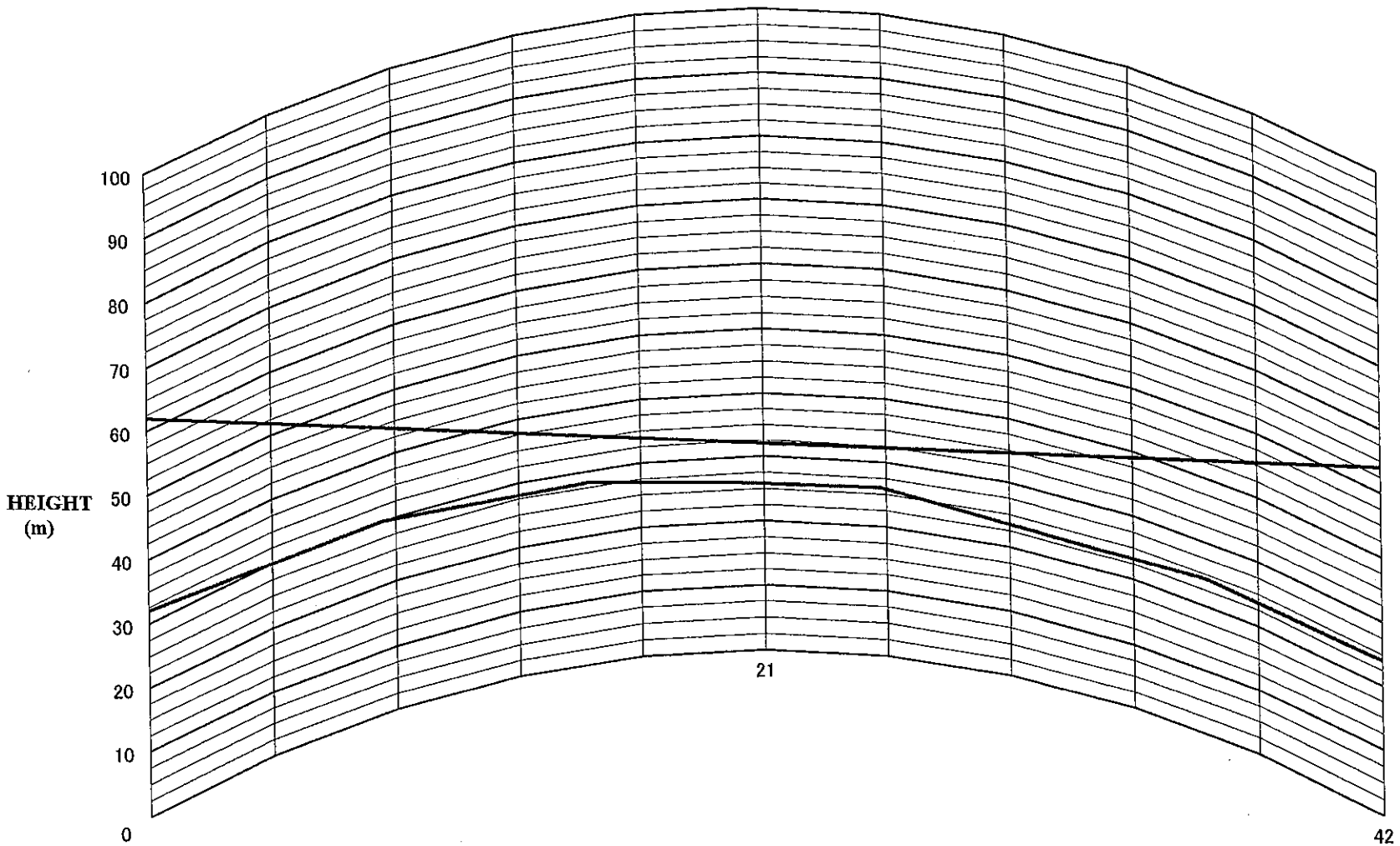


Station Name : Noonkhawa
Site Elevation : 26 m
Antenna Height : 10 m

Station Name : Kurigram
Site Elevation : 26 m
Antenna Height : 30 m

Project Name : FFWS (Figure 5.7)

TERRAIN PROFILE

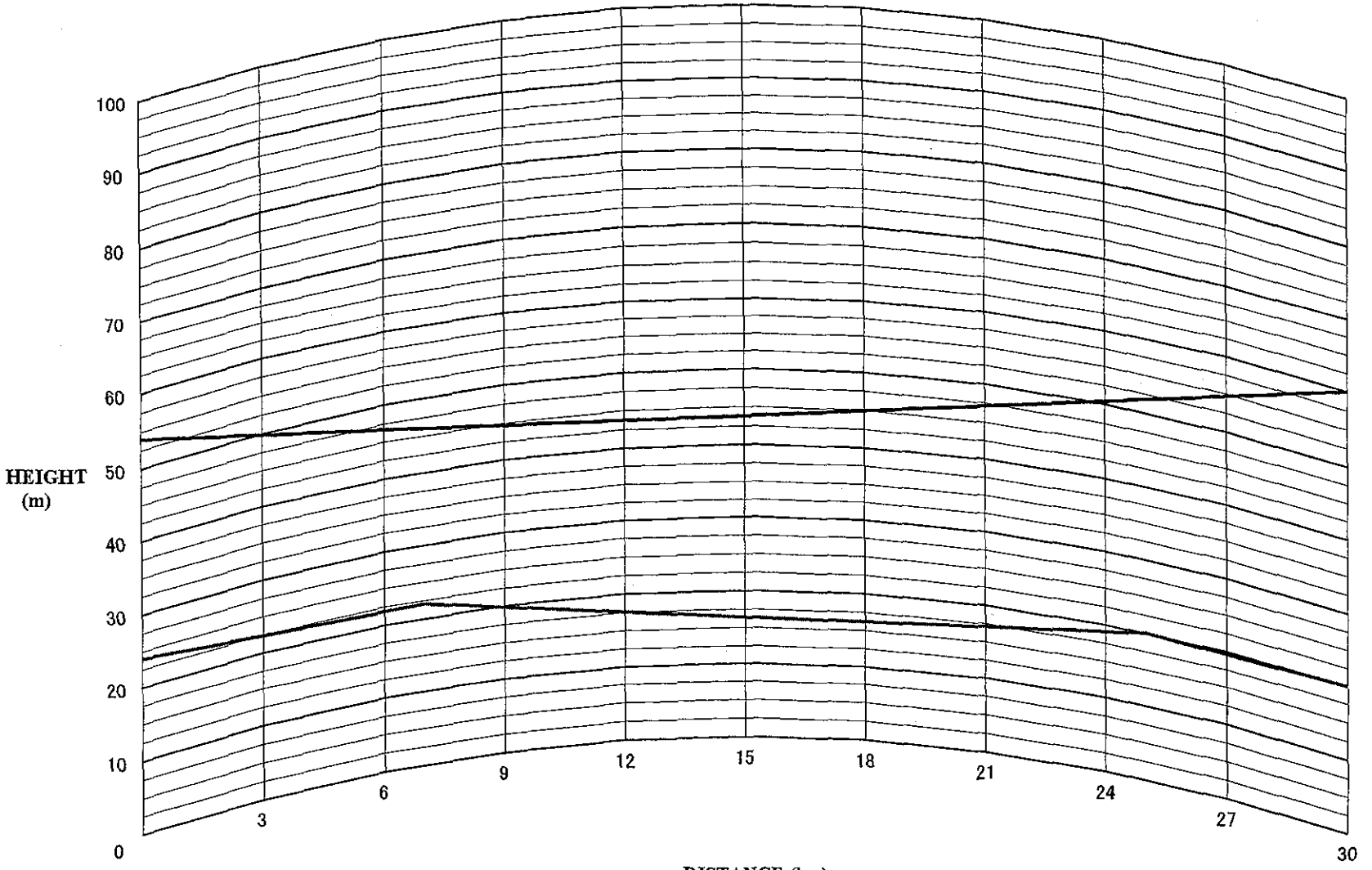


Station Name : Rangpur
Site Elevation : 32 m
Antenna Height : 30 m

Station Name : Chimari
Site Elevation : 24 m
Antenna Height : 30 m

Project Name : FFWS (Figure 5.8)

TERRAIN PROFILE

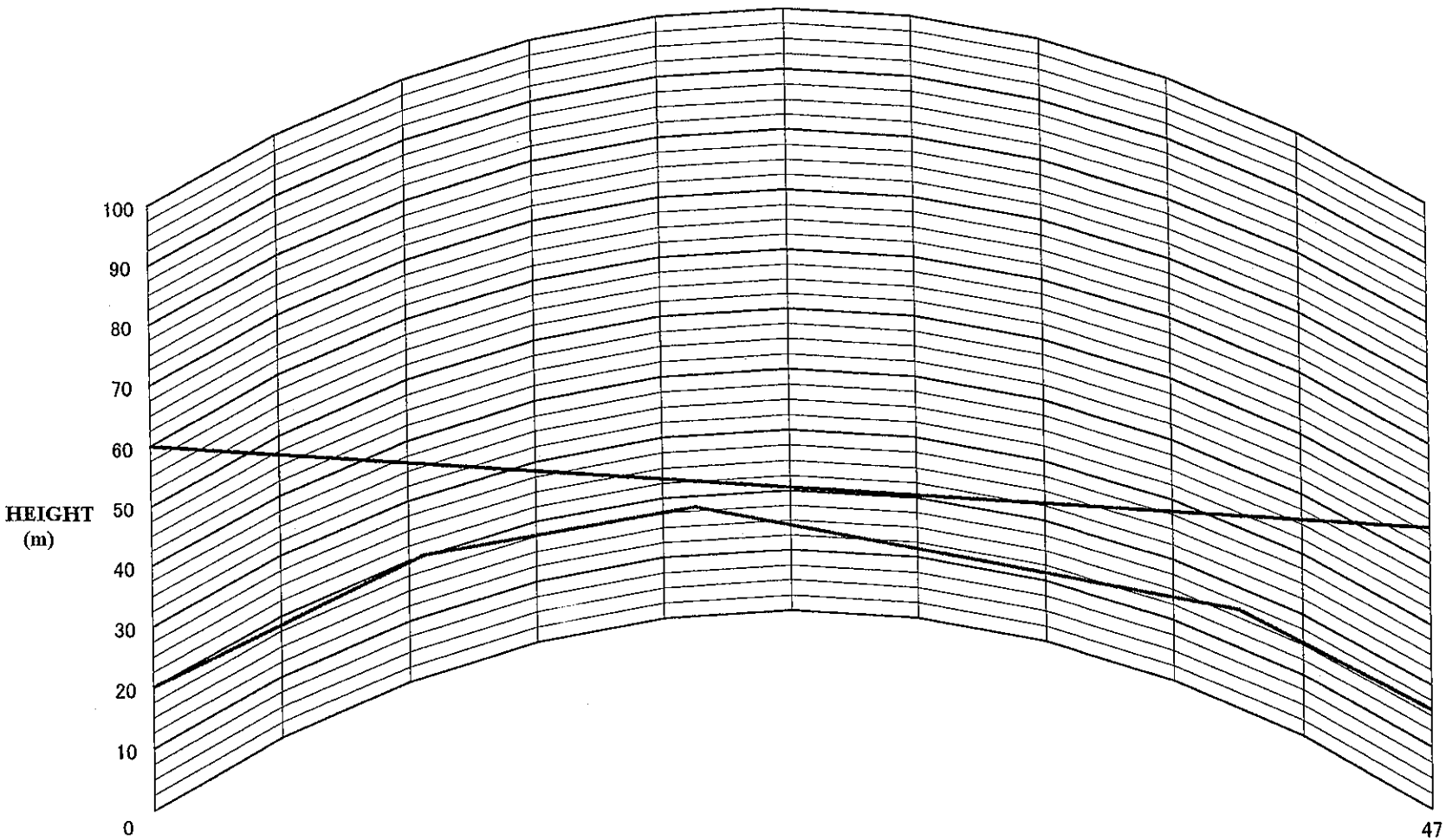


Station Name : Chimari
Site Elevation : 24 m
Antenna Height : 30 m

Station Name : Gaibandha
Site Elevation : 20 m
Antenna Height : 40 m

Project Name : FFWS (Figure 5.9)

TERRAIN PROFILE



Station Name : Gaibandha
Site Elevation : 20 m
Antenna Height : 40 m

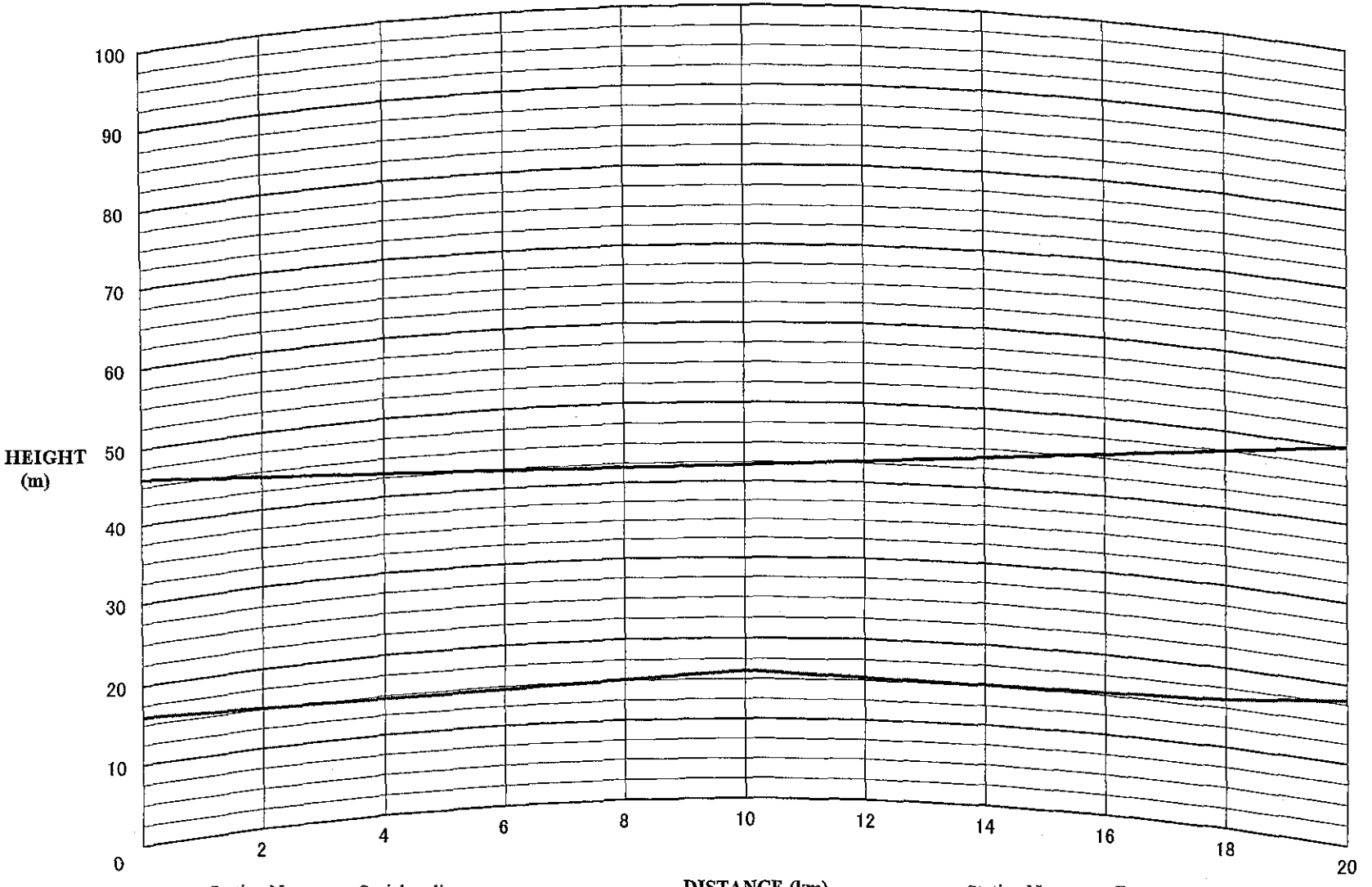
DISTANCE (km)

47 (km)

Station Name : Sariakandi
Site Elevation : 16 m
Antenna Height : 30 m

Project Name : FFWS (Figure 5.10)

TERRAIN PROFILE

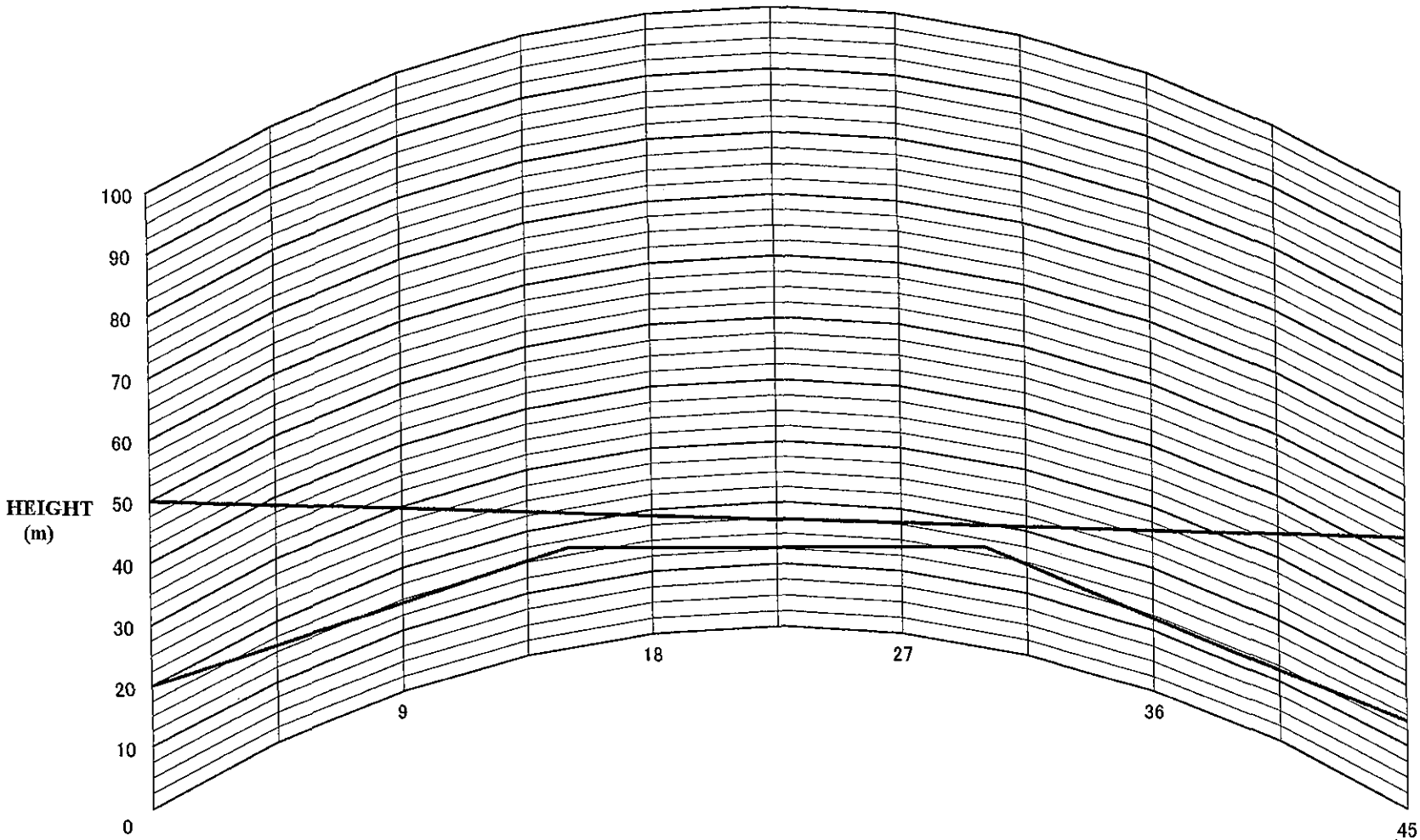


Station Name : Sariakandi
Site Elevation : 16 m
Antenna Height : 30 m

Station Name : Bogra
Site Elevation : 20 m
Antenna Height : 30 m

Project Name : FFWS (Figure 5.11)

TERRAIN PROFILE

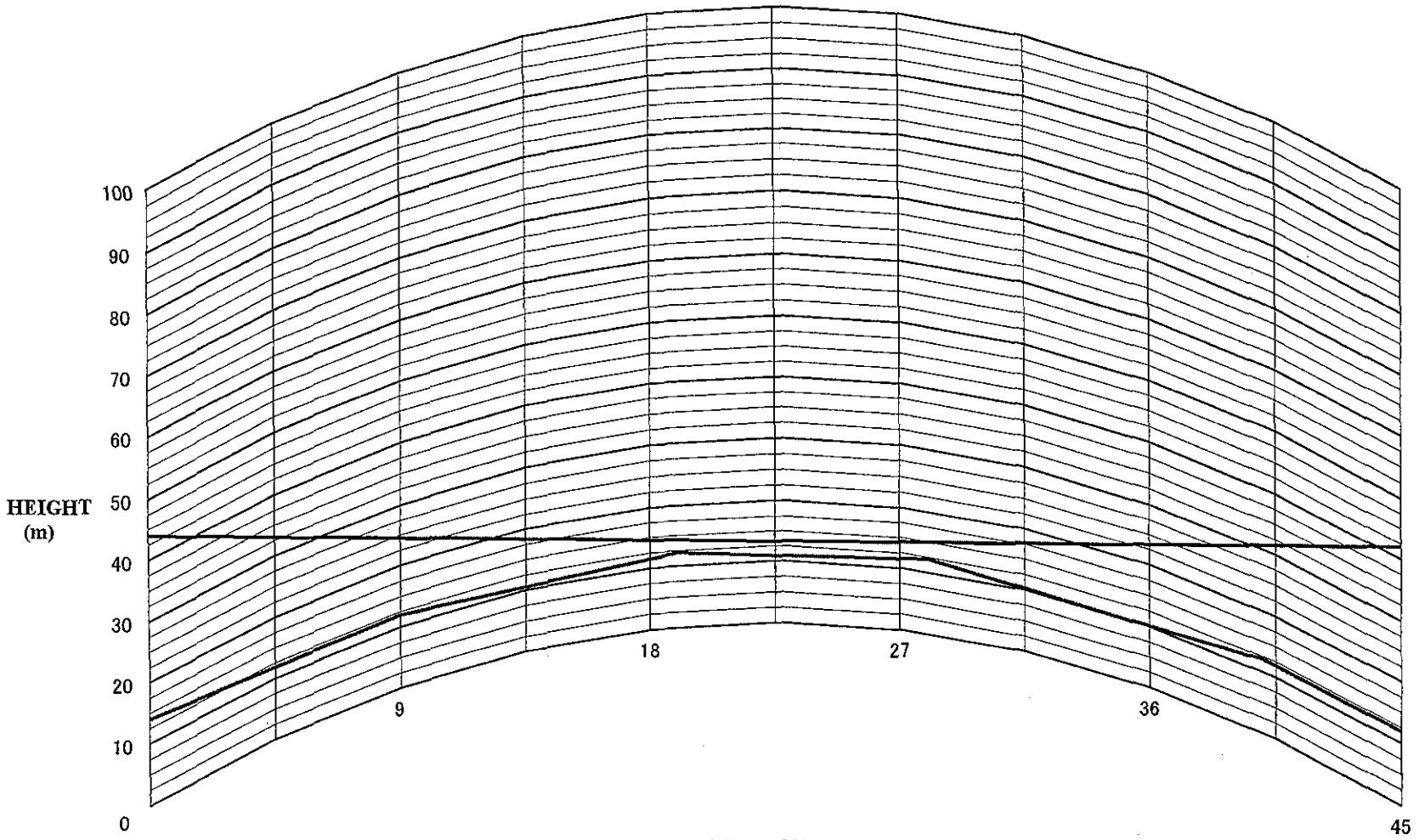


Station Name : Bogra
Site Elevation : 20 m
Antenna Height : 30 m

Station Name : Naogaun
Site Elevation : 14 m
Antenna Height : 30 m

Project Name : FFWS (Figure 5.12)

TERRAIN PROFILE

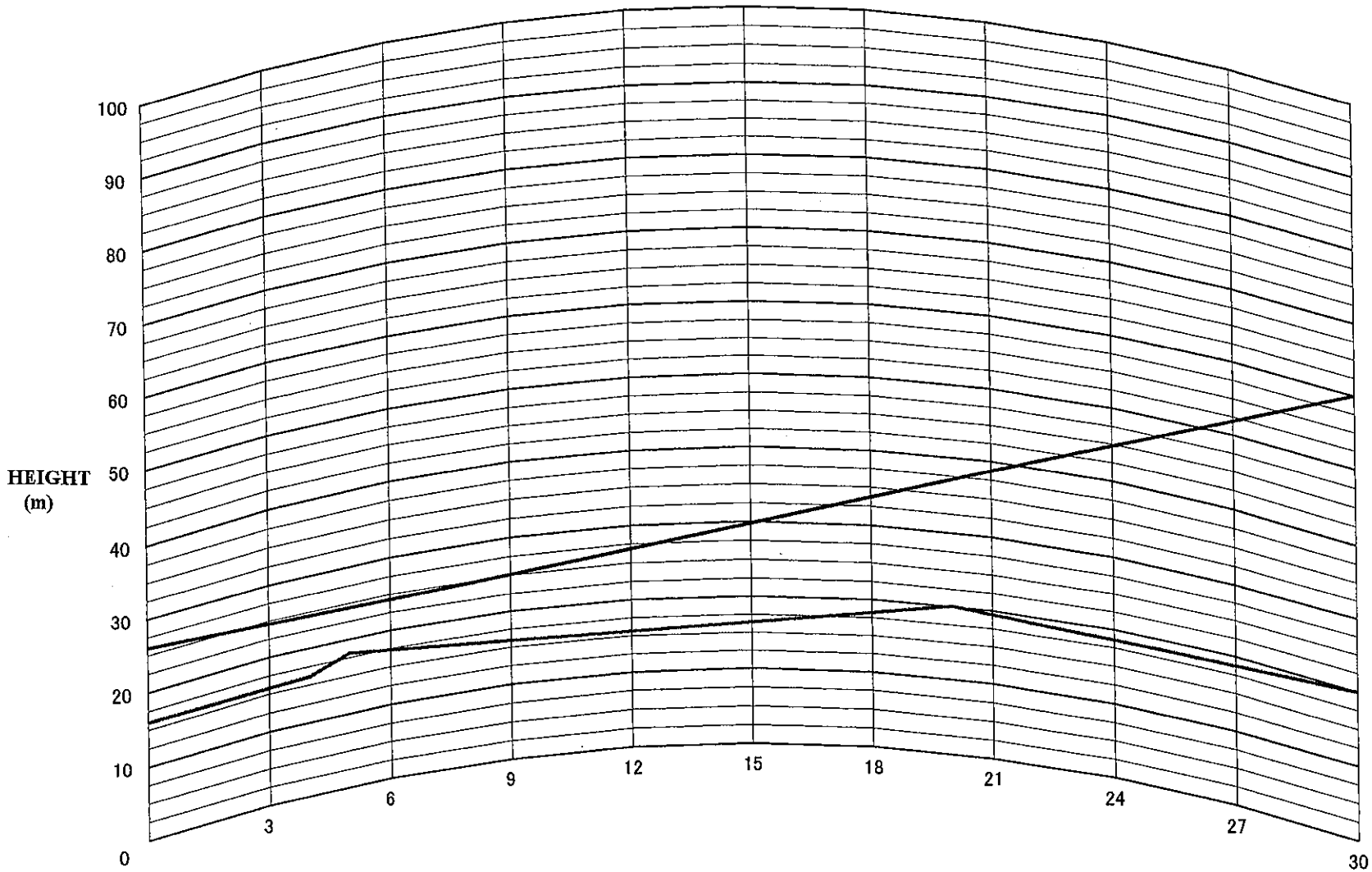


Station Name : Naogaun
Site Elevation : 14 m
Antenna Height : 30 m

Station Name : Natore
Site Elevation : 12 m
Antenna Height : 30 m

Project Name : FFWS (Figure 5.13)

TERRAIN PROFILE

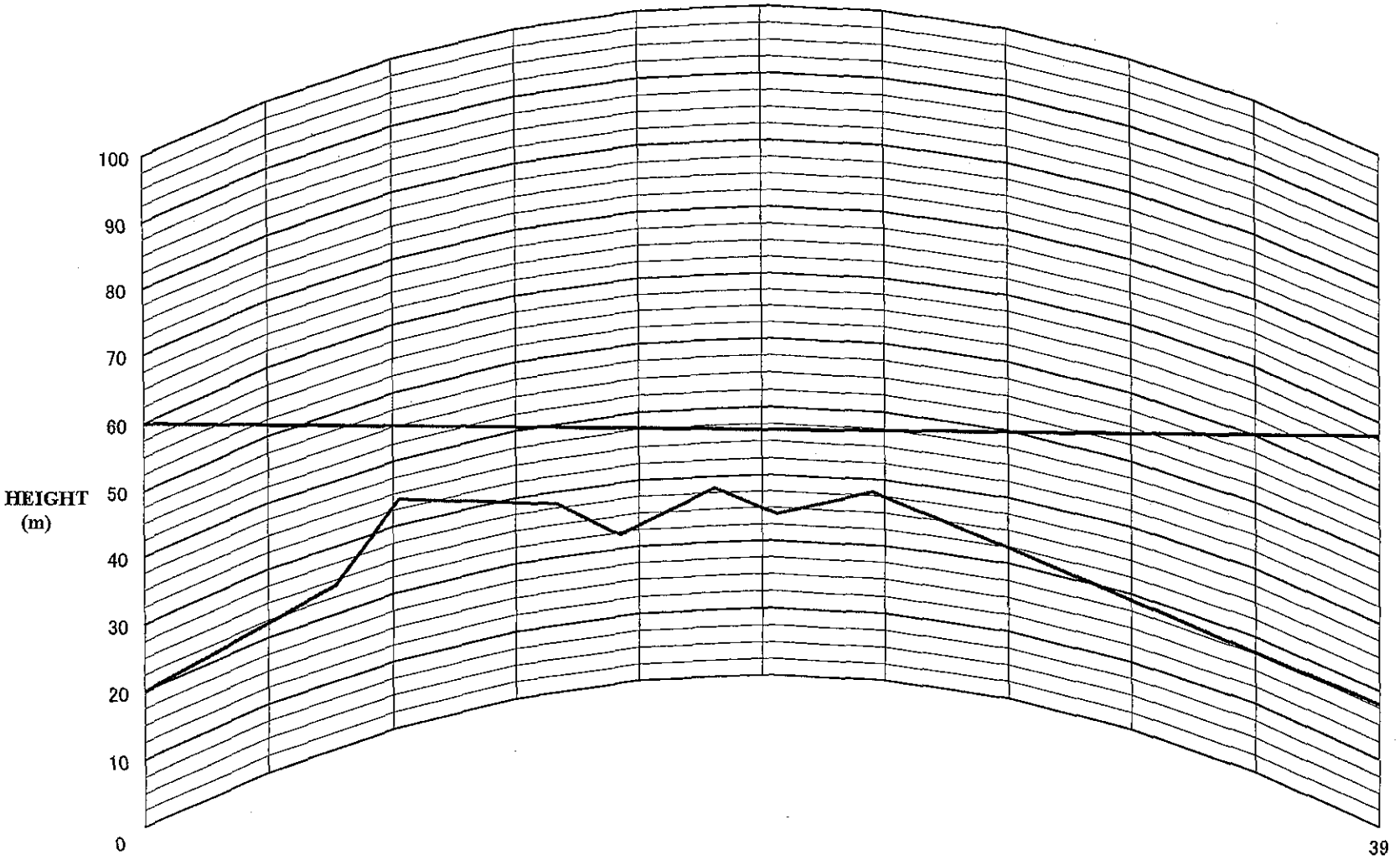


Station Name : Pankha
Site Elevation : 16 m
Antenna Height : 10 m

Station Name : Nawabganj
Site Elevation : 20 m
Antenna Height : 40 m

Project Name : FFWS (Figure 5.14)

TERRAIN PROFILE



Station Name : Nawabganj
Site Elevation : 20 m
Antenna Height : 40 m

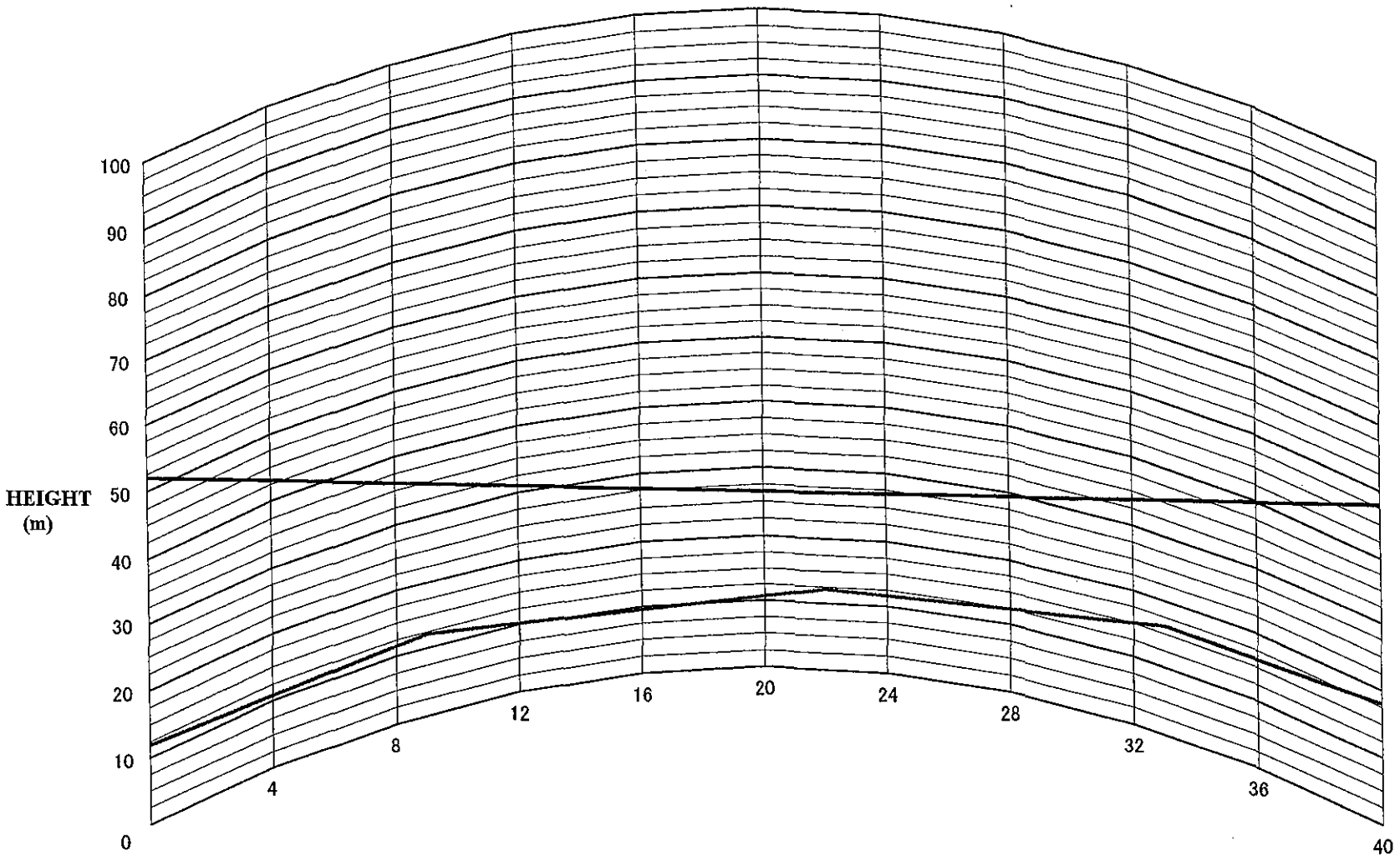
DISTANCE (km)

39 (km)

Station Name : Rajshahi
Site Elevation : 18 m
Antenna Height : 40 m

Project Name : FFWS (Figure 5.15)

TERRAIN PROFILE

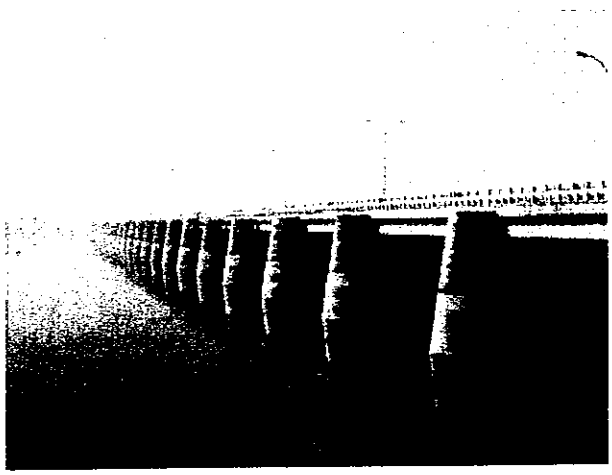


Station Name : Natore
Site Elevation : 12 m
Antenna Height : 40 m

Station Name : Rajshahi
Site Elevation : 18 m
Antenna Height : 30 m

ANNEX-IX

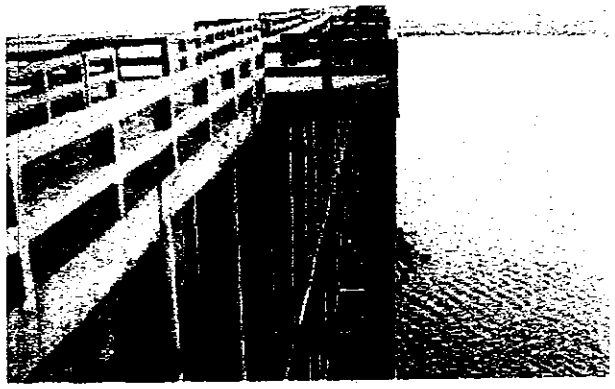
PHOTOGRAPHS



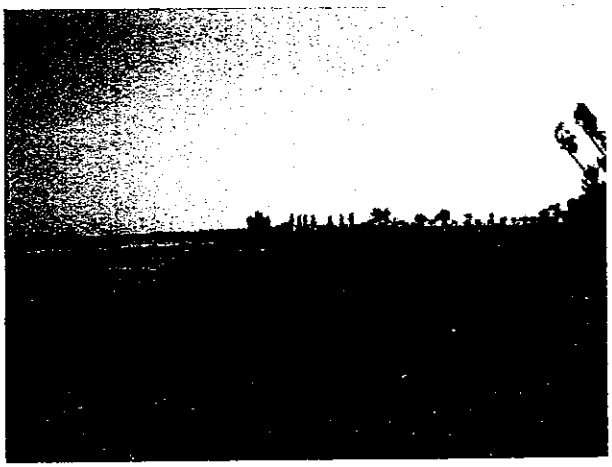
Teesta Irrigation Project, [January 2003]

Coastal Embankment (Chittagong), [January 2003]

Brahmaputra Right Embankment (BRE) Project (Sirajganj), [July 2003]



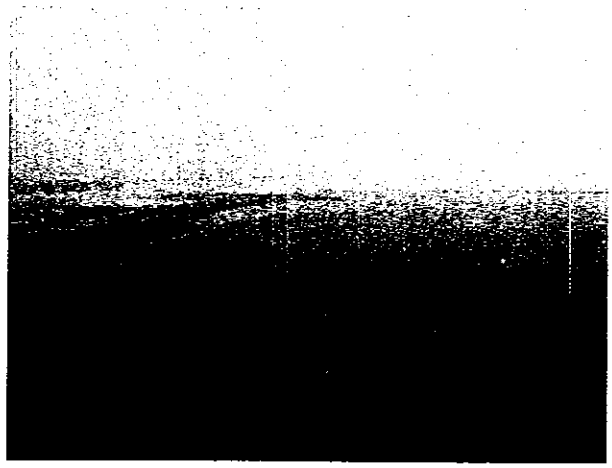
Spur Dike at Pankha, [January 2003]



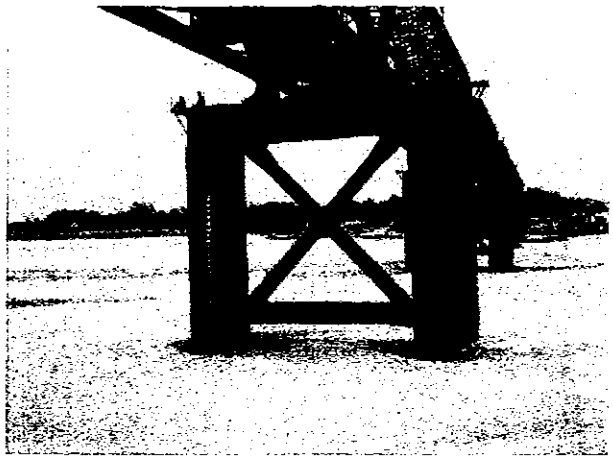
Groin at Kurigram, [January 2003]

Khulna-Jessor Drainage Rehabilitation (KJDR) Project, [February 2003]

Buriganga River at Mill Barak (Dhaka), [December 2002]

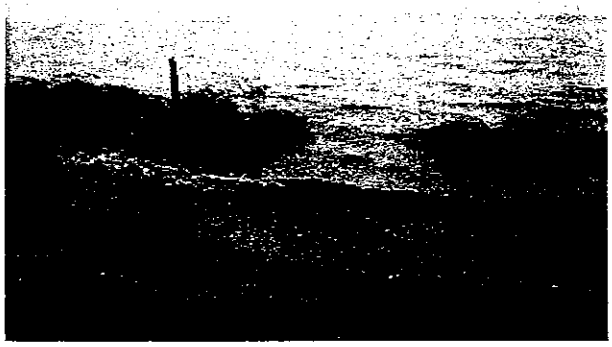


Upper Padma River at Pankha, [January 2003]



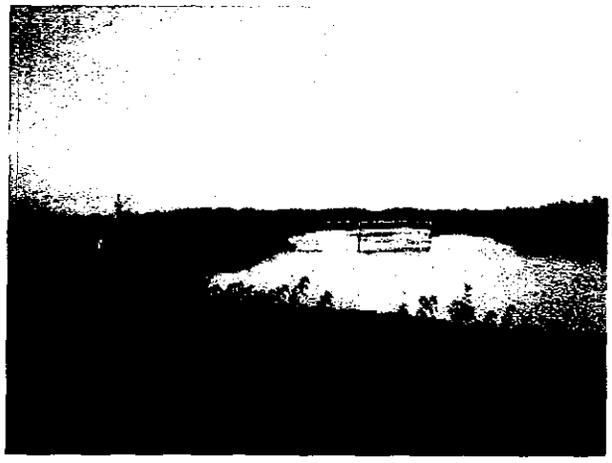
Gorai River at Gorai Railway Bridge, [January 2003]

Brahmaputra River at Noonkhawa, [January 2003]



Lower Padma River at Mawa, [June 2003]

Upper Meghna River at Bhairab, [July 2003]



Monu River at Chatlaghat, [July 2003]

Kushiyara River at Zakiganj, [July 2003]

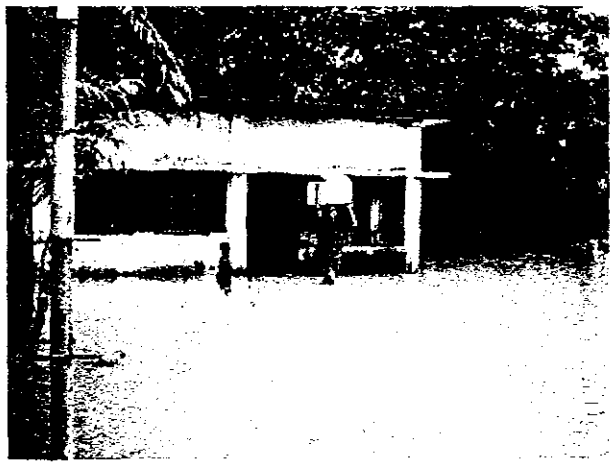
Gumti River at Comilla, [August 2003]

Halda River at Panchapukuria, [August 2003]

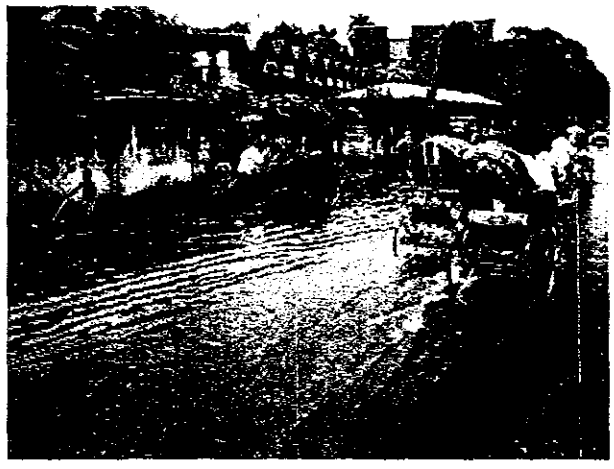
Jadukata River at Laurergarh, [July 2003]

Surma River at Kanaighat, [July 2003]

RIVER CONDITIONS (FLASHY RIVERS)



Nakuagaon, [August 2003]



Dhaka, [August 2003]

Kazipur, [July 2003]

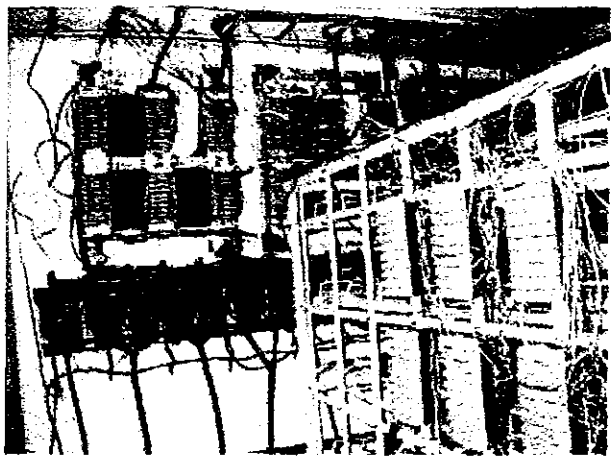
Kazipur, [July 2003]

Panchapukuria, [August 2003]

Chatlaghat, [July 2003]

Mirpur Telemeter House,
[November 2002]

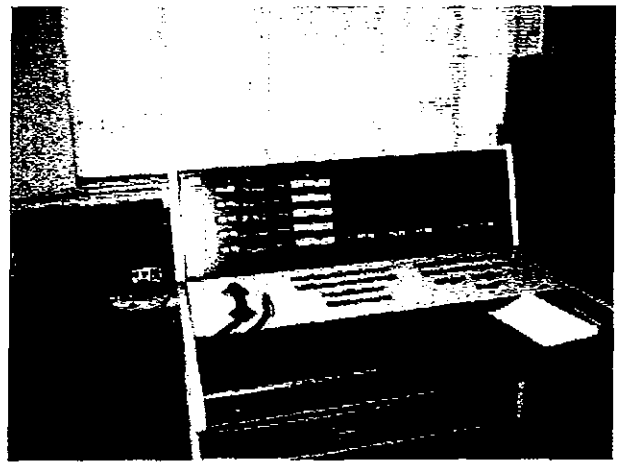
Shaistaganj Telemeter House,
[December 2002]



Beani Bazar Repeater Station,
[December 2002]

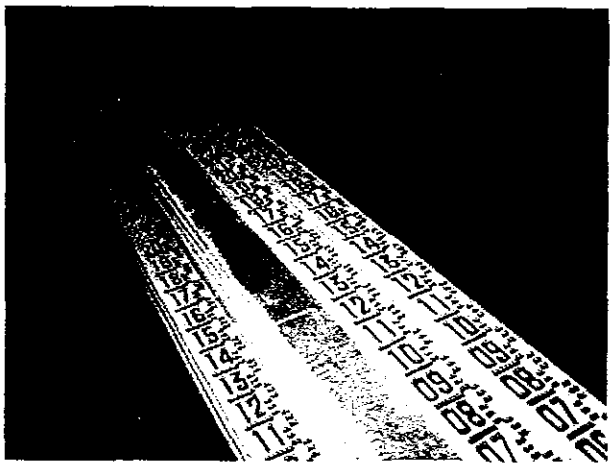
Jatrapur Telemetric Station,
[January 2003]

Monu Railway Bridge Telemetric Station,
[December 2002]

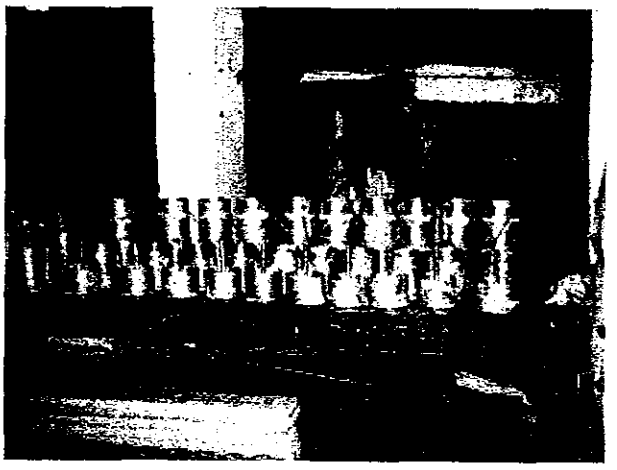


Equipment in FFWC, [November 2002]

EXISTING TELEMETERS



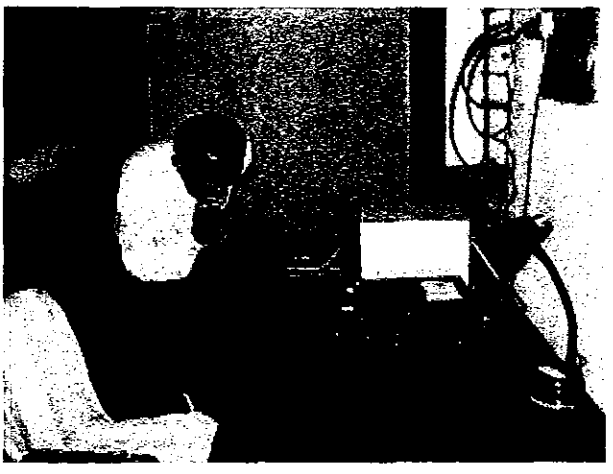
Manual Staff Gauge Production (BWDB), [Jaunary 2003]



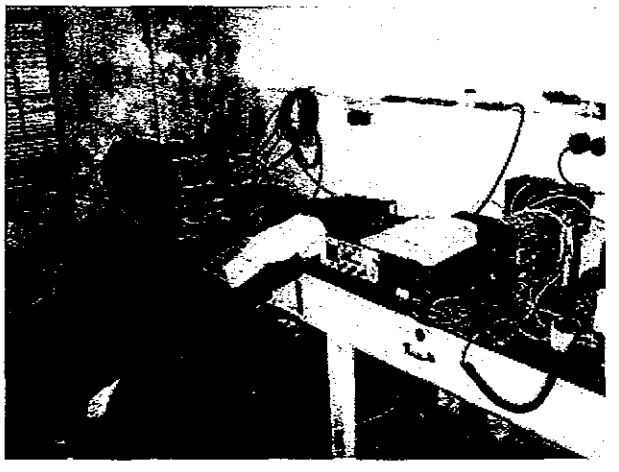
Manual Rainfall Gauge Production (BWDB), [January 2003]

Ballar Manual Water Level Gauging Station, [December 2002]

Sheola Manual Rainfall Gauging Station, [December 2002]



Wireless Communication (Chittagong), [January 2003]

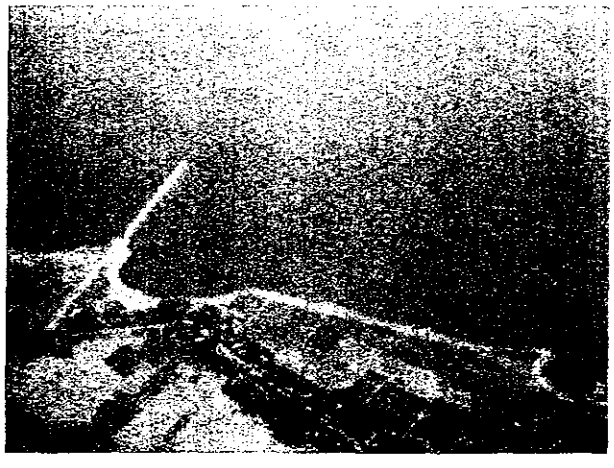


Testing New Equipment (BWDB), [January 2003]

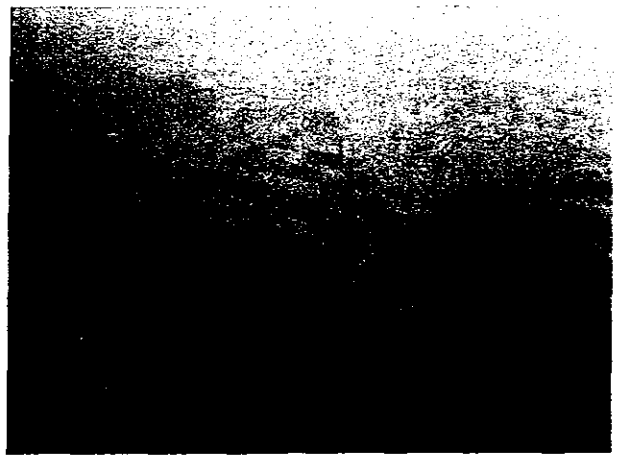
OPERATION OF MANUAL GAUGES AND DATA TRANSMISSION

Around Dhaka,
[January 2003]

Jamuna River around Sirajganj,
[January 2003]



Jamuna River around Sirajganj,
[January 2003]

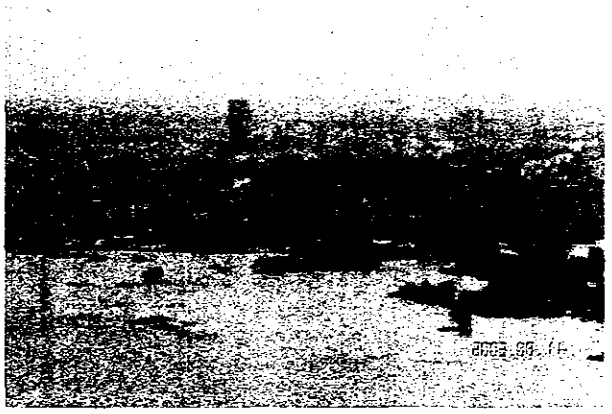


Northeastern Haor Area around
Jalia-Janjail, [January 2003]

Surma River around Sylhet,
[January 2003]

Meghna River around Gazaria,
[January 2003]

AERIAL PHOTO (DRY SEASON)



Around Dhaka,
[August 2003]

Char in Jamuna River,
[August 2003]

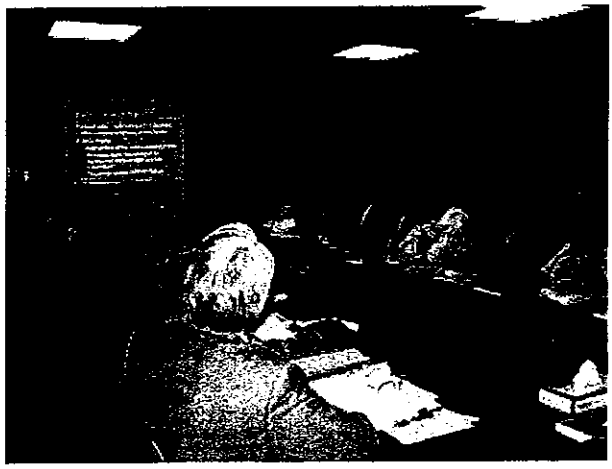
Jamuna River around Ghaibanda,
[August 2003]

Northeastern Haor Area around
Jalia-Janjail, [August 2003]

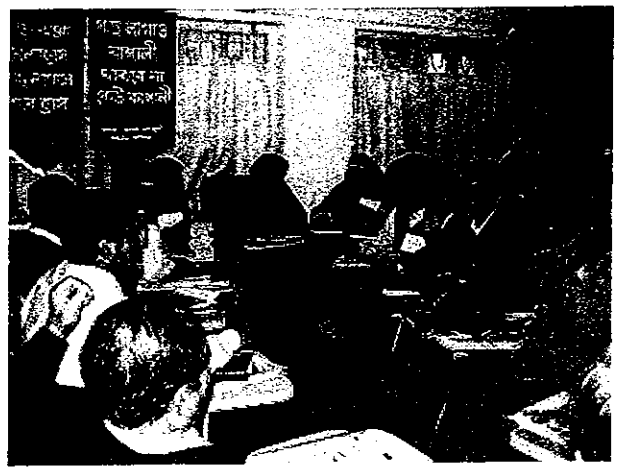
Kushiyara River around Sherpur,
[August 2003]

Meghna River around Bhairab Bazar,
[August 2003]

AERIAL PHOTO (MONSOON SEASON)



First Steering Committee Meeting, [November 2002]



PCM Workshop in Barisal, [January 2003]

Signing of Minutes of Meeting, [March 2003]

Joint Meeting, [August 2003]

First Technology Transfer Seminar/ Workshop, [June 2003]

Second Technology Transfer Seminar/ Workshop, [October 2003]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