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Government of the People's Republic of Bangladesh
Bangladesh Water Development Board
Water Resources Planning Organization

FLOOD ACTION PLAN
NORTHEAST REGIONAL WATER MANAGEMENT PROJECT
(FAP 6)

**KALNI-KUSHIYARA RIVER
MANAGEMENT PROJECT
FEASIBILITY STUDY**

**MAIN REPORT
VOLUME 2 - FIGURES**

**Final Report
March 1998**

**SNC ♦ Lavalin International
Northwest Hydraulic Consultants**

in association with

**Engineering and Planning Consultants Ltd.
Bangladesh Engineering and Technological Services**

Canadian International Development Agency

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v- 3

BN- 267
A- 320(2)



52

COVER PHOTO: A typical village in the deeply flooded area of the Northeast Region. The earthen village platform is created to keep the houses above water during the flood season which lasts for five to seven months of the year. The platform is threatened by erosion from wave action; bamboo fencing is used as bank protection but often proves ineffective. The single *hijal* tree in front of the village is all that remains of the past lowland forest. The houses on the platform are squeezed together leaving no space for courtyards, gardens or livestock. Water surrounding the platform is used as a source of drinking water and for waste disposal by the hanging latrines. Life in these crowded villages can become very stressful especially for the women, because of the isolation during the flood season. The only form of transport from the village is by small country boats seen in the picture. The Northeast Regional Water Management Plan aims to improve the quality of life for these people.

FLOOD ACTION PLAN

NORTHEAST REGIONAL WATER MANAGEMENT PROJECT (FAP 6)

KALNI-KUSHIYARA RIVER MANAGEMENT PROJECT FEASIBILITY STUDY

MAIN REPORT VOLUME 2 - FIGURES

Final Report
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A-135A

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Bangladesh Engineering and Technological Services

Canadian International Development Agency

(i)

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Figure 1.1

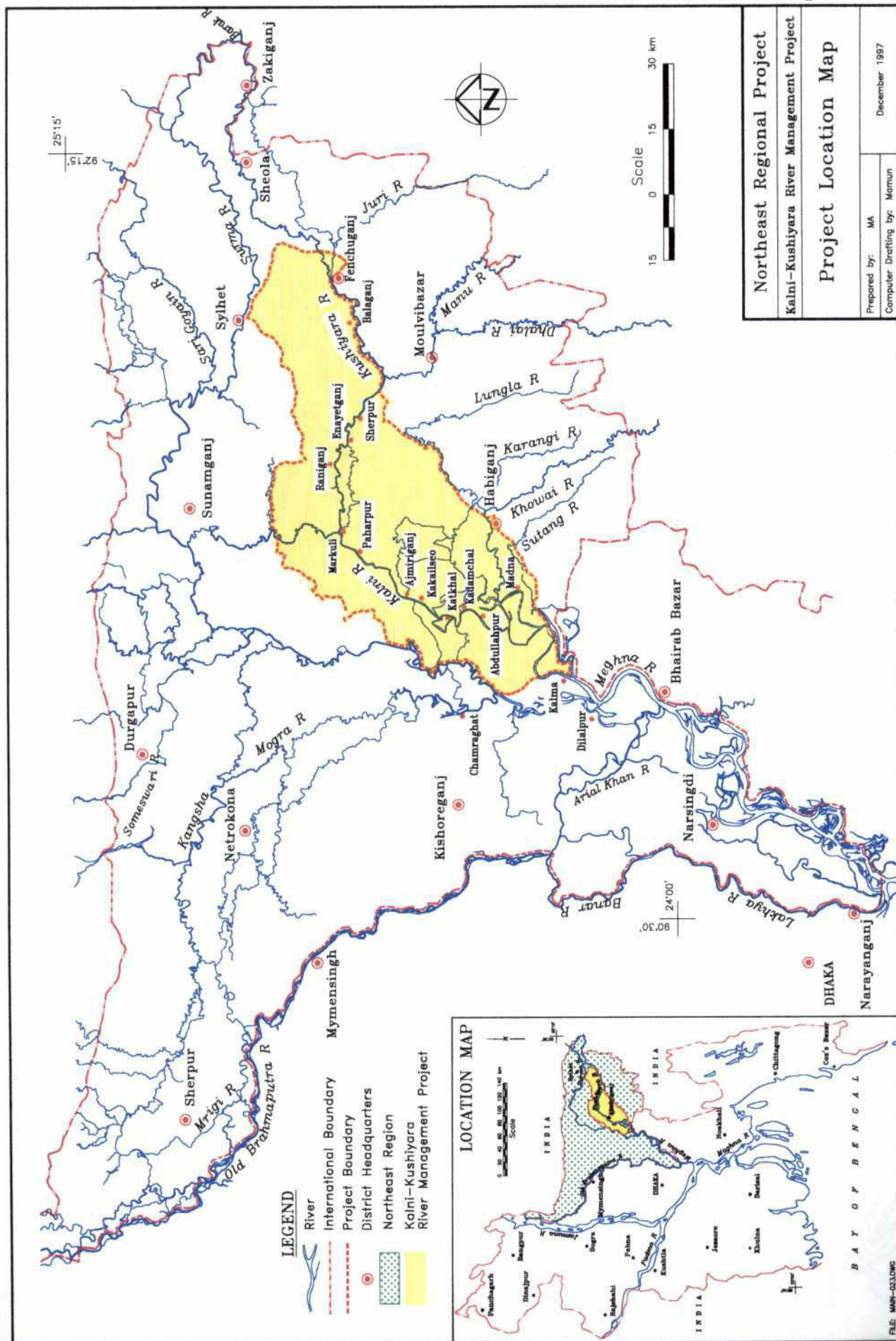


Figure 1.2

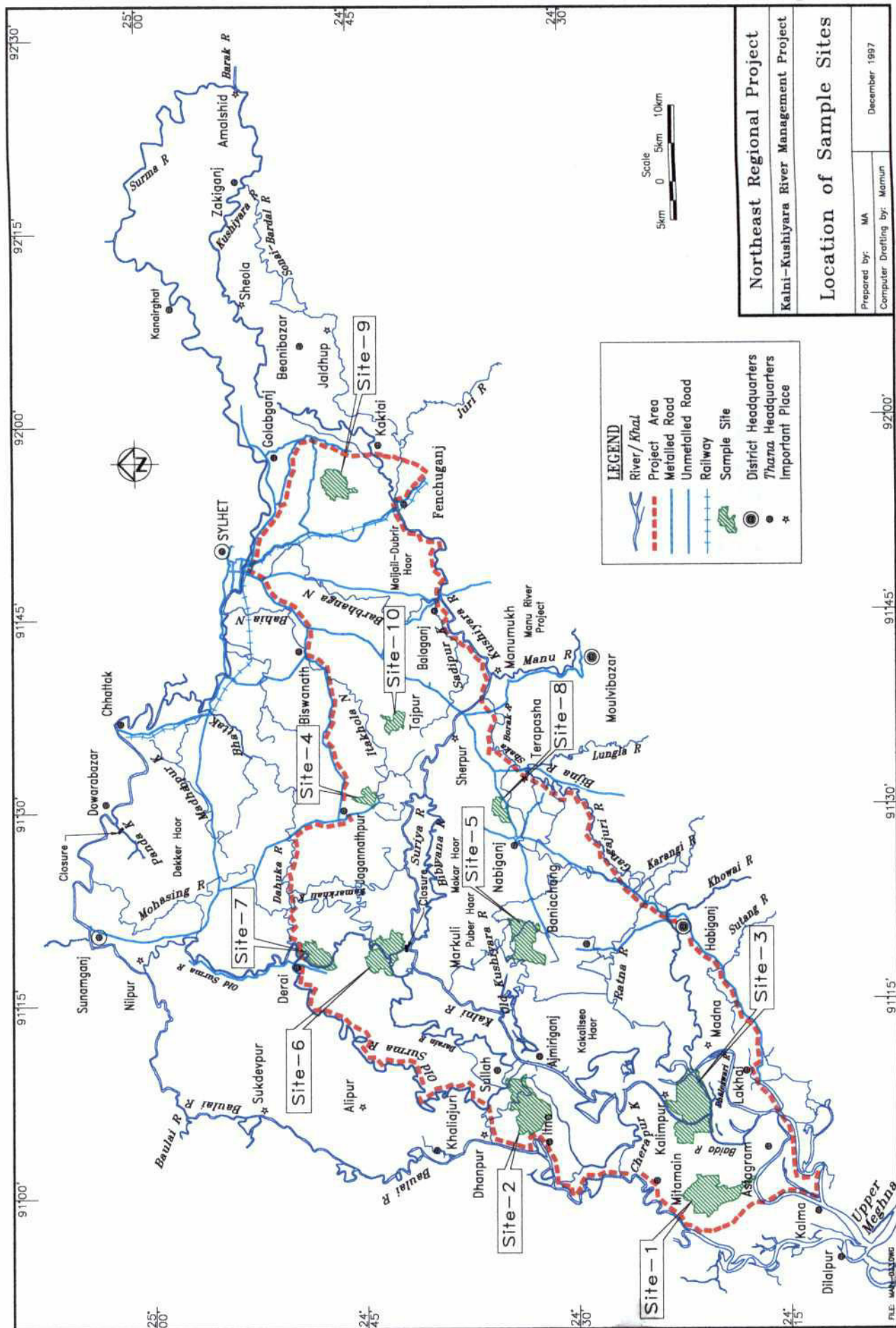


Figure 2.1

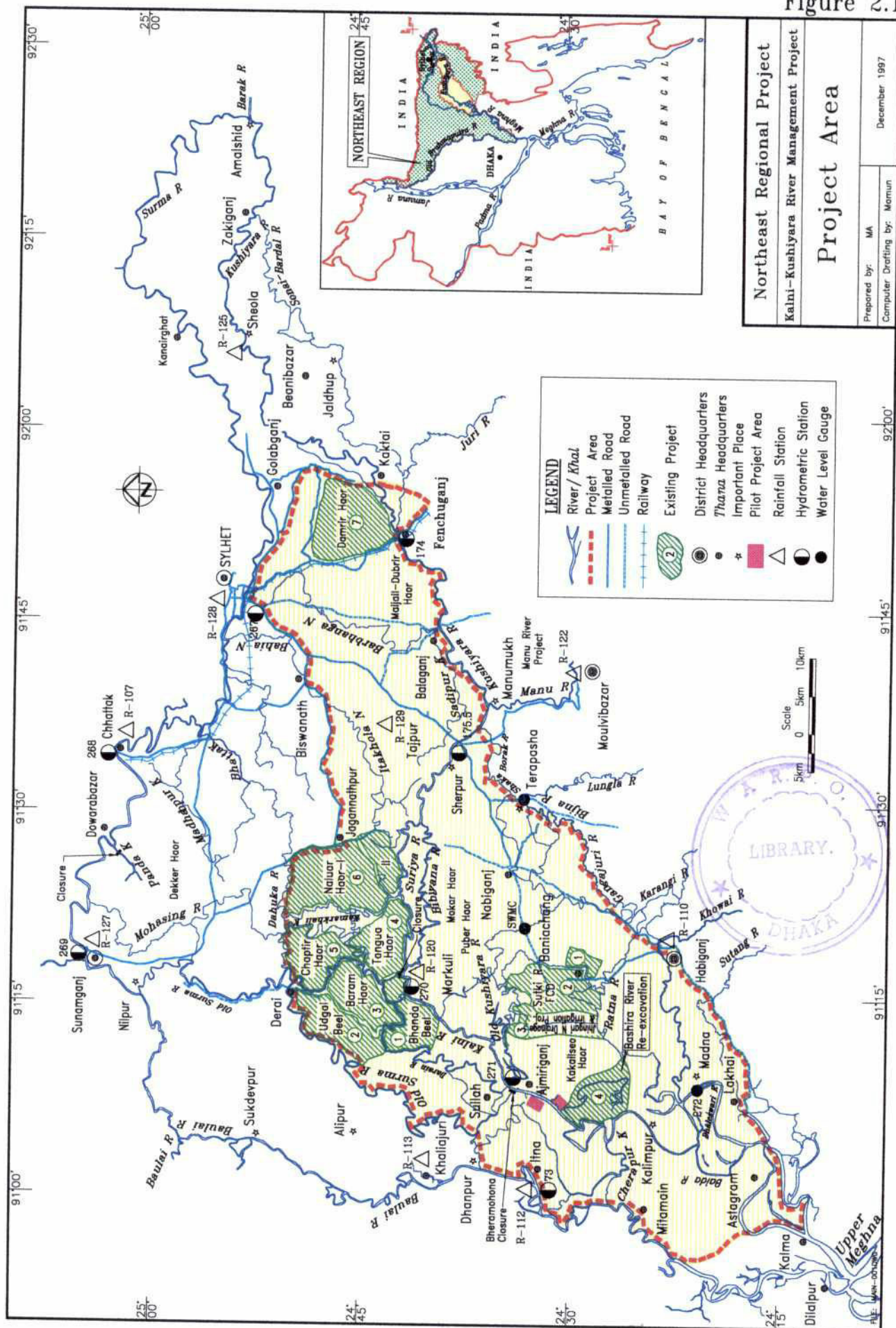
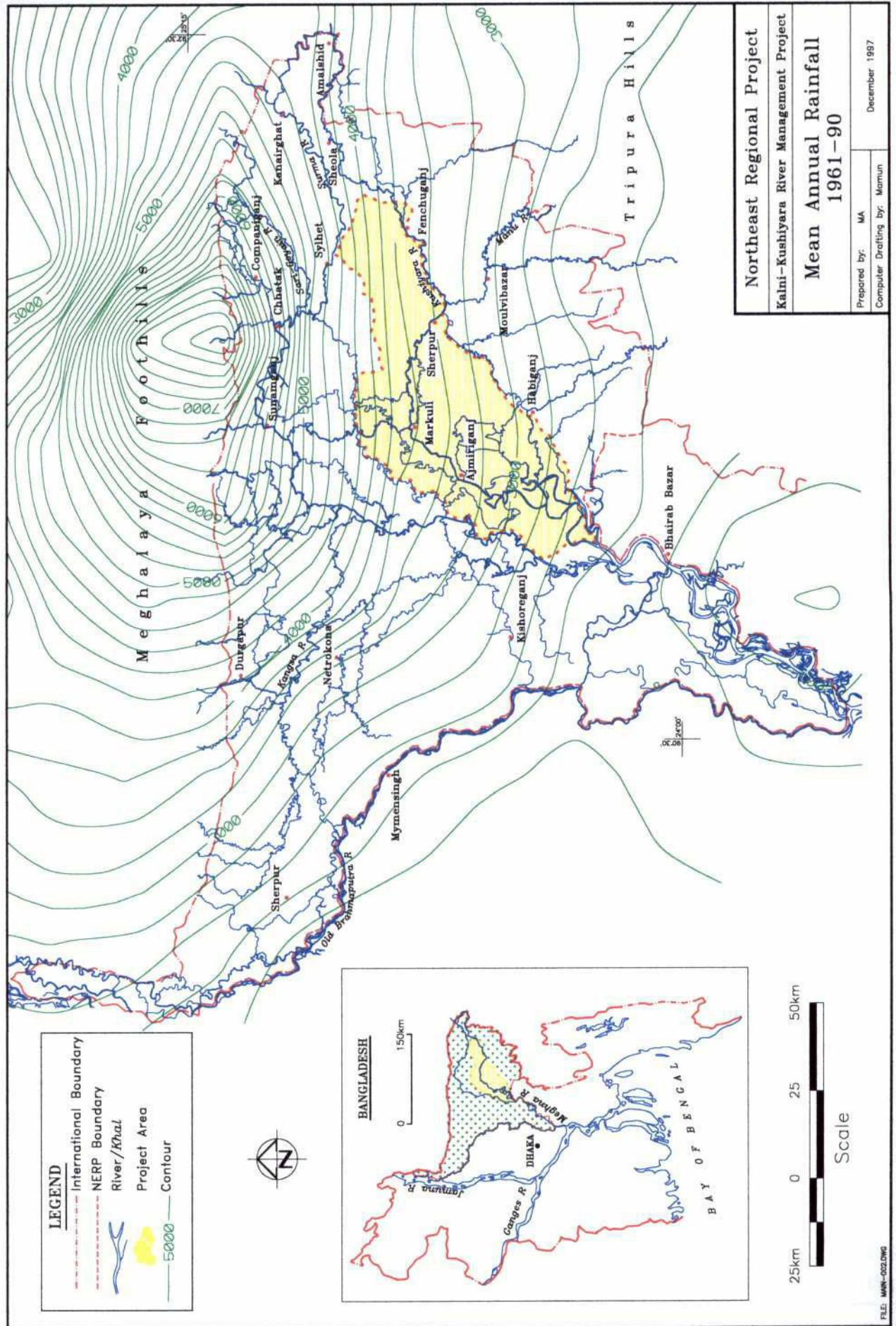
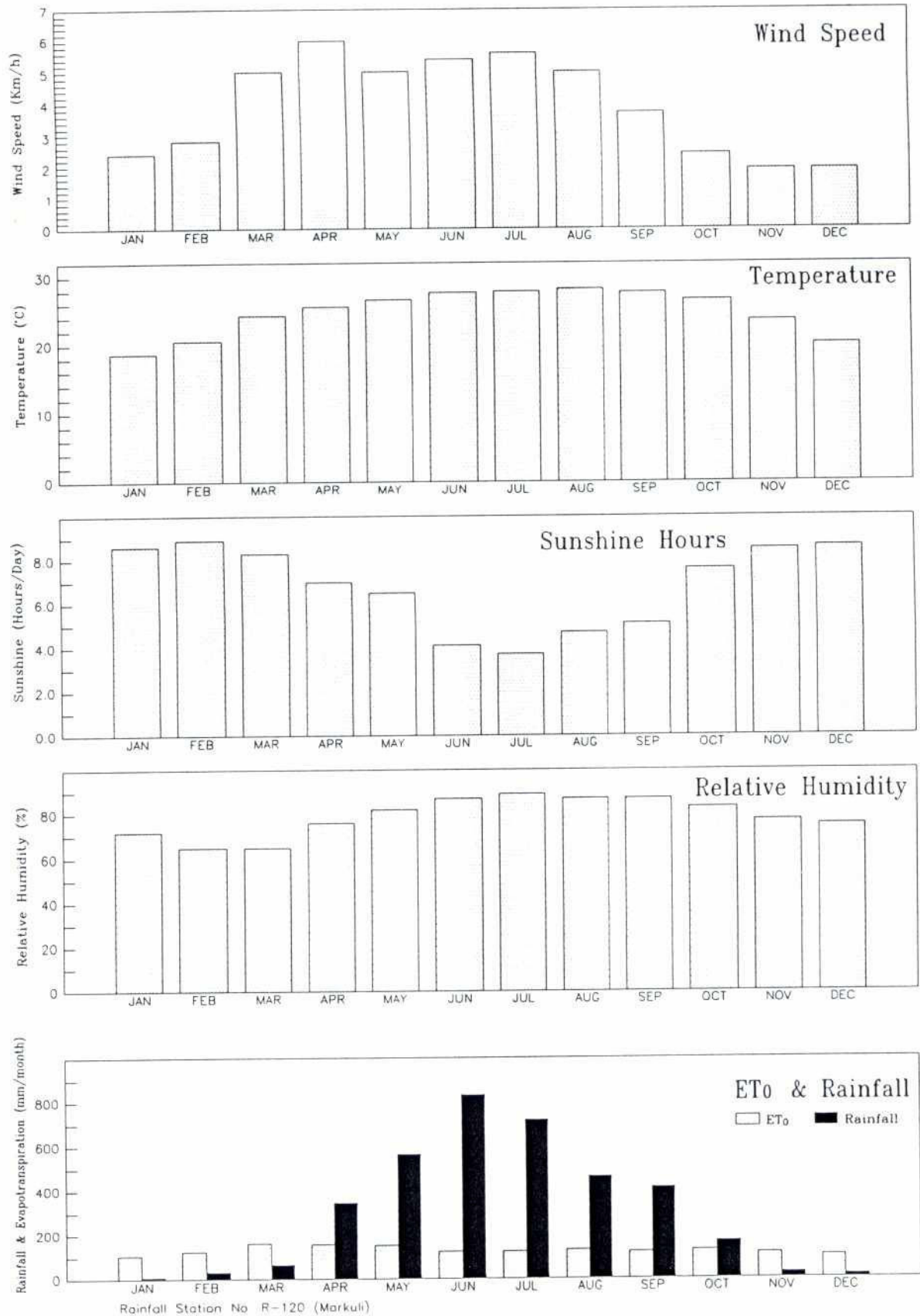


Figure 2.2





Kalni-Kushiyara River Management Project

Climatic Conditions
at Sylhet

Figure 2.4(a)

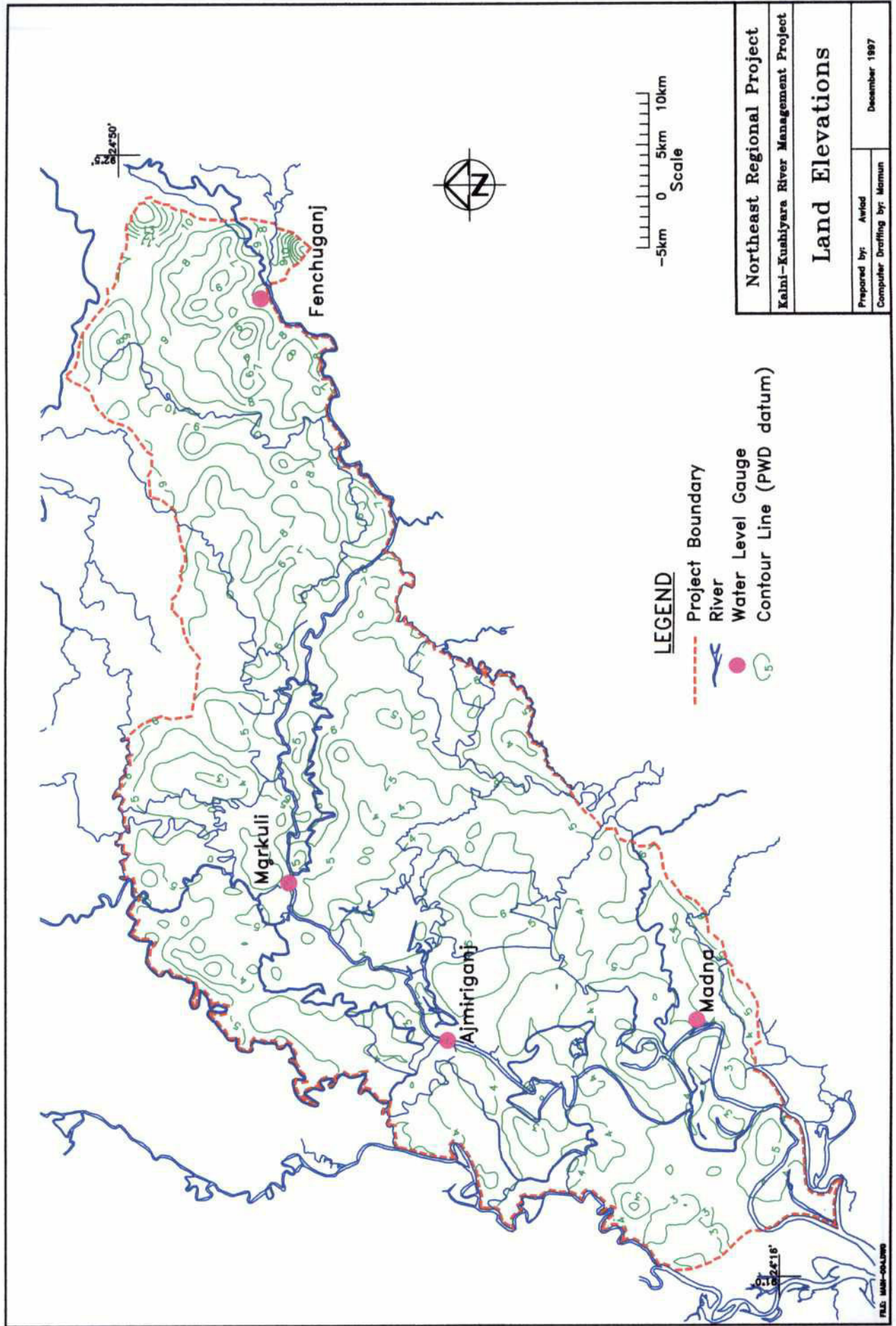
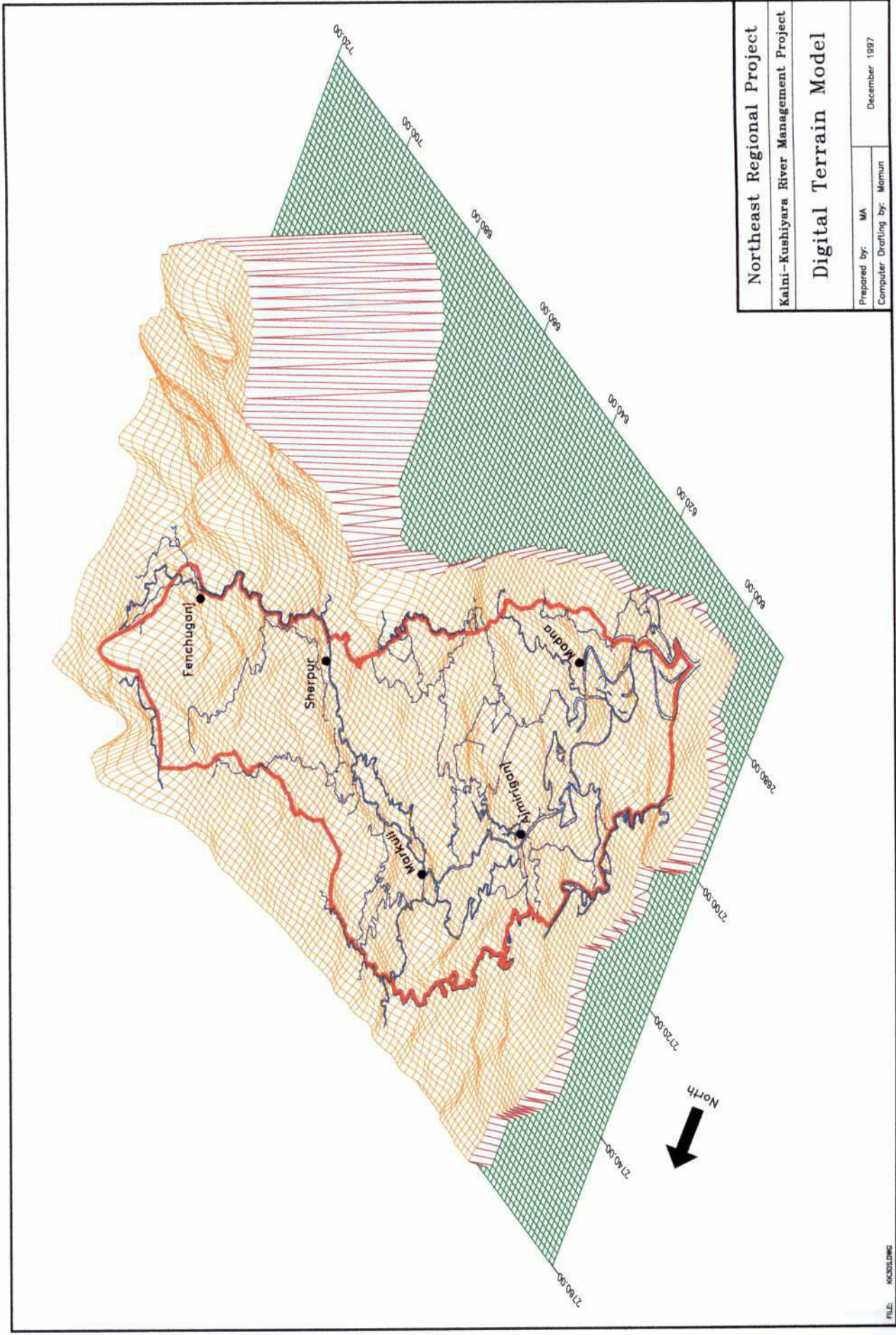
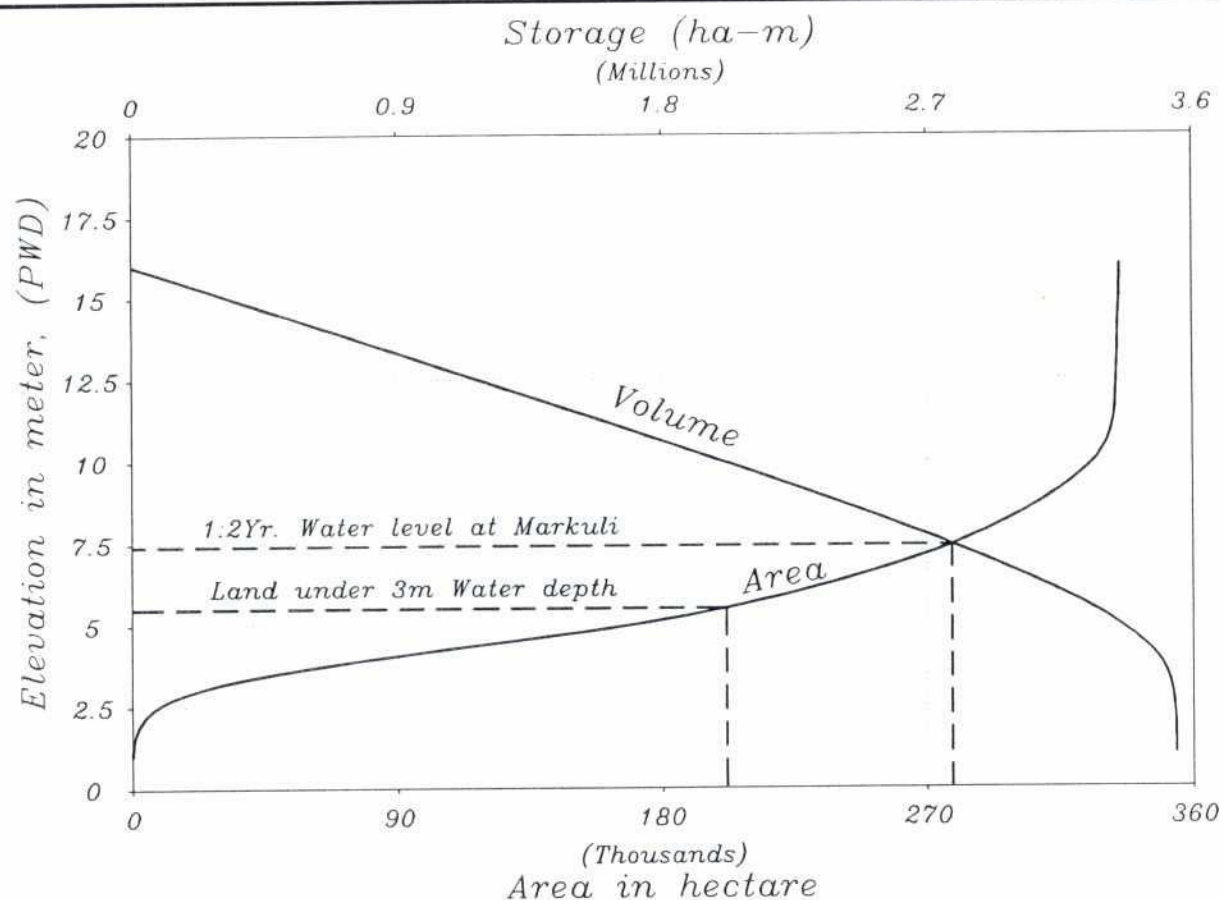


Figure 2.4(b)





EL(m, PWD)	Area(ha)	Storage(ha-m)
1	0	0
2	202	101
3	8592	4498
4	80836	49212
5	178400	178830
6	228206	382133
7	267297	629885
8	294841	910954
9	314096	1215422
10	328297	1536619
11	333301	1867418
12	334033	2201085
13	334438	2535320
14	334791	2869935
15	335297	3204979
16	335600	3540427

Northeast Regional Project

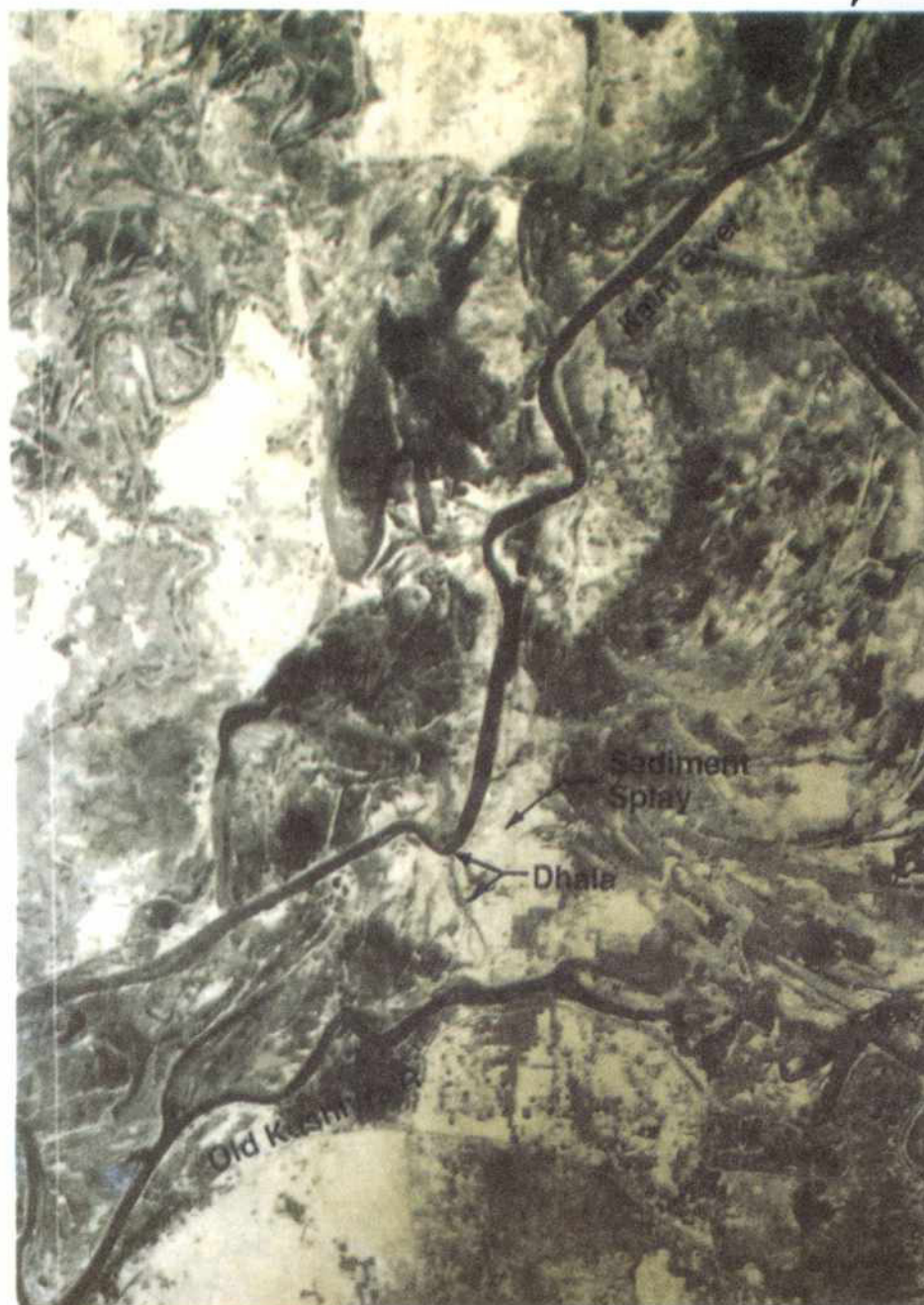
Kalni-Kushiyara River Management Project

Elevation-Area-Storage

Prepared by Tarek

Computer Drafting by Tarek

December 1997



Scale



FILE: FIG2-6.DWG

Northeast Regional Project

Kalni-Kushiyara River Management Project

Overbank Sedimentation
at Koyer Dhala

Prepared by: D.G.M.

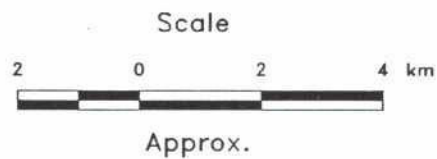
Computer Drafting by: Mamun

December 1997



Note abandoned Bibiyana R

Manu R.



SPOT image 78P10

Northeast Regional Project

Kalni-Kushiya River Management Project

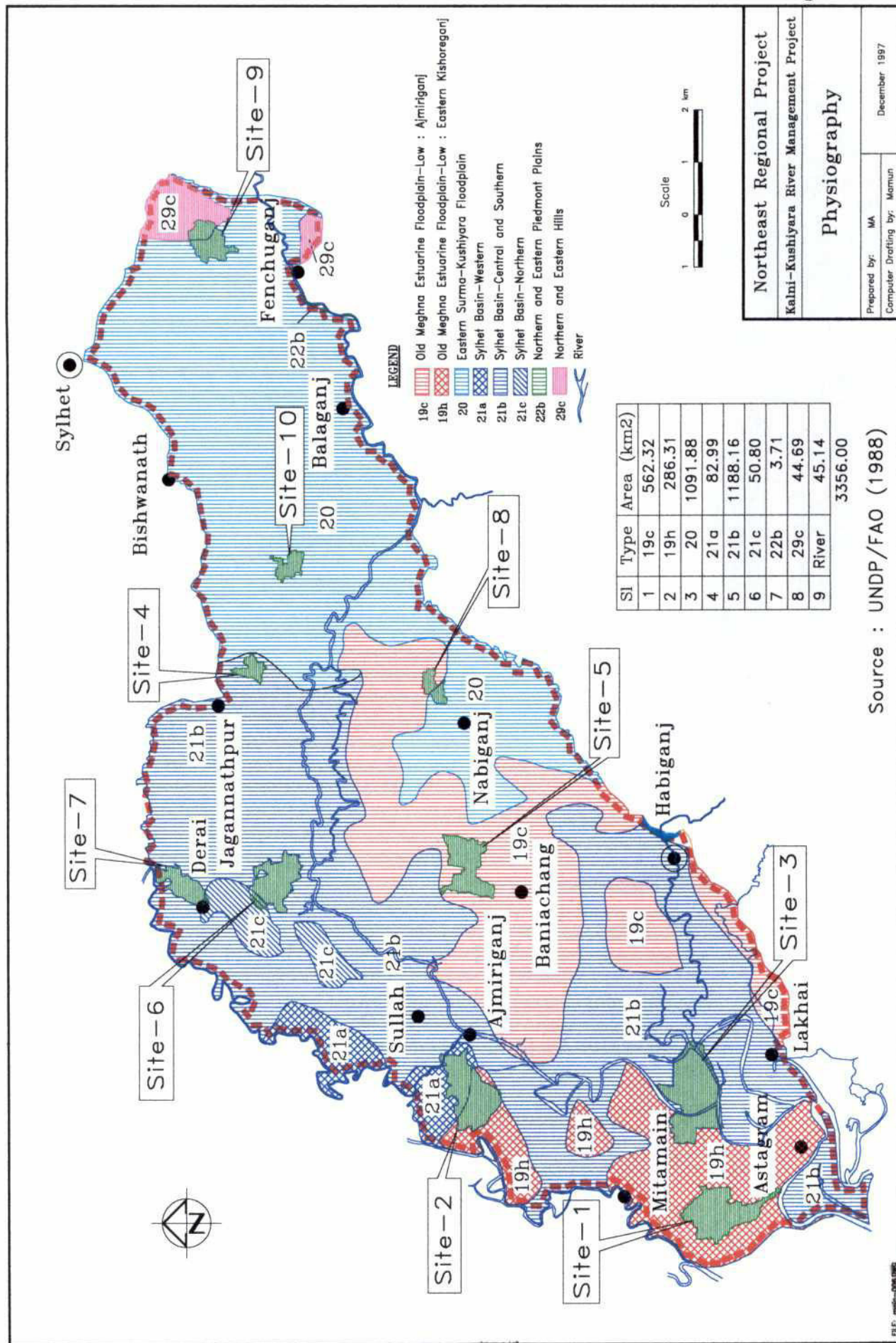
Kushiya River
Near Sherpur

Prepared by: D.G.M.

Computer Drafting by: Mamun

December 1997

Figure 2.8



Northeast Regional Project

Kalini-Kushiyara River Management Project

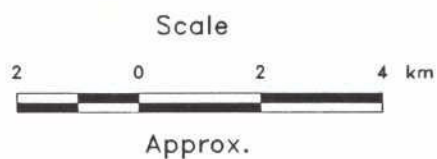
Physiography

Prepared by: MA
Computer Drafting by: Mamun

December 1997



Note Loop cuts and abandoned Bibiyana R



SPOT image 78P10

Northeast Regional Project

Kalni-Kushiya River Management Project

Kalni River Near Markuli

Prepared by: D.G.M.

Computer Drafting by: Mamun

December 1997

Figure 2.10

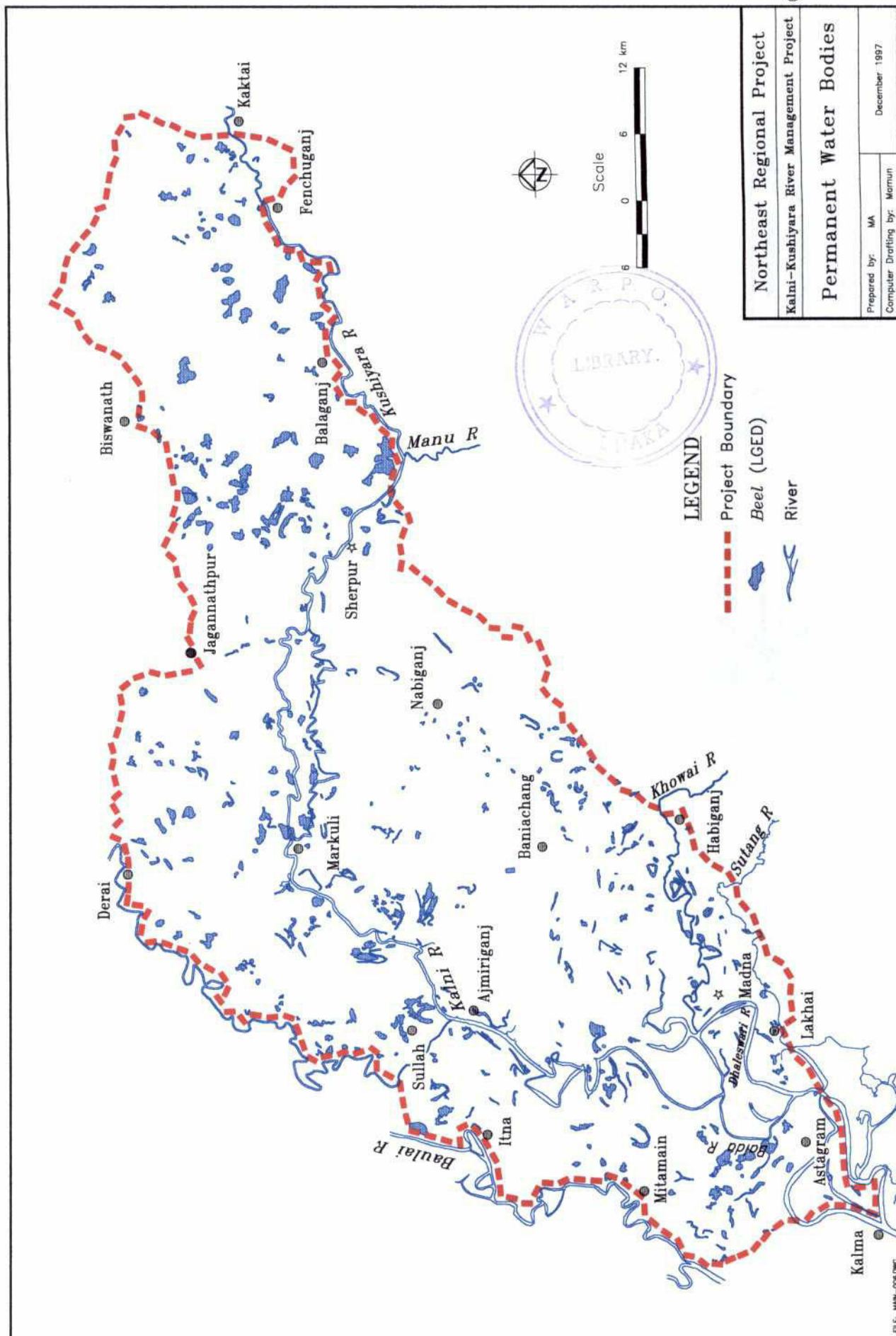
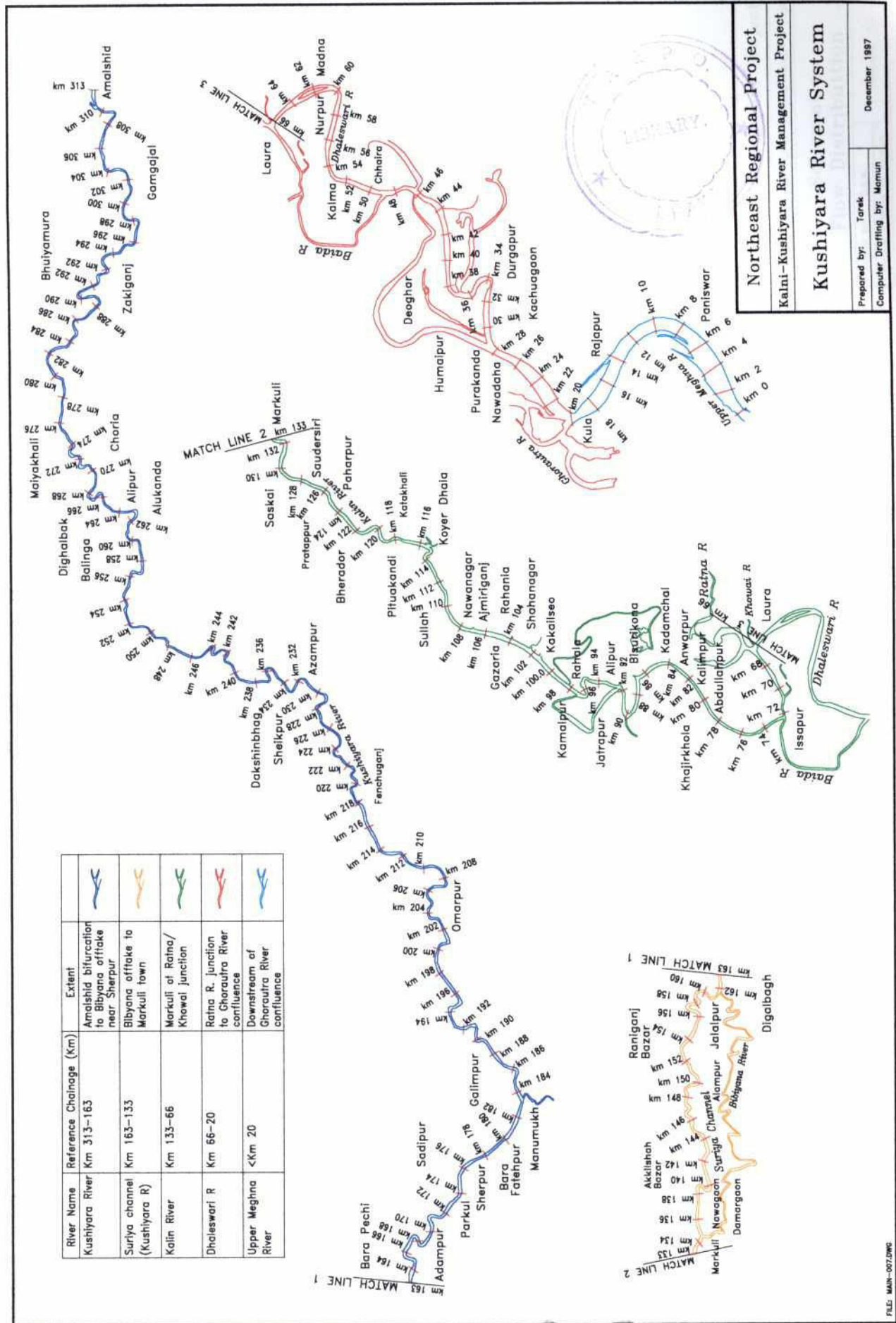
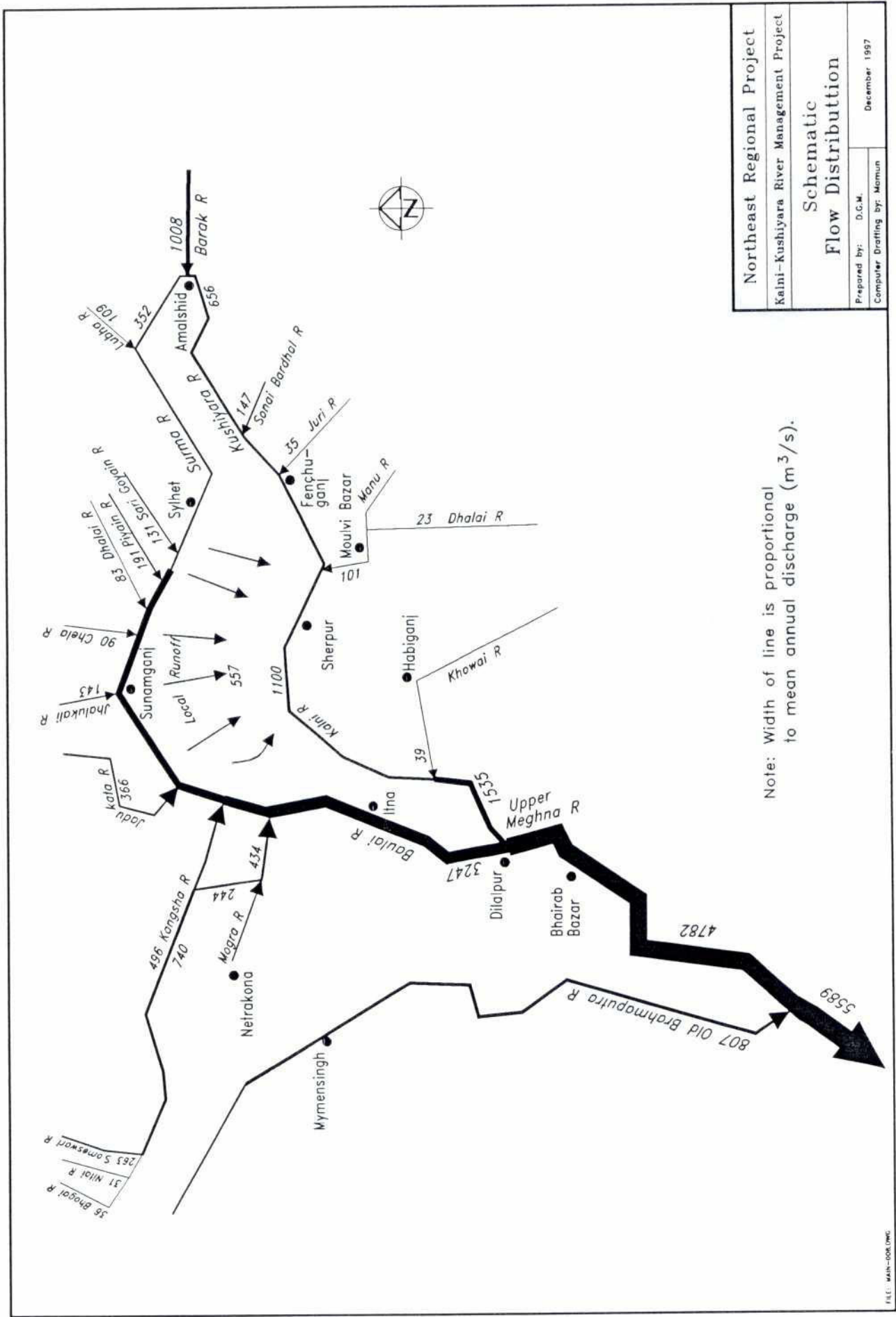
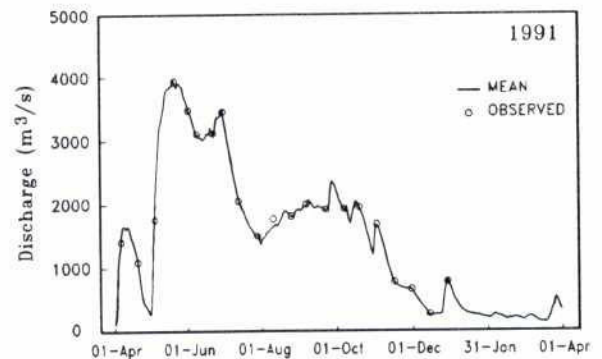
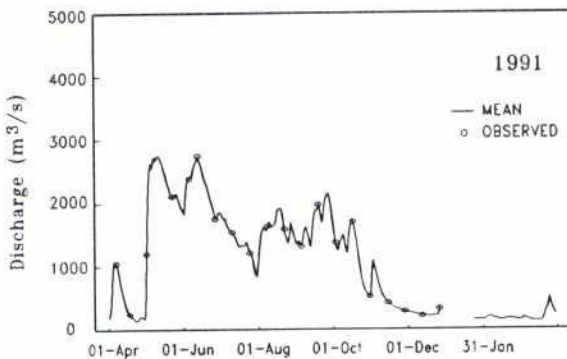
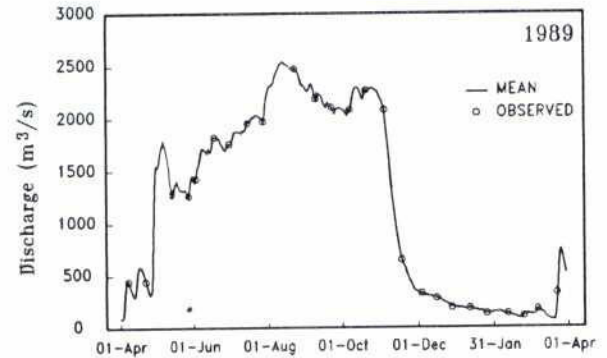
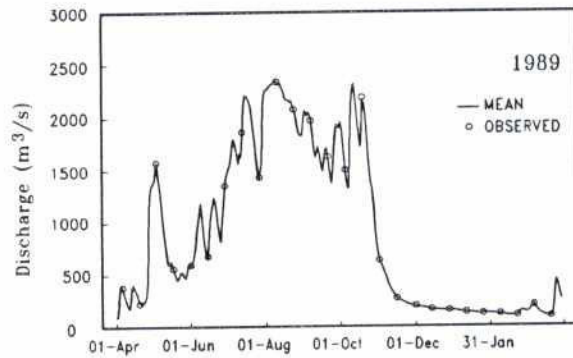
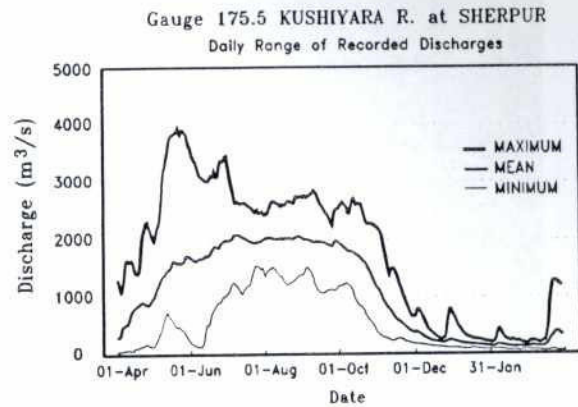
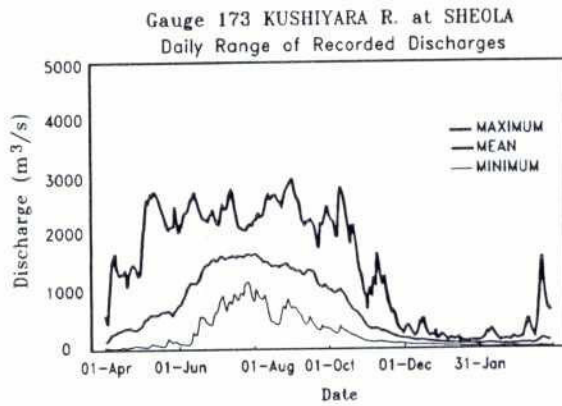


Figure 2.11





Northeast Regional Project	
Kalni-Kushiyara River Management Project	
Schematic Flow Distribution	
Prepared by: D.G.M.	December 1997
Computer Drafting by: Mamun	



Northeast Regional Project

Kalni-Kushiyara River Management Project

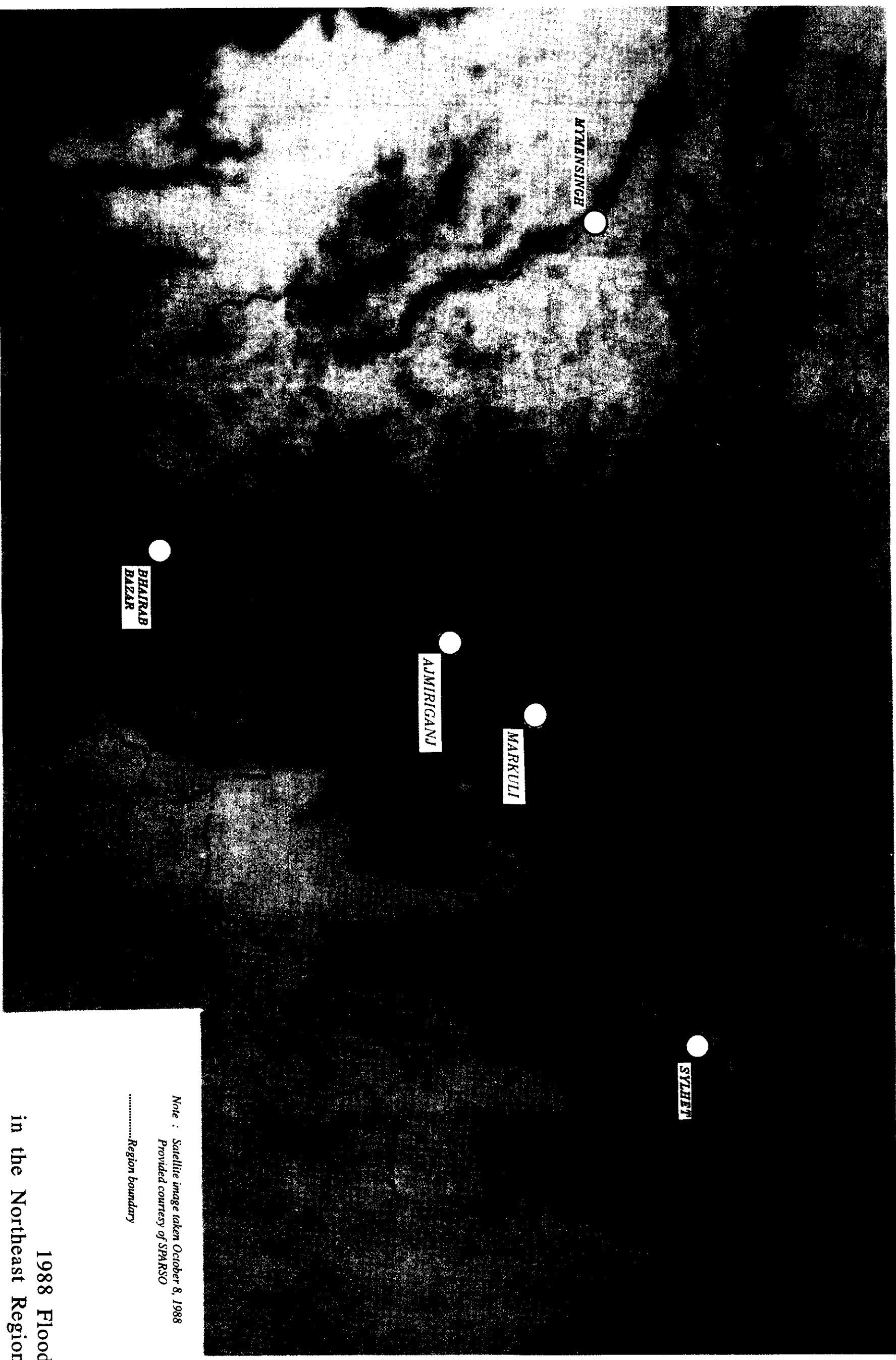
Discharge Hydrographs on Kushiyara River

Prepared by: Nahid

Computer Drafting by: Mamun

December 1997

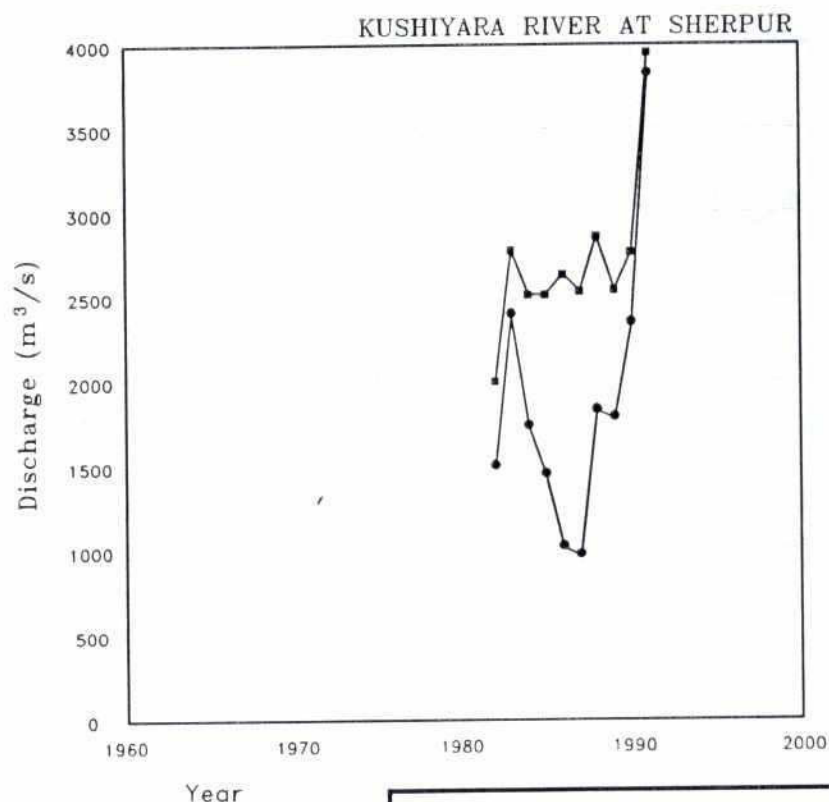
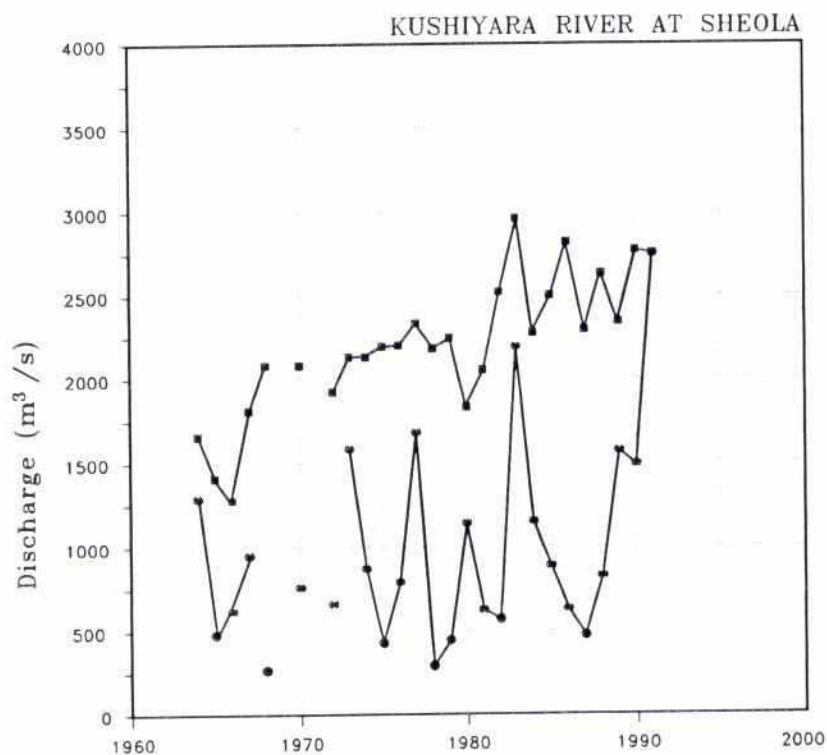
Figure 2.14



Note : Satellite image taken October 8, 1988
Provided courtesy of SIP/RSO

.....Region boundary

1988 Flood
in the Northeast Region

**LEGEND**

- Annual Maximum
- Maximum in Pre-monsoon

Note:

Pre-monsoon season is period
from March 1 - May 15

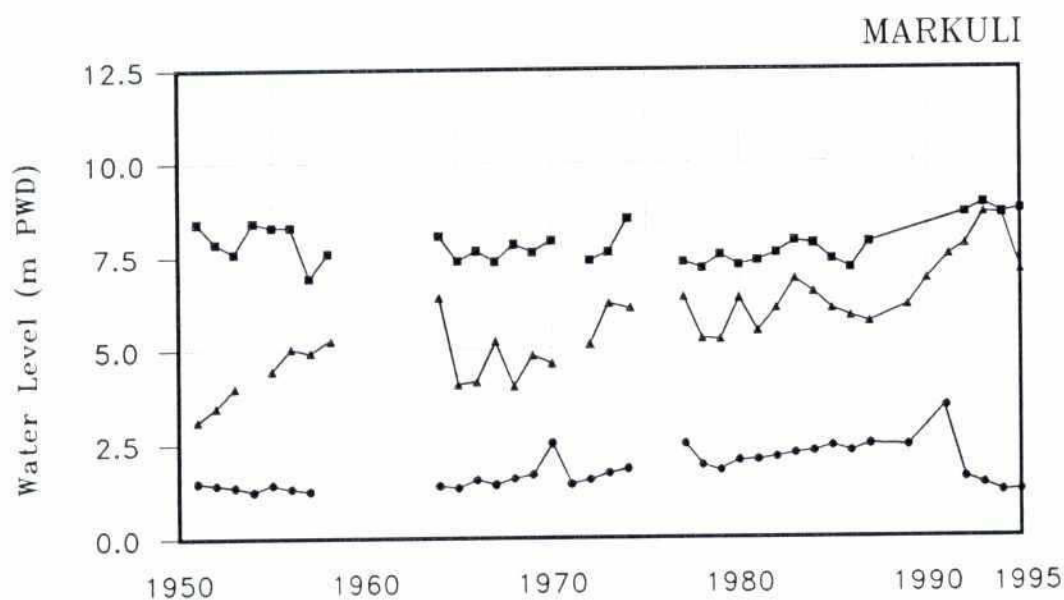
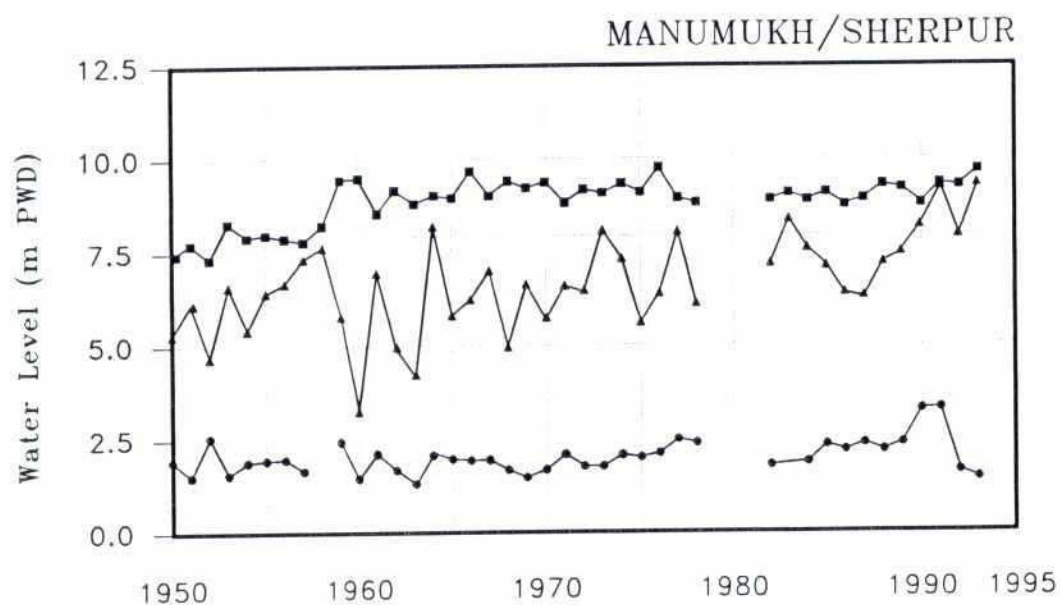
FILE: MAIN-010.DWG

Northeast Regional Project**Kalni-Kushiya River Management Project****Maximum Daily Discharges
Kushiya River**

Prepared by: D.G.M.

Computer Drafting by: Mamun

December 1997



LEGEND

- Annual Maximum
- ▲ Pre-Monsoon
- Minimum

Northeast Regional Project

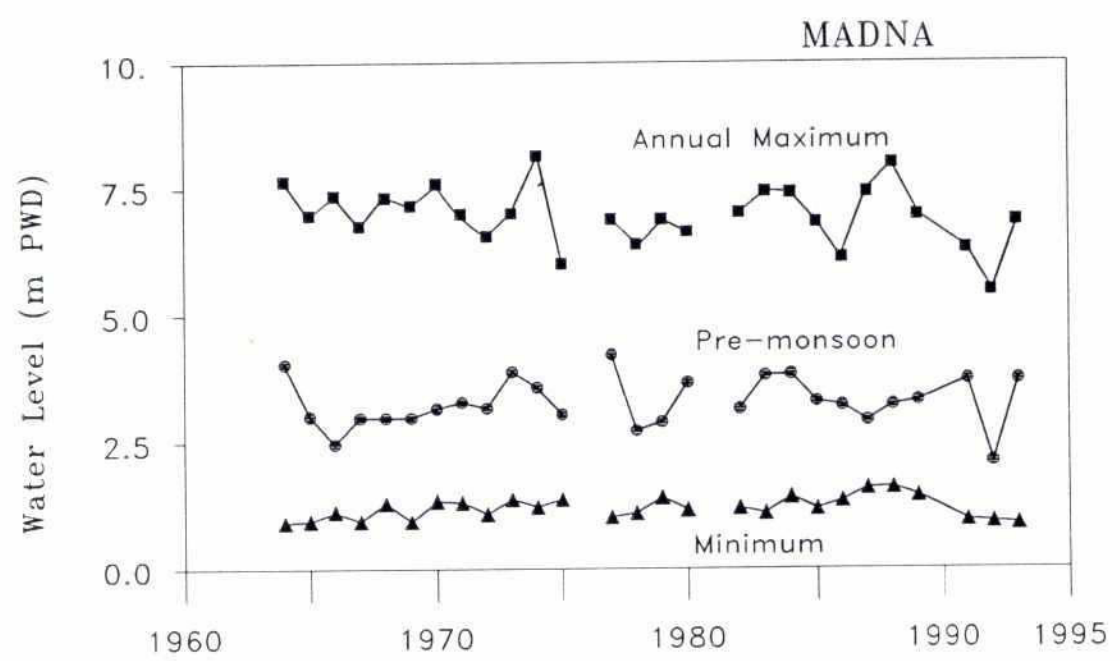
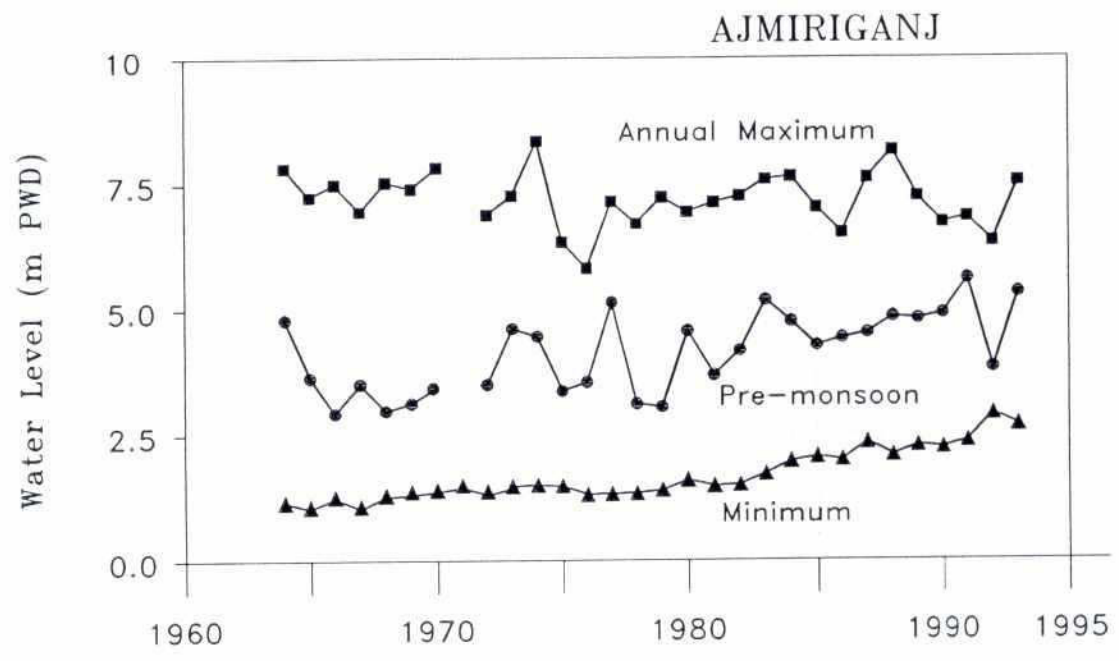
Kalni-Kushiyara River Management Project

Annual Water Levels
Kushiyara River

Prepared by: D.G.M.

Computer Drafting by: Mamun

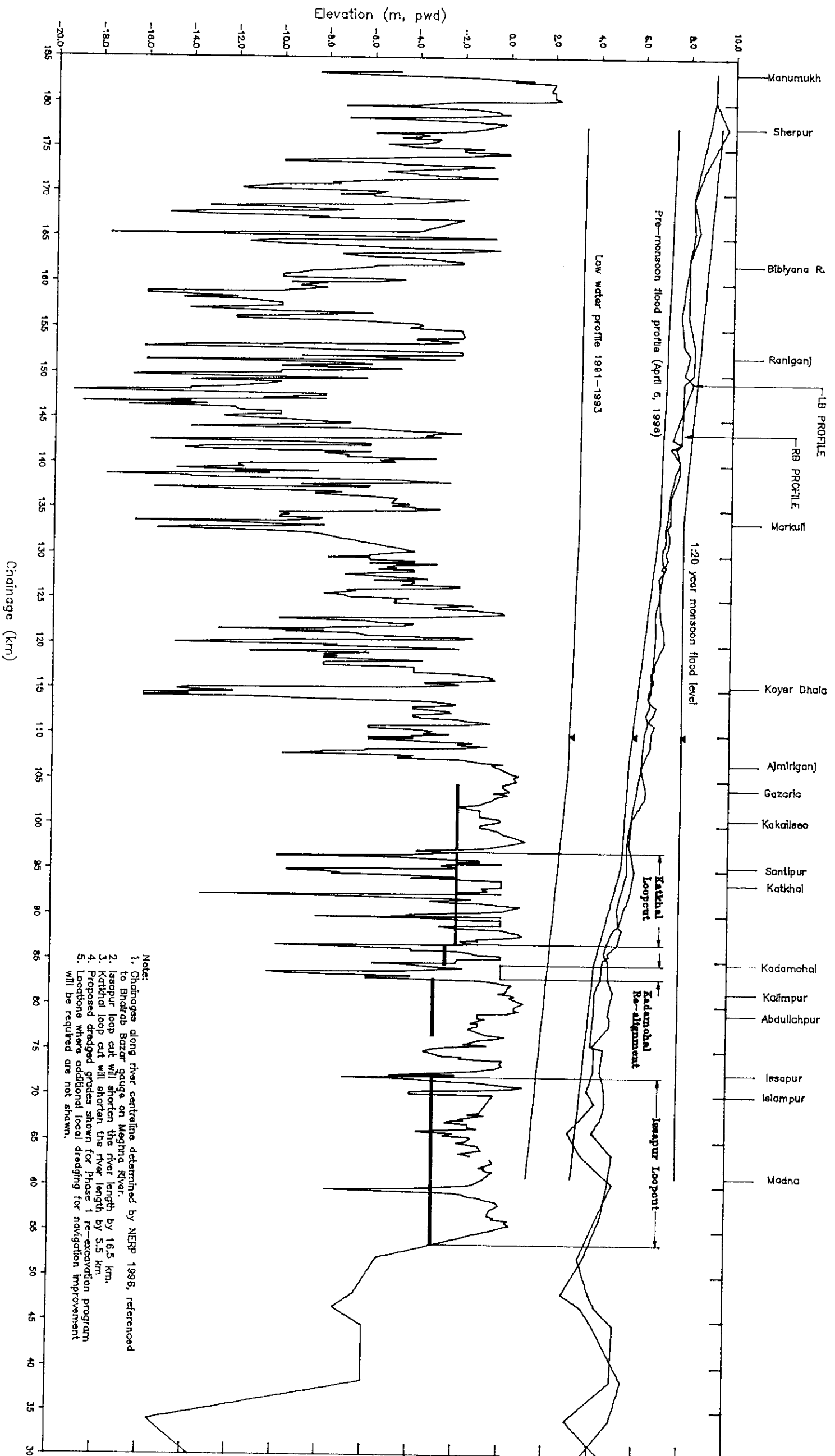
December 1997



- LEGEND**
- Annual Maximum
 - Pre-monsoon
 - ▲ Minimum

Northeast Regional Project	
Kalni-Kushiyara River Management Project	
Annual Water Levels Kalni River	
Prepared by: D.G.M.	December 1997
Computer Drafting by: Mamun	

27
Figure 2.18

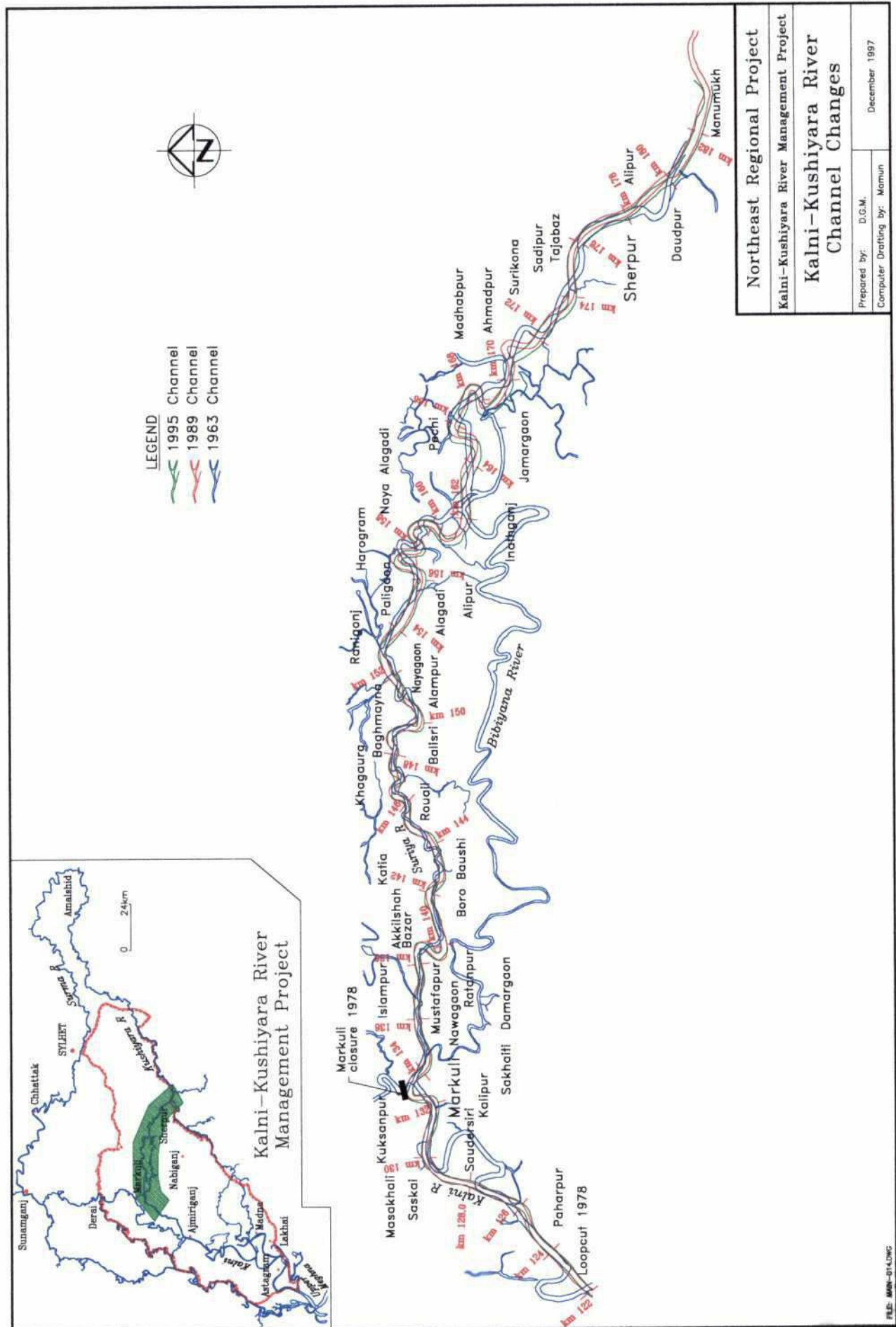


Note:
1. Chainages along river centreline determined by NERP 1986, referenced to Bhadrab Bazar gauge on Meghna River.
2. Isapur loop cut will shorten the river length by 16.5 km.
3. Katkhal loop cut will shorten the river length by 5.5 km.
4. Proposed dredged grades shown for Phase 1 re-excavation program
5. Locations where additional local dredging for navigation improvement will be required are not shown.

Northeast Regional Project
Kalni-Kushiyara River Management Project
Longitudinal Profile of
Kalni-Kushiyara River

Prepared by: D.G.M.
Computer Drafting by: Jaiid
December 1997

Figure 2.19(a)



28
Figure 2.19(b)

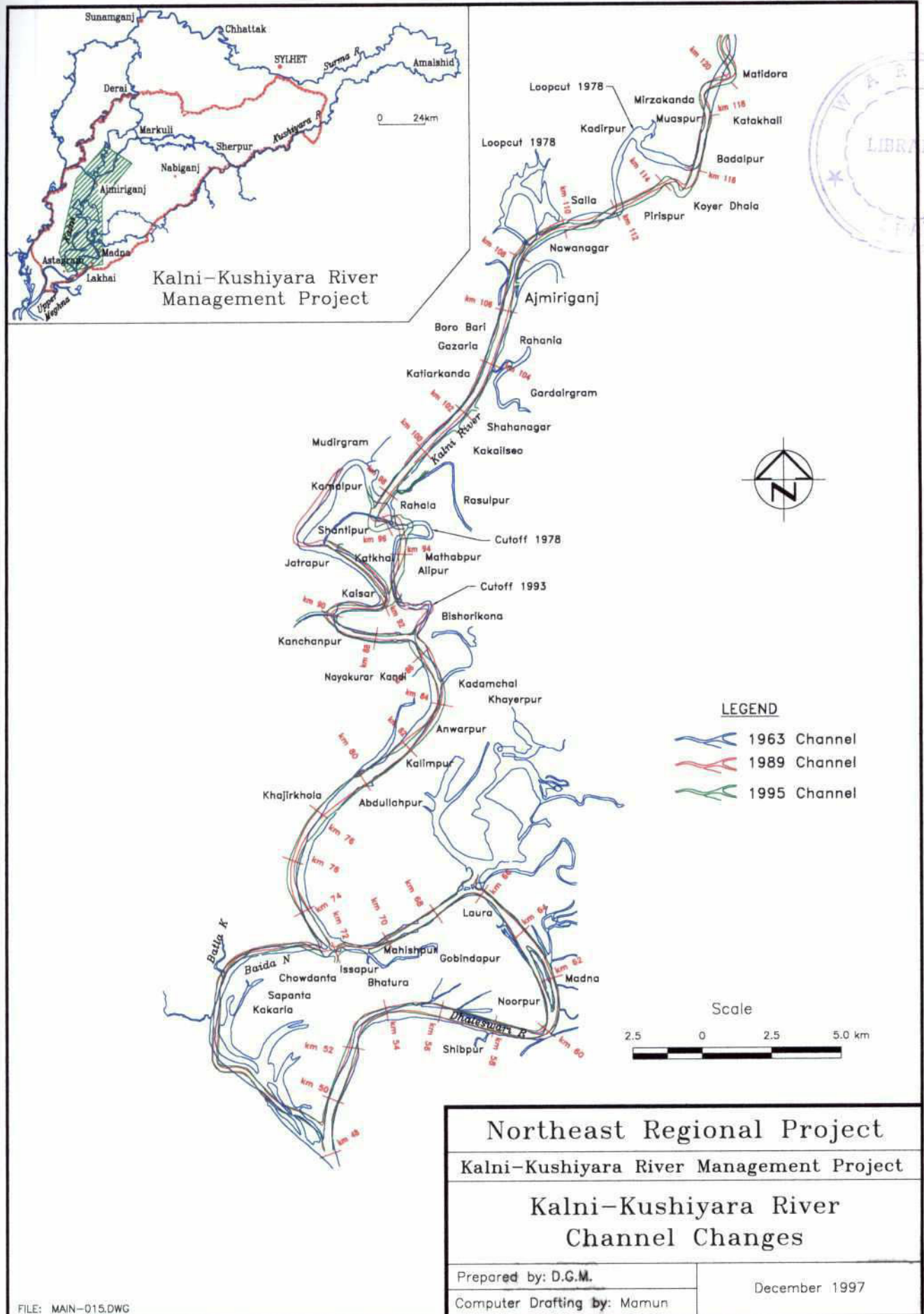


Figure 2.20

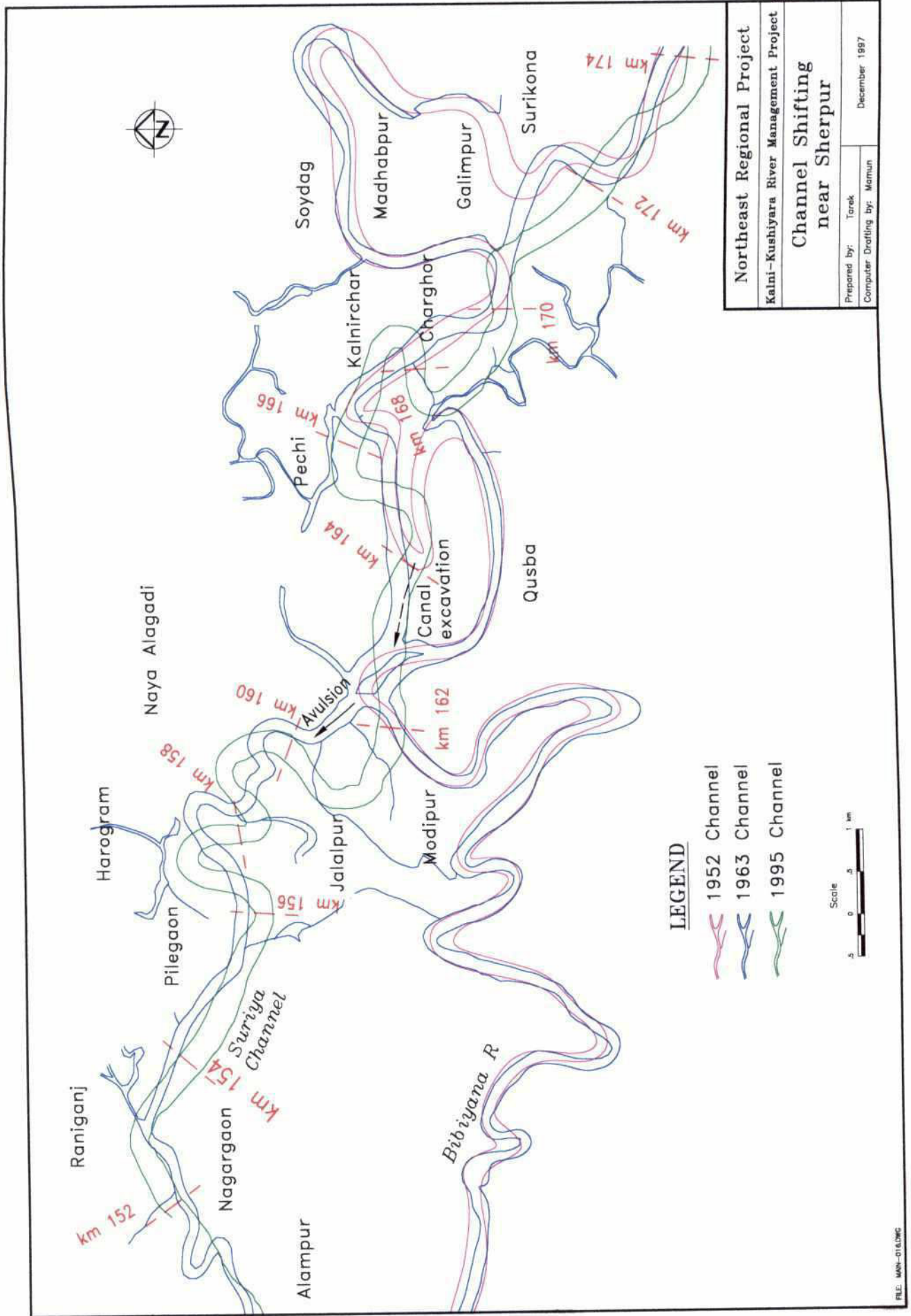
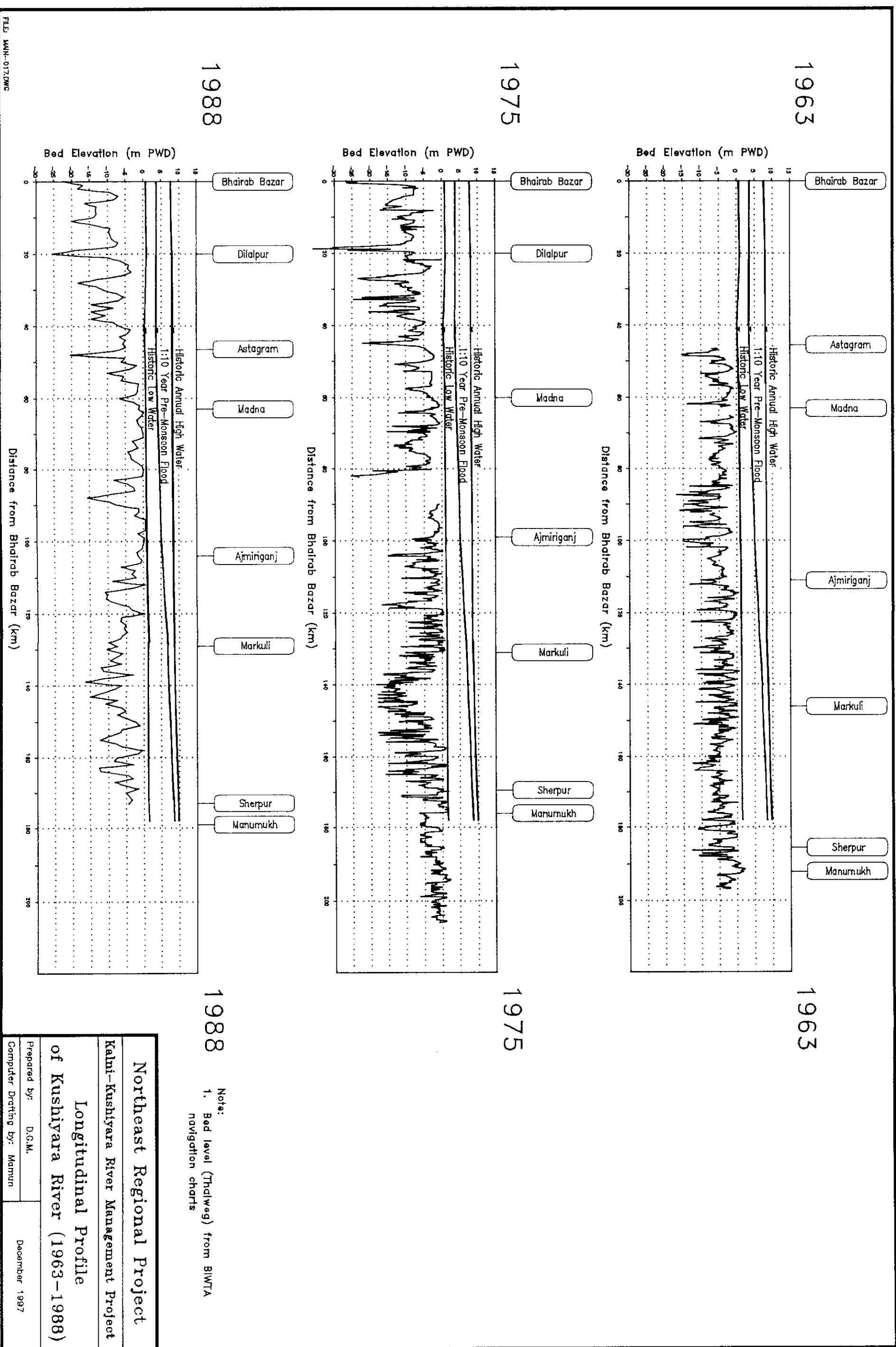


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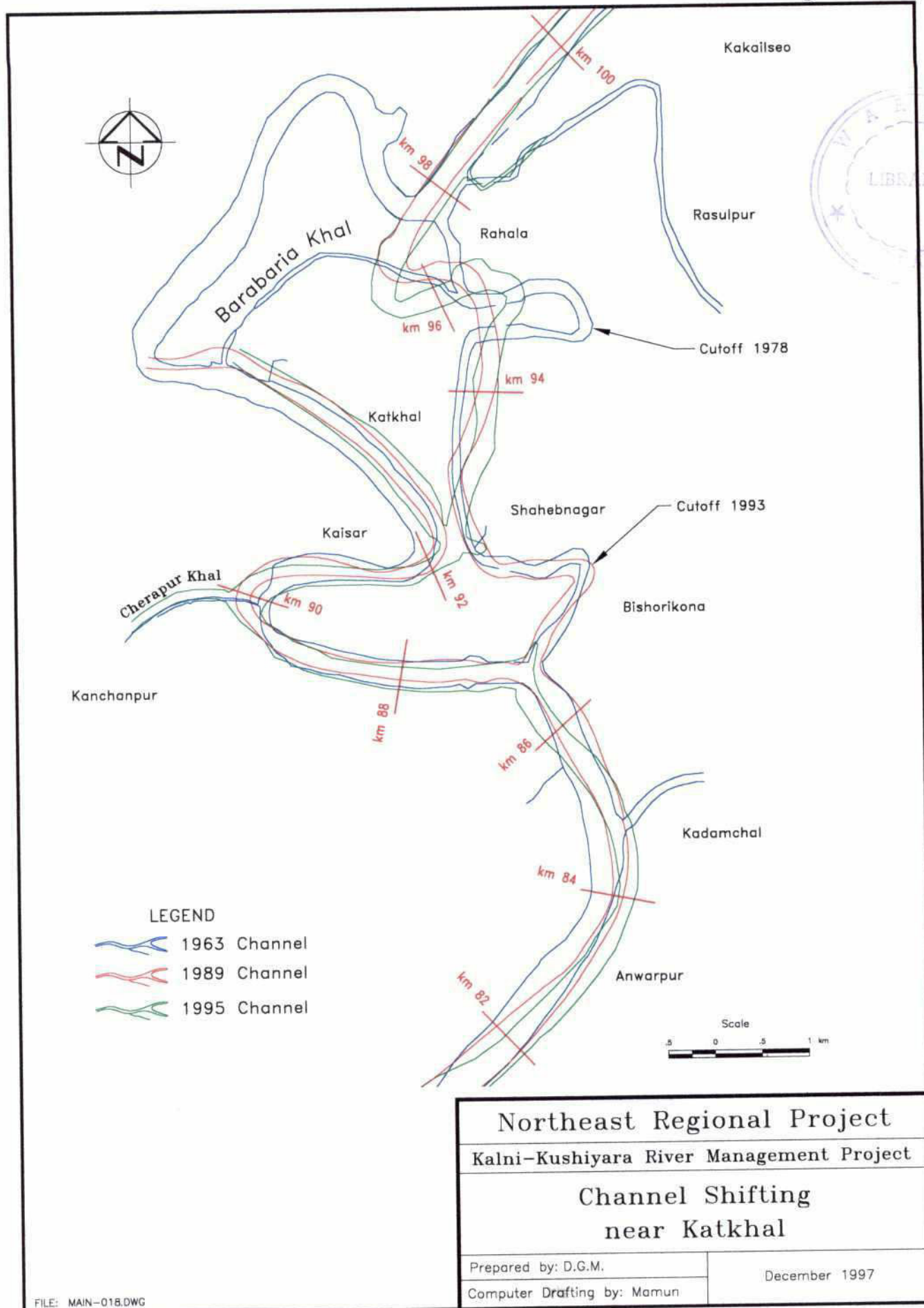


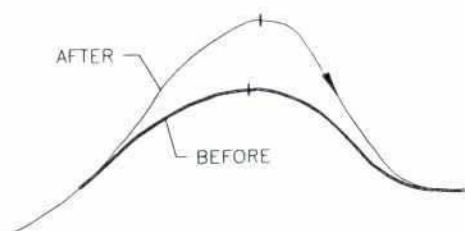
Note:
1. Bed level (Thalweg) from BIWTA
navigation charts

Northeast Regional Project
Kalmi-Kushiyara River Management Project

Longitudinal Profile
of Kushiyara River (1963-1988)

Prepared by: D.G.M.
Computer Drafting by: Mamun
December 1997

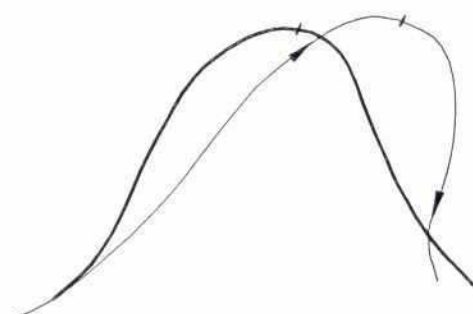




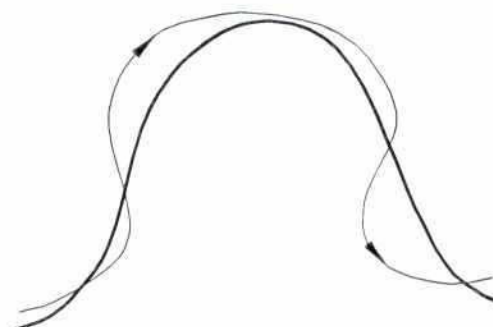
A-EXTENSION



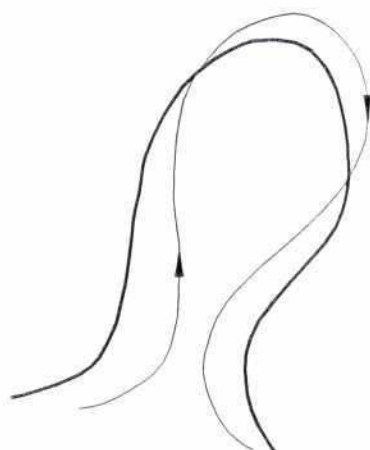
B-TRANSLATION



C-ROTATION



D-CONVERSION TO A
COMPOUND MEANDER



E-NECK CUTOFF



F-CHUTE CUTOFFS
(FROM BRICE, 1974)

Northeast Regional Project

Kalni-Kushiyara River Management Project

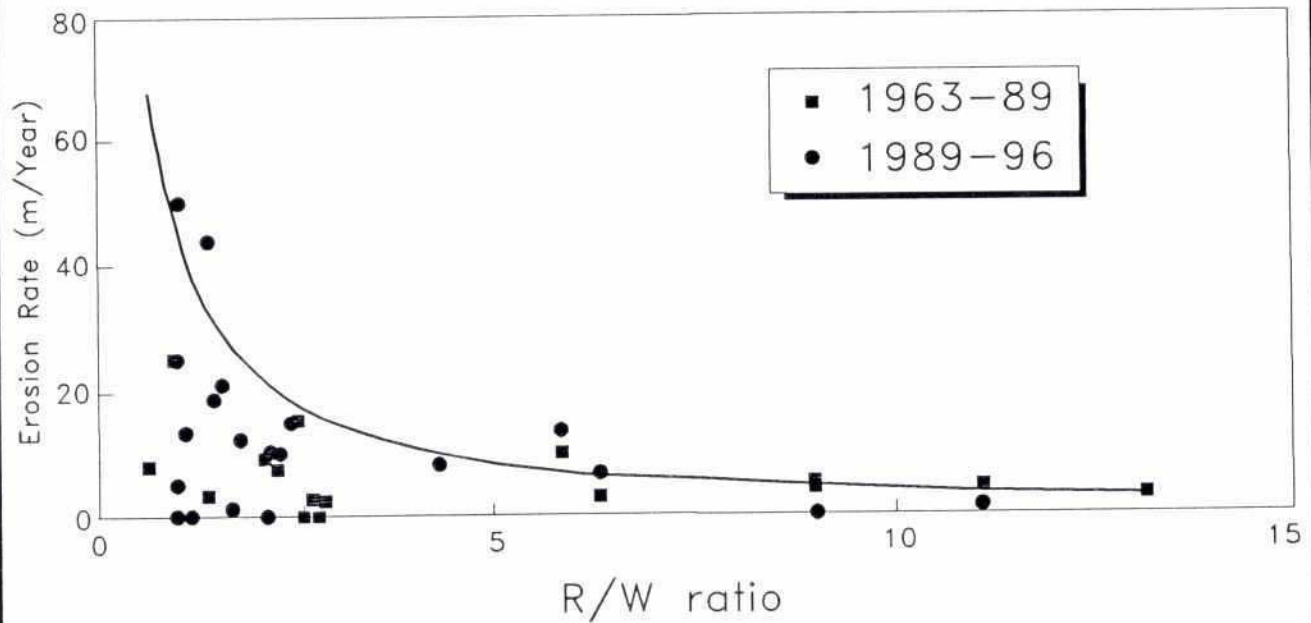
Meander Changes

Prepared by: D.G.M.

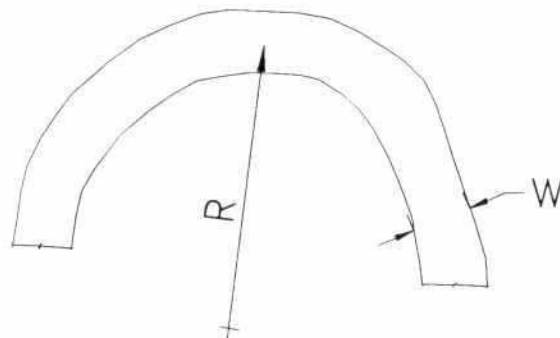
Computer Drafting by: Momun

December 1997

Bank Erosion in Bends



width measured at bend entrance



Northeast Regional Project

Kalni-Kushiyara River Management Project

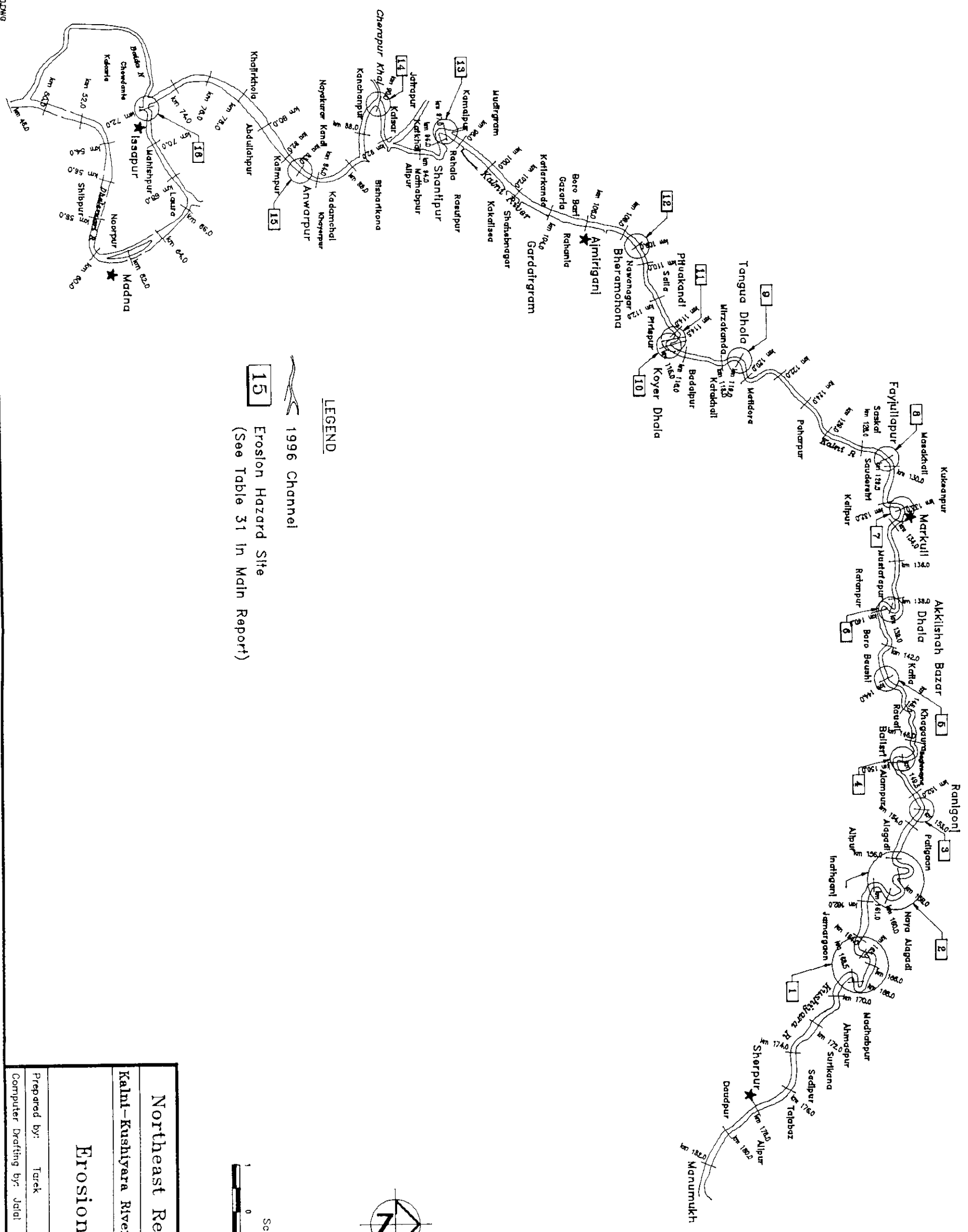
Rates of Erosion
on Kalni-Kushiyara River

Prepared by: Tarek

Computer Drafting by: Mamun

December 1997

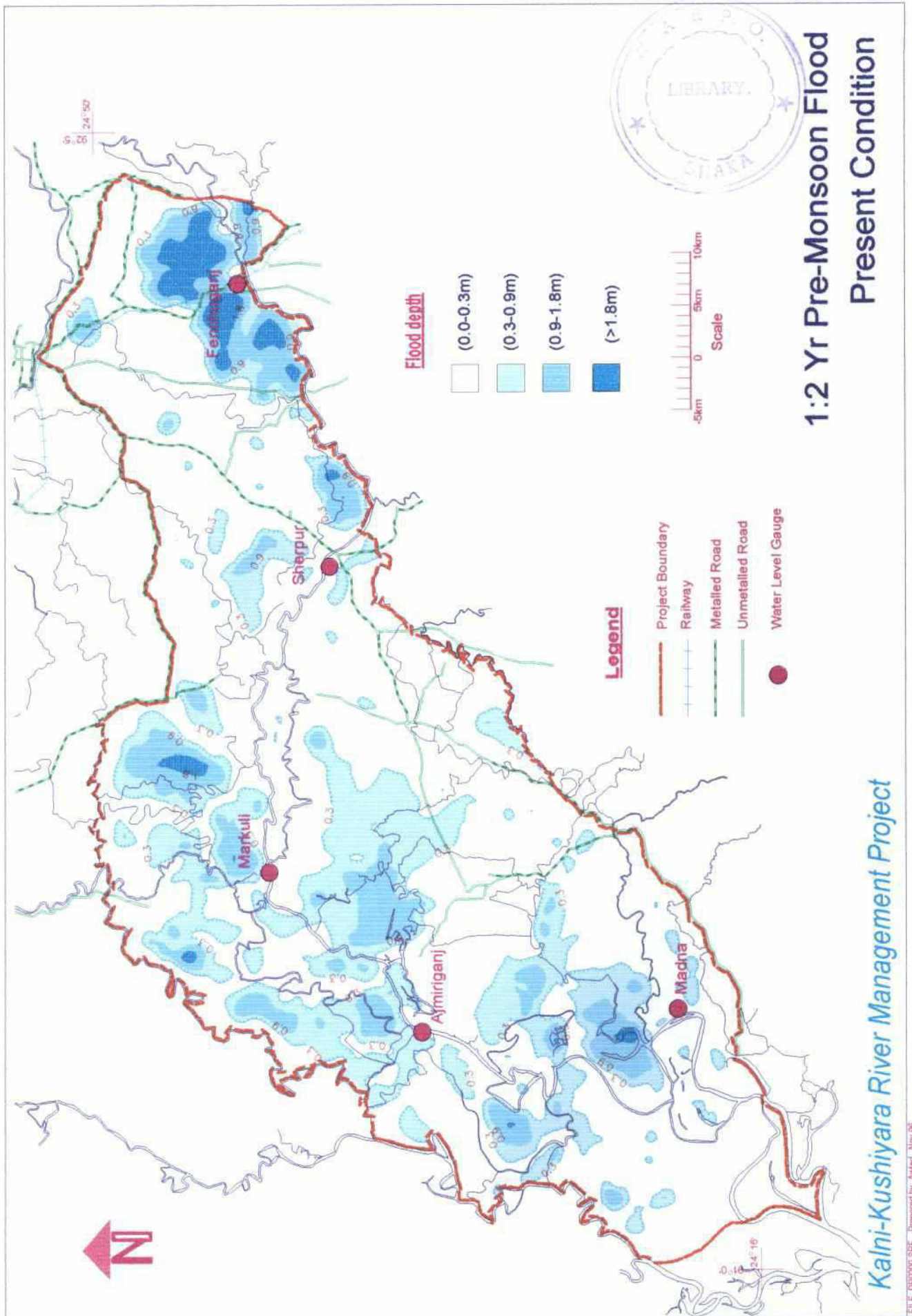
Figure 2.25



FILE: MAIN-0202.MWG

Northeast Regional Project		
Kaml-Kushiyara River Management Project		
Erosion Hazard		
Prepared by:	Tarek	
Computer Drafting by:	Jalal	
	December 1997	

Figure 2.26



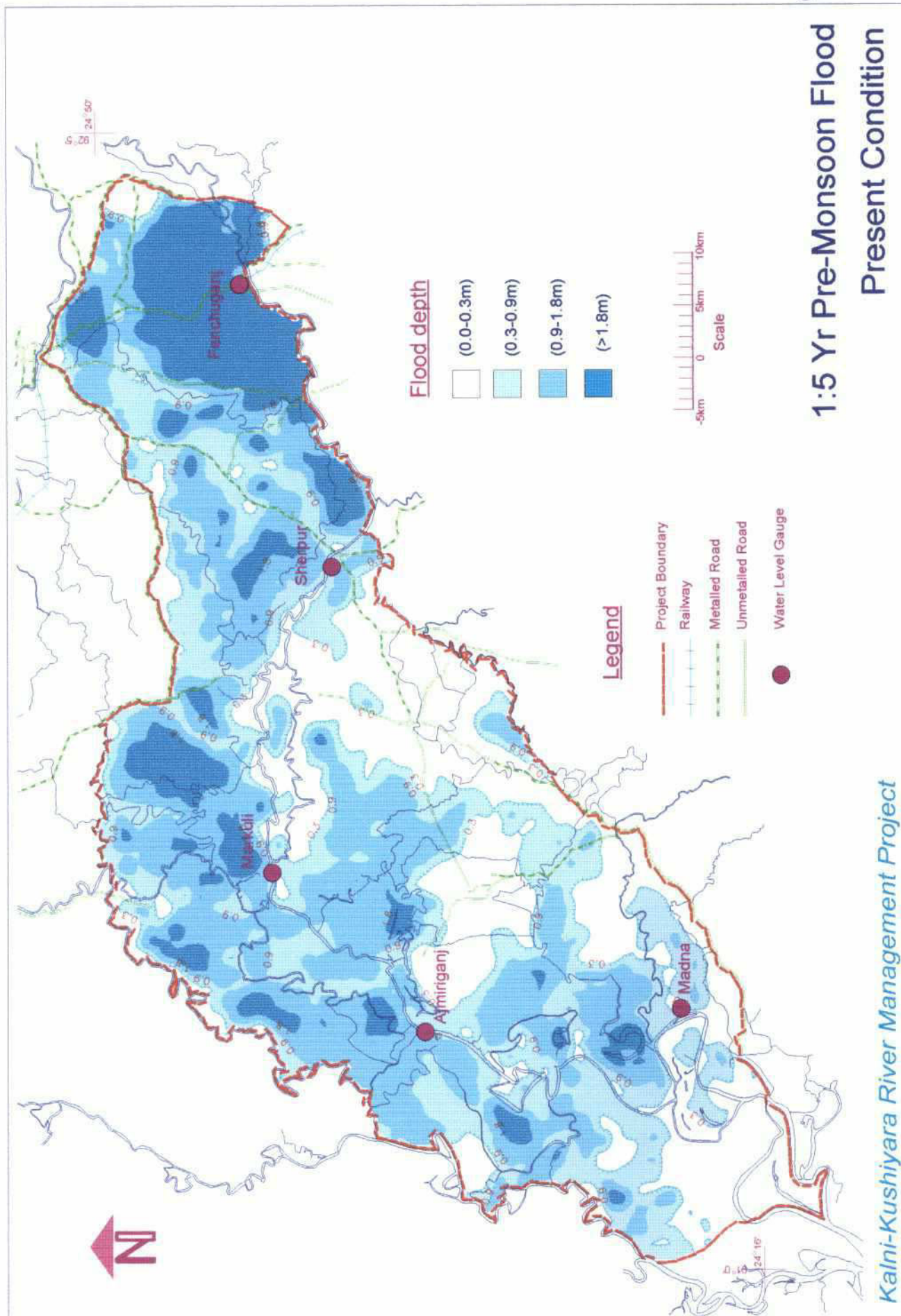
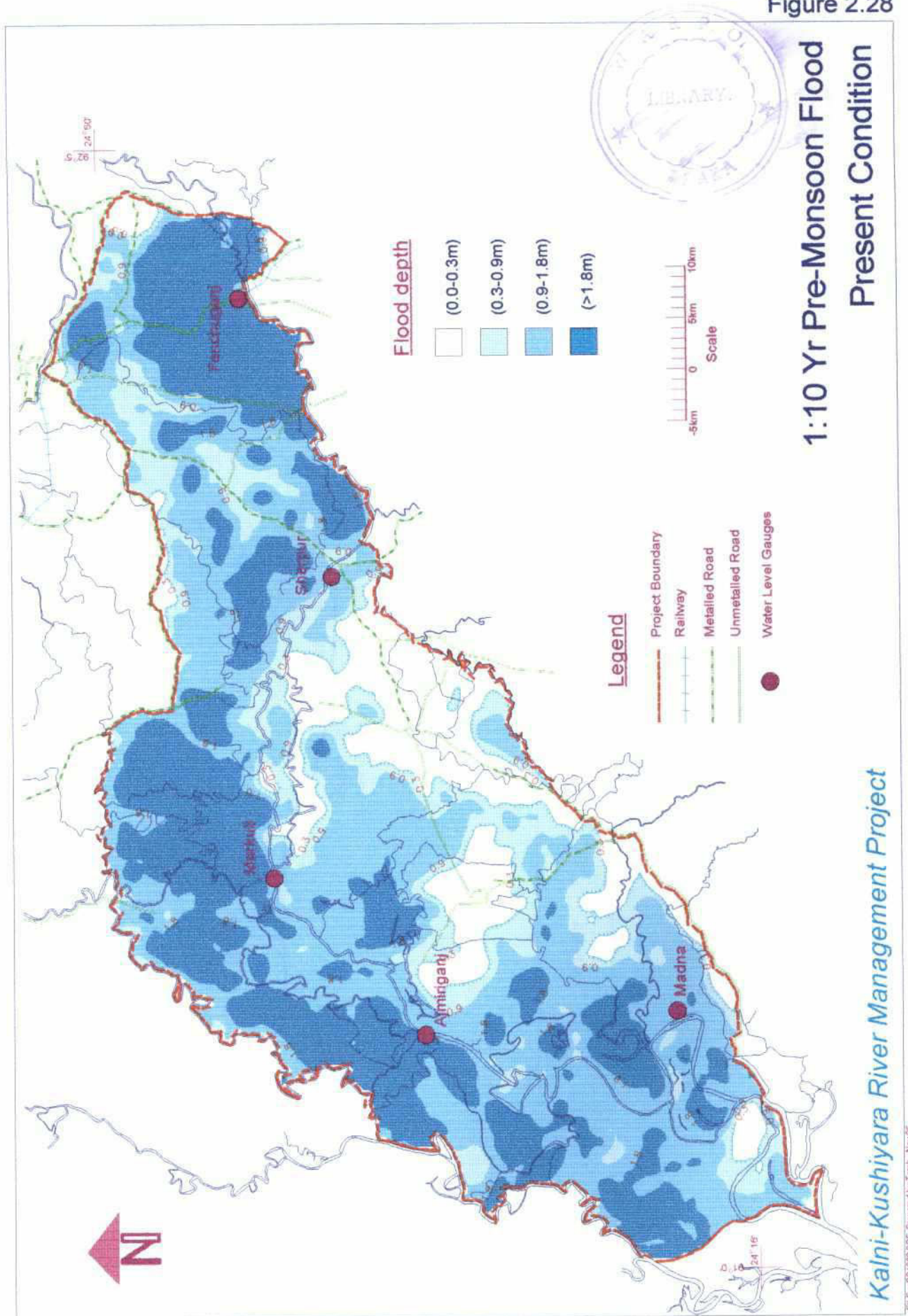
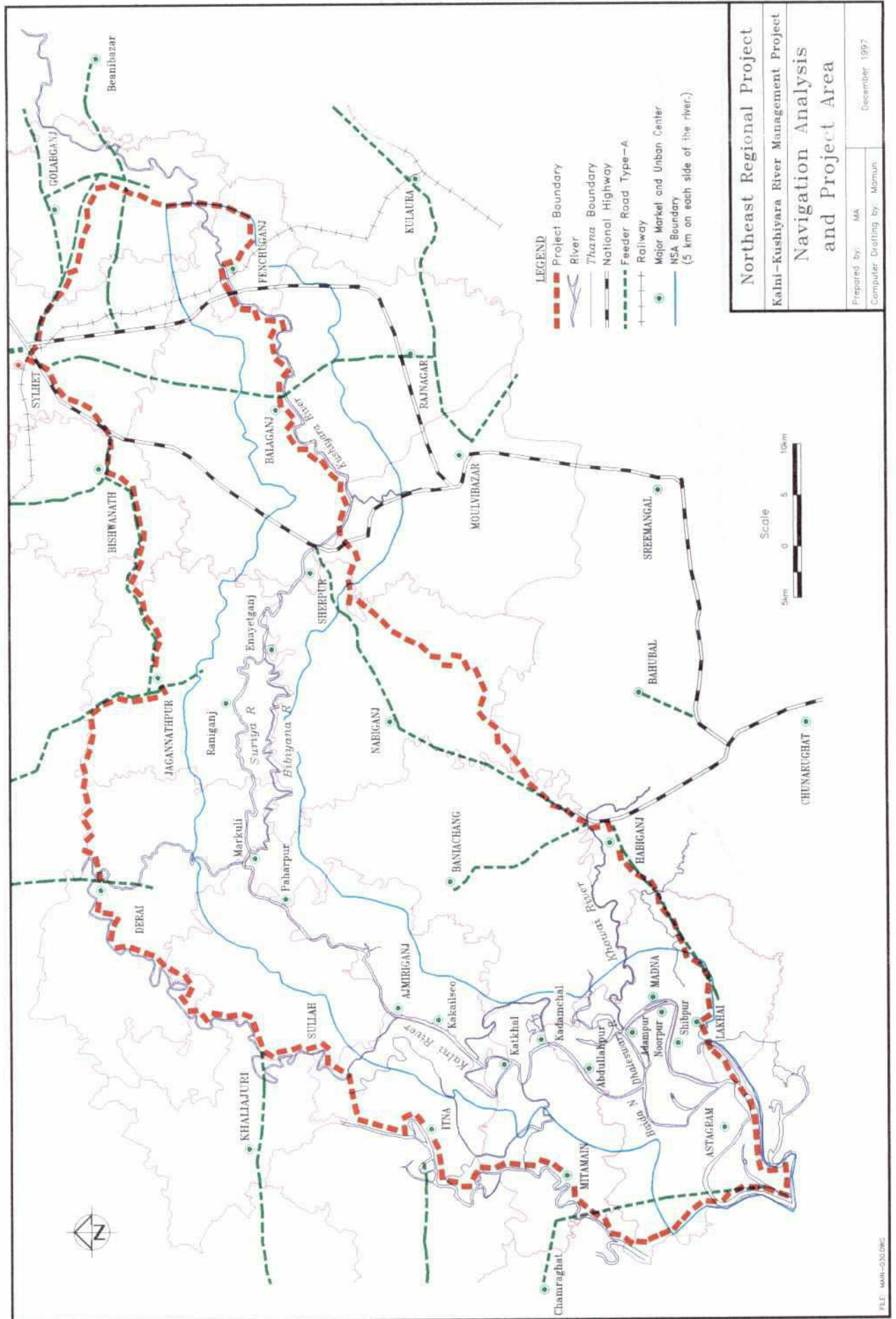


Figure 2.28







Northeast Regional Project	
Kalmi-Kushiyara River Management Project	
Navigation Analysis and Project Area	
Prepared by: MA	December 1997
Computer Drafting by: Mamun	

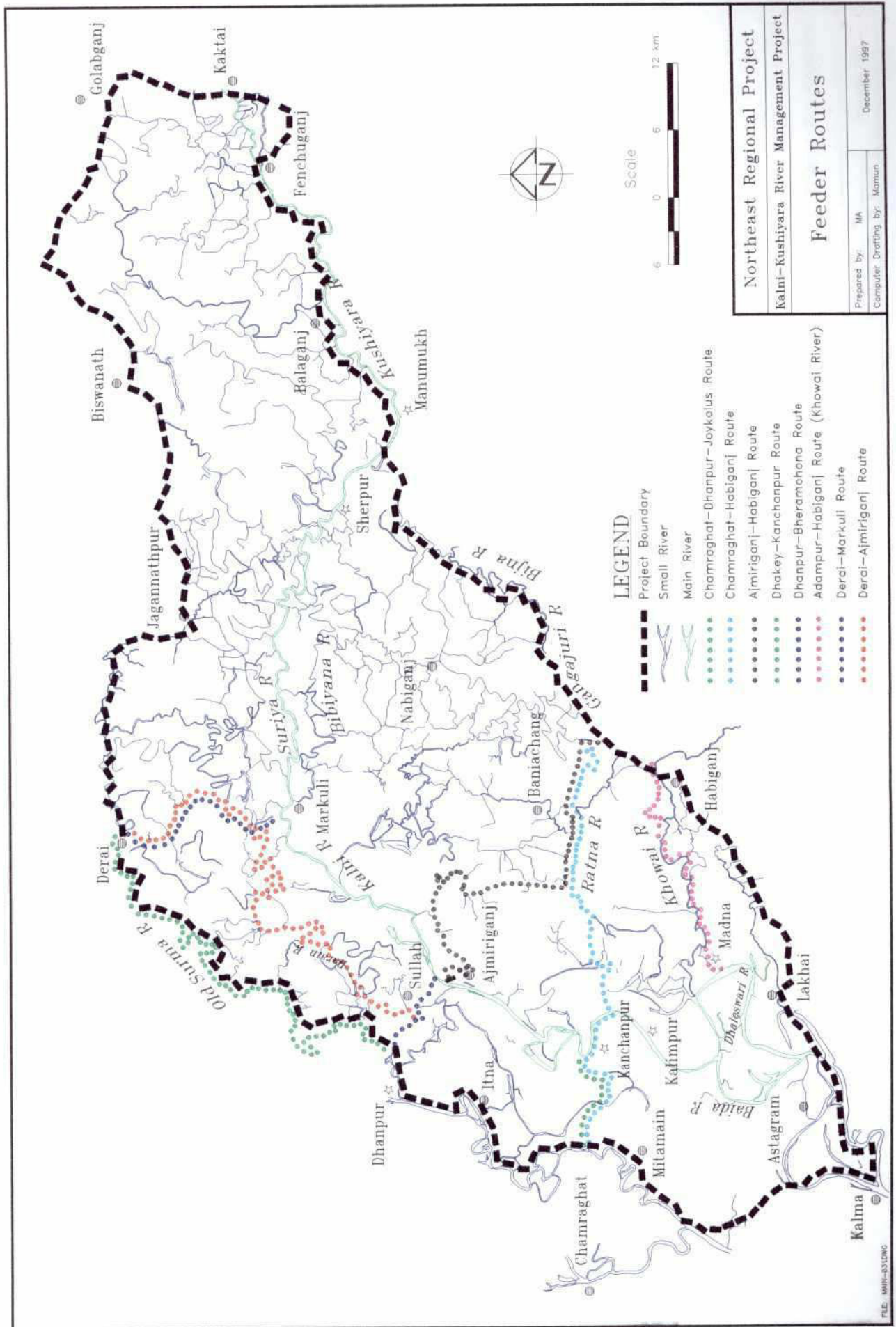
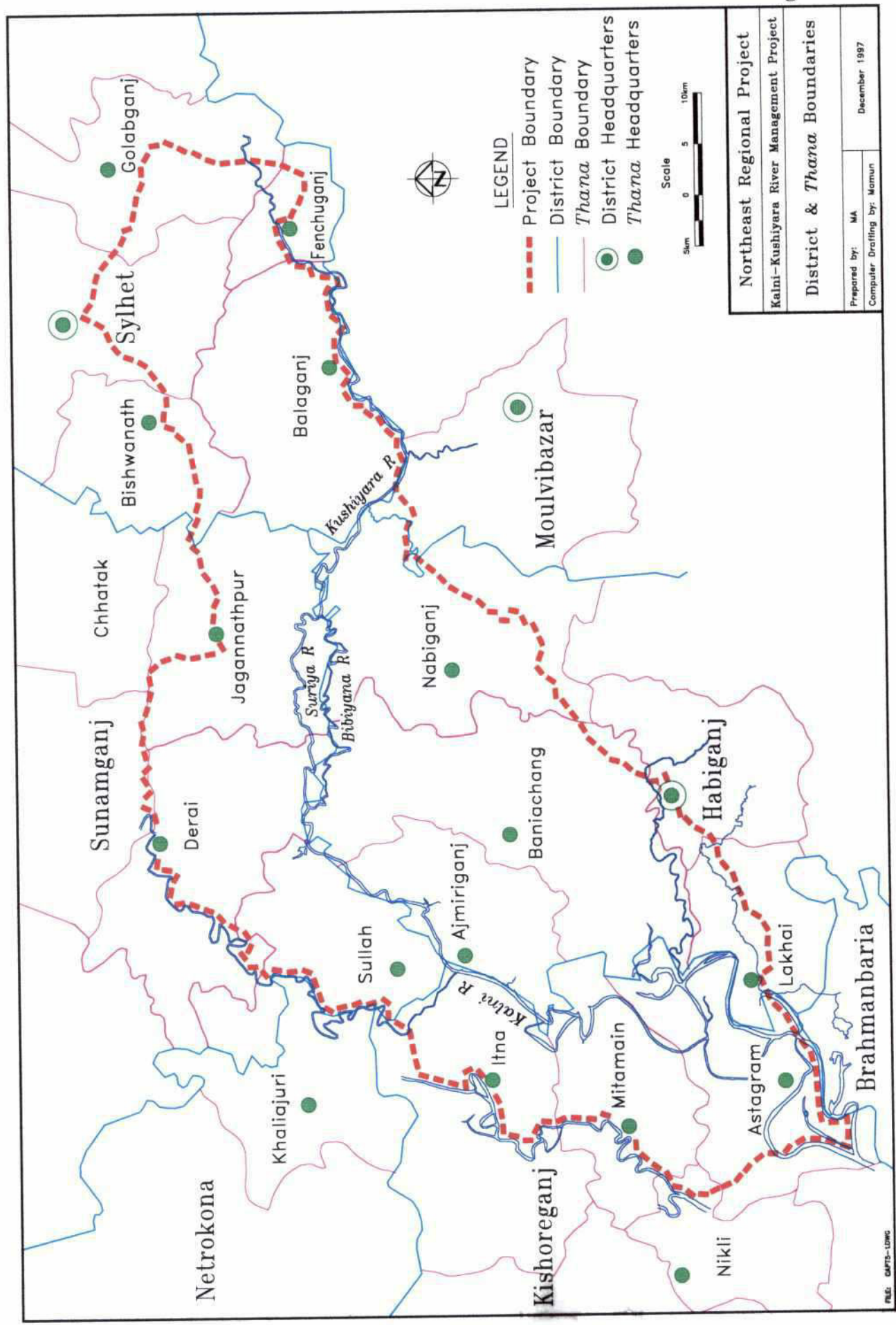
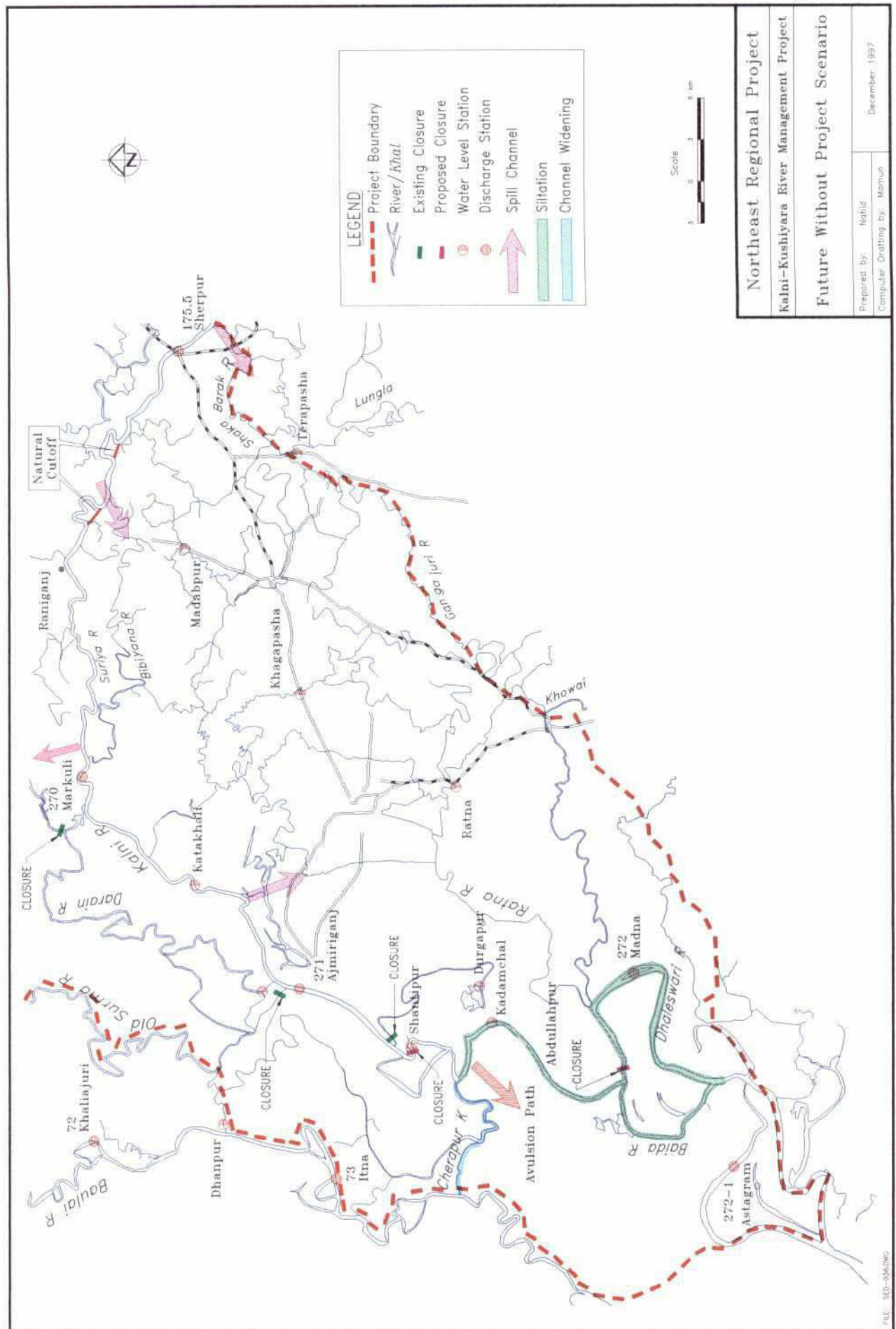


Figure 5.1



Northeast Regional Project		
Kalni-Kushiyara River Management Project		
District & Thana Boundaries		
Prepared by:	MA	December 1997
Computer Drafting by:	Mamun	



Northeast Regional Project

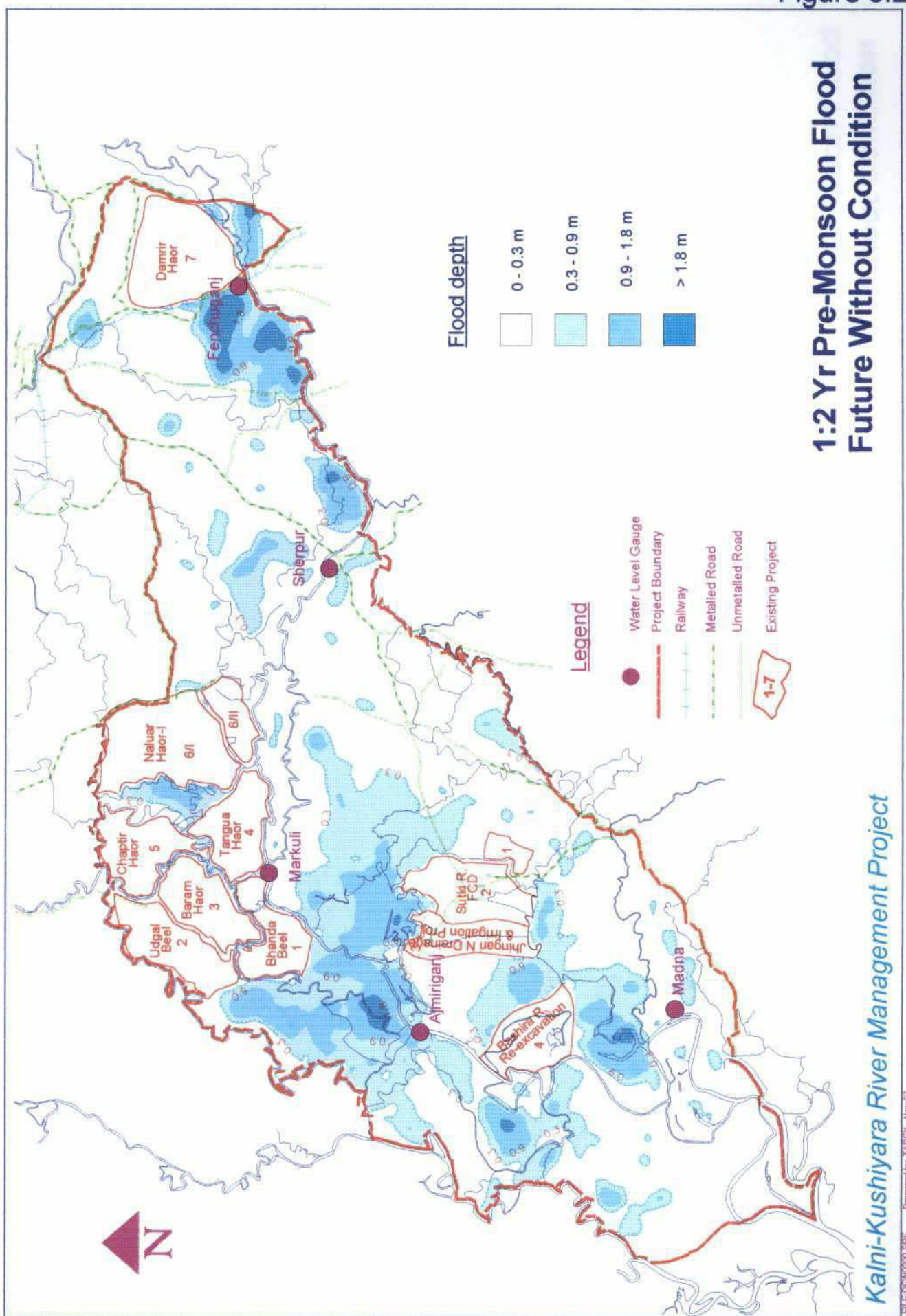
Kalni-Kushiyara River Management Project

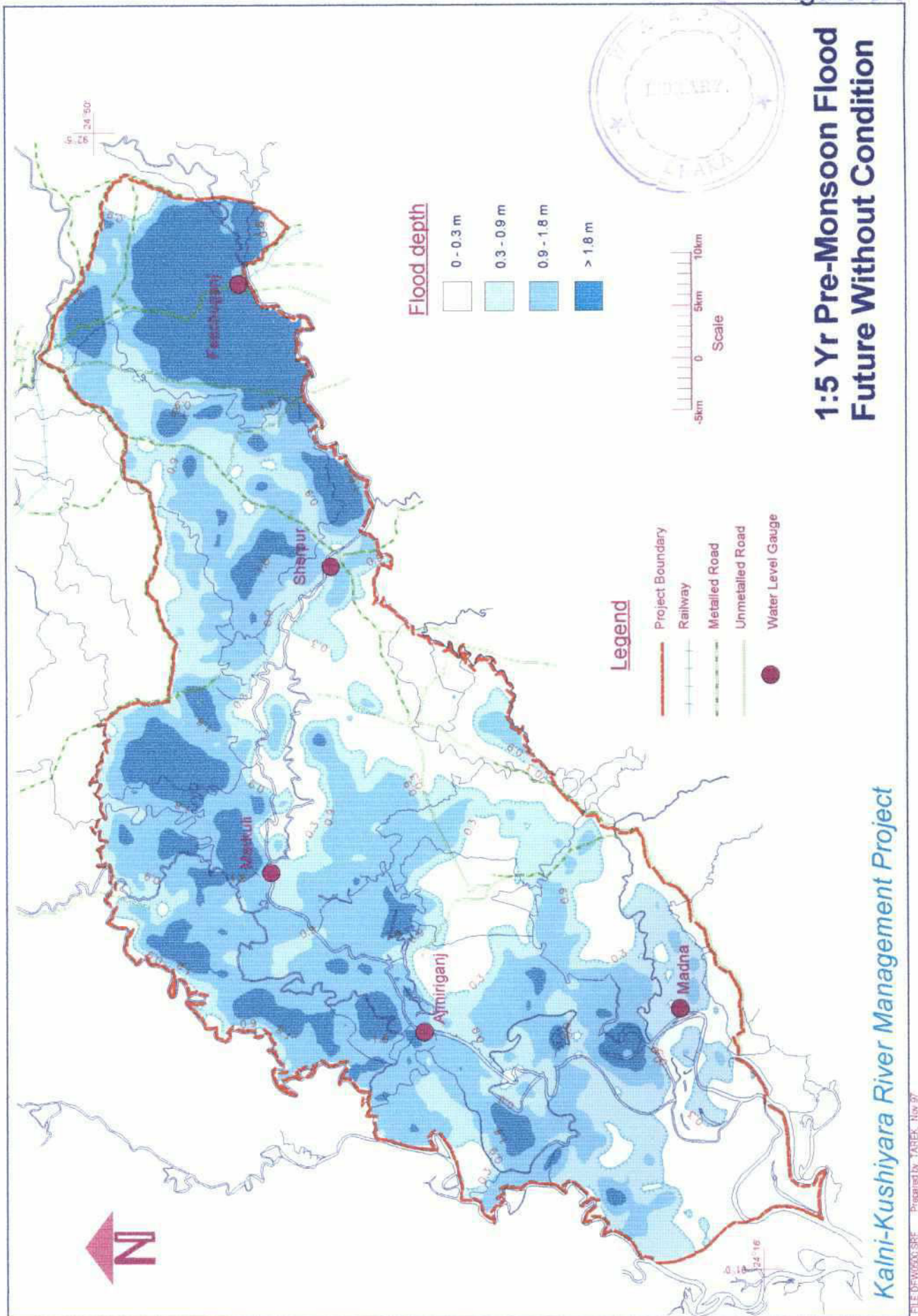
Future Without Project Scenario

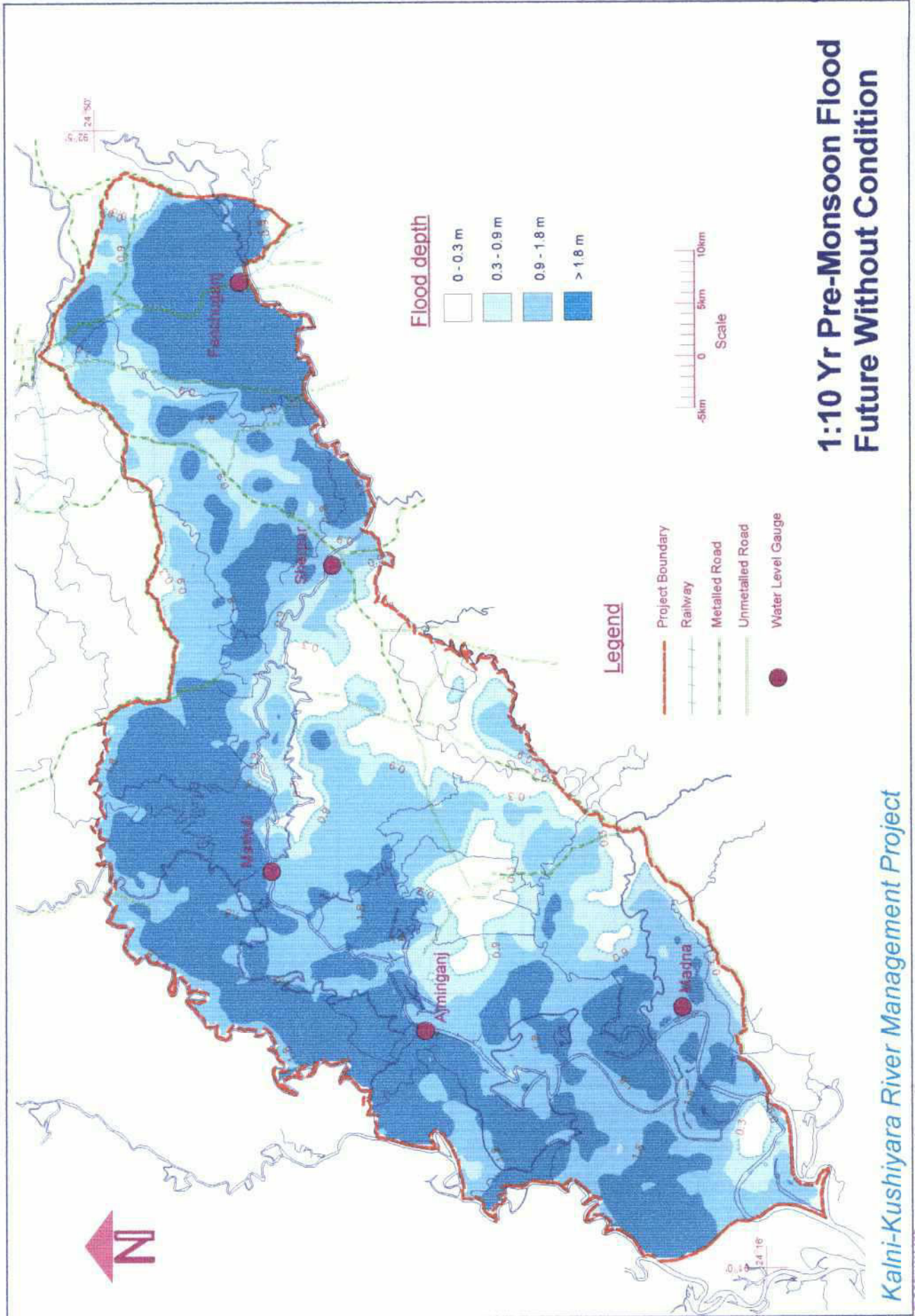
Prepared by: Nohid

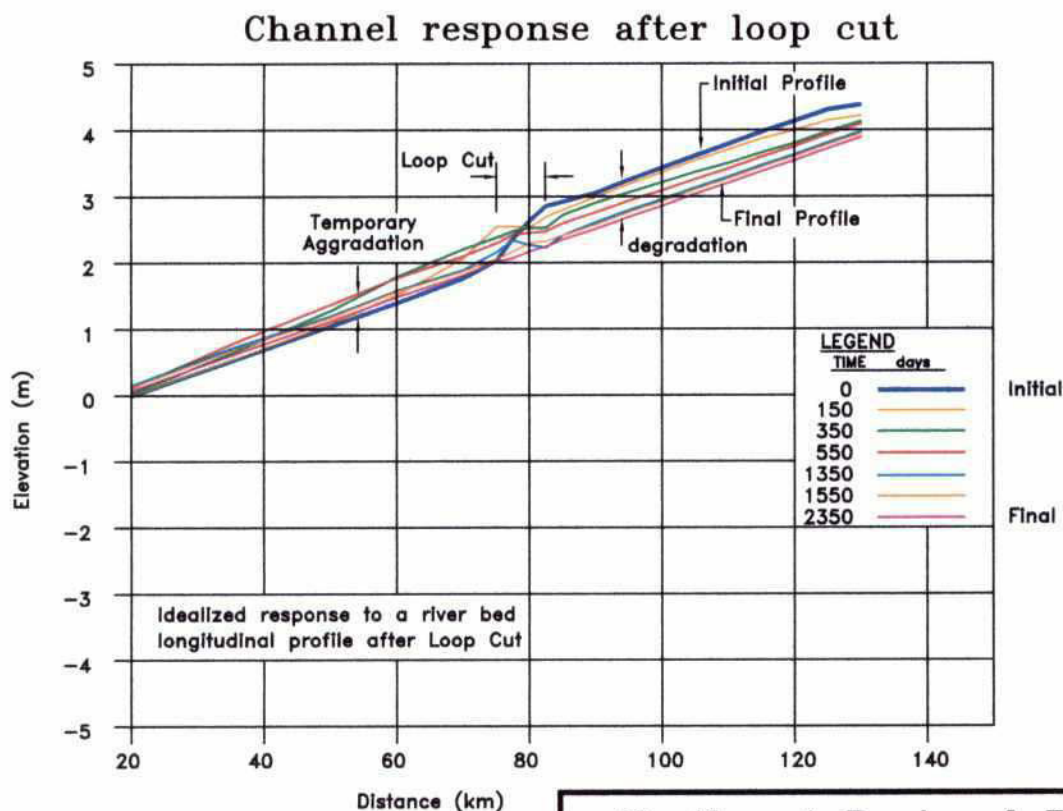
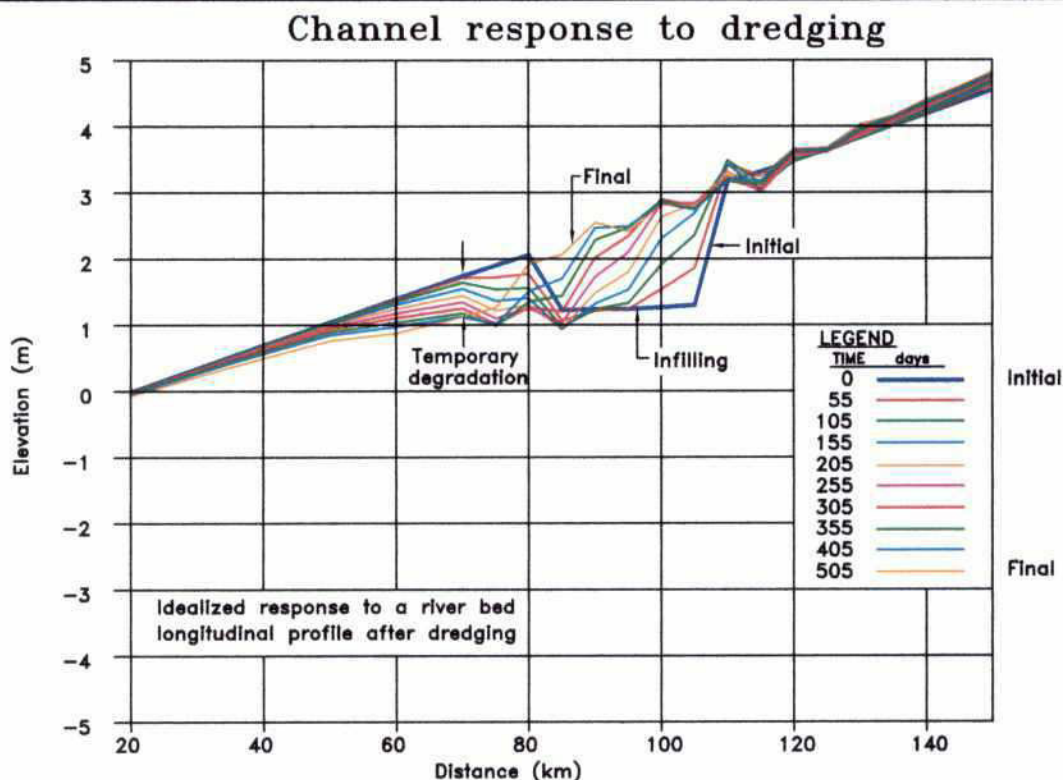
Computer Drafting by: Mamun

December, 1997









Northeast Regional Project

Kalni-Kushiyara River Management Project

Channel Response to Dredging and Loop Cutting

Prepared by: D.G.M.

Computer Drafting by: Mamun

December 1997





1990 Spot Image



LEGEND

- ==== New Channel
- ③ Disposal Sites
- ⑤ Filled-in Flood-prone Land

FILE: FIG7-3.DWG

Northeast Regional Project

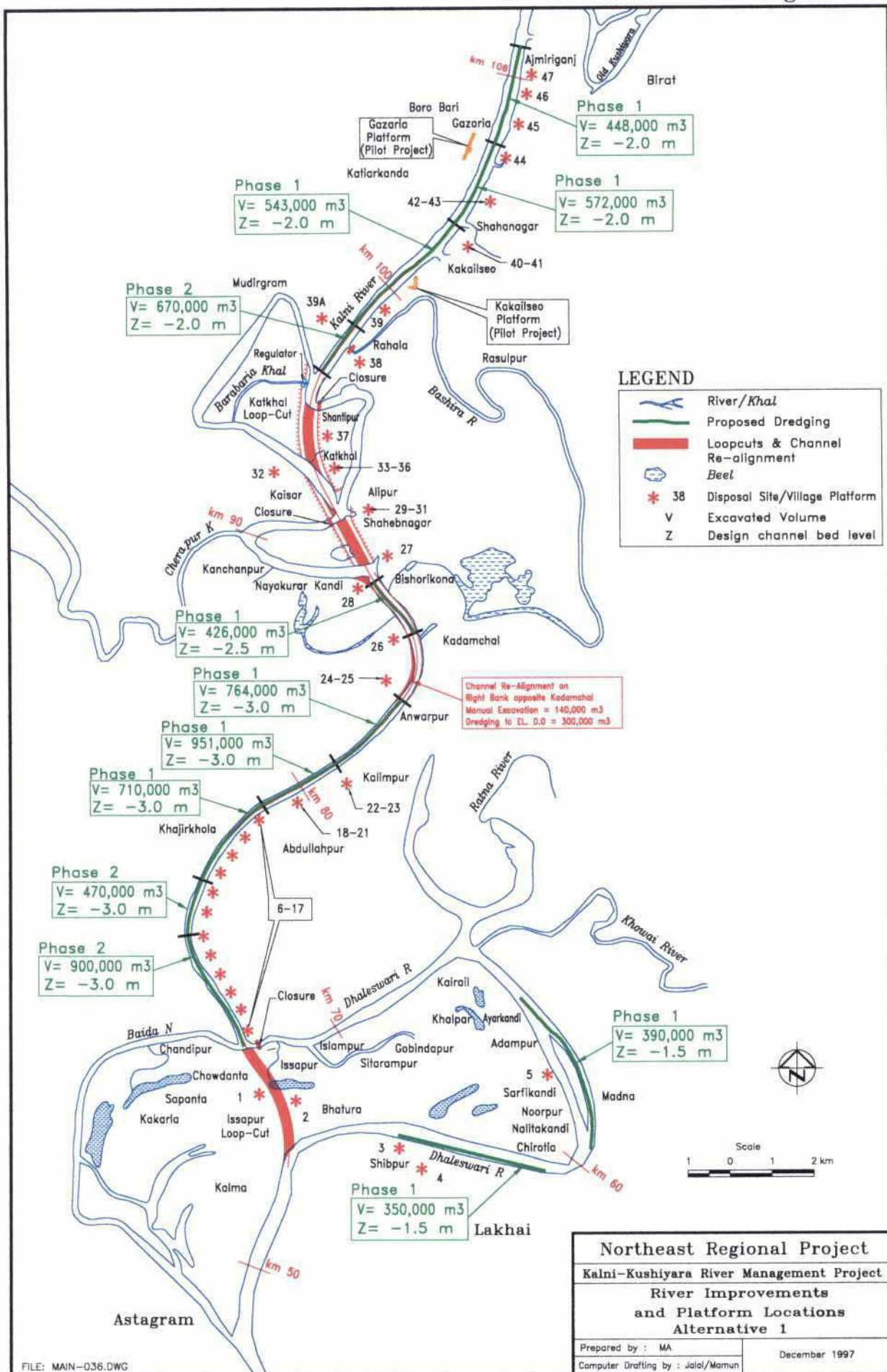
Kalni-Kushiyara River Management Project

Issapur Loop Cut

Prepared by: D.G.M.

Computer Drafting by: Mamun

December 1997



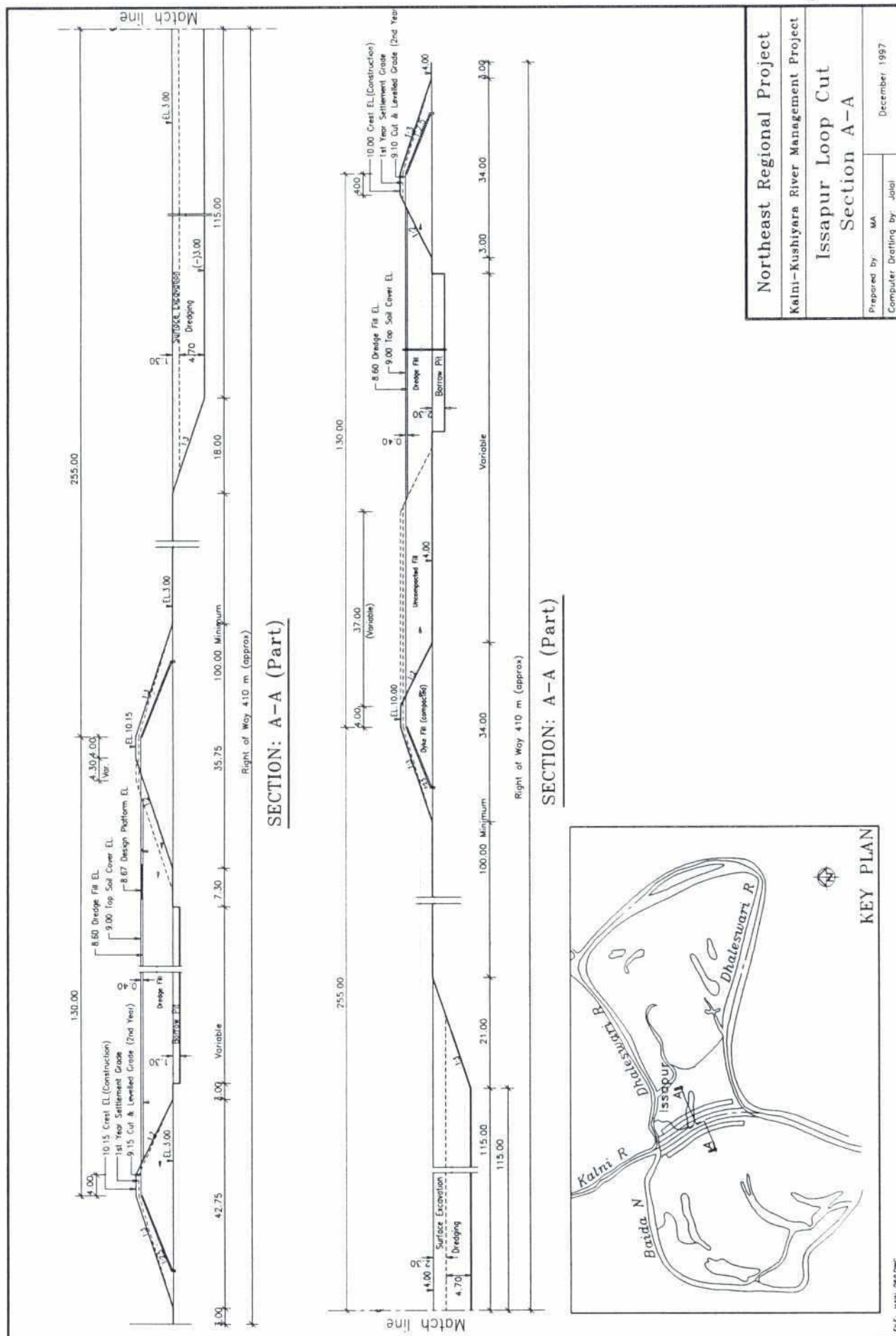
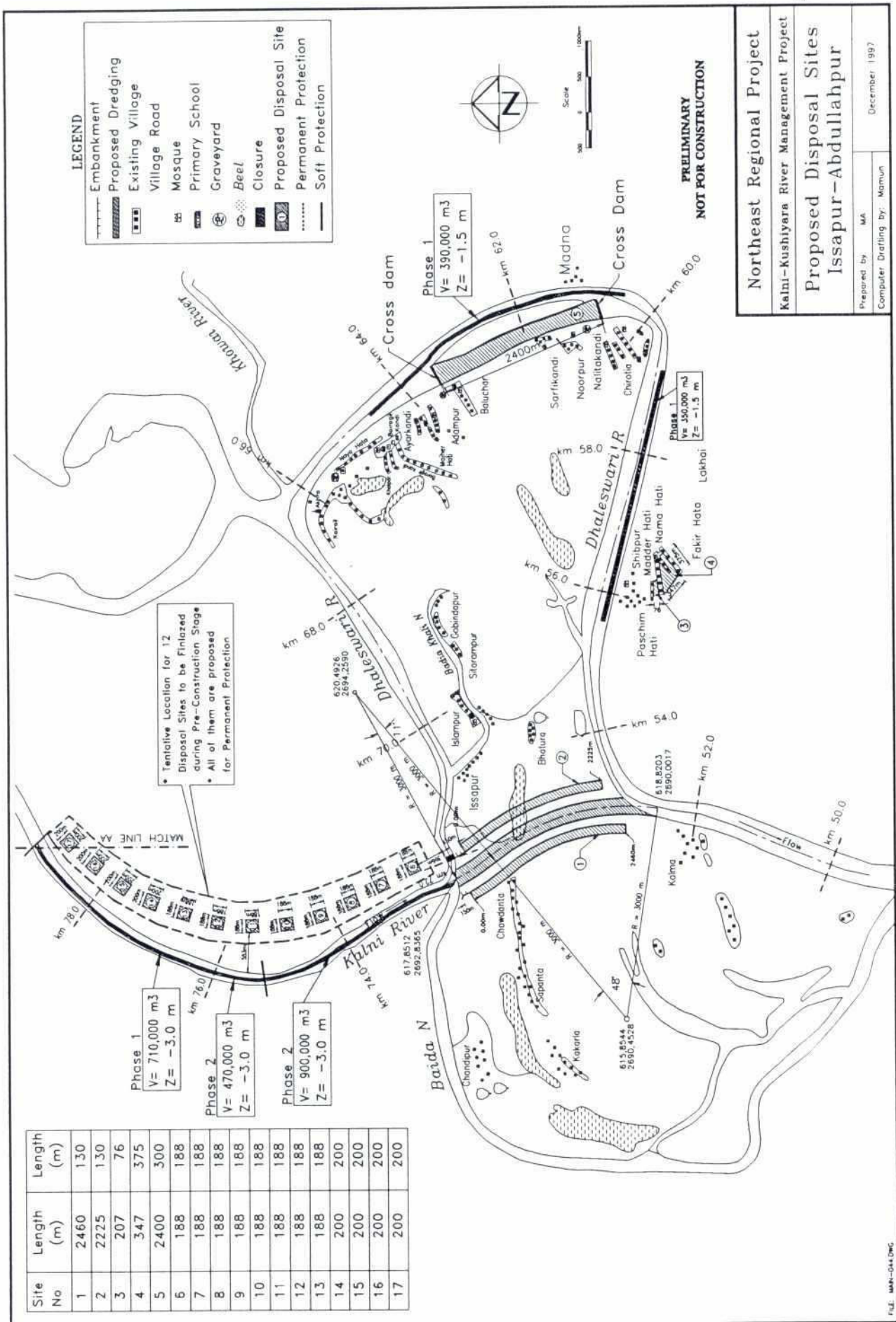
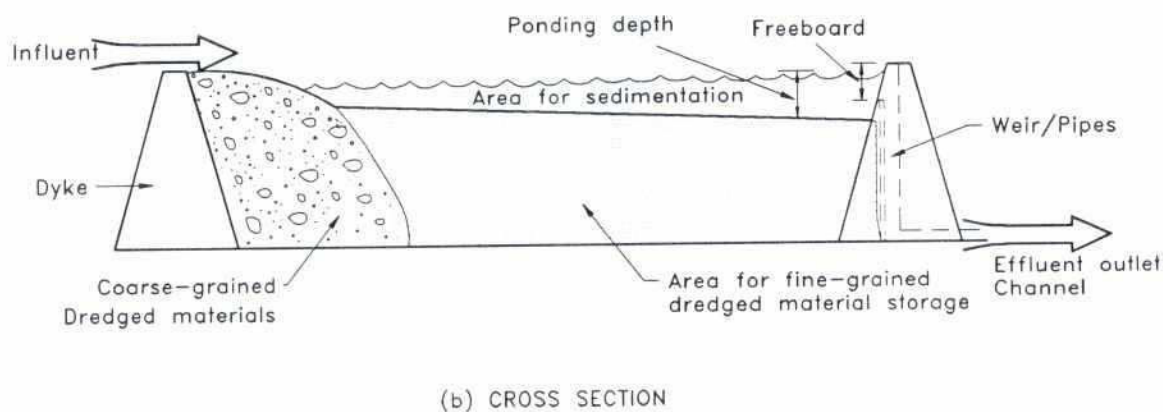
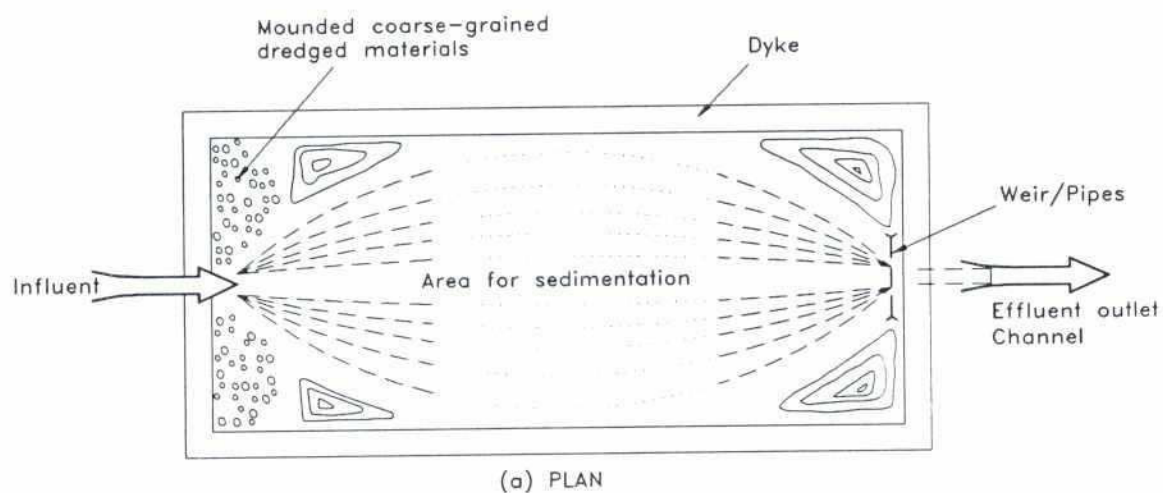


Figure 7.6





Northeast Regional Project
 Kalni-Kushiyara River Management Project
 Main Features of Confined
 Disposal Chamber

Prepared by: D.G.M.

Computer Drafting by: Mamun




December 1997



1990 Spot Image



LEGEND

-  New Channel
 Kadamchal re-alignment
 Silted in-channel

Northeast Regional Project

Kalni-Kushiyara River Management Project

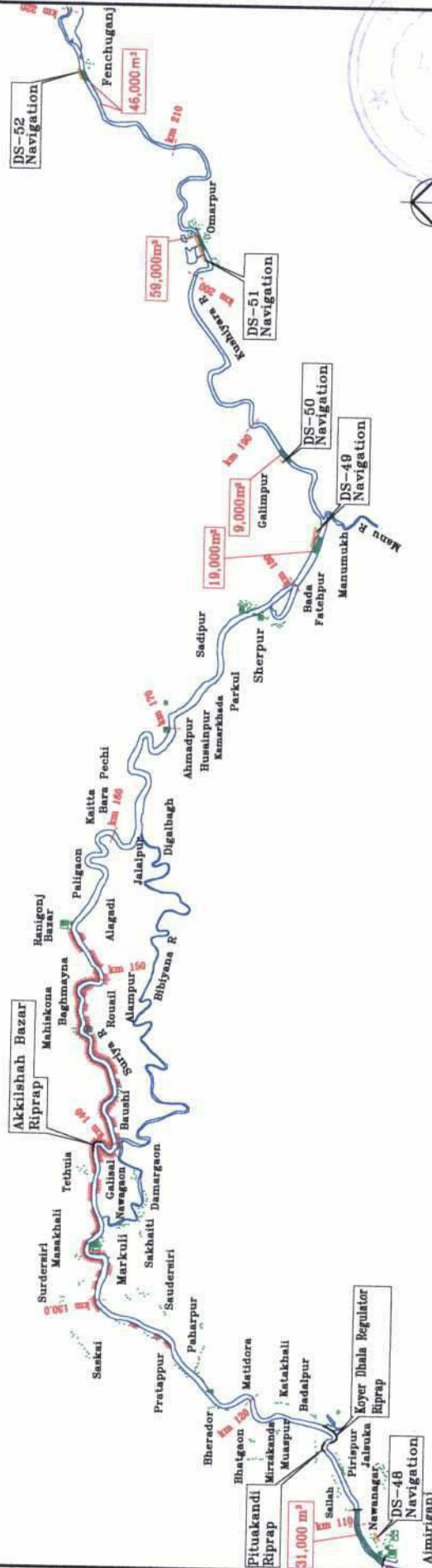
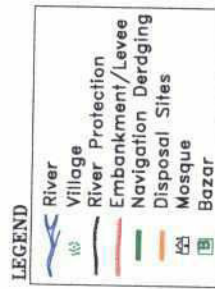
Katkhal Loop Cut

Prepared by: D.G.M.

Computer Drafting by: Mamun

December 1997

Figure 7.9



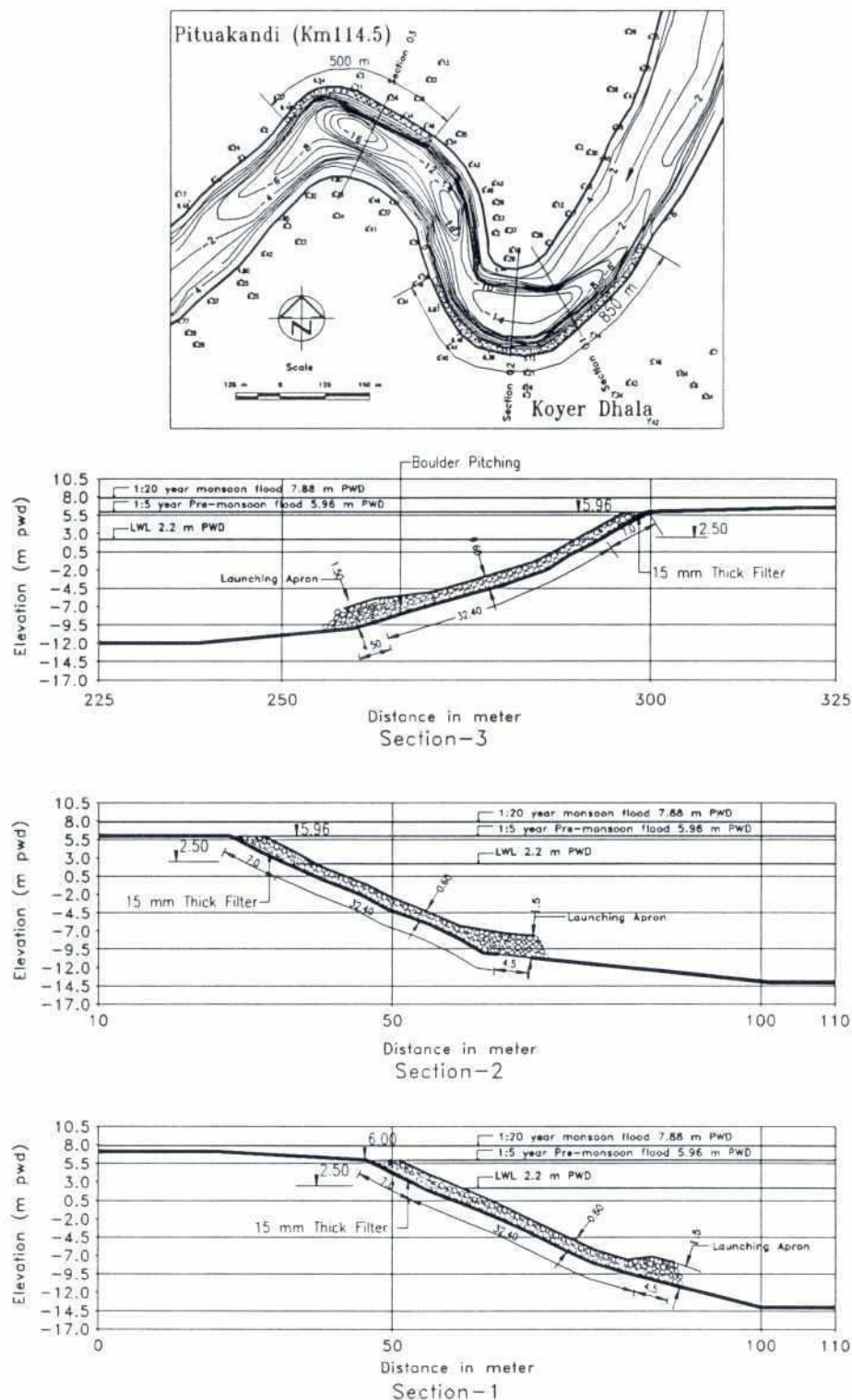
Northeast Regional Project

Kalni-Kushiya River Management Project

River Training, Levees & Navigation Dredging

Location Plan

Prepared by: MA
Computer Drafting by: Mamun
December 1997



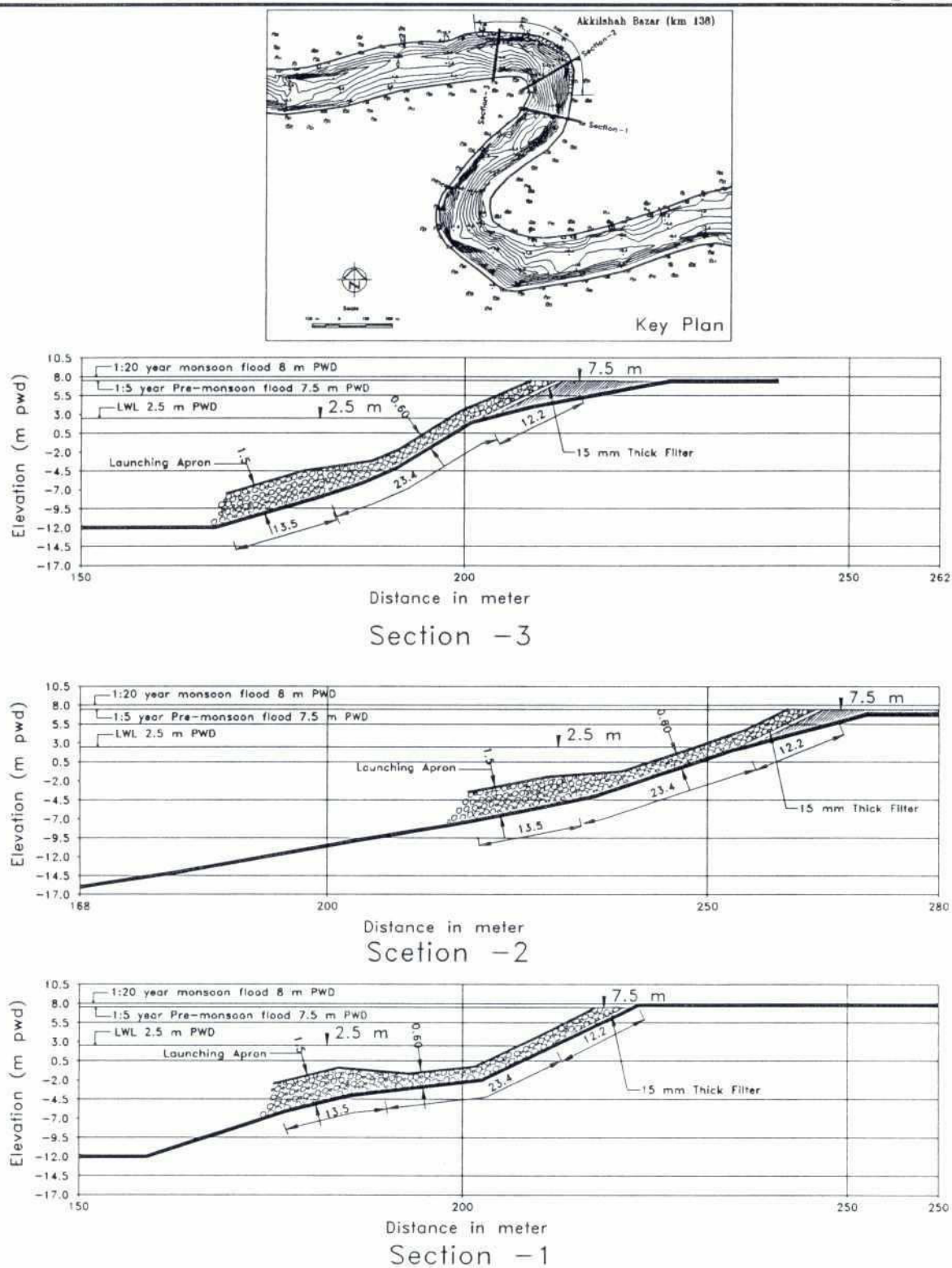
Northeast Regional Project
Kalni-Kushiyara River Management Project
Erosion Protection at
Koyer Dhala and Pituakandi

Prepared by: Tarek

December 1997

Computer Drafting by: Jalal

ay

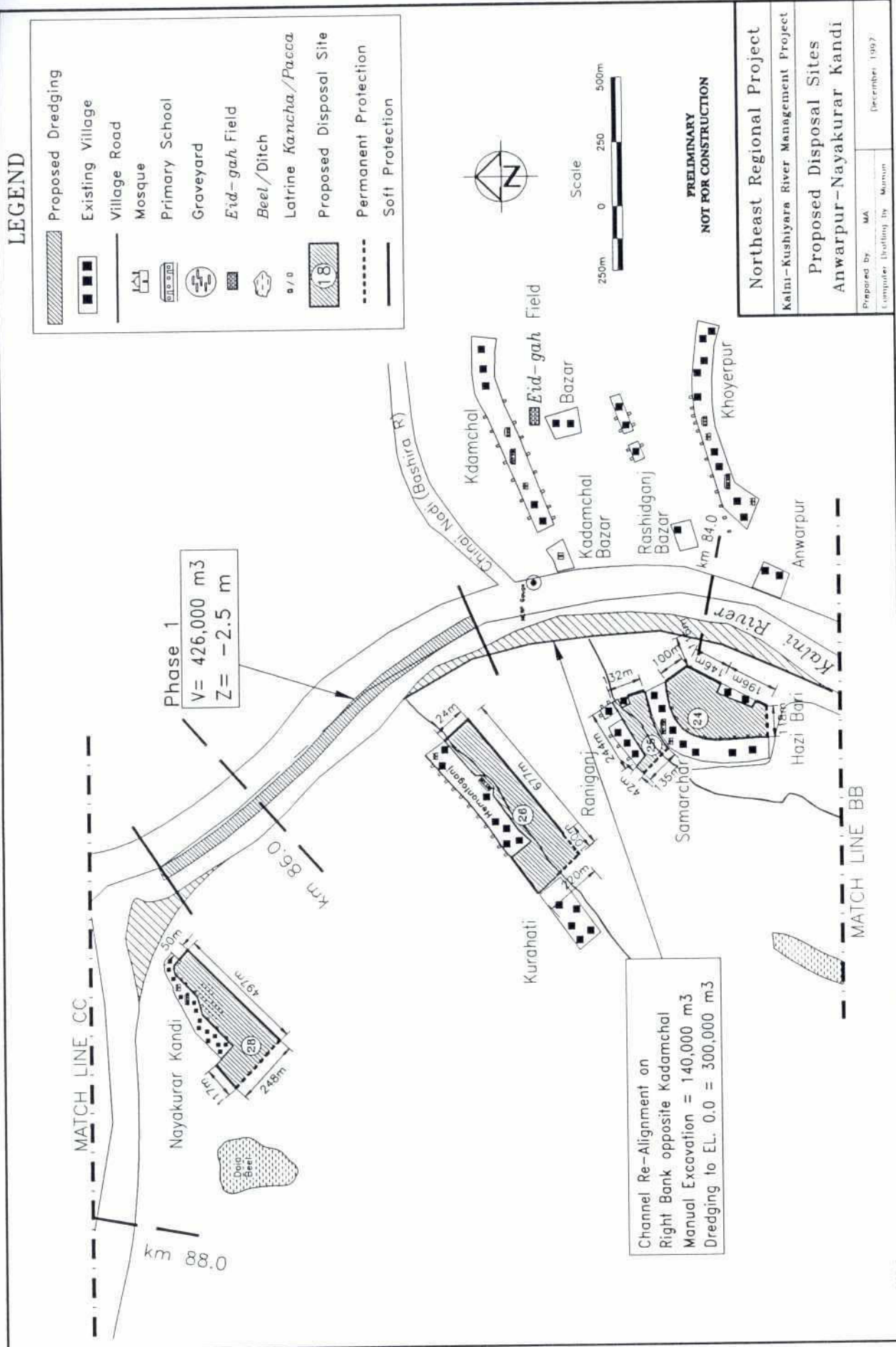


Northeast Regional Project	
Kalni-Kushiyara River Management Project	
Erosion Protection at Akkilshah Bazar	
Prepared by: Tarek	December 1997
Computer Drafting by: Jalal	

Northeast Regional Project		Typical Section of Village Platform	December, 1997
Kaini-Kushiyara River Management Project			
Prepared by	MA		
Computer Drafting by: Jalal			



Figure 7.14



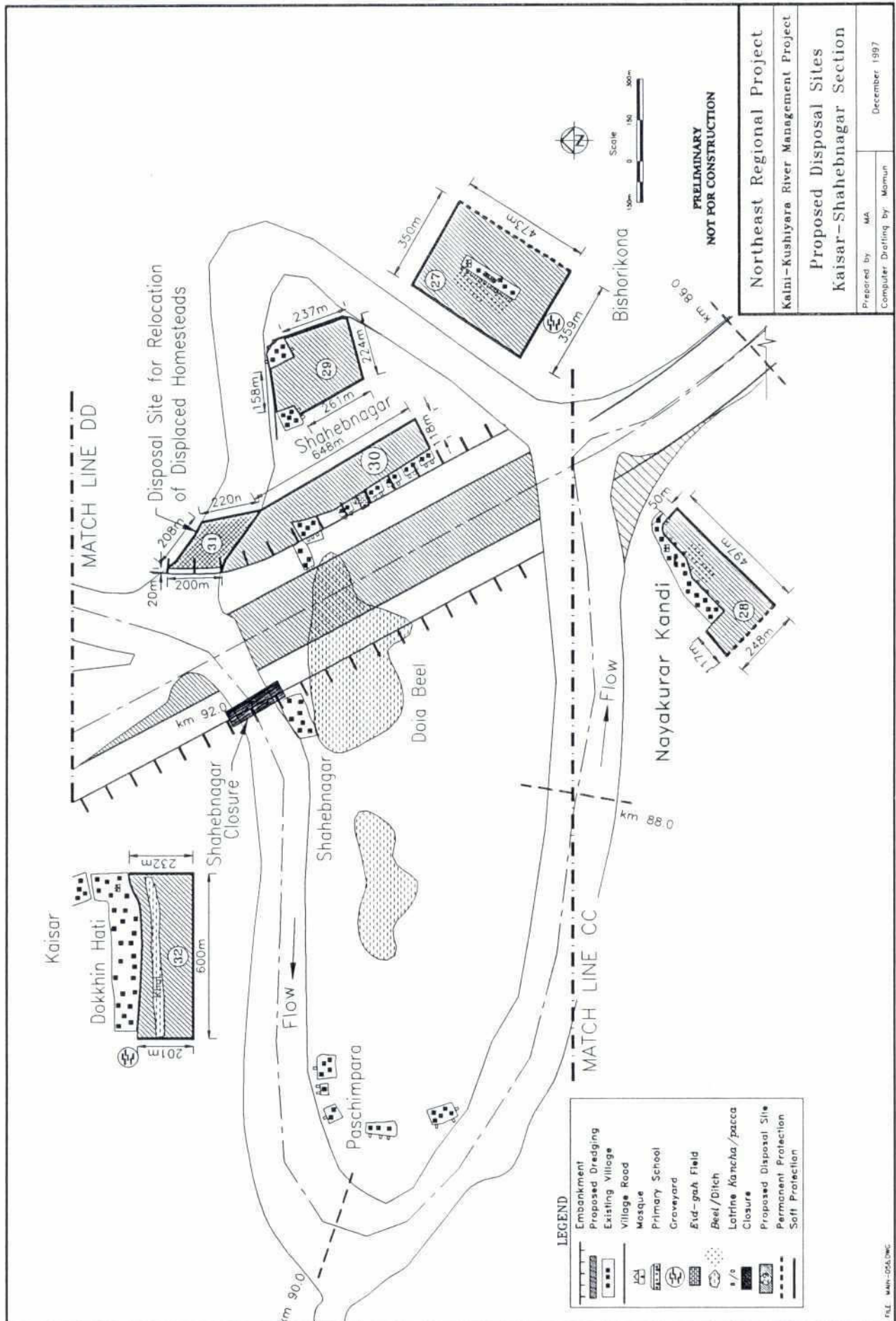


Figure 7.16

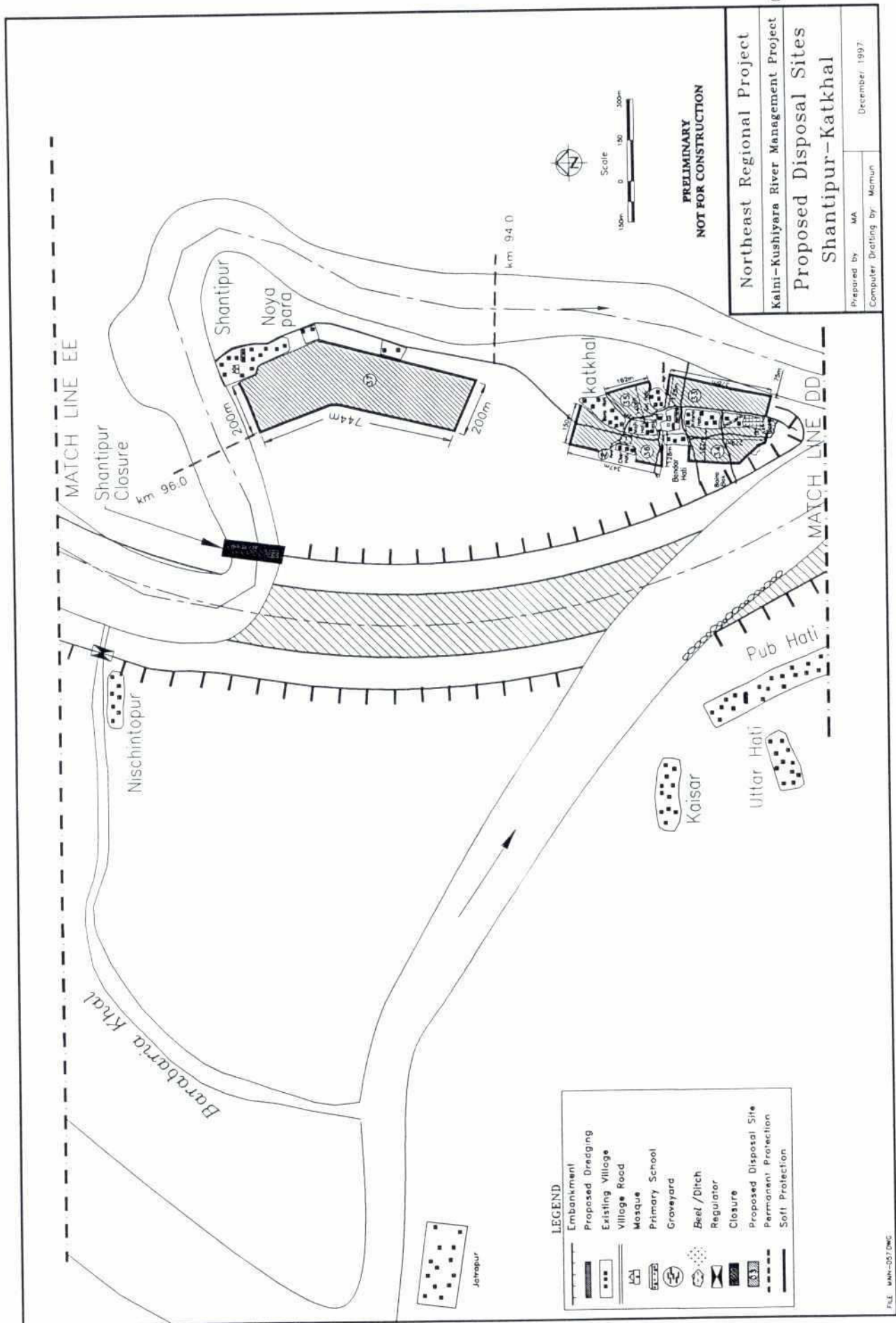


Figure 7.17

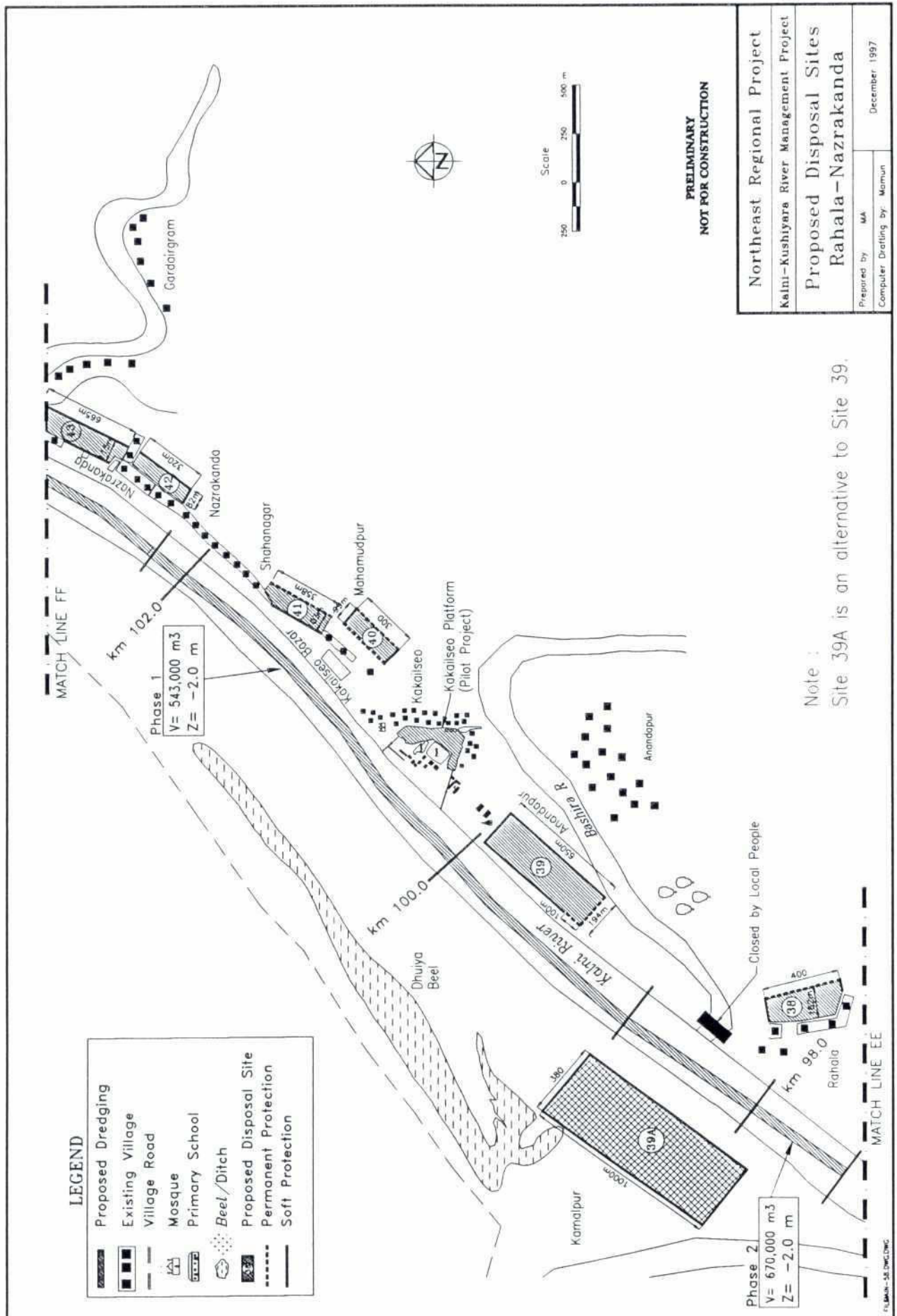


Figure 7.18

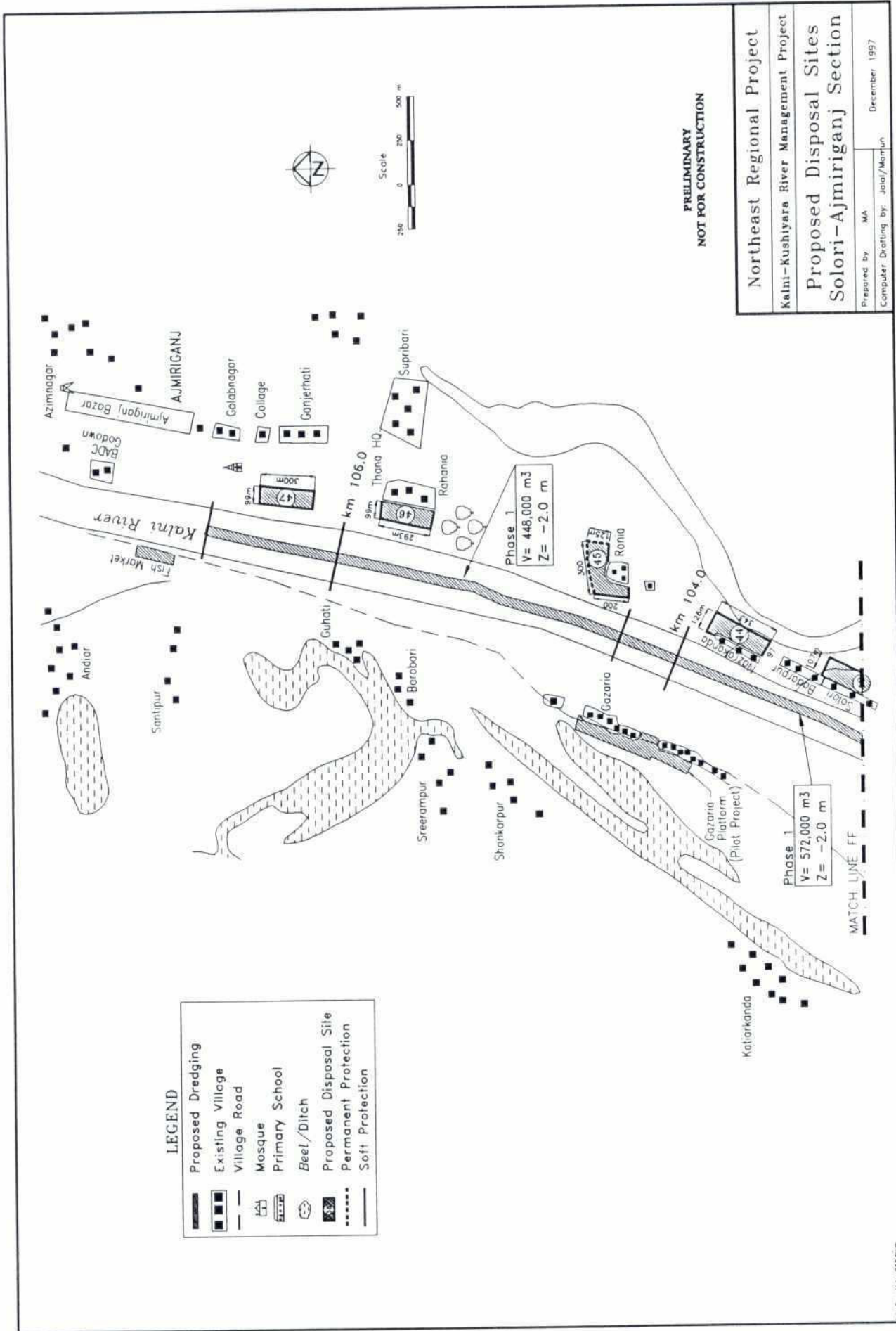
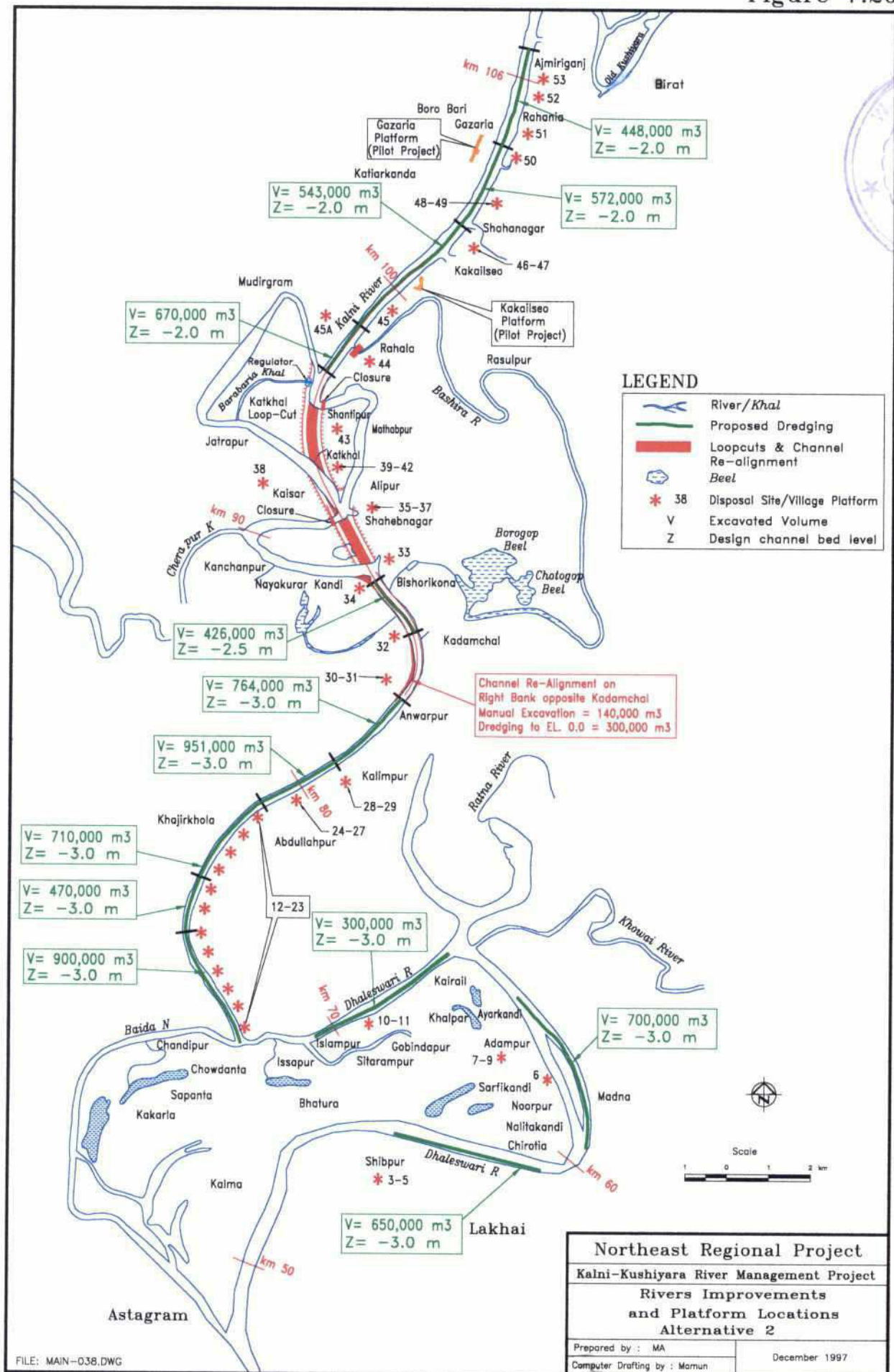
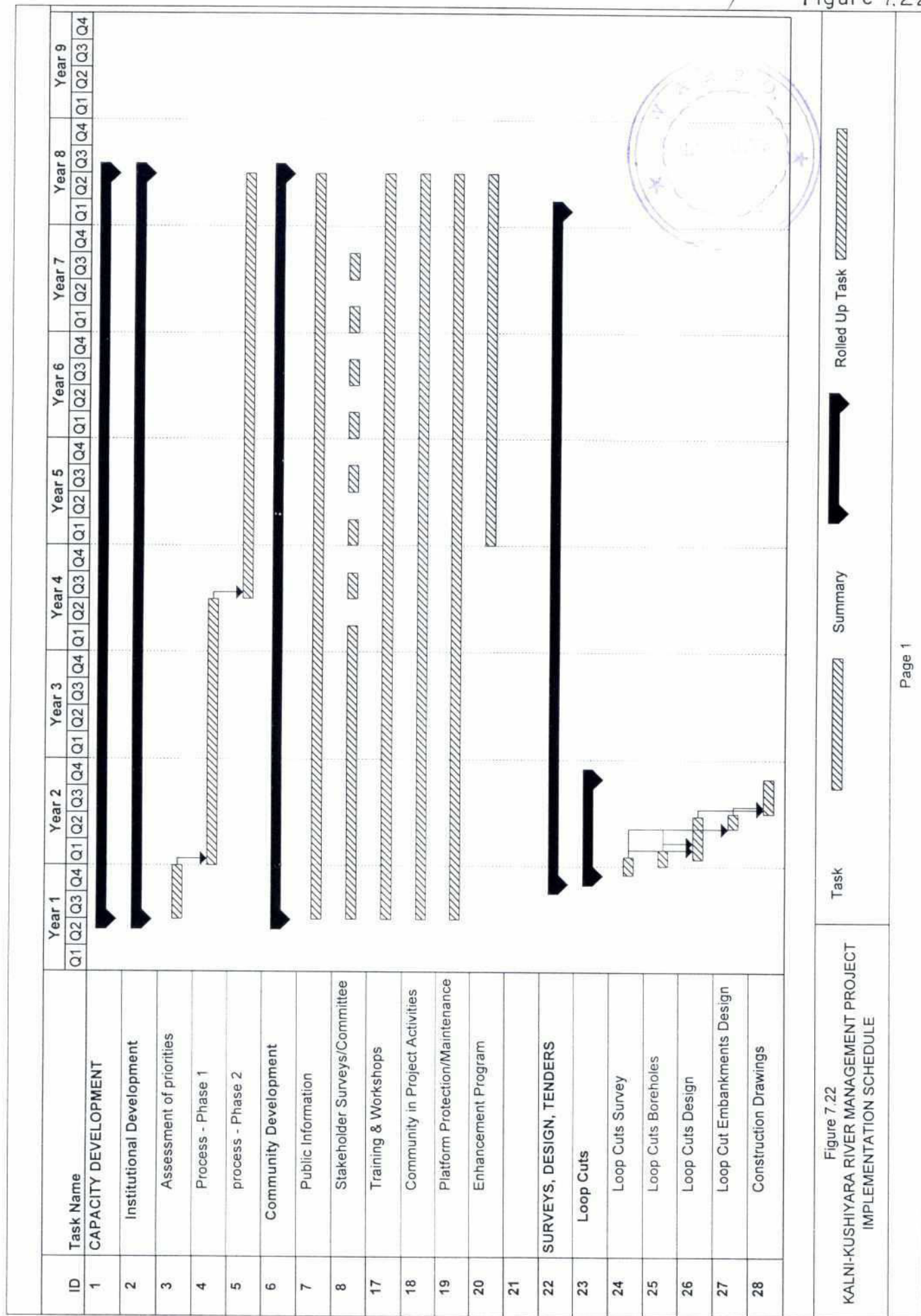


Figure 7.20



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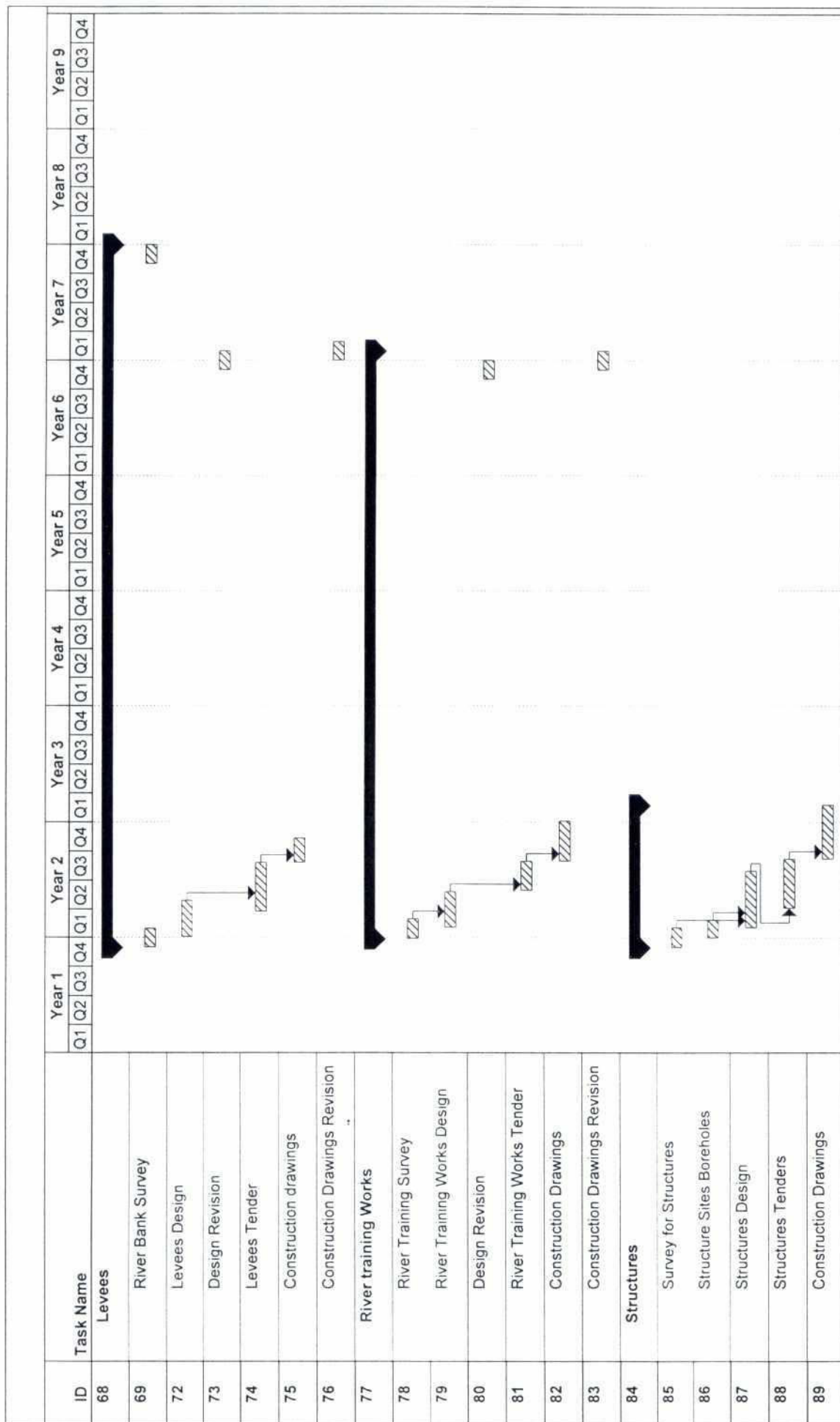


Figure 7.22
KALNI-KUSHIYARA RIVER MANAGEMENT PROJECT
IMPLEMENTATION SCHEDULE

ID	Task Name	Year 1				Year 2				Year 3				Year 4				Year 5				Year 6				Year 7				Year 8				Year 9			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
120																																					
121	Dhaleswari River																																				
122	Construction of Madna Closure																																				
123	Constr. Confinement Dykes																																				
124	Dredging at Madna																																				
125	Dredging & Filling																																				
126	Slope Protection																																				
131	Top Soil																																				
132	Slope Protection																																				
137	EMP																																				
142	Katkhal Loop Cut																																				
143	Manual Excavation																																				
144	Const. Confinement Dykes																																				
145	Dredging & Filling																																				
149	Channel Opening																																				
150	Construction of Closures																																				
151	Slope Protection																																				
157	Top Soil																																				
161	EMP																																				
167																																					

Figure 7.22
KALNI-KUSHIYARA RIVER MANAGEMENT PROJECT
IMPLEMENTATION SCHEDULE


Task Summary

Rolled Up Task

Figure 7.22

Summary

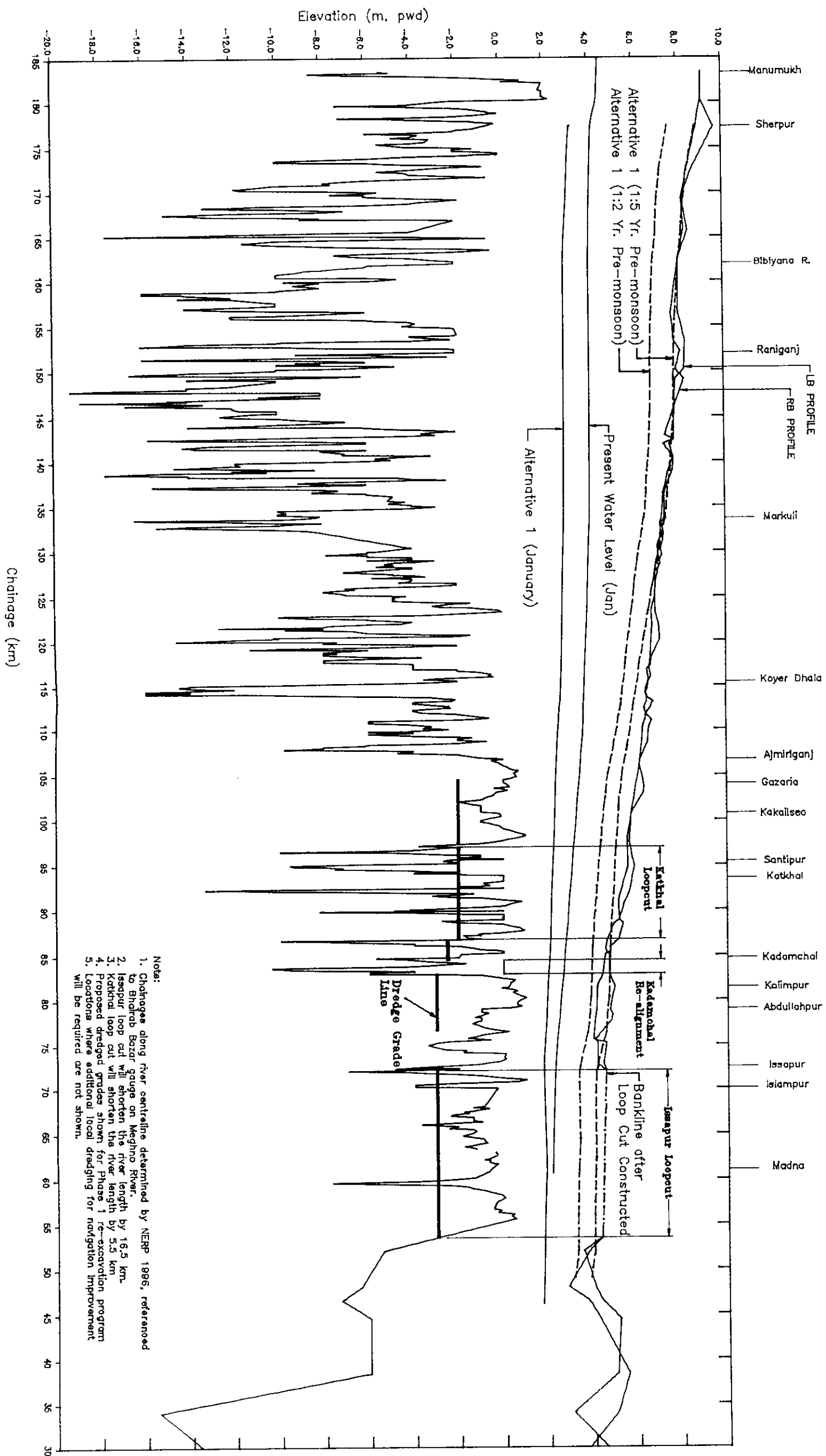
Task

Rollover Task 

[illegible]

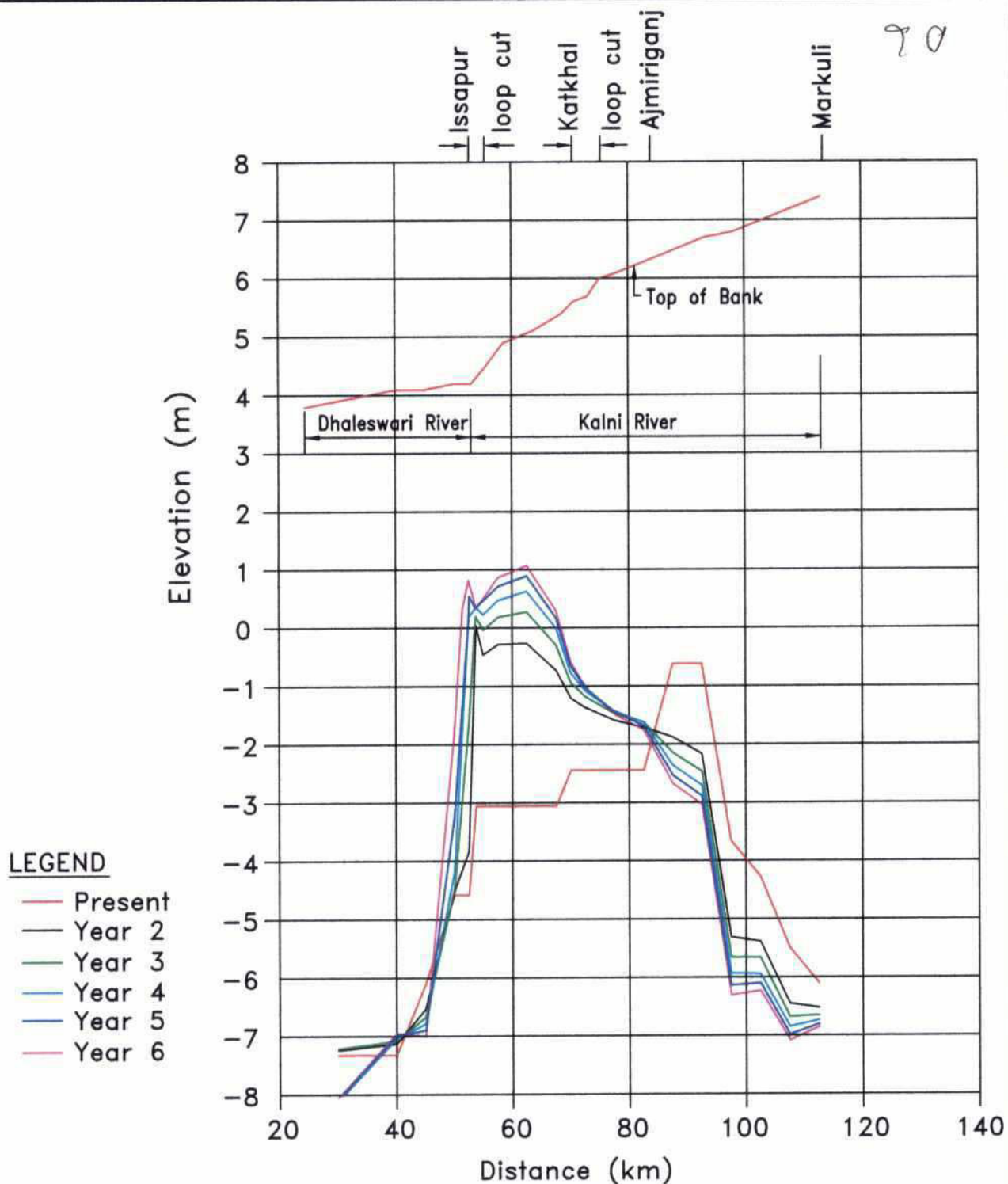
Figure 7.22
KALNI-KUSHIYARA RIVER MANAGEMENT PROJECT
IMPLEMENTATION SCHEDULE

Figure 8.1



Note:
 1. Chainages along river centreline determined by NERP 1986, referenced to Bhadrab Bazar gauge on Meghna River.
 2. Issapur loop cut will shorten the river length by 16.5 km.
 3. Katkhal loop cut will shorten the river length by 5.5 km.
 4. Proposed dredged grades shown for Phase 1 re-excavation program
 5. Locations where additional local dredging for navigation improvement will be required are not shown.

Northeast Regional Project		
Kalmi-Kushiyara River Management Project		
Water Surface Profile (1:5yr Flood)		
(Alternative 1)		
Prepared by:	D.G.M.	December 1997
Computer Drafting by:	Jalal	



FILE: CAPT8-11.DWG

Northeast Regional Project

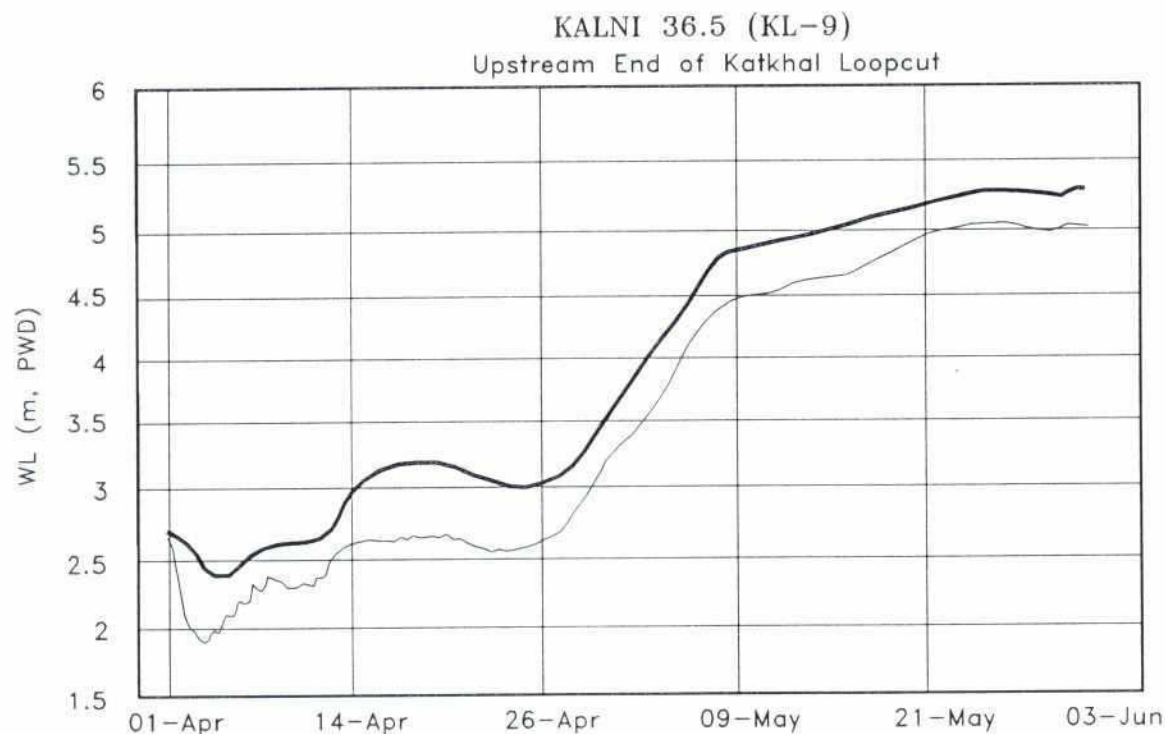
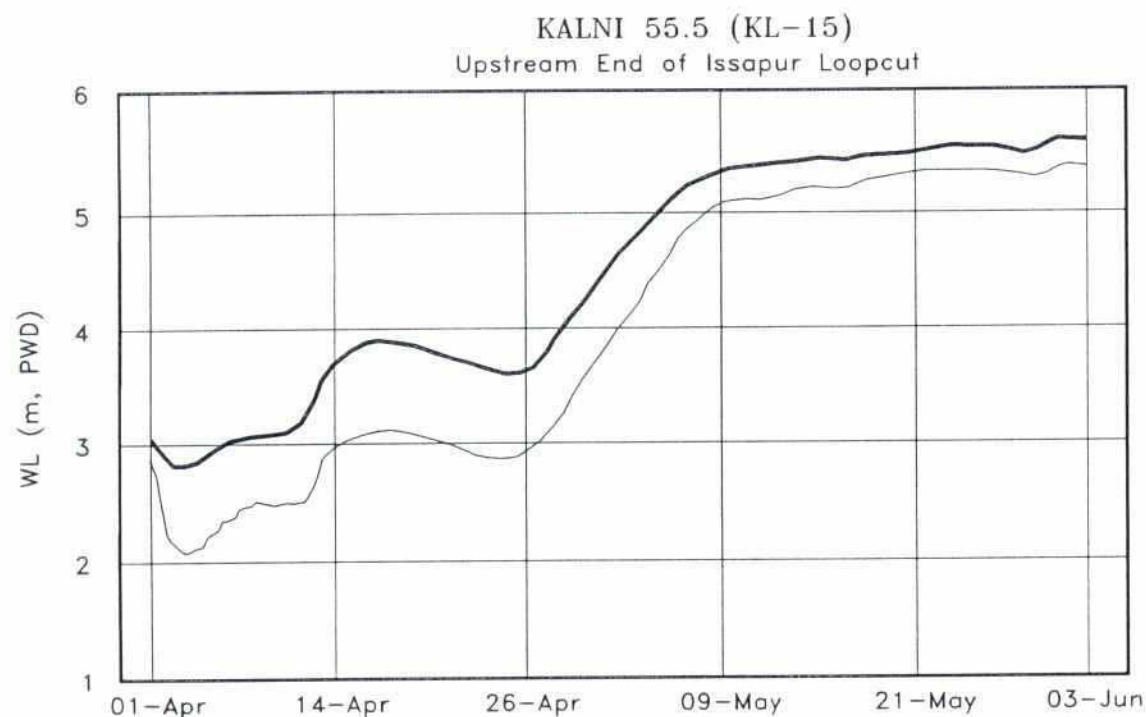
Kalni-Kushiyara River Management Project

Long term Bed Profile Response-Alternative 1

Prepared by: D.G.M.

Computer Drafting by: Mamun

December 1997

**LEGEND:**

- Water Levels without Loop Cut
— Water Levels with Loop Cut

Note : Refer to Figure B.23 for
Location of Cross Sections

Northeast Regional Project

Kalni-Kushiyara River Management Project

Impact of Loop Cuts on Water Levels

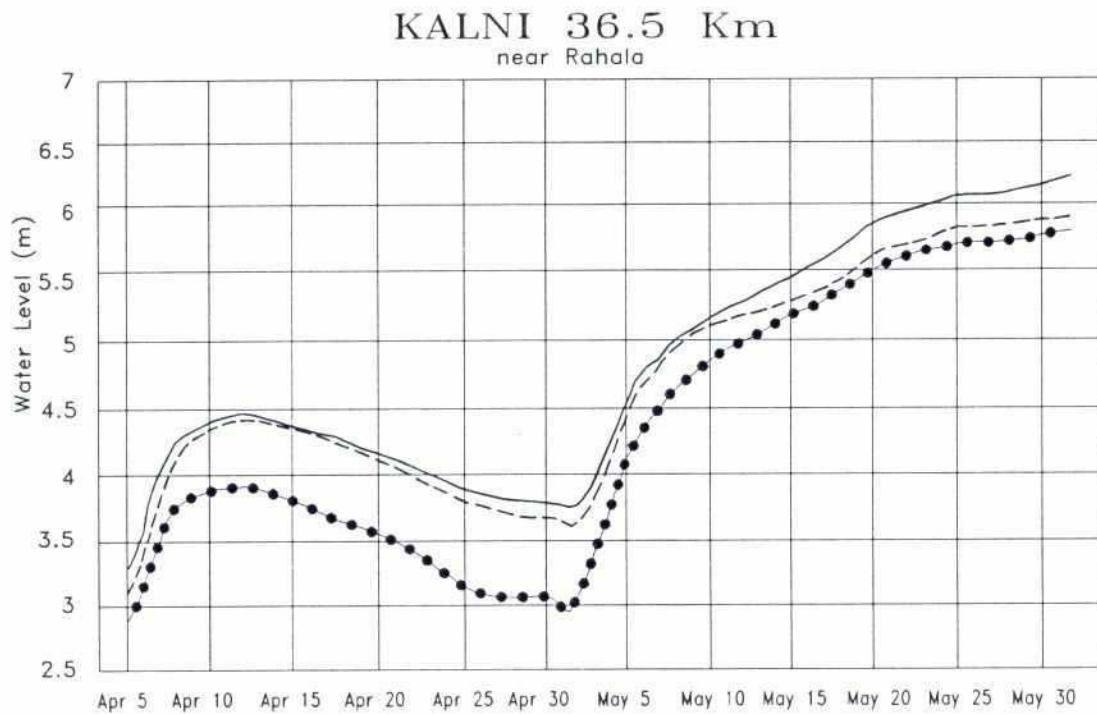
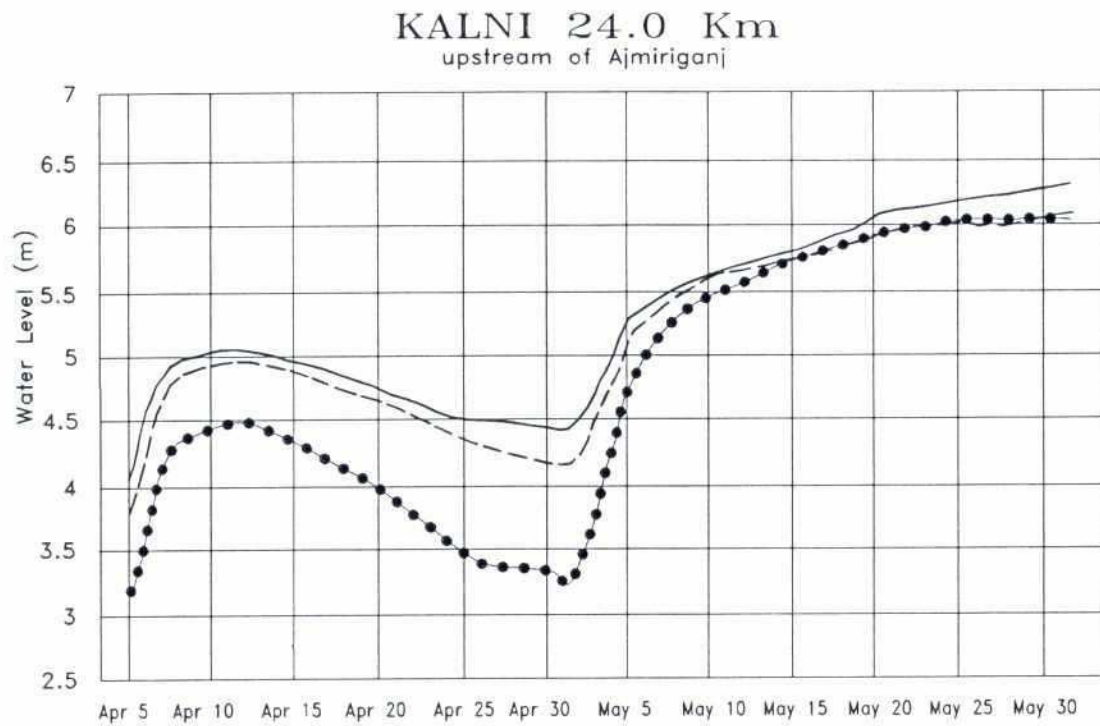
Prepared by: D.G.M.

Computer Drafting by: Mamun

December 1997

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Figure 8.4



LEGEND:

- PRESENT
- FWO
- FW (Alternative 1)

Northeast Regional Project

Kalni-Kushiyara River Management Project

**Pre-Monsoon Water Levels
near Ajmiriganj**

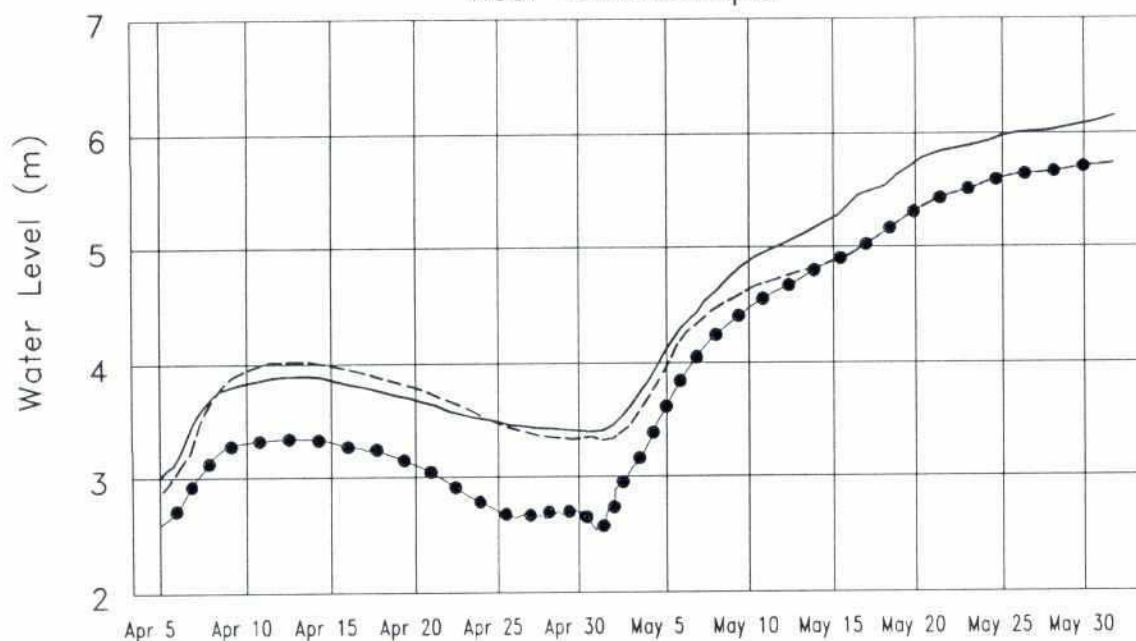
Prepared by: Nahid

Computer Drafting by: Mamun

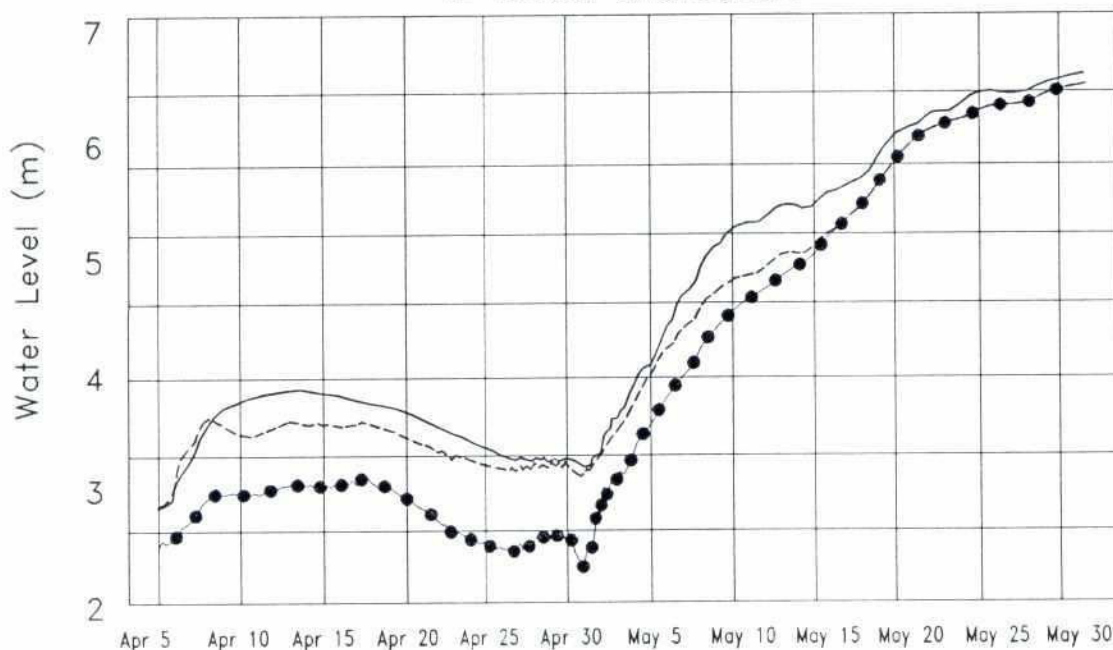
December 1997

96

Kalni 47.5 Km near Abdhullhapur



Kalni 55.5 Km at Baida Bifurcation



LEGEND:

- PRESENT
- FWO
- FW (Alternative 1)

Northeast Regional Project

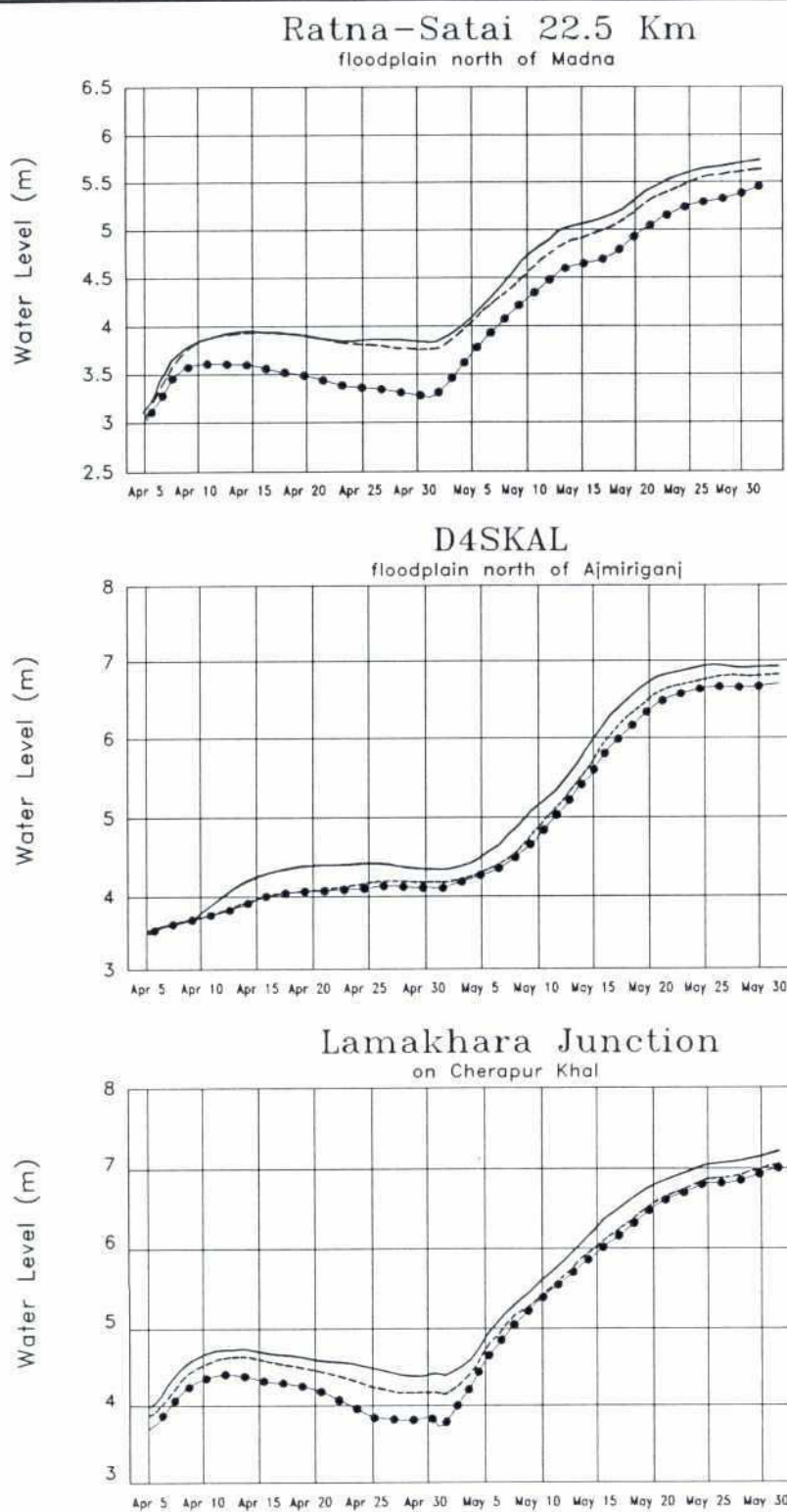
Kalni-Kushiyara River Management Project

Pre-monsoon Water Levels on Lower Kalni River

Prepared by: Nahid

Computer Drafting by: Mamun

December 1997



LEGEND:

- PRESENT
- FWO
- FW (Alternative 1)

Northeast Regional Project

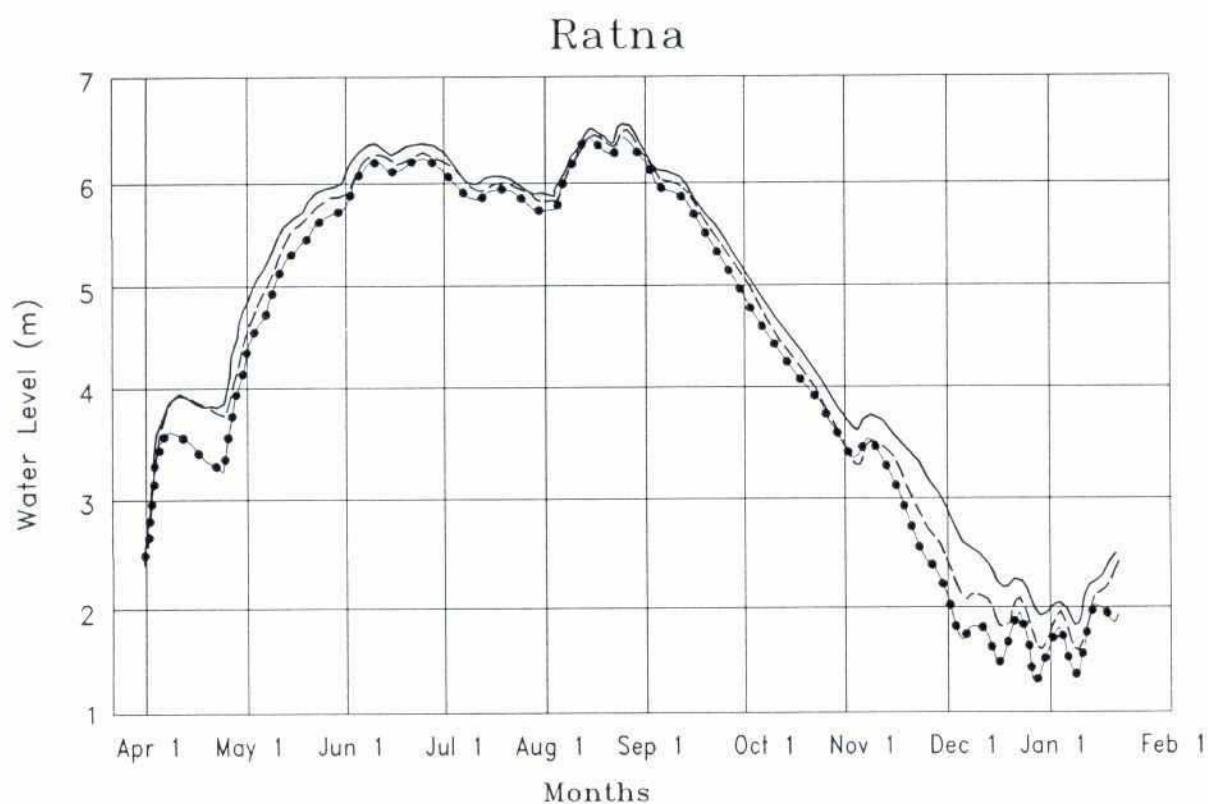
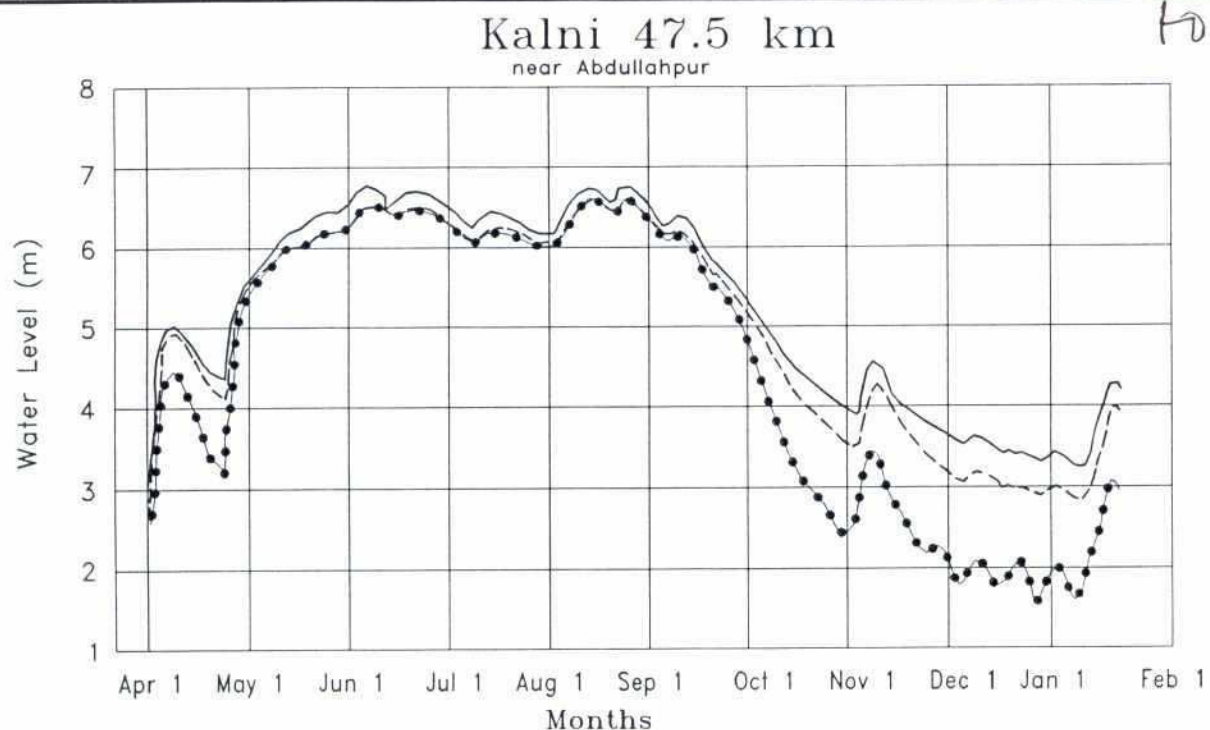
Kalni-Kushiyara River Management Project

**Pre-monsoon Water Levels
in Floodplain Areas**

Prepared by: Nahid

Computer Drafting by: Mamun

December 1997

**LEGEND:**

- PRESENT
 — FWO
 FW (Alternative 1)

Northeast Regional Project

Kalni-Kushiyara River Management Project

**Annual Time Series
of Water Levels**

Prepared by: Nahid

Computer Drafting by: Mamun

December 1997

Figure 8.8

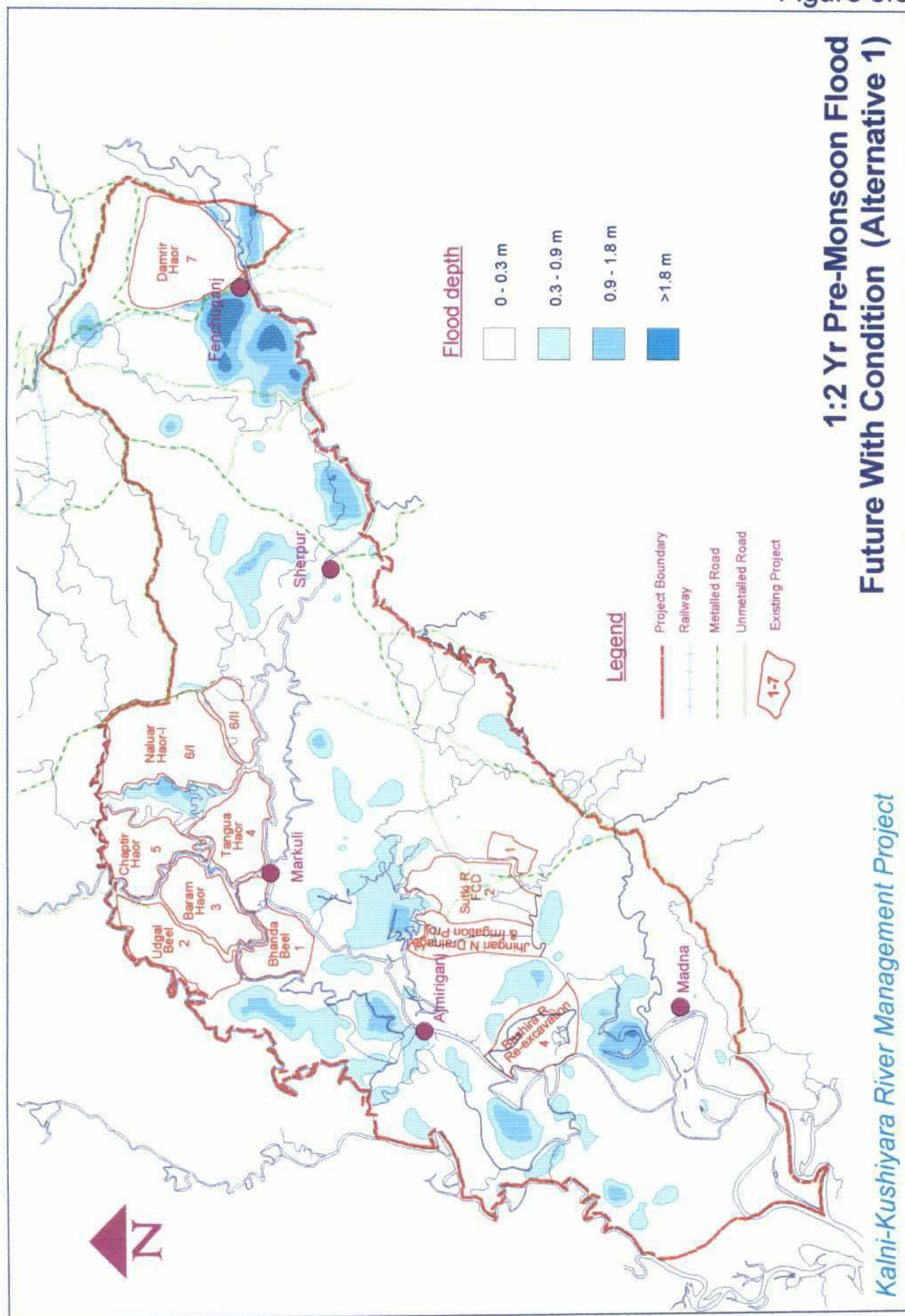


Figure 8.10

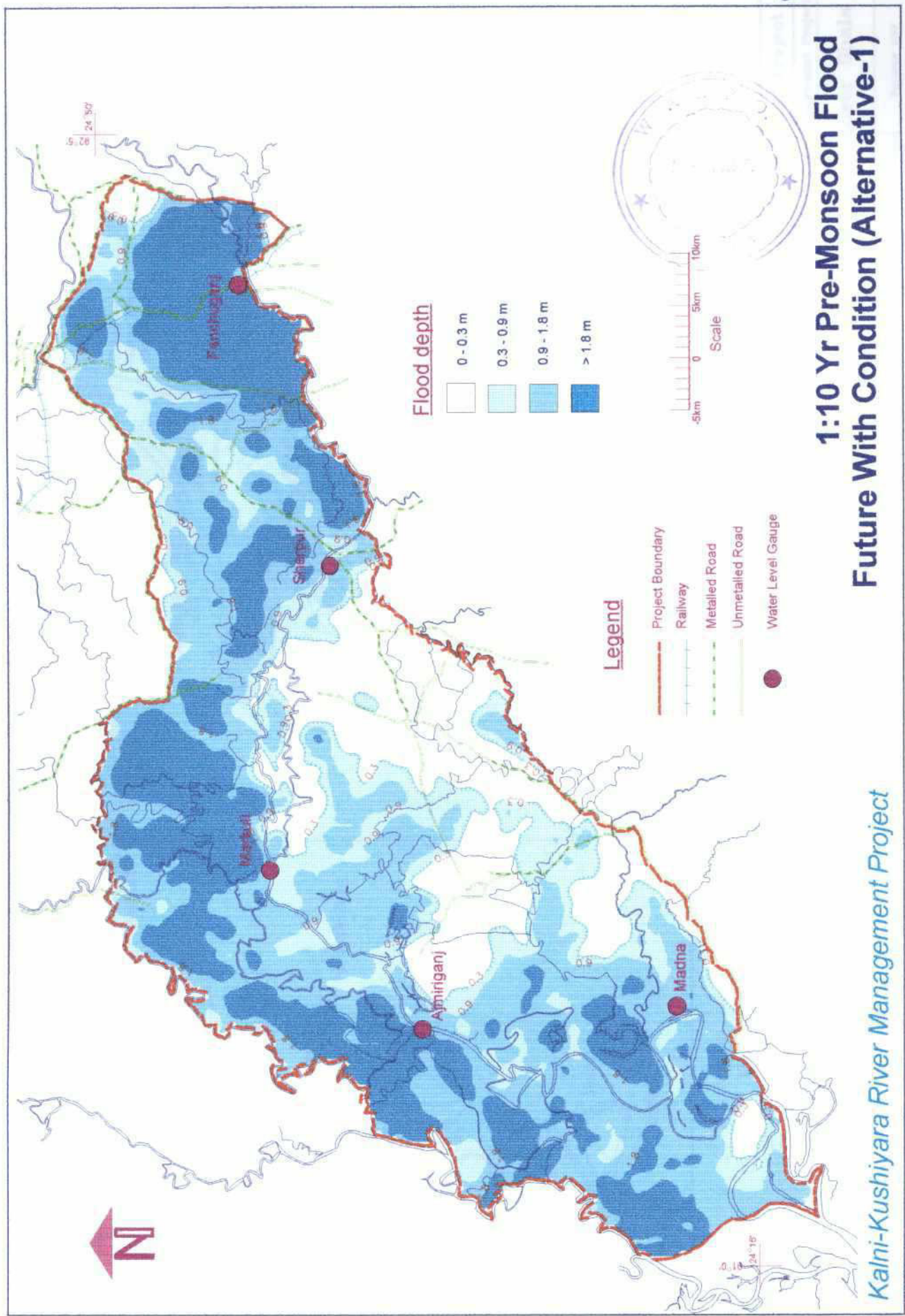
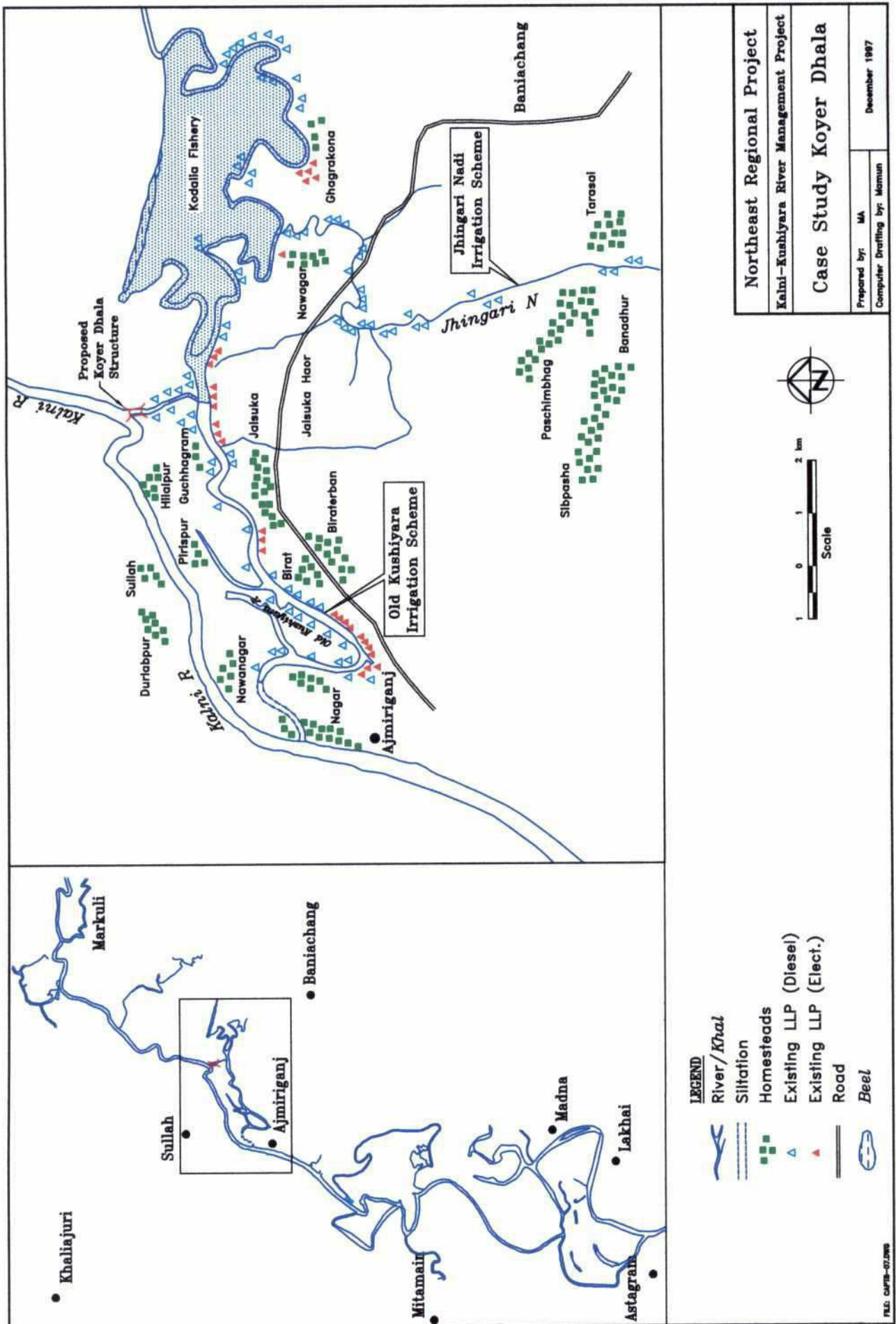


Figure 8.11



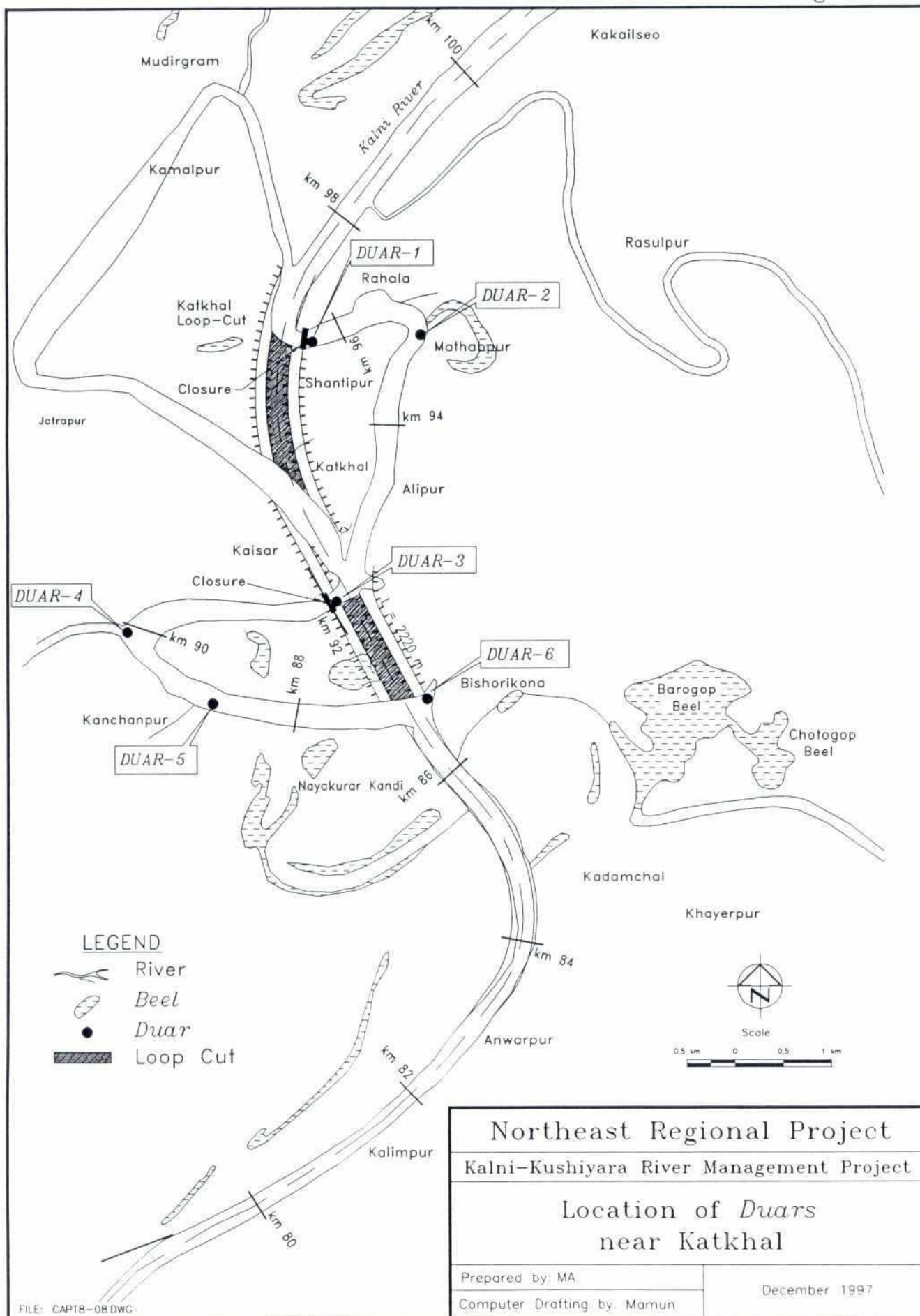
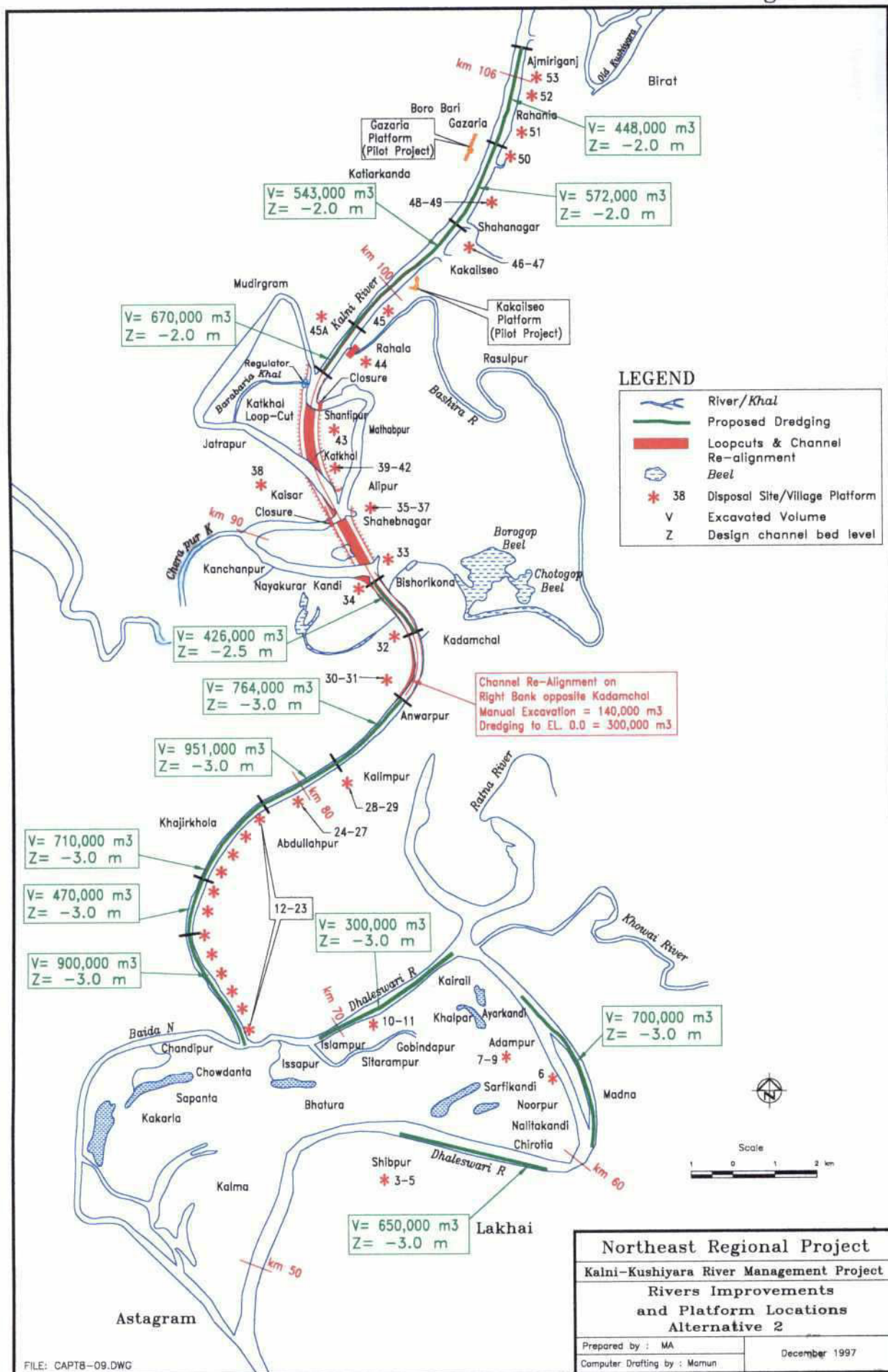


Figure 8.13



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Figure 11.1

