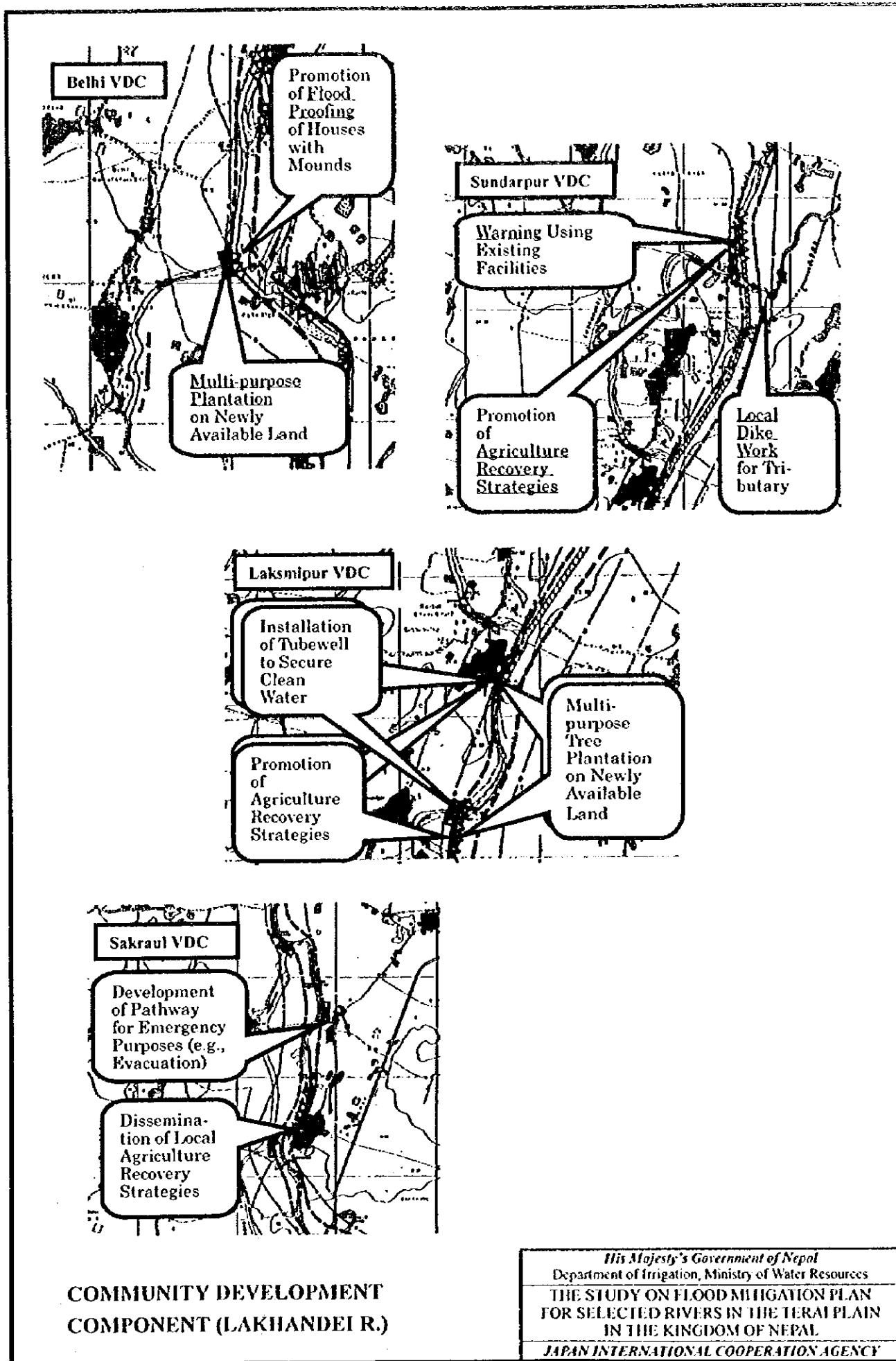
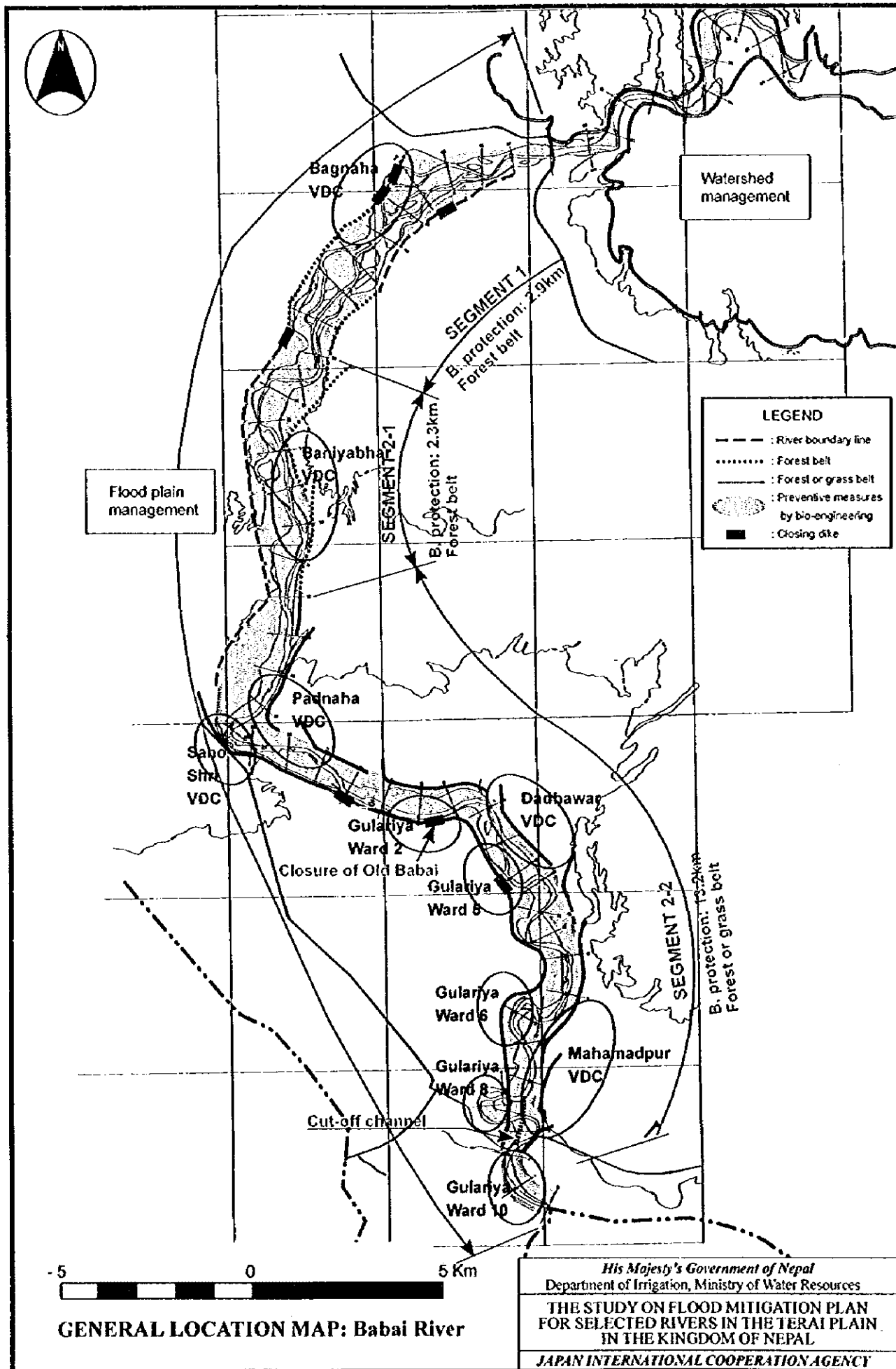
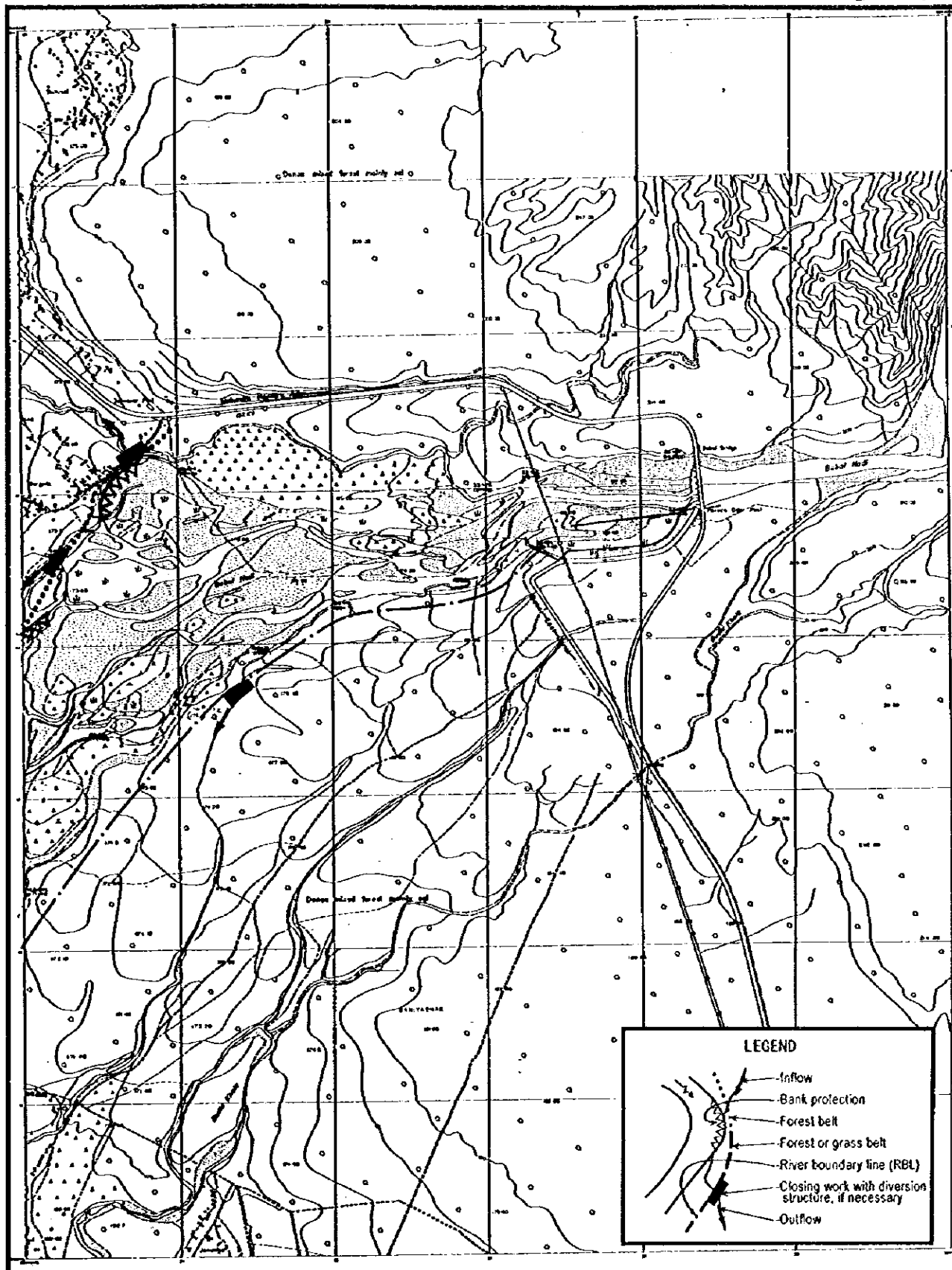


**COMMUNITY DEVELOPMENT COMPONENT (LAKHANDEI R.)**

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 Department of Irrigation, Ministry of Water Resources  
**THE STUDY ON FLOOD MITIGATION PLAN FOR SELECTED RIVERS IN THE TERAI PLAIN IN THE KINGDOM OF NEPAL**  
 JAPAN INTERNATIONAL COOPERATION AGENCY



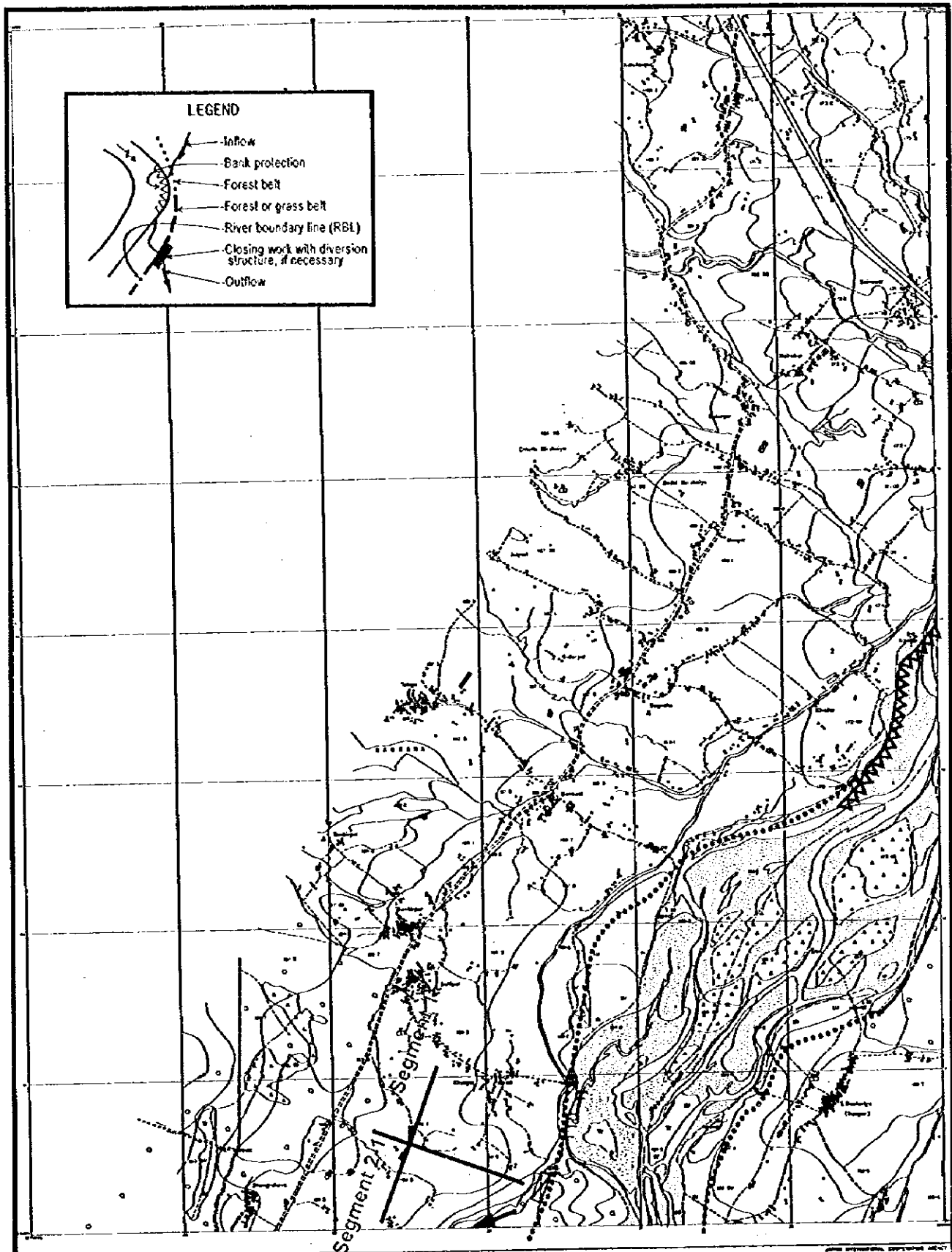




**LAYOUT PLAN FOR FLOOD MITIGATION  
Babai River (1/7)**

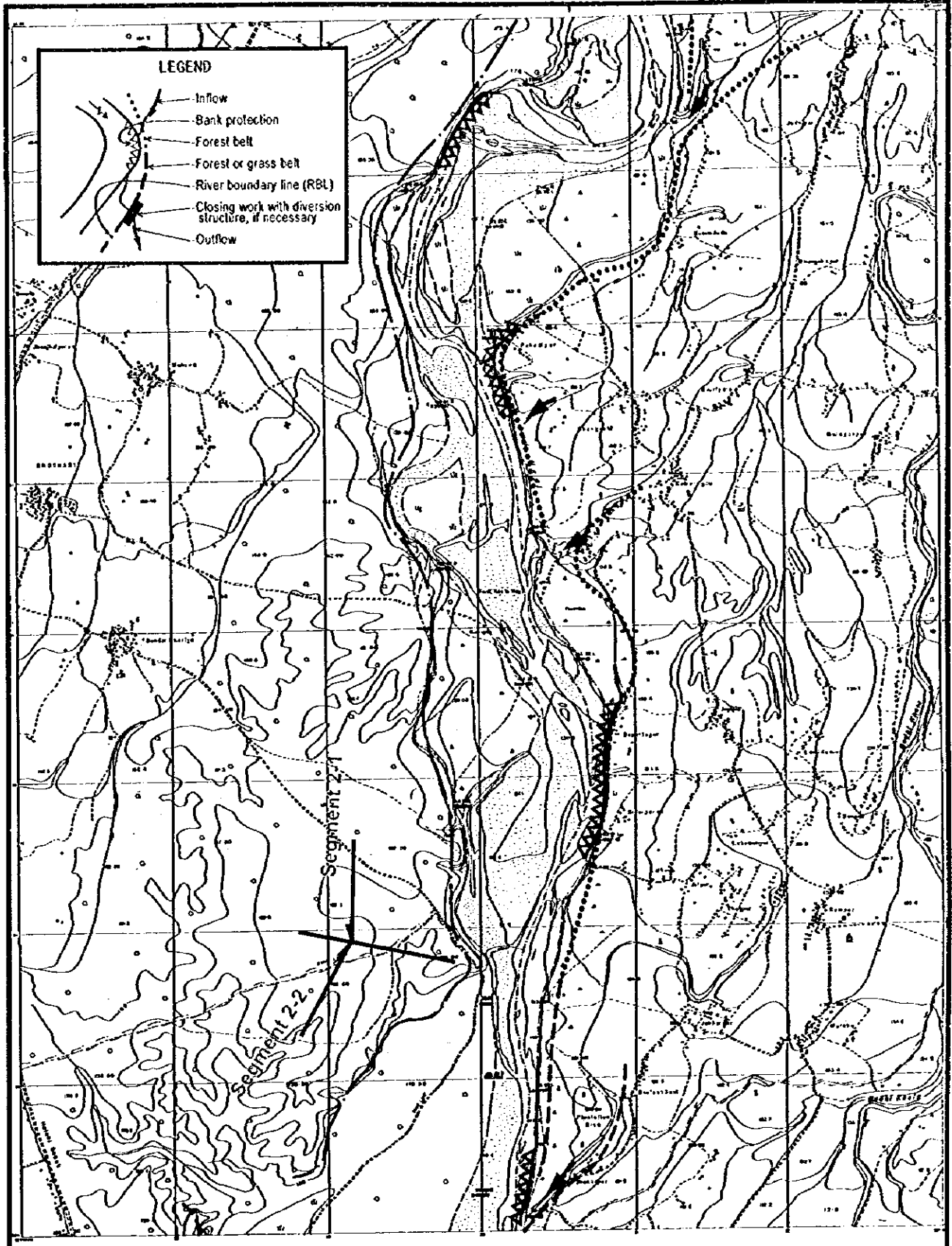
*His Majesty's Government of Nepal*  
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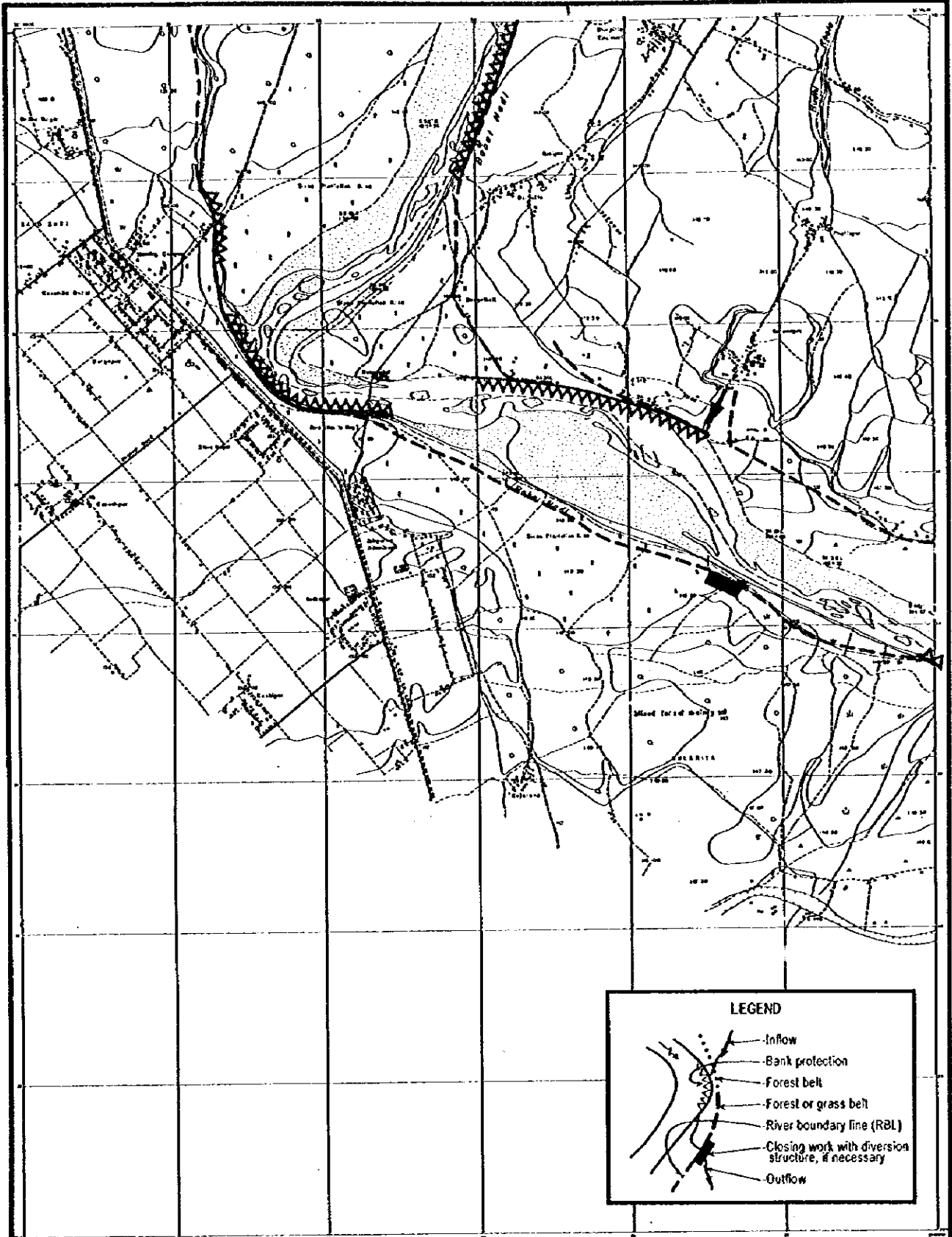
**LAYOUT PLAN FOR FLOOD MITIGATION  
Babai River (2/7)**

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**THE STUDY ON FLOOD MITIGATION PLAN  
 FOR SELECTED RIVERS IN THE TERAI PLAIN  
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**LAYOUT PLAN FOR FLOOD MITIGATION  
Babai River (3/7)**

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**THE STUDY ON FLOOD MITIGATION PLAN  
 FOR SELECTED RIVERS IN THE TERAI PLAIN  
 IN THE KINGDOM OF NEPAL**  
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**LEGEND**

- Inflow
- - - Bank protection
- Forest belt
- ▨ Forest or grass belt
- River boundary line (RBL)
- ▬ Closing work with diversion structure, if necessary
- Outflow

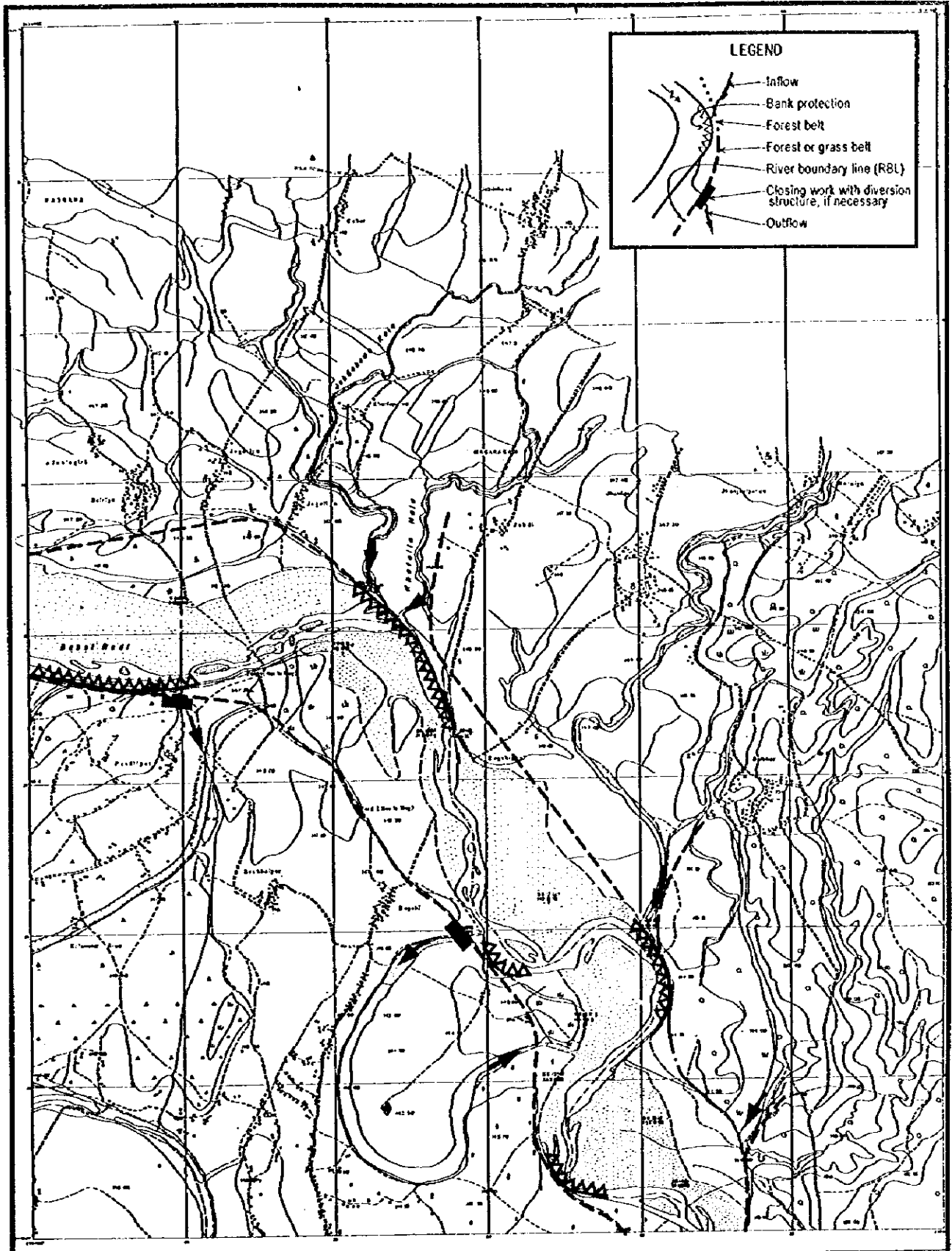


**LAYOUT PLAN FOR FLOOD MITIGATION  
Babai River (4/7)**

*His Majesty's Government of Nepal*  
 Department of Irrigation, Ministry of Water Resources  
**THE STUDY ON FLOOD MITIGATION PLAN  
 FOR SELECTED RIVERS IN THE TERAI PLAIN  
 IN THE KINGDOM OF NEPAL**  
**JAPAN INTERNATIONAL COOPERATION AGENCY**

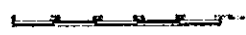


Fig. 7.15 (5/7)



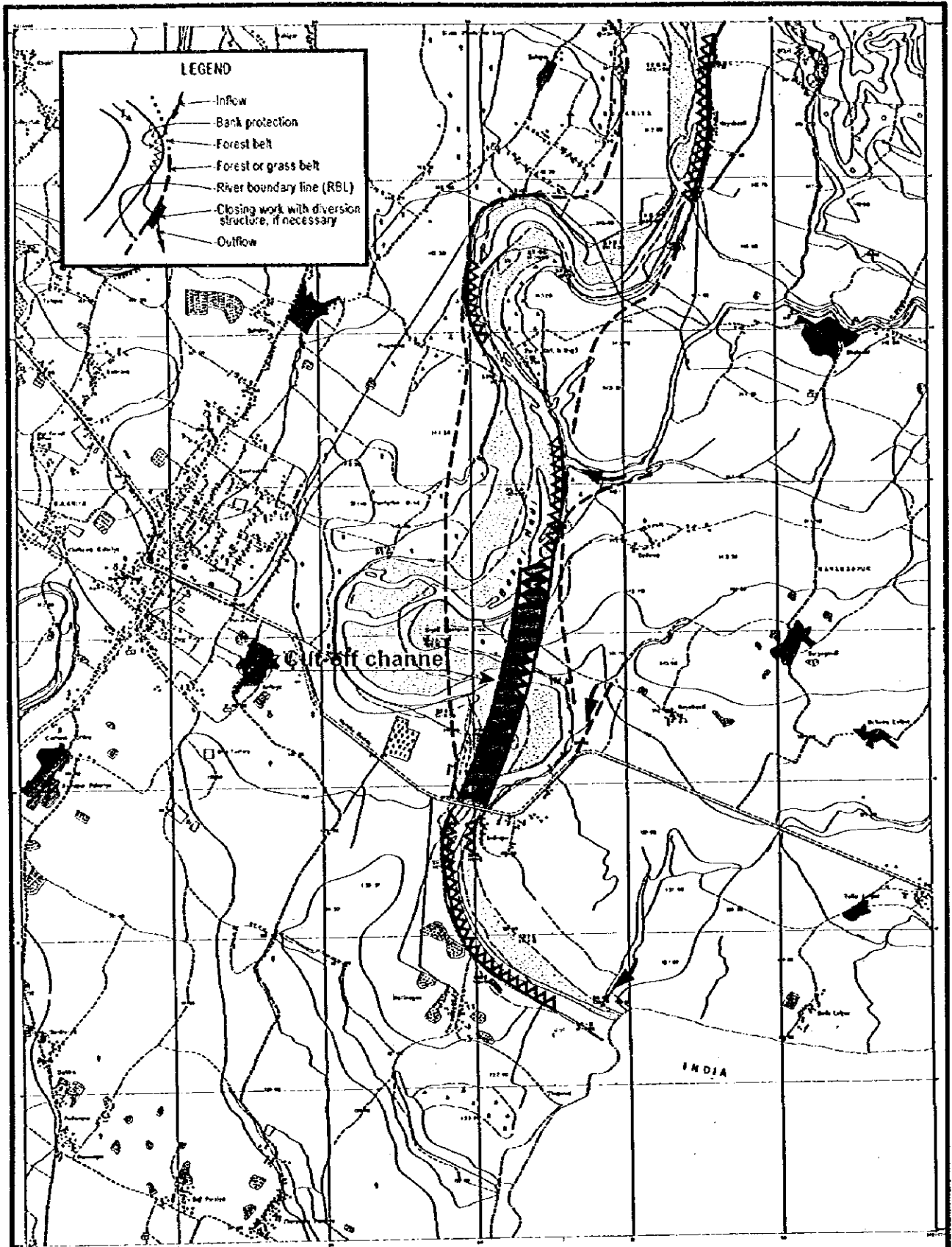
**LEGEND**

- Inflow
- Bank protection
- Forest belt
- Forest or grass belt
- River boundary line (RBL)
- Closing work with diversion structure, if necessary
- Outflow



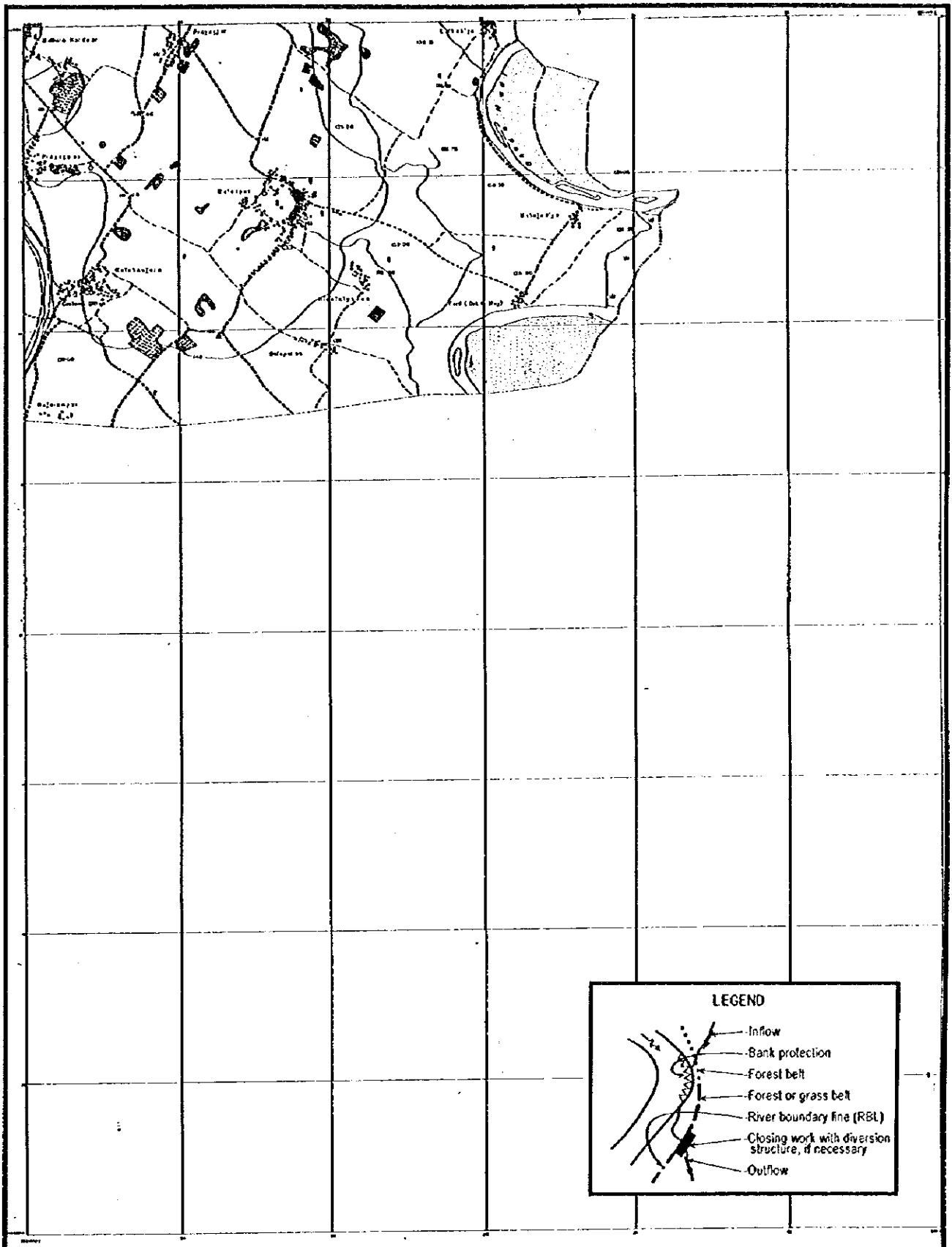
**LAYOUT PLAN FOR FLOOD MITIGATION**  
**Babai River (5/7)**

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**THE STUDY ON FLOOD MITIGATION PLAN**  
**FOR SELECTED RIVERS IN THE TERAI PLAIN**  
**IN THE KINGDOM OF NEPAL**  
**JAPAN INTERNATIONAL COOPERATION AGENCY**



**LAYOUT PLAN FOR FLOOD MITIGATION  
Babai River (6/7)**

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**THE STUDY ON FLOOD MITIGATION PLAN  
 FOR SELECTED RIVERS IN THE TERAI PLAIN  
 IN THE KINGDOM OF NEPAL**  
**JAPAN INTERNATIONAL COOPERATION AGENCY**



**LEGEND**

- Inflow
- - - Bank protection
- Forest belt
- ▨ Forest or grass belt
- River boundary line (RBL)
- Closing work with diversion structure, if necessary
- Outflow

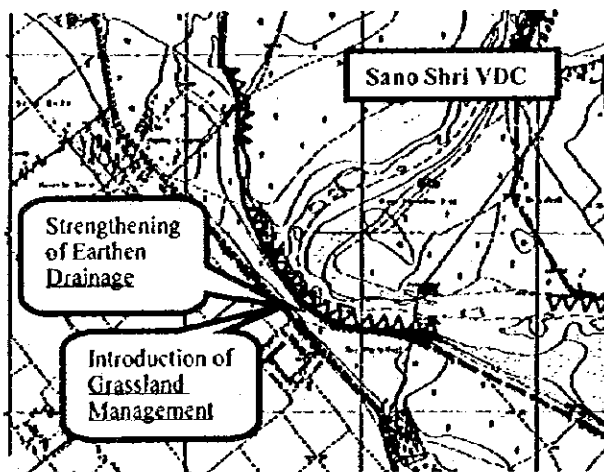
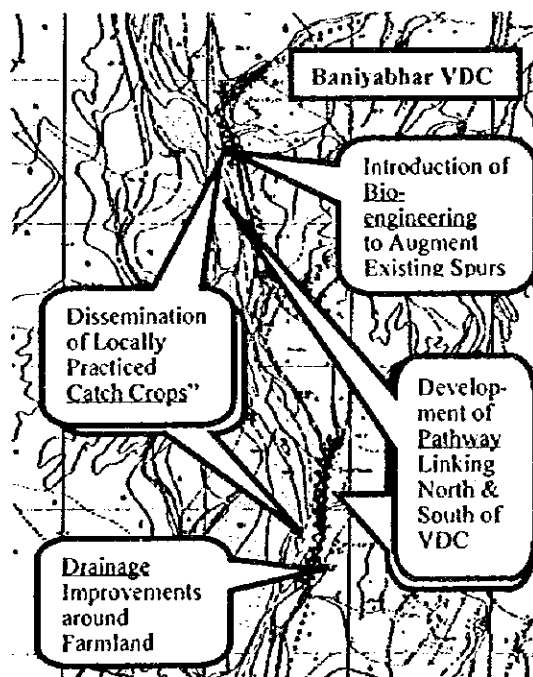
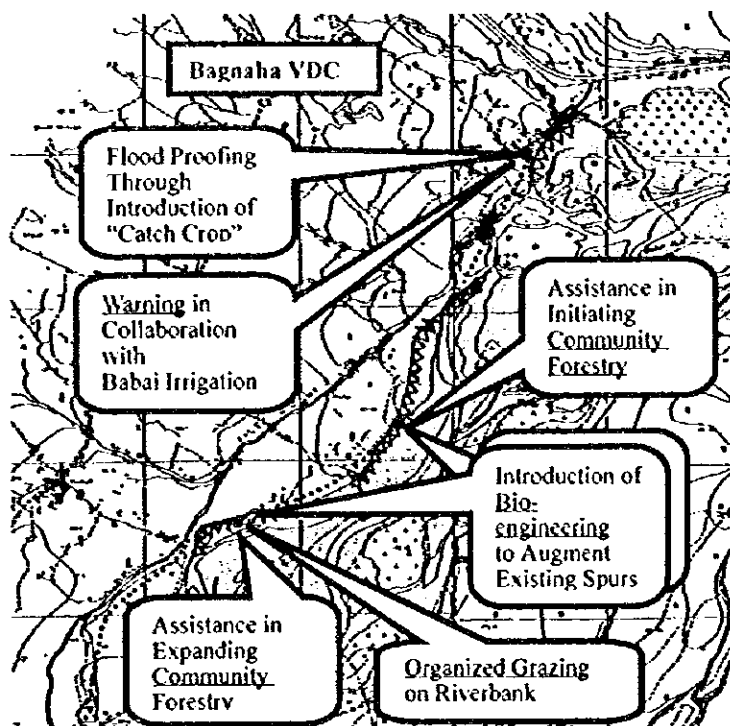
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**LAYOUT PLAN FOR FLOOD MITIGATION**  
**Babai River (7/7)**

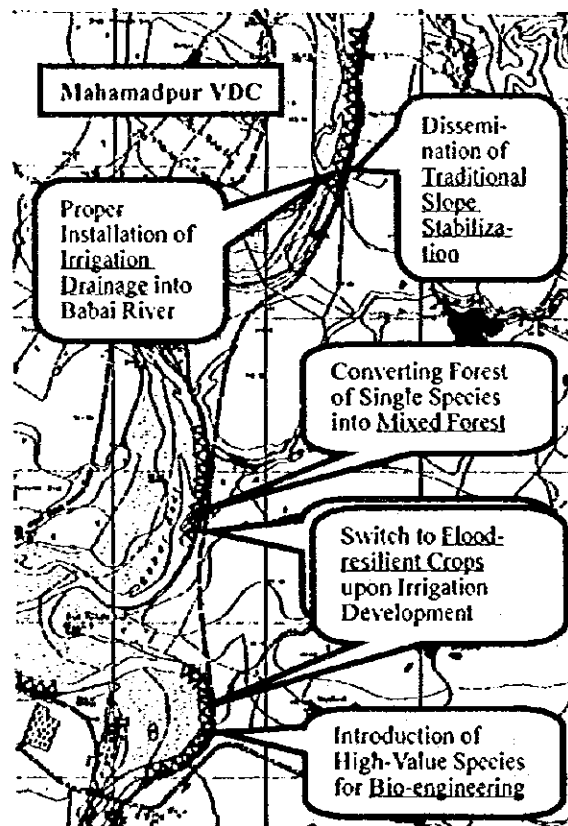
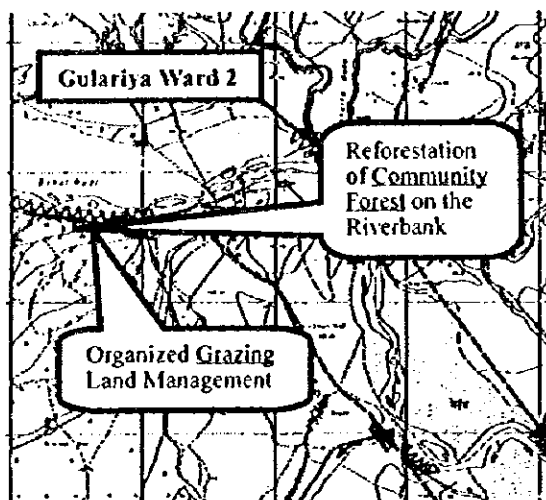
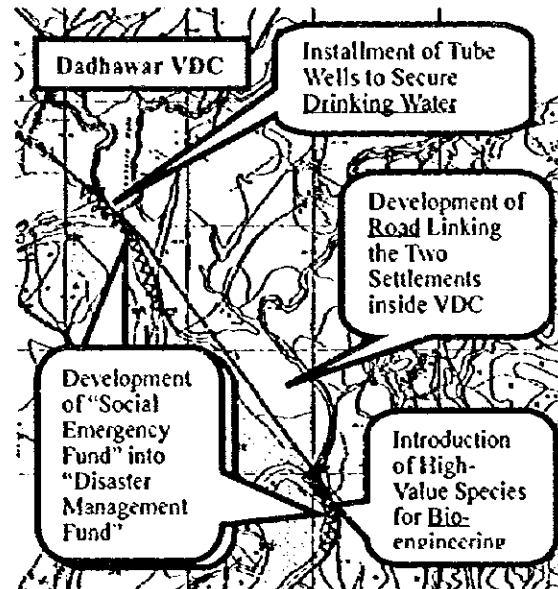
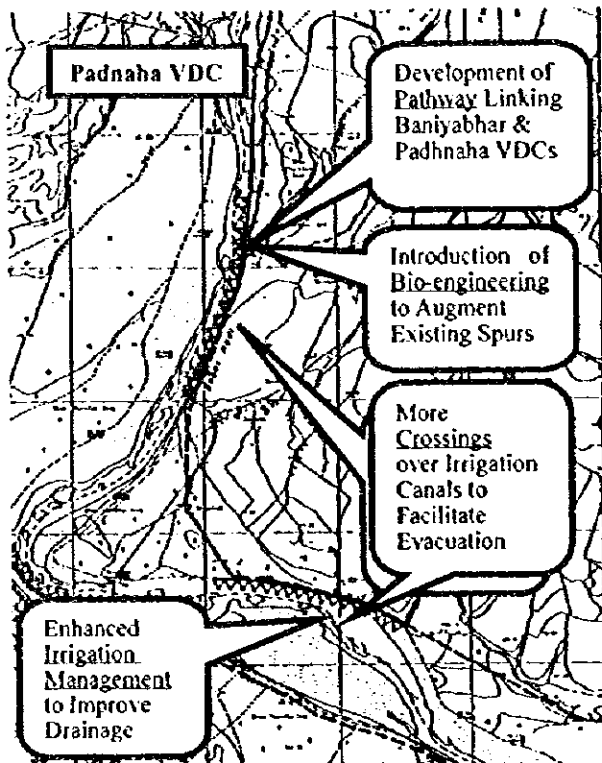
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**FOR SELECTED RIVERS IN THE TERAI PLAIN**  
**IN THE KINGDOM OF NEPAL**  
**JAPAN INTERNATIONAL COOPERATION AGENCY**





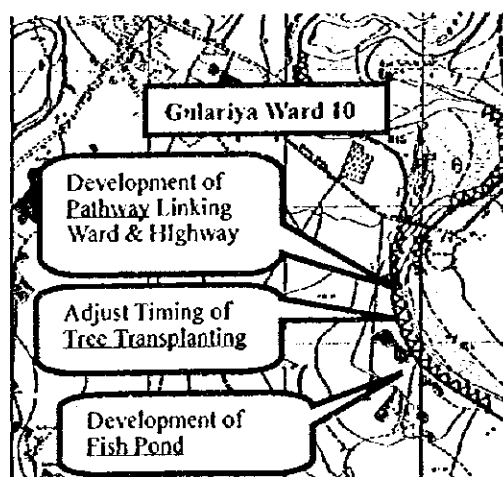
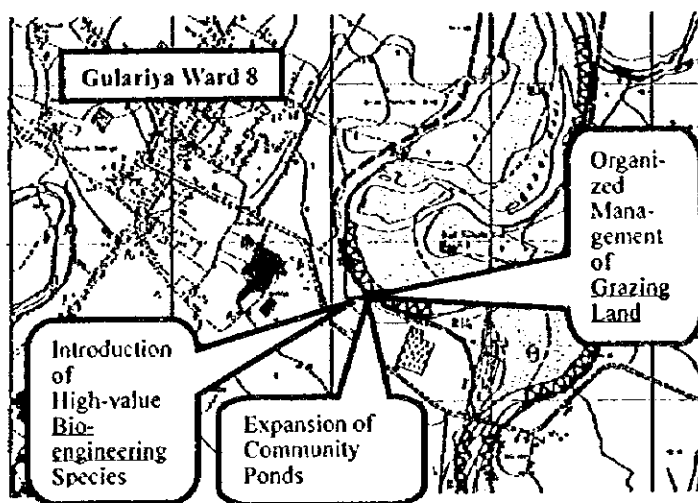
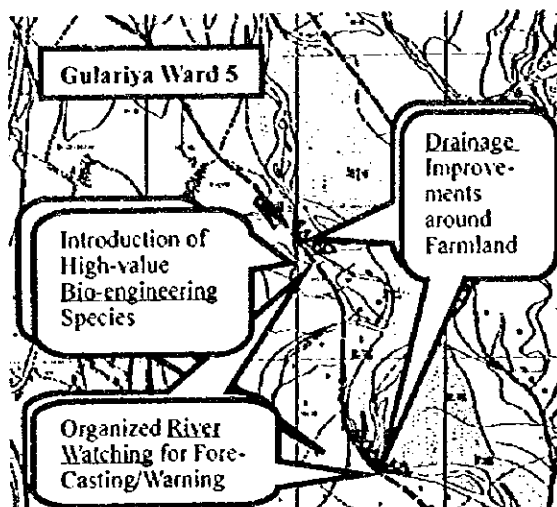
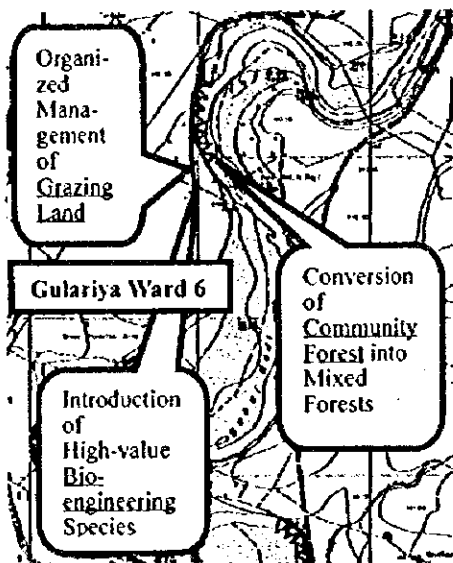
**COMMUNITY DEVELOPMENT COMPONENT (BABAI R.)**

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 JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.17

Work Component and Items	1st.Phase(9th plan) (1997-2002)					2nd.Phase(10th plan) (2002-2007)					3rd.Phase (11-12th plan) (2007-2017)
	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	
<b>PREPARATORY WORKS</b>											
Master plan/ feasibility study	█										
Fund arrangement			█								
Definite plan/detailed design, etc				█							
Preservation of land					█						
Coordination among agencies/communities						█	█	█	█	█	█
<b>WATERSHED MANAGEMENT COMPONENT</b>											
Afforestation and Land use Regulation						█	█	█	█	█	█
Publicity activities						█	█	█	█	█	█
<b>RIVER CONTROL COMPONENT</b>											
<b>Channel treatment works:</b>											
Branch/anabranh works					█	█	█	█	█	█	█
<b>Bank protection works:</b>											
Groyne/revetment works					█	█	█	█	█	█	█
<b>Dike works:</b>											
Forest/grass belt works					█	█	█	█	█	█	█
Cut-off channel works					█	█	█	█	█	█	█
<b>Land use regulation:</b>											
Flood hazard map				█							
Conservation of channel storage					█	█	█	█	█	█	█
<b>COMMUNITY DEVELOPMENT COMPONENT</b>											
<b>Community mobilization:</b>											
Workshop for local government leaders				█							
Formation of COs				█							
Formation of inter-CO groups				█							
Disaster relief fund/ group saving					█	█	█	█	█	█	█
Promotion of public awareness					█	█	█	█	█	█	█
<b>Local coping measures:</b>											
Land use regulation					█	█	█	█	█	█	█
Flood proofing					█	█	█	█	█	█	█
Flood forecasting and warning					█	█	█	█	█	█	█
Evacuation					█	█	█	█	█	█	█
Flood fighting					█	█	█	█	█	█	█
<b>Community-based sustainable mesures:</b>											
<b>Bank protection works:</b>											
- Preventive bank protection works					█	█	█	█	█	█	█
<b>Dike works:</b>											
- Forest/grass belt works					█	█	█	█	█	█	█
<b>Channel excavation works:</b>											
- Bed material collection					█	█	█	█	█	█	█
Opration & maintenance of F.M. facilities					█	█	█	█	█	█	█
<b>ASSOCIATE ACTIVITIES</b>											
<b>Research/investigation:</b>											
Technical guidance:					█	█	█	█	█	█	█

**IMPLEMENTATION SCHEDULE: BABAI RIVER**



Fig. 7.18

Work Component and Items	1st.Phase(9th plan) (1997-2002)					2nd.Phase(10th plan) (2002-2007)					3rd.Phase (11-12th plan) (2007-2017)
	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	
<b>PREPARATORY WORKS</b>											
Master plan/ feasibility study	[Bar from 1997/98 to 1998/99]										
Fund arrangement	[Bar from 1998/99 to 2000/01]										
Definite plan/detailed design, etc	[Bar from 2000/01 to 2001/02]										
Preservation of land	[Bar from 2001/02 to 2002/03]										
Coordination among agencies/communities	[Bar from 1998/99 to 2006/07]										
<b>WATERSHED MANAGEMENT COMPONENT</b>											
Erosion control works:											
Erosion control test works	[Bar from 2002/03 to 2006/07]										
Afforestation and Land use Regulation	[Bar from 1998/99 to 2006/07]										
Publicity activities	[Bar from 1998/99 to 2006/07]										
<b>RIVER CONTROL COMPONENT</b>											
Channel treatment works:											
Branch/anabranch works	[Bar from 2002/03 to 2004/05]										
Re-alignment of river channel	[Bar from 2002/03 to 2004/05]										
Bank protection works:											
Groyne/revetment works	[Bar from 2002/03 to 2004/05]										
Dike works:											
Forest/grass belt pilot works	[Bar from 2002/03 to 2004/05]										
Dike road works	[Bar from 2002/03 to 2004/05]										
Ring dike works	[Bar from 2002/03 to 2004/05]										
Channel excavation works:											
Pilot channel works	[Bar from 2002/03 to 2004/05]										
Land use regulation:											
Flood hazard map	[Bar from 2000/01 to 2001/02]										
Conservation of channel storage	[Bar from 2002/03 to 2006/07]										
<b>COMMUNITY DEVELOPMENT COMPONENT</b>											
Community mobilization:											
Workshop for local government leaders	[Bar from 2000/01 to 2001/02]										
Formation of COs	[Bar from 2000/01 to 2001/02]										
Formation of inter-CO groups	[Bar from 2000/01 to 2001/02]										
Disaster relief fund/ group saving	[Bar from 2002/03 to 2006/07]										
Promotion of public awareness	[Bar from 2002/03 to 2006/07]										
Local coping measures:											
Land use regulation	[Bar from 2002/03 to 2006/07]										
Flood proofing	[Bar from 2002/03 to 2006/07]										
Flood forecasting and warning	[Bar from 2002/03 to 2006/07]										
Evacuation	[Bar from 2002/03 to 2006/07]										
Flood fighting	[Bar from 2002/03 to 2006/07]										
Community-based sustainable measures:											
Bank protection works:											
- Preventive bank protection works	[Bar from 2002/03 to 2006/07]										
Dike works:											
- Forest/grass belt works	[Bar from 2002/03 to 2006/07]										
Channel excavation works:											
- Bed material collection	[Bar from 2002/03 to 2006/07]										
Operation & maintenance of F.M. facilities	[Bar from 2002/03 to 2006/07]										
<b>ASSOCIATE ACTIVITIES</b>											
Research/investigation:	[Bar from 1998/99 to 2006/07]										
Technical guidance:	[Bar from 1998/99 to 2006/07]										

**IMPLEMENTATION SCHEDULE: LAKHANDEI RIVER**

Fig. 7.19

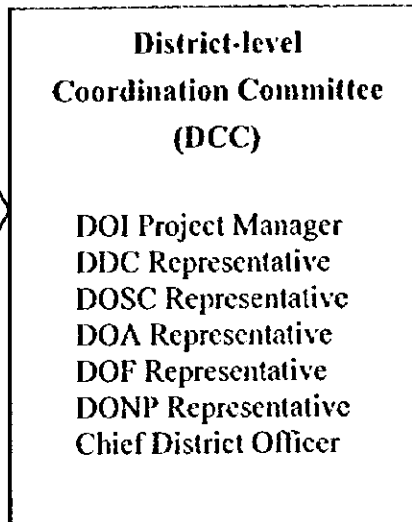
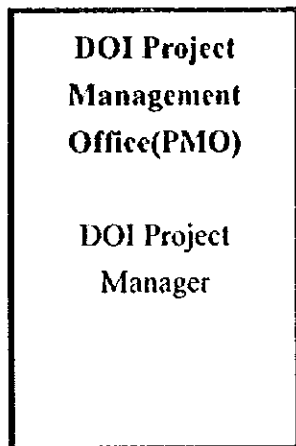
Work Items	Central Government				Local Government		Local community
	DO/DIO	DOSC	DPTC	Other agencies	DDC	VDC	
Preparatory works							
Feasibility study	⊙	.	.	.	○	○	○
Fund arrangement	⊙	.	.	.	⊙	⊙	⊙
Definite plan/detailed design, etc	⊙	.	.	.	○	○	○
Preservation of land	⊙	.	.	.	⊙	⊙	○
Research/investigation	⊙	⊙	⊙	.	.	.	.
Technical guidance	⊙	⊙	⊙	.	.	.	.
Organizing communities	○	○	○	.	○	○	⊙
Coordinations among organizations	⊙	○	○	○	○	○	○
Channel treatment works							
Tributary works	⊙	-	-	-	○	○	○
Branch/anabranch works	⊙	-	-	-	○	○	○
Bank protection works							
Groyne/revetment works	⊙	-	-	-	○	⊙	○
Preventive bank protection works	○	-	-	-	○	⊙	○
Dike embankment works							
Forest/grass belt works	⊙*	-	-	.	○	⊙	○
Dike road works	⊙	-	-	○	⊙	○	○
Ring dike works	○	-	-	-	.	⊙	○
Channel excavation works							
Bed material collection	○	-	-	-	⊙	⊙	.
Pilot channel works	⊙	-	-	-	○	○	.
Cut-off channel works	⊙	-	-	-	○	○	.
Retarding basin works	⊙	-	-	-	○	○	.
Sabo works	○	⊙	○	-	○	⊙	○
Forest reserve							
Forest reserve	○	⊙	○	-	○	⊙	○
Refoerstation	○	⊙	○	-	○	⊙	○
Conservation of channel storage	⊙	-	-	○	○	○	○
Land use regulation	○	-	-	-	-	⊙	○
Flood proofing	○	-	-	-	-	⊙	⊙
Flood forecasting/warning/evacuation							
Flood forecasting/warning facilities	⊙	-	-	-	○	○	○
Flood forecasting/warning	○	-	-	-	⊙	⊙	○
Flood fighting	○	-	-	-	○	⊙	⊙
Promotion of public awareness	⊙	⊙	⊙	-	○	⊙	○
Disaster relief fund	-	-	-	○	○	⊙	⊙
Tax adjustment	○	-	-	⊙	-	-	-

- (Remarks)
- ⊙ :In charge of implementation
  - :To cooperate and/or participate
  - ⊙\* :Implementation as pilot project

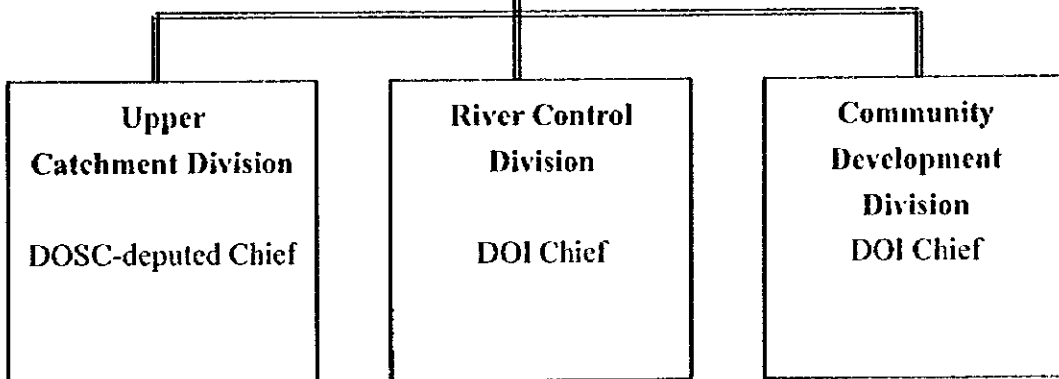
## IMPLEMENTATION AGENCIES AND ORGANIZATIONS

**IMPLEMENTATION ARRANGEMENT  
FOR  
FLOOD MITIGATION IN TERAI**

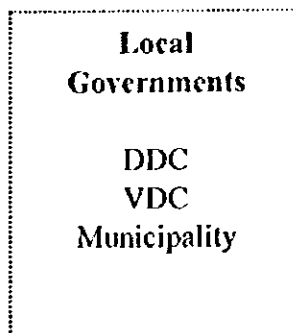
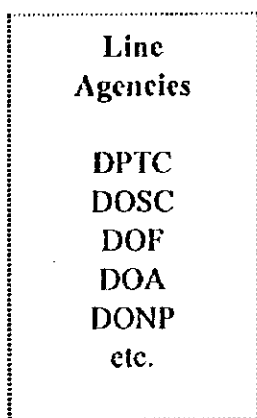
*Coordinating Agency*



*Implementing Division*



*Cooperating Agency*



*His Majesty's Government of Nepal*  
Department of Irrigation, Ministry of Water Resources  
**THE STUDY ON FLOOD MITIGATION PLAN  
FOR SELECTED RIVERS IN THE TERAI PLAIN  
IN THE KINGDOM OF NEPAL**  
*JAPAN INTERNATIONAL COOPERATION AGENCY*



## CHAPTER 8 CONCLUSION AND RECOMMENDATION

**Economic Viability of Master Plan:** Implementation of the Master Plan is expected to bring about various tangible and intangible benefits to the communities in the Study Area. According to the preliminary cost-benefit analysis, the Babai river yields high EIRR-value, while the value is low for the Lohandra and Khytiya rivers. This result should be handled only as a rule-of-thumb and reviewed through feasibility study based on the river survey data.

**Economic Viability of Priority Project:** According to the cost-benefit analysis based on the river survey data, the priority projects (the Lakhandai and Babai rivers) yield high EIRR-values under the future basin condition, though the value is low under the existing basin. The proposed flood mitigation measures can be implemented at any place and at any size. The project can be economically viable, since the project works would be implemented from those of higher cost-performance, keeping pace with basin's development.

**Environmental Impacts:** From environmental conservation viewpoint, the proposed project overwhelmingly positive exerting favorable effects on social and natural environment and no pollution problems will accrue. Only problems found so far are conservation of wetlands most of which have already been developed as farm lands or reserved as national parks.

**Technical Aspects:** The technology proposed for the project are appropriate from the viewpoint of technical competence, since the plan took much consideration on fitness to the local situation, technical capability and financial solvency to make the project sustainable.

**Recommendation:** Considering the crucial importance of the flood mitigation in the Terai plain, the proposed Master Plan for the Ratuwa, Lohandra, Narayani, Tinau, West Rapti and Khuliya rivers should be promoted to the Feasibility Study. As to the proposed flood mitigation projects for the Lakhandai and Babai rivers, the Feasibility Study verified that the projects are economically and technically feasible and exert little adverse effect to the environment. The projects are recommended for implementation in order to support people's livelihood and sound development of the basin.











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