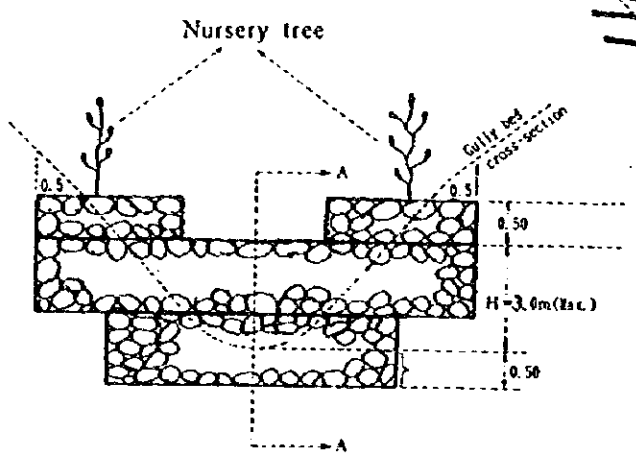
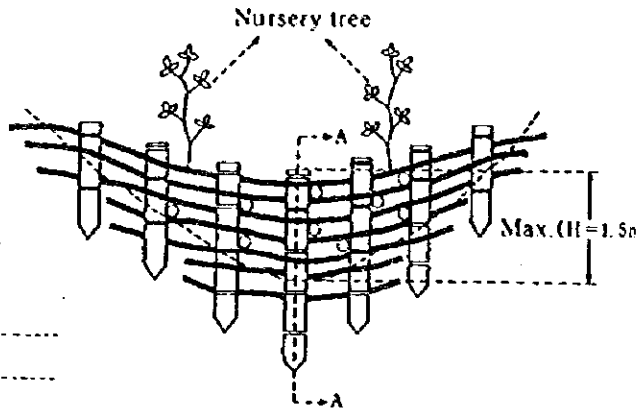
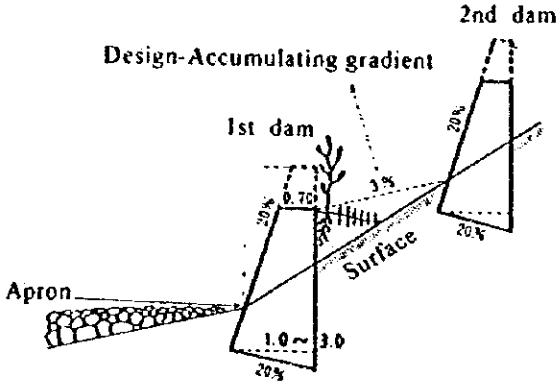



Front view

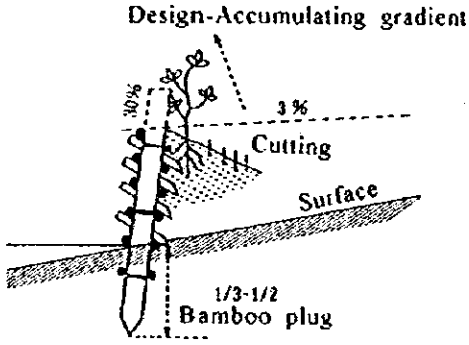



Front view



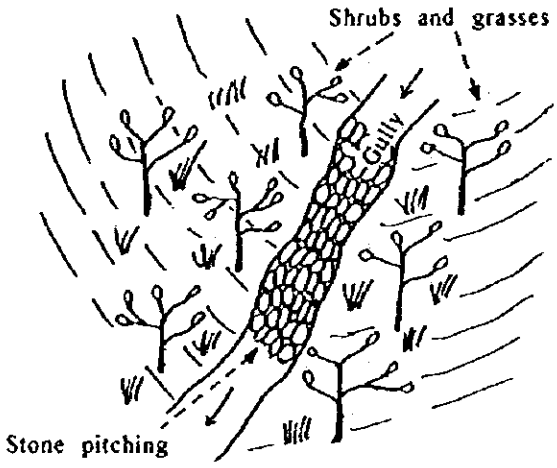

Side view

(b) Small gabion check dam for gully control

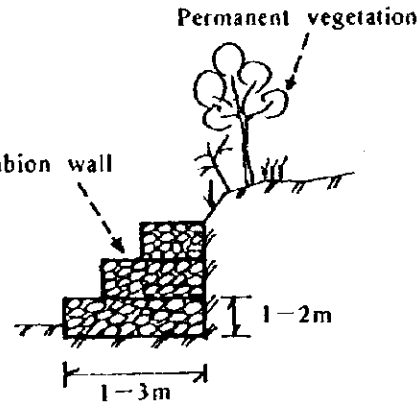



Side view

(a) Bamboo gully plug fence




(c) Stone pitching gully control with shrubs and grasses




(d) Gabion wall and permanent vegetation

**EROSION CONTROL MEASURES IN WATERSHED AREA**

| |
|---|
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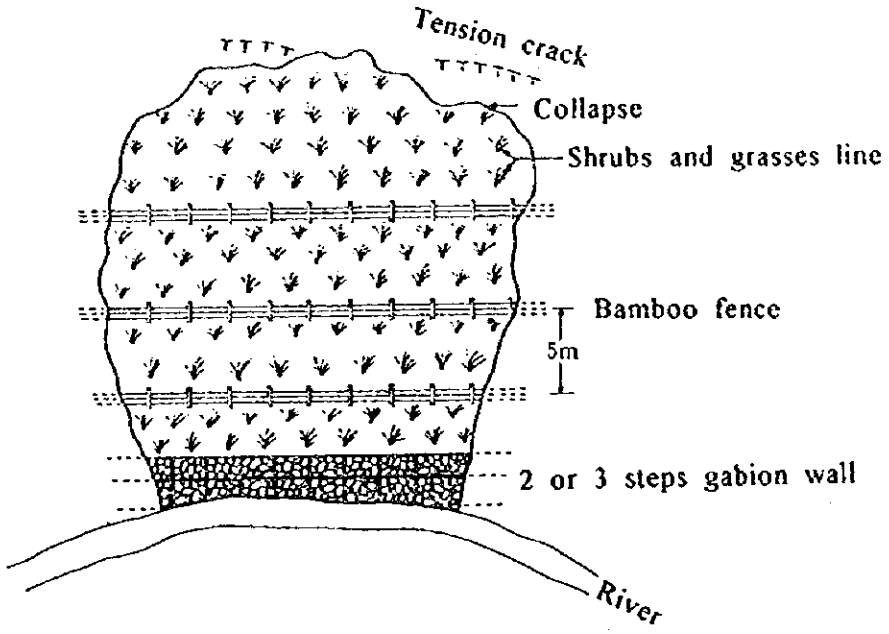
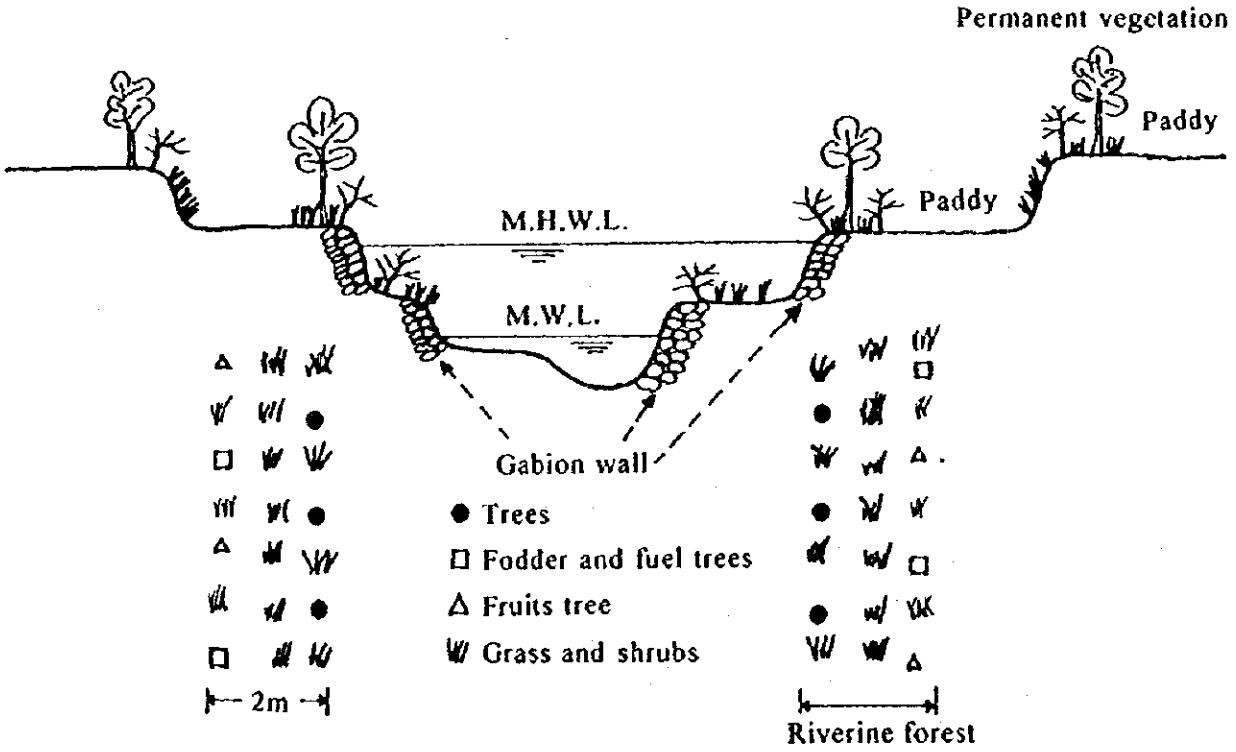
| *JAPAN INTERNATIONAL COOPERATION AGENCY* |




(e) Repair works of small collapse




(f) Bank erosion control of mountain stream terraces by gabion works and riverine forest

**EROSION CONTROL MEASURES IN WATERSHED AREA**

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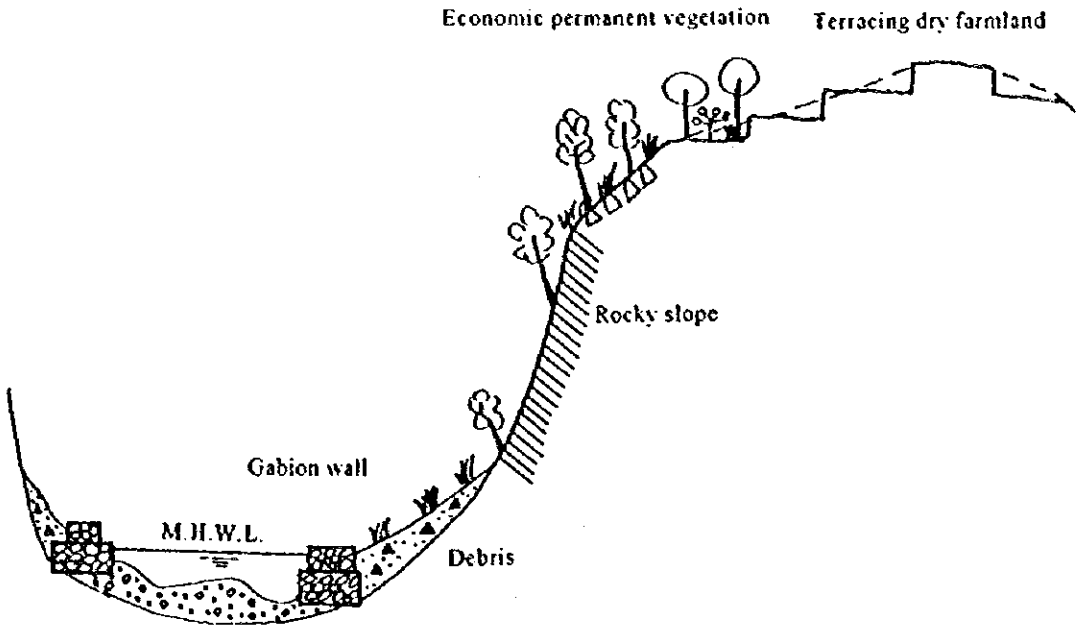
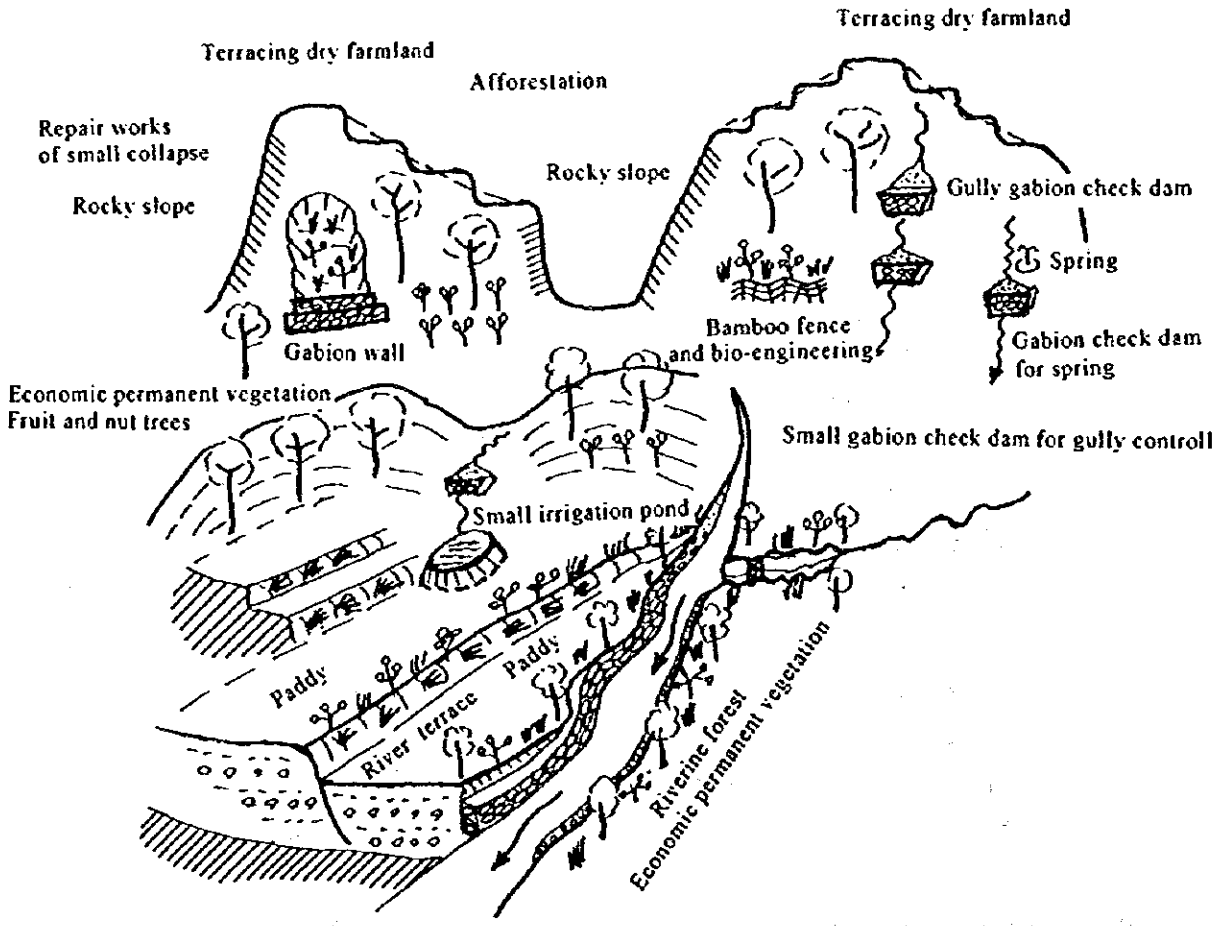
*JAPAN INTERNATIONAL COOPERATION AGENCY*




(g) A schematic cross-section of a slope showing different segments.




(h) A schematic panorama view of total watershed maintenance shoeing different segments.

**EROSION CONTROL MEASURES IN WATERSHED AREA**

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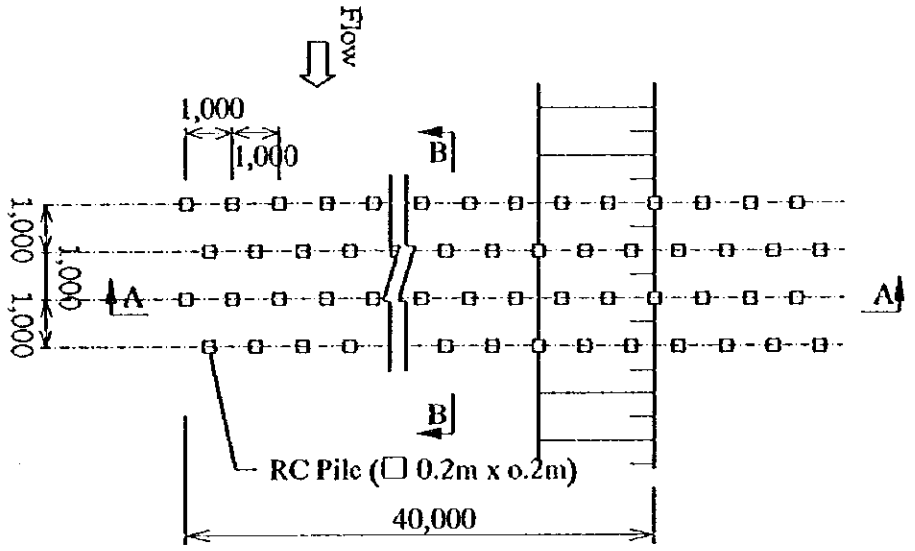
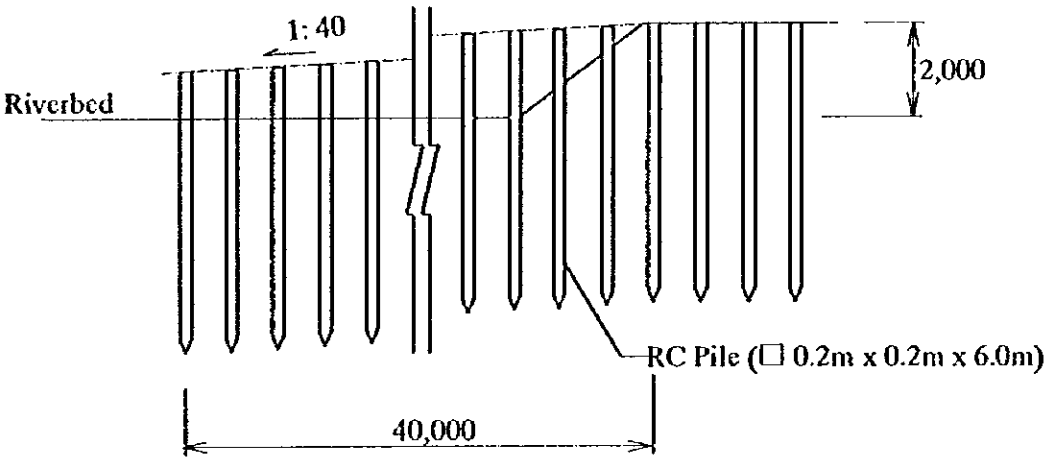
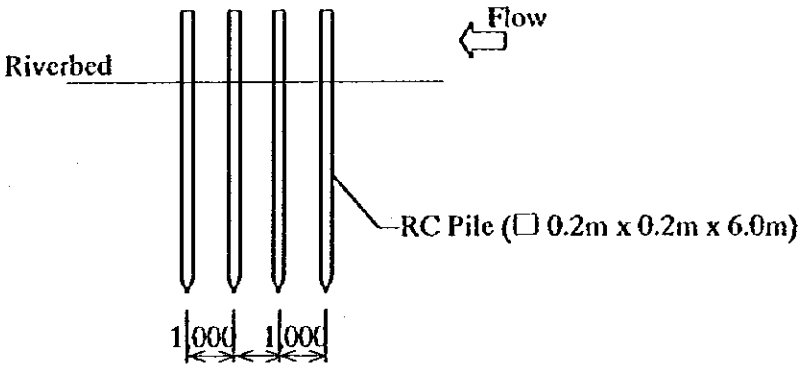



**PLAN**




**SECTION A-A**




(unit: mm)

**SECTION B-B**

**TYPICAL DESIGN OF PILE SPUR**
**(Type-Pb)**

| |
|---|
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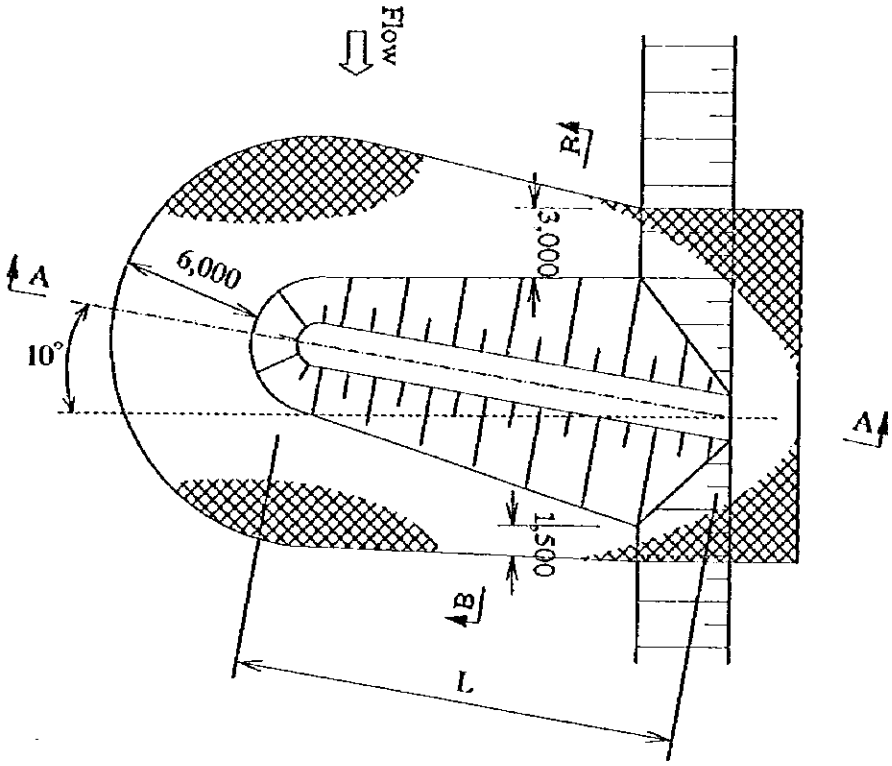
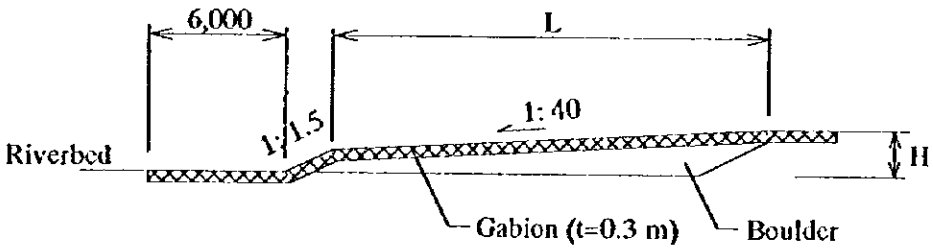
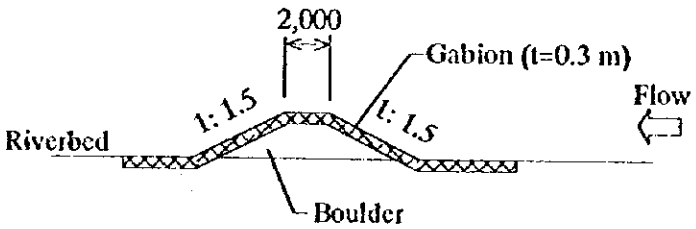



**PLAN**




**SECTION A-A**




| Type | L (m) | H (m) |
|---|---|---|
| Type-Ic | 40.0 | 2.5 |
| Type-Id | 40.0 | 3.0 |

(unit: mm)

**SECTION B-B**

# TYPICAL DESIGN OF GABION SPUR

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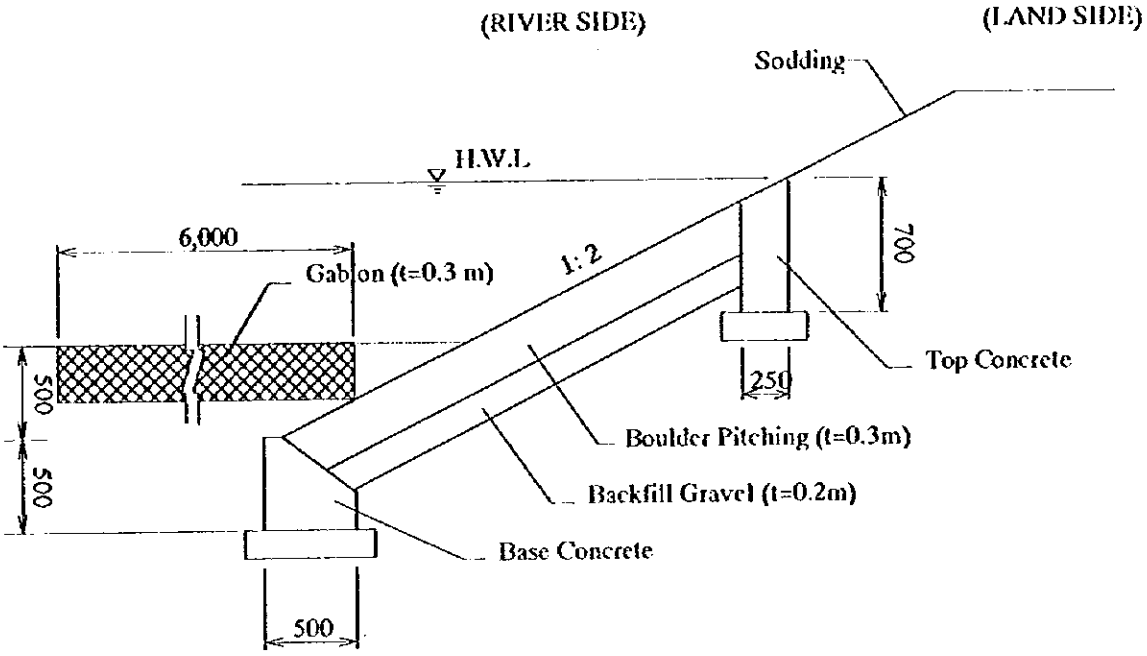
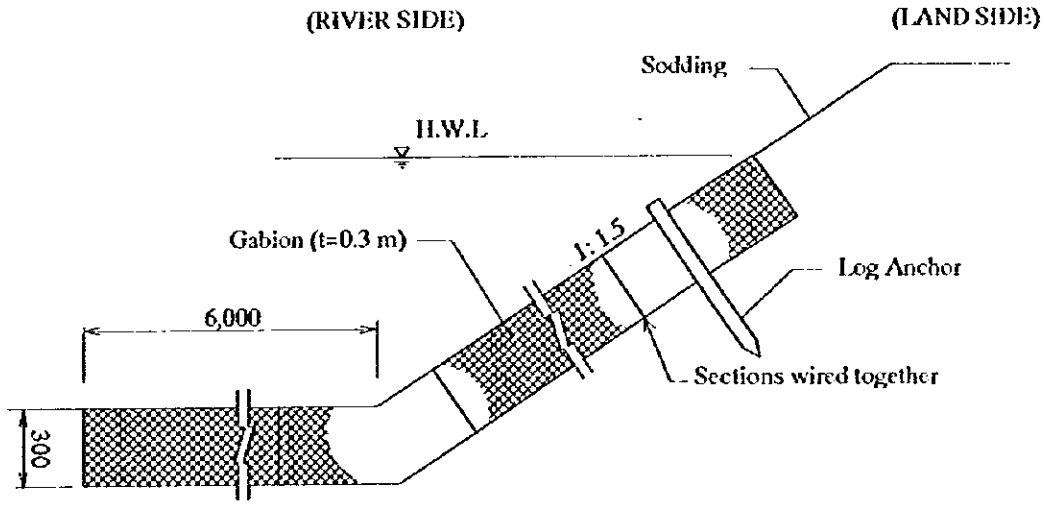
*JAPAN INTERNATIONAL COOPERATION AGENCY*




**REVETMENT (TYPE -Ra)**

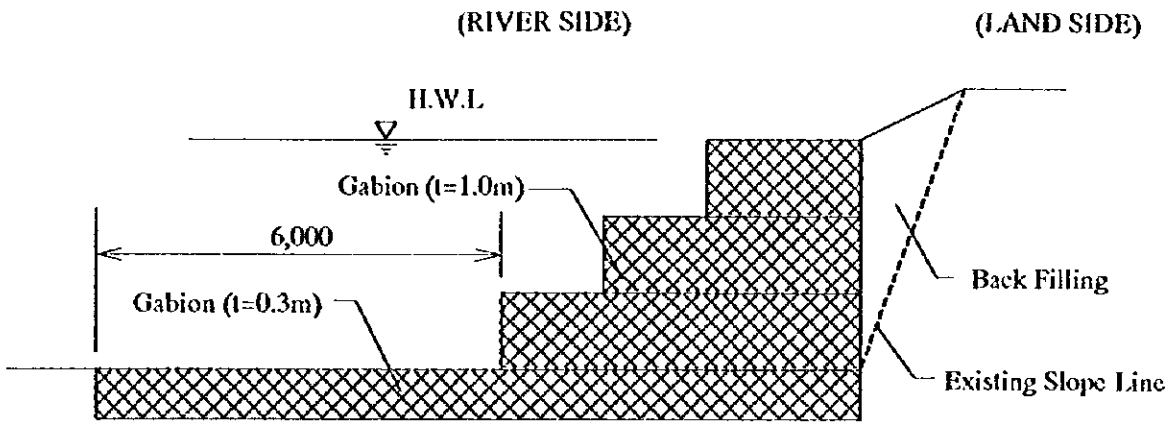



**REVETMENT (TYPE -Rb)**

(unit: mm)

# TYPICAL SECTION OF REVETMENT

| |
|---|
| *His Majesty's Government of Nepal*<br>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* |




**REVETMENT (TYPE -Rc)**

(unit: mm)

# TYPICAL SECTION OF REVETMENT

| |
|---|
| *His Majesty's Government of Nepal*<br>Department of Irrigation, Ministry of Water Resources |
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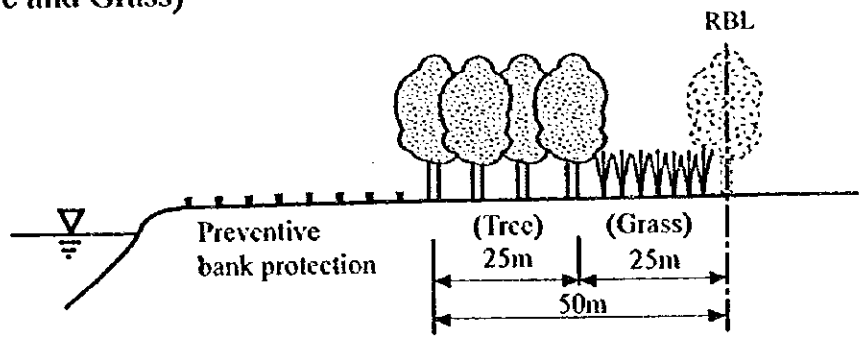
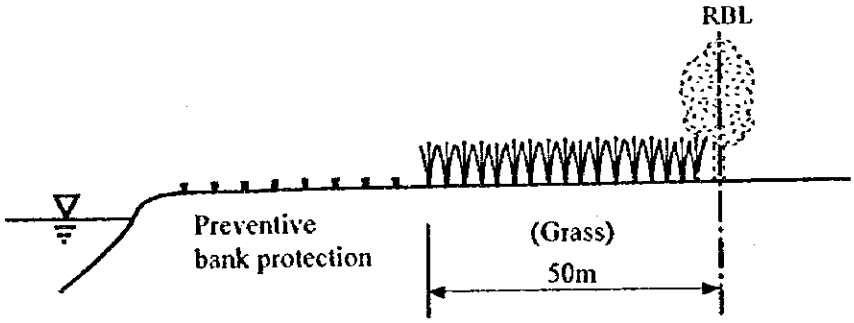
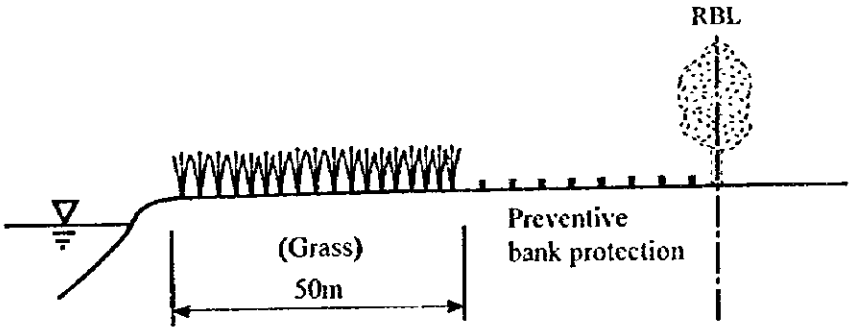
## Forest Belt
(Tree and Grass)




## Grass Belt




## Grass Belt along Low Water Channel (Seg.2-2 of Lakhandei R.)




- RBL shall be marked clearly in field by tree-row or stacker.
- If there are forests more than 50m-wide on river side of RBL, tree/grass belt is not necessary.
- If the river side bank area of RBL is less than 50m in width, width of grass belt should be reduced.

**FOREST/GRASS BELT AND RIVER BOUNDARY LINE**

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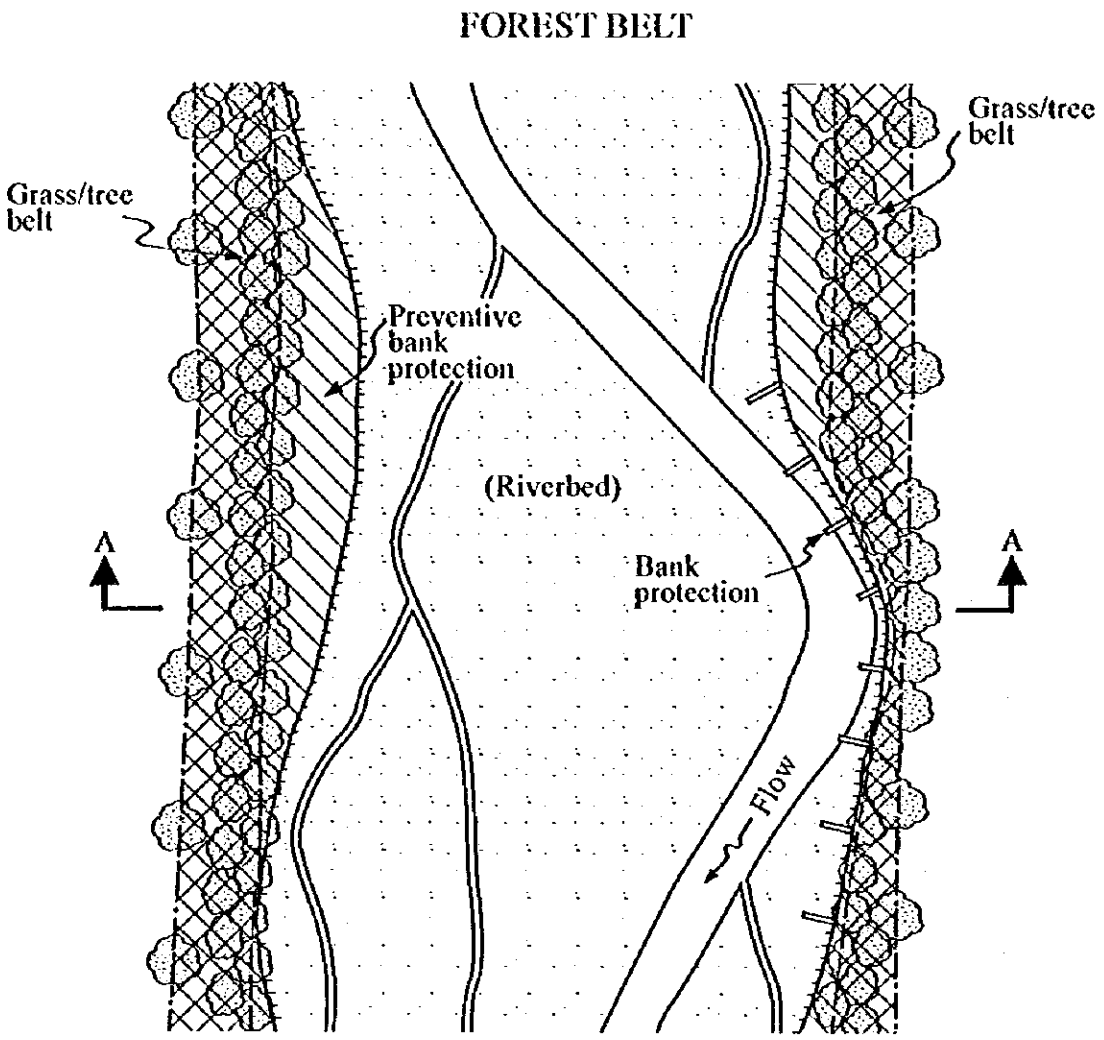


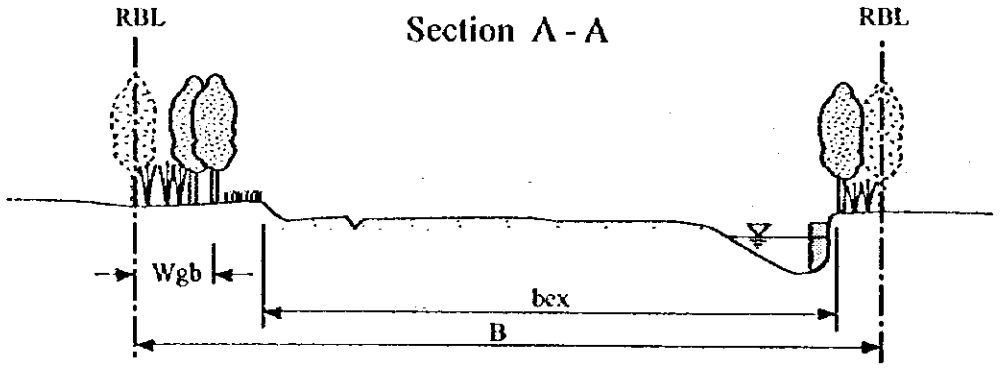


RBL : River boundary line
B : Width of river zone
Wgb : Width of grass/tree belt
bex : Existing channel width

**FOREST/GRASS BELT AND RIVER BOUNDARY LINE**

*His Majesty's Government of Nepal*
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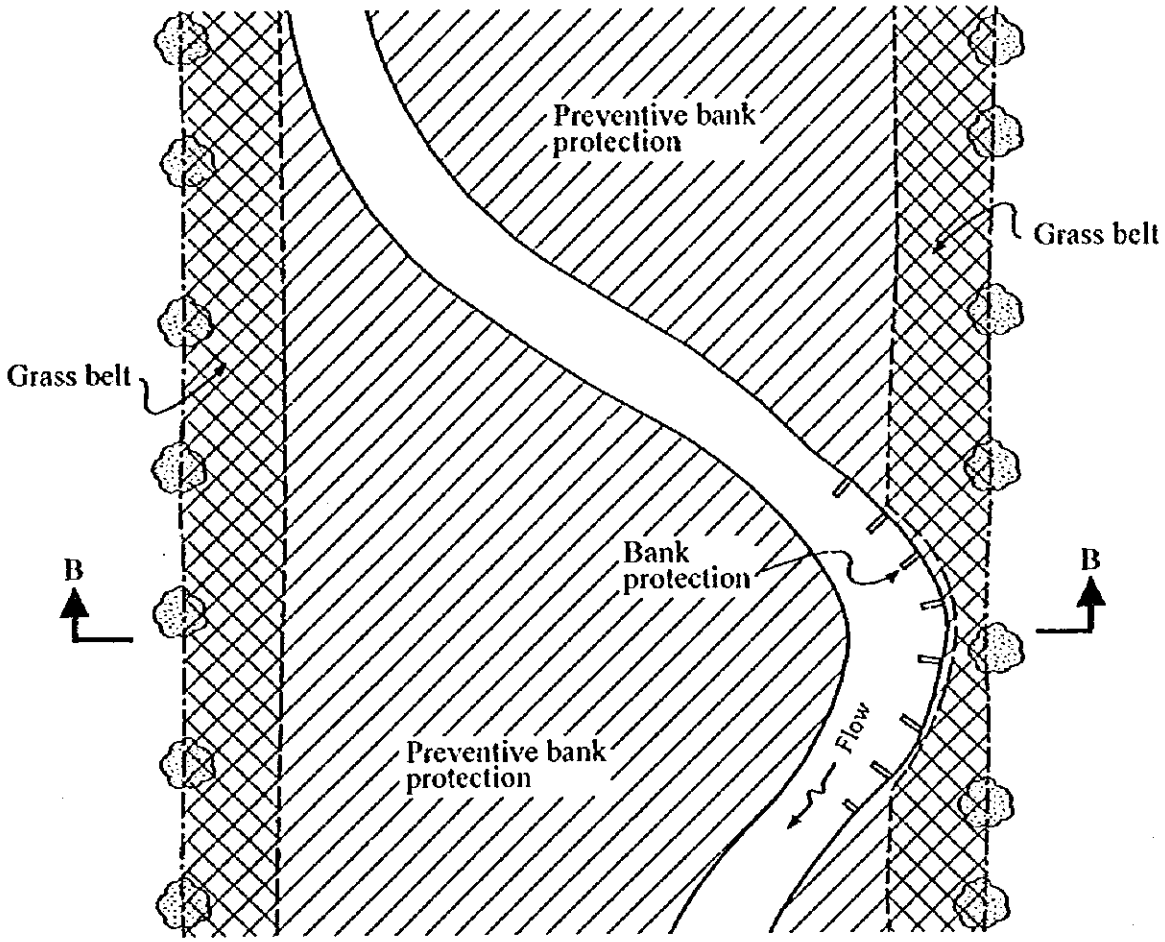
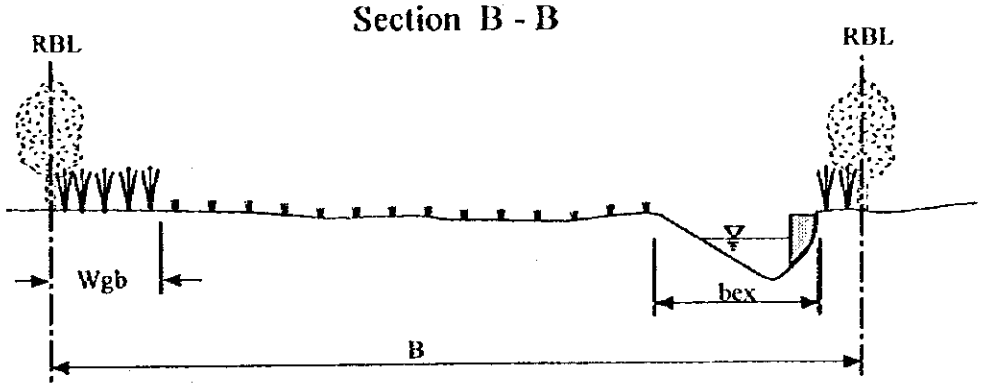
## GRASS BELT




### Section B - B




RBL : River boundary line
B : Width of river zone
Wgb : Width of grass belt
bex : Existing channel width

**FOREST/GRASS BELT AND RIVER BOUNDARY LINE**

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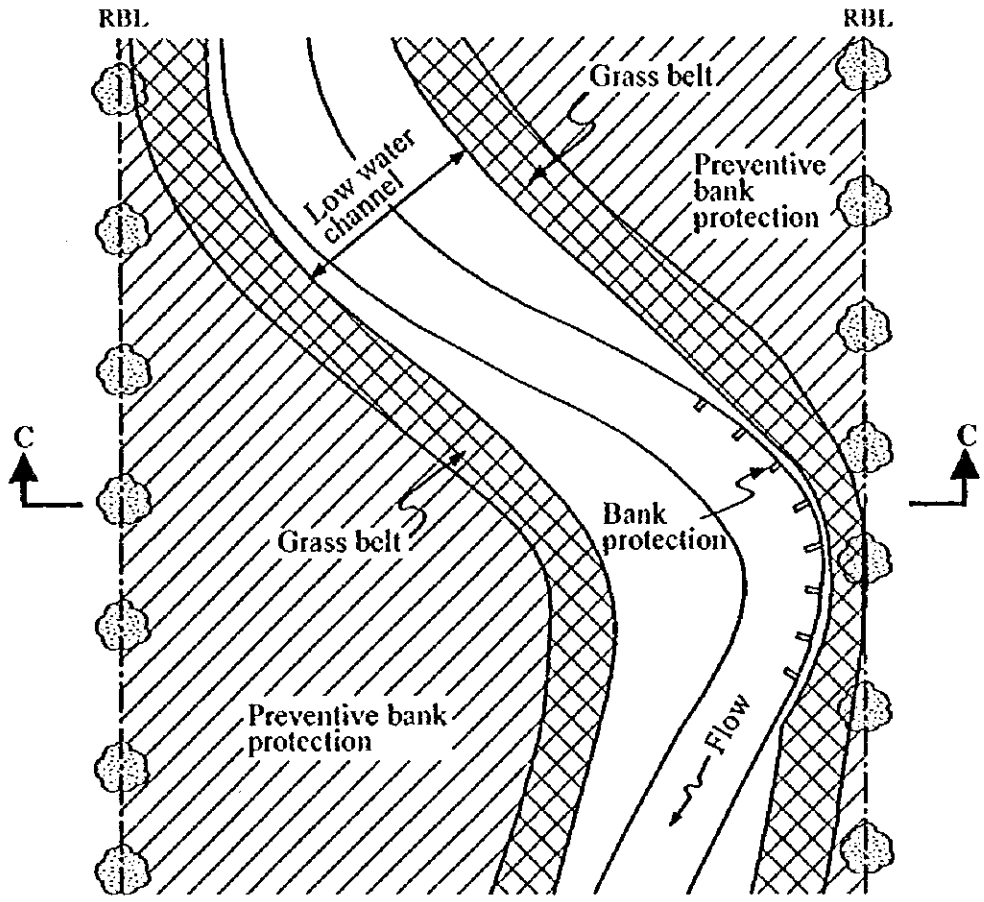
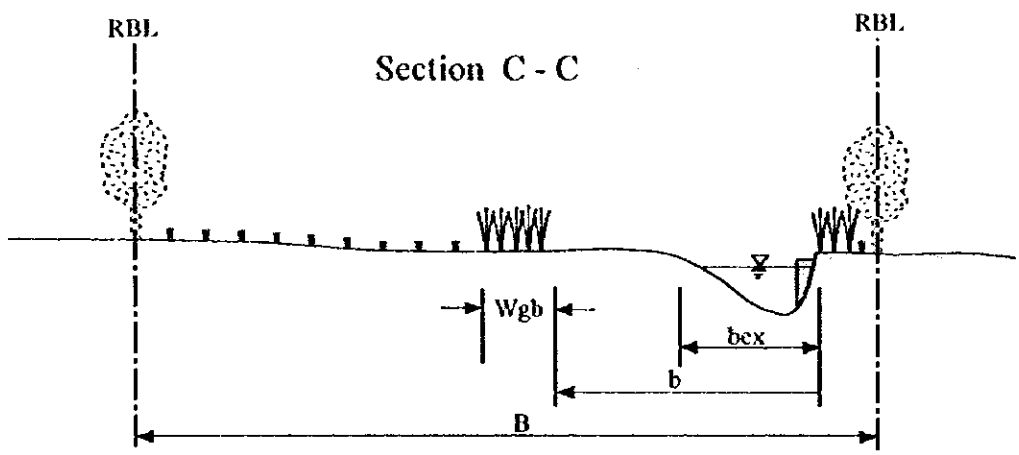
## GRASS BELT ALONG LOW WATER CHANNEL




RBL : River boundary line
B : Width of river zone
Wgb : Width of grass belt
b : Width of low water channel
bex : Existing channel width

**FOREST/GRASS BELT AND RIVER BOUNDARY LINE**

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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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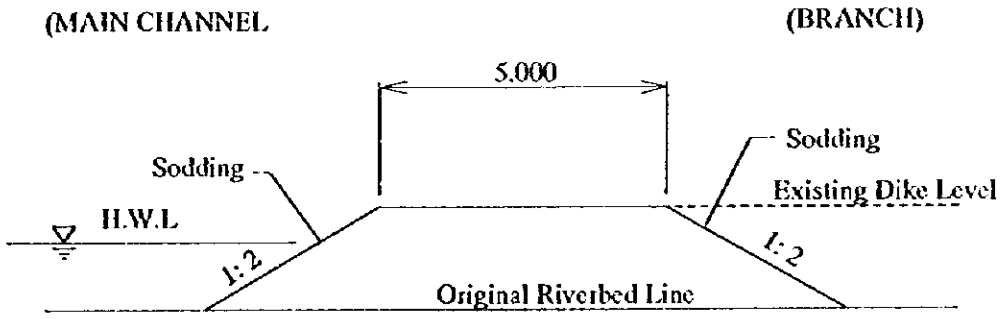


(unit:mm)

## TYPICAL SECTION OF CLOSING DIKE

## TYPICAL EARTH DIKE SECTION

| |
|---|
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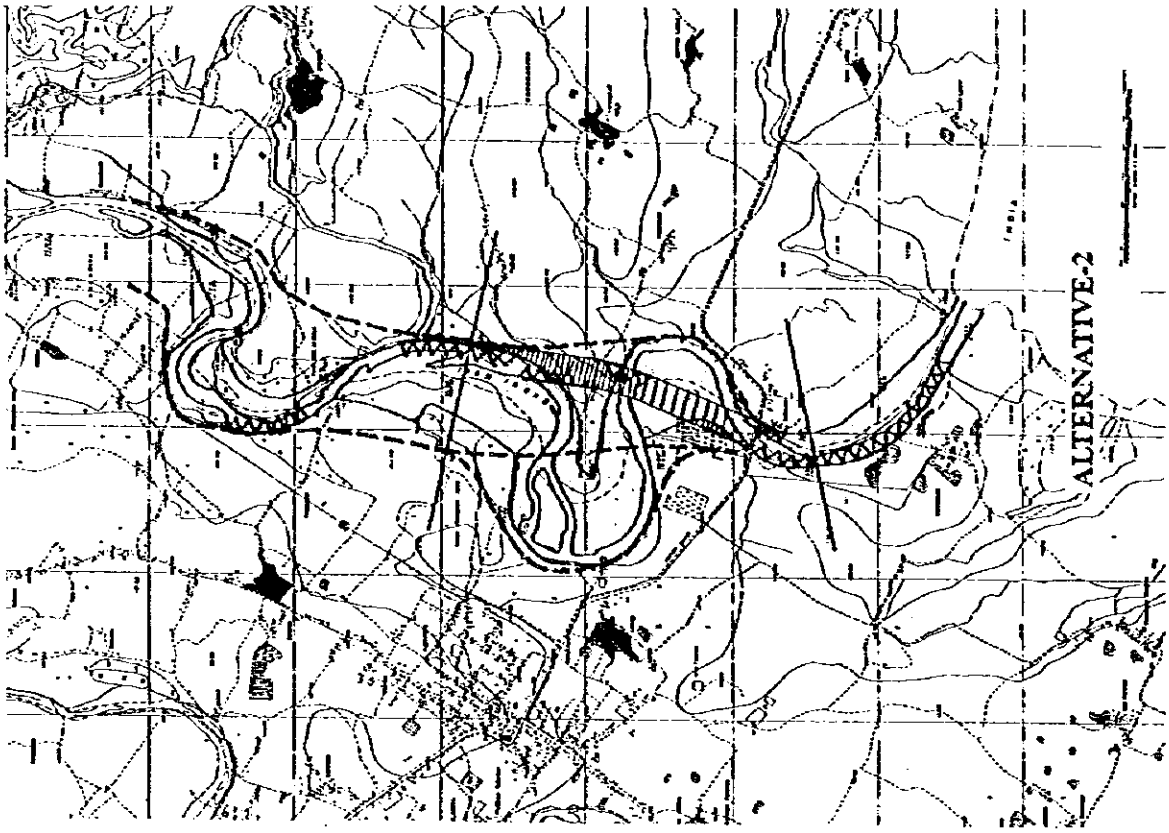


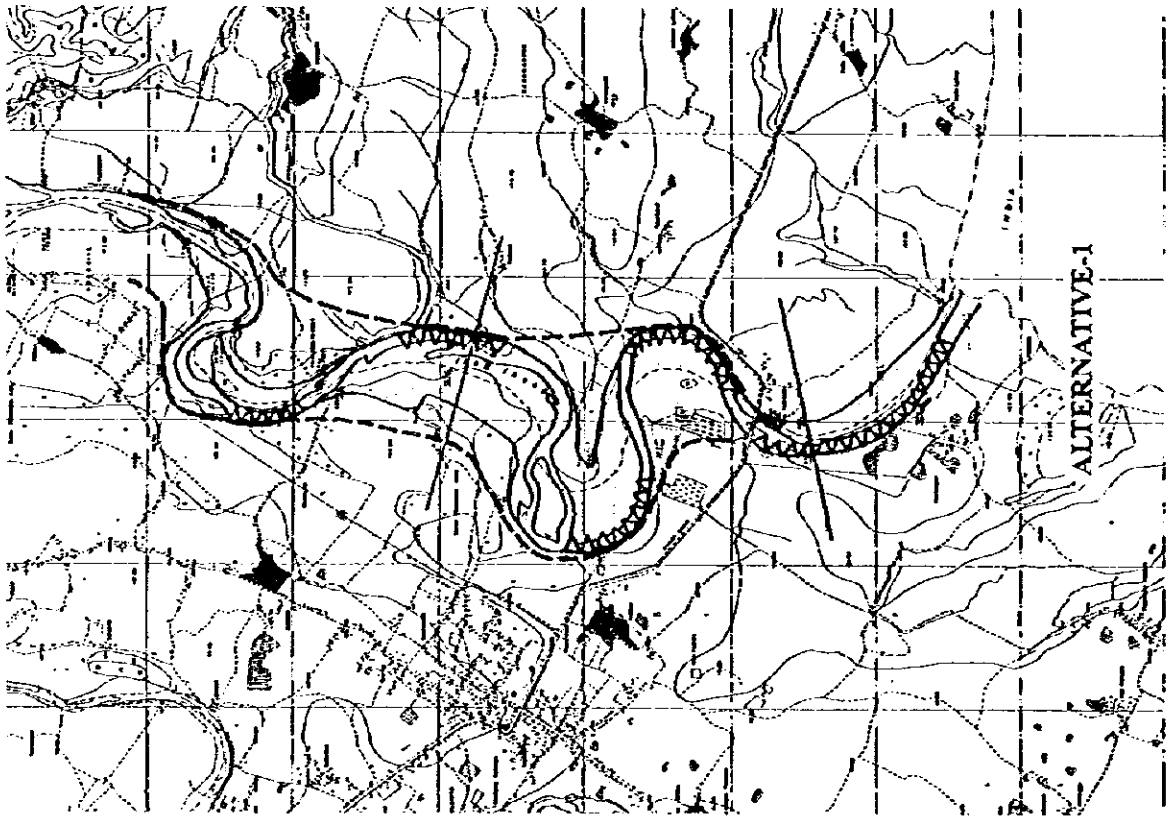


**Severe Meanderring of Babai River at Indrapur Bridge**

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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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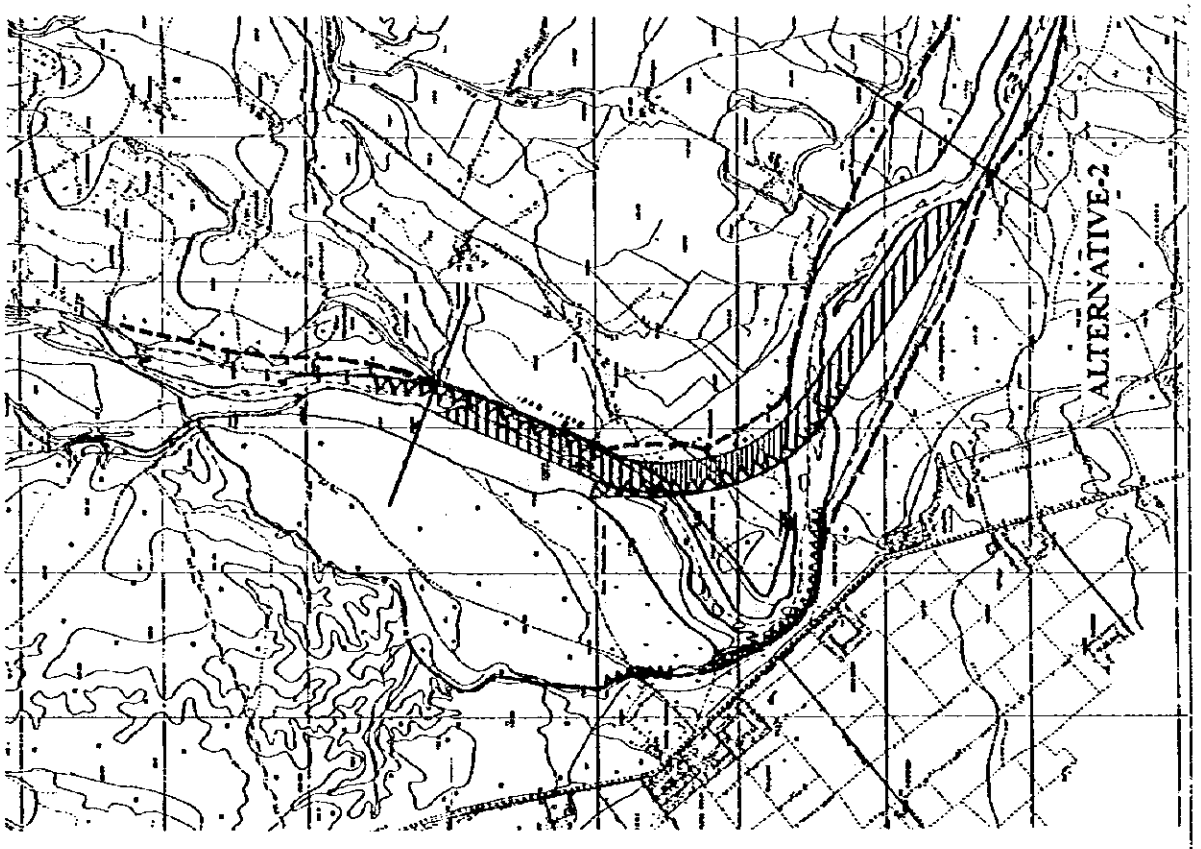


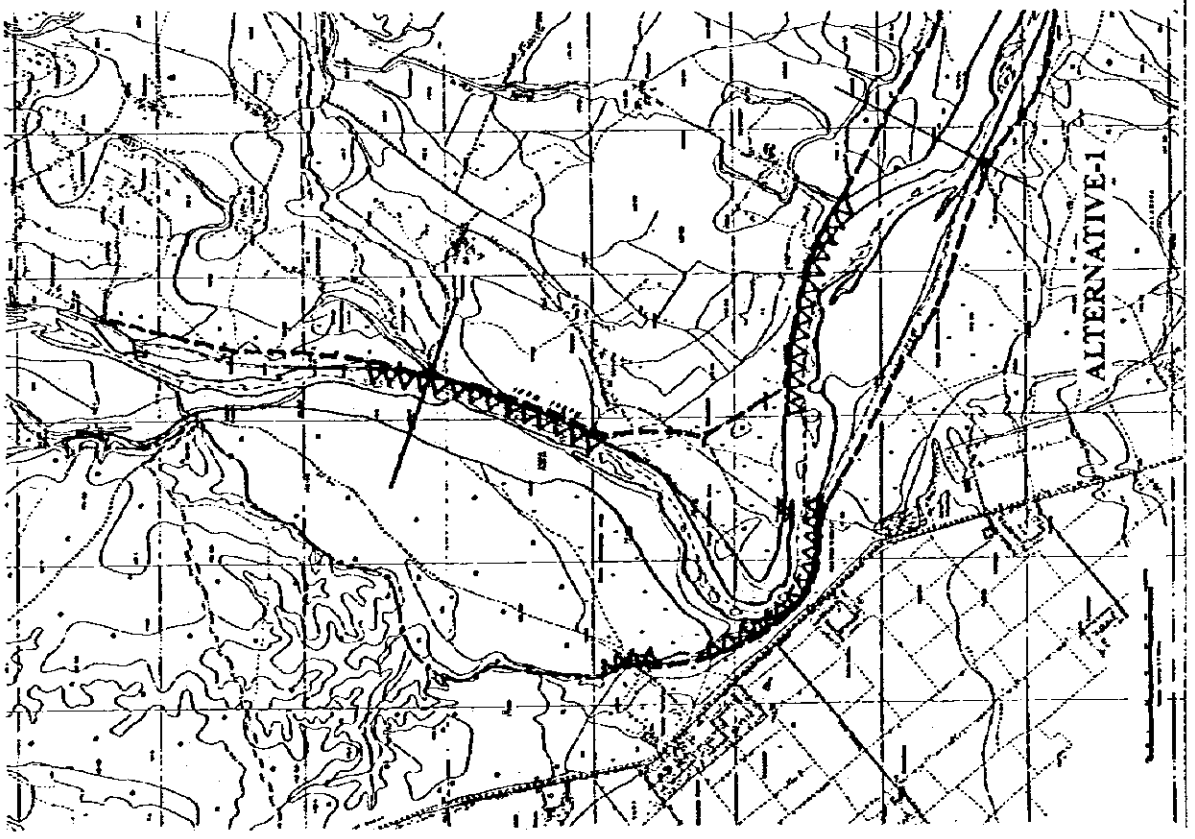


**SHARP BEND OF BABAI RIVER**
**near Kusumbo Bazar**

*His Majesty's Government of Nepal*
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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*

| Item | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Preparatory Works | | | | | ■ | | | | | |
| 2. Bank Protection | | | | | | | | | | |
| 2-1 Pile Spur | | | | | ■ | ■ | ■ | ■ | | |
| 2-2 Gabion Spur | | | | | ■ | ■ | ■ | ■ | | |
| 2-3 Revetment | | | | | ■ | ■ | ■ | ■ | | |
| 3. Dike Embankment | | | | | | | | | | |
| 3-1 Forest and Grass Belt | | | | | ■ | ■ | ■ | ■ | | |
| 3-2 Closing Dike | | | | | ■ | ■ | ■ | ■ | | |
| 4. Miscellaneous Works | | | | | ■ | ■ | ■ | ■ | | |

**CONSTRUCTION SCHEDULE FOR BABAI RIVER IN FEASIBILITY STUDY**

Fig.A6.9

*His Majesty's Government of Nepal*
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Fig.A6.10

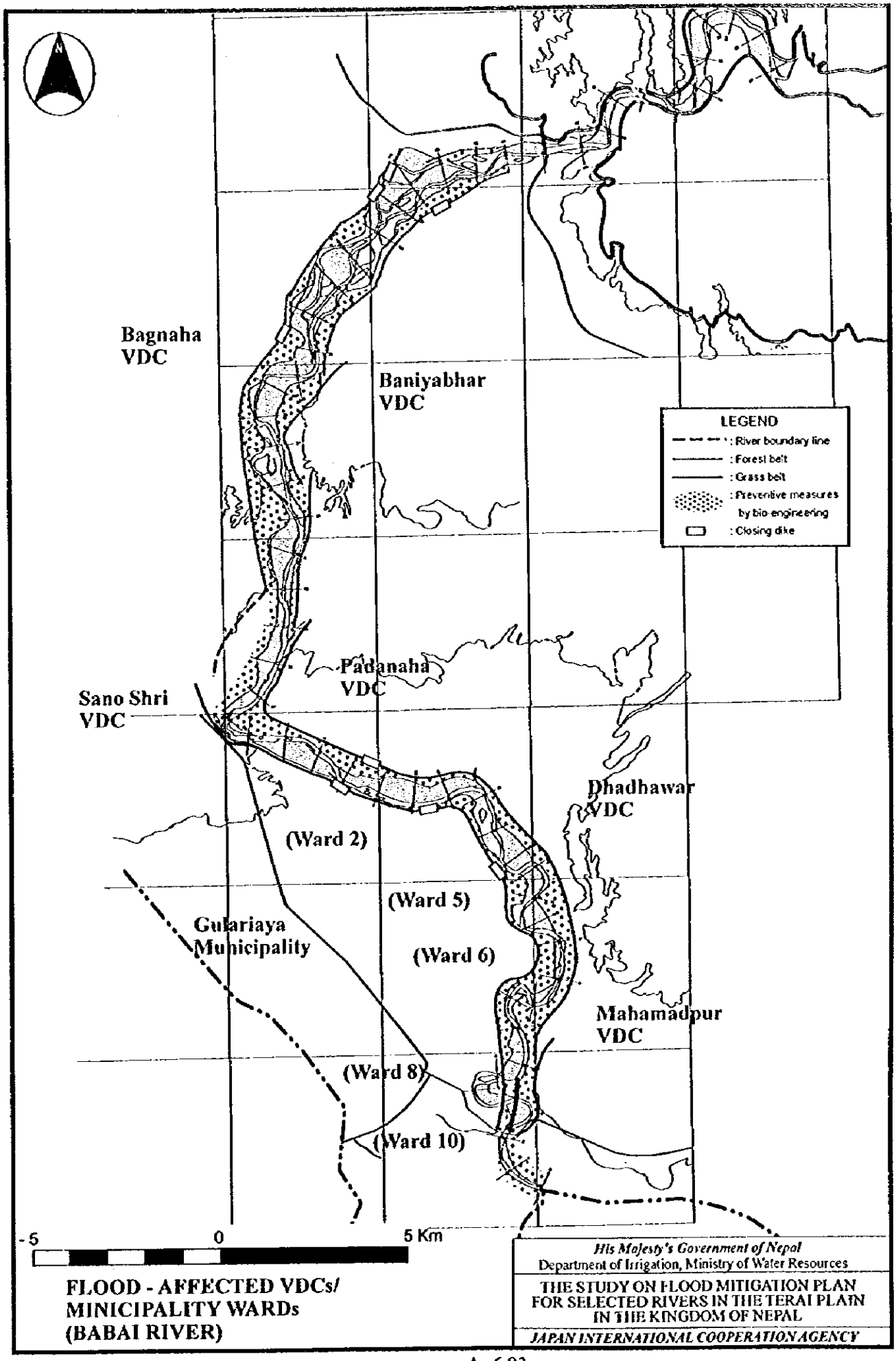
Bagnaha VDC
Baniyabhar VDC
LEGEND
: River boundary line
: Forest belt
: Grass belt
: Preventive measures by bio-engineering
: Closing dike
Padanaha VDC
Sano Shri VDC
Dhadhawar VDC
(Ward 2)
(Ward 5)
Gulariaya Municipality
(Ward 6)
Mahamadpur VDC
(Ward 8)
(Ward 10)
- 5
0
5 Km
FLOOD - AFFECTED VDCs/ MINICIPALITY WARDs (BABAI RIVER)
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
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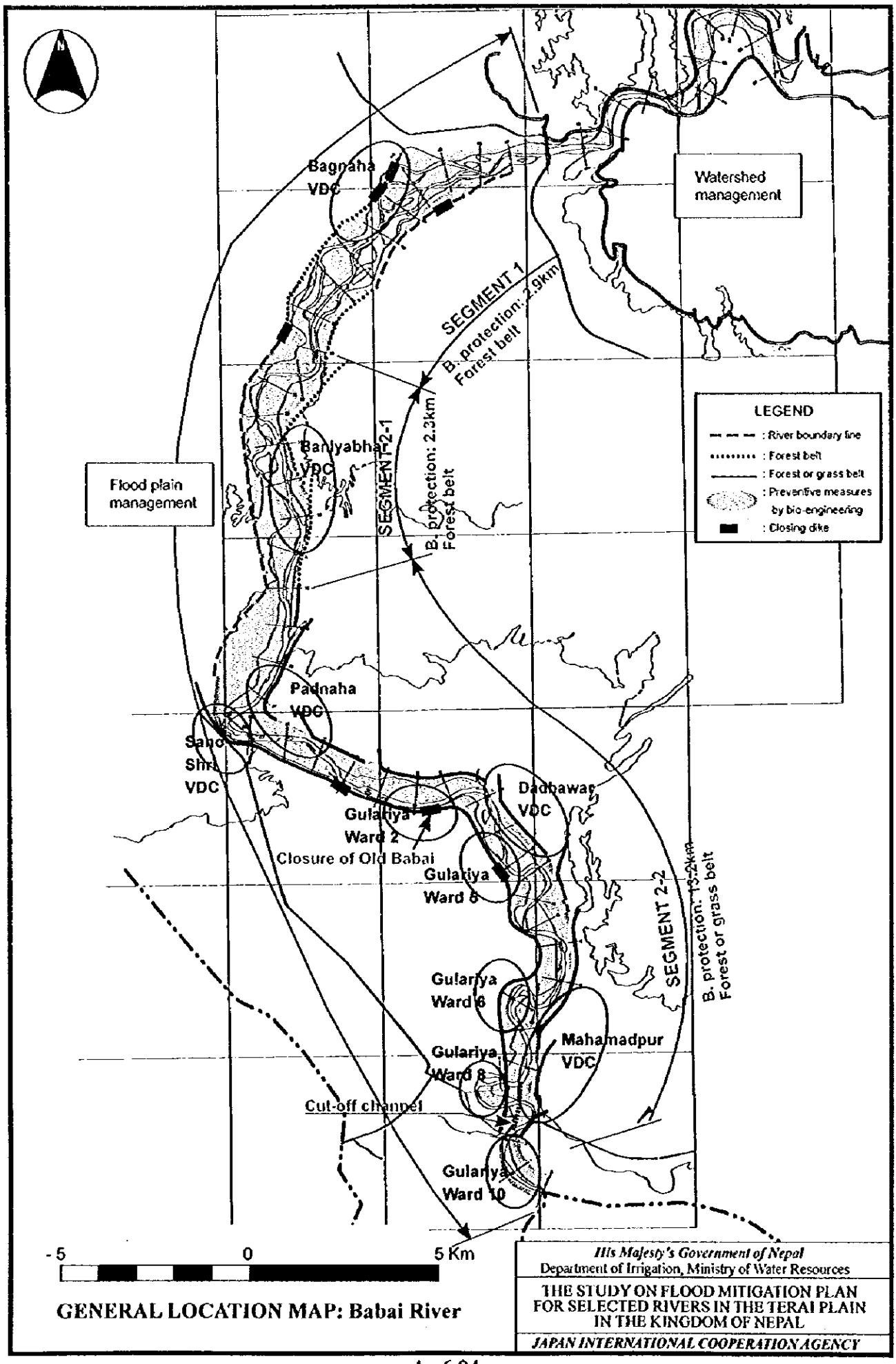
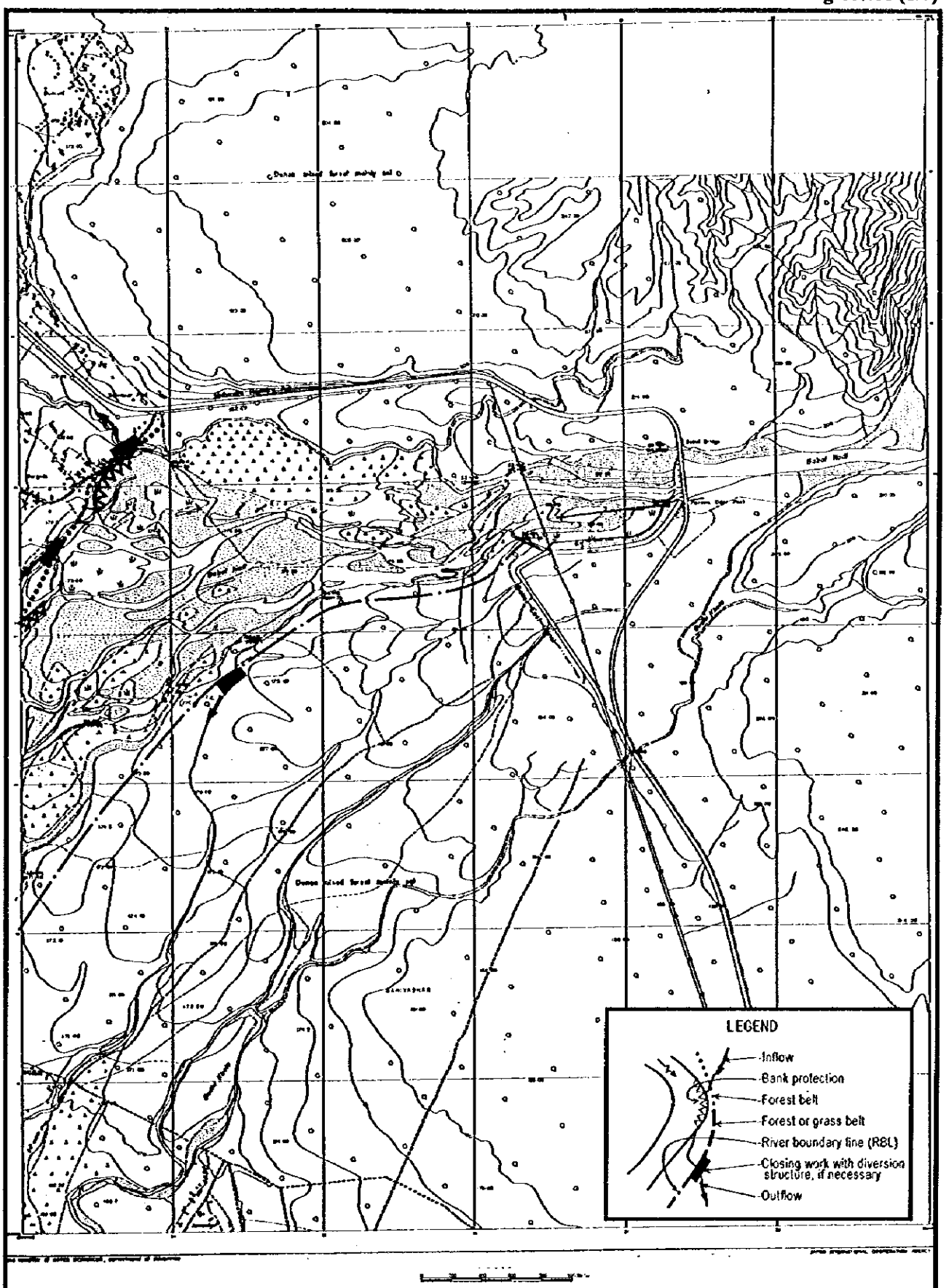
Fig. A6.11




GENERAL LOCATION MAP: Babai River




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

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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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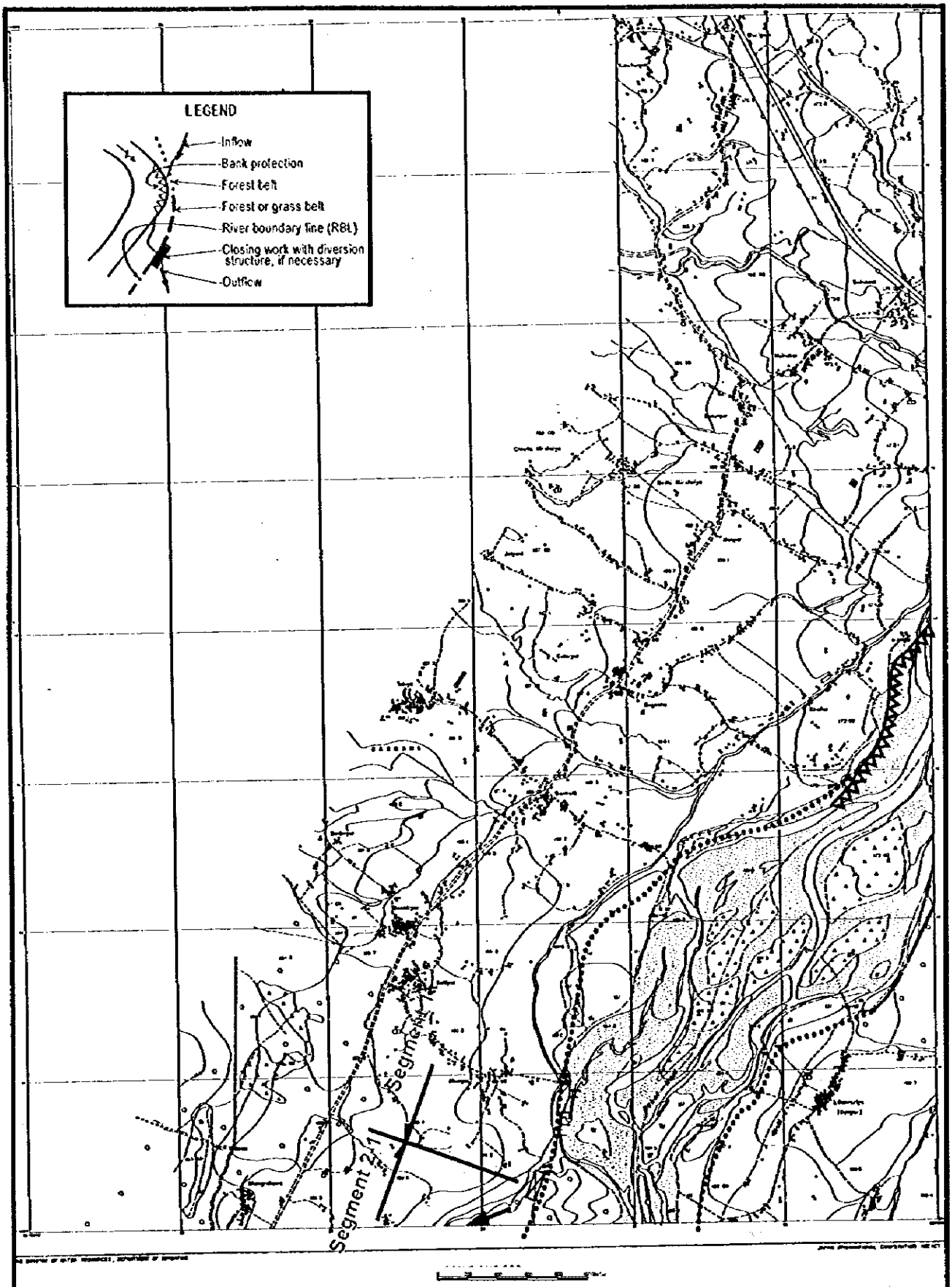


**LAYOUT PLAN FOR FLOOD MITIGATION**
**Babai River (2/7)**

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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

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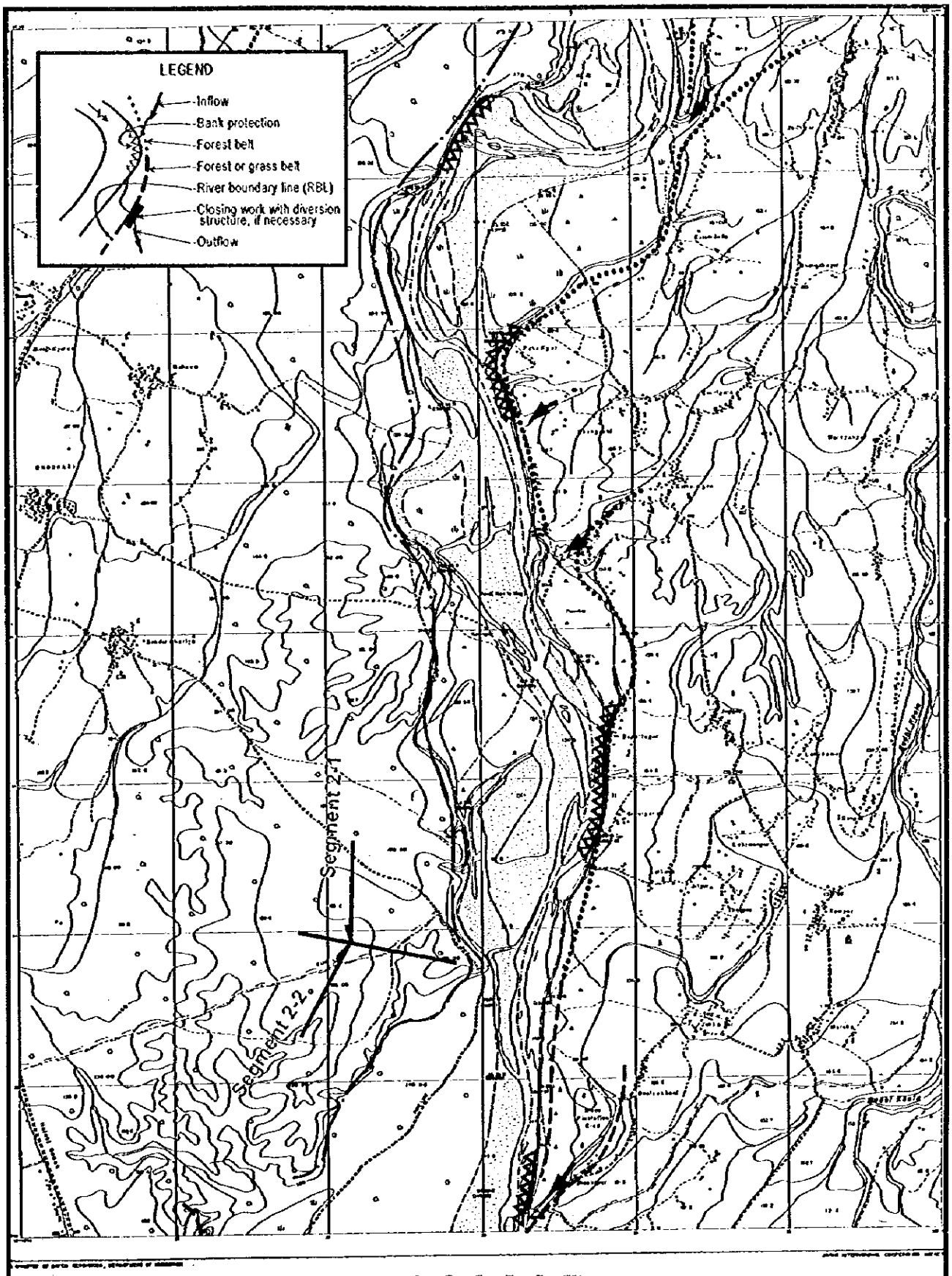


**LAYOUT PLAN FOR FLOOD MITIGATION**
**Babai River (3/7)**

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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

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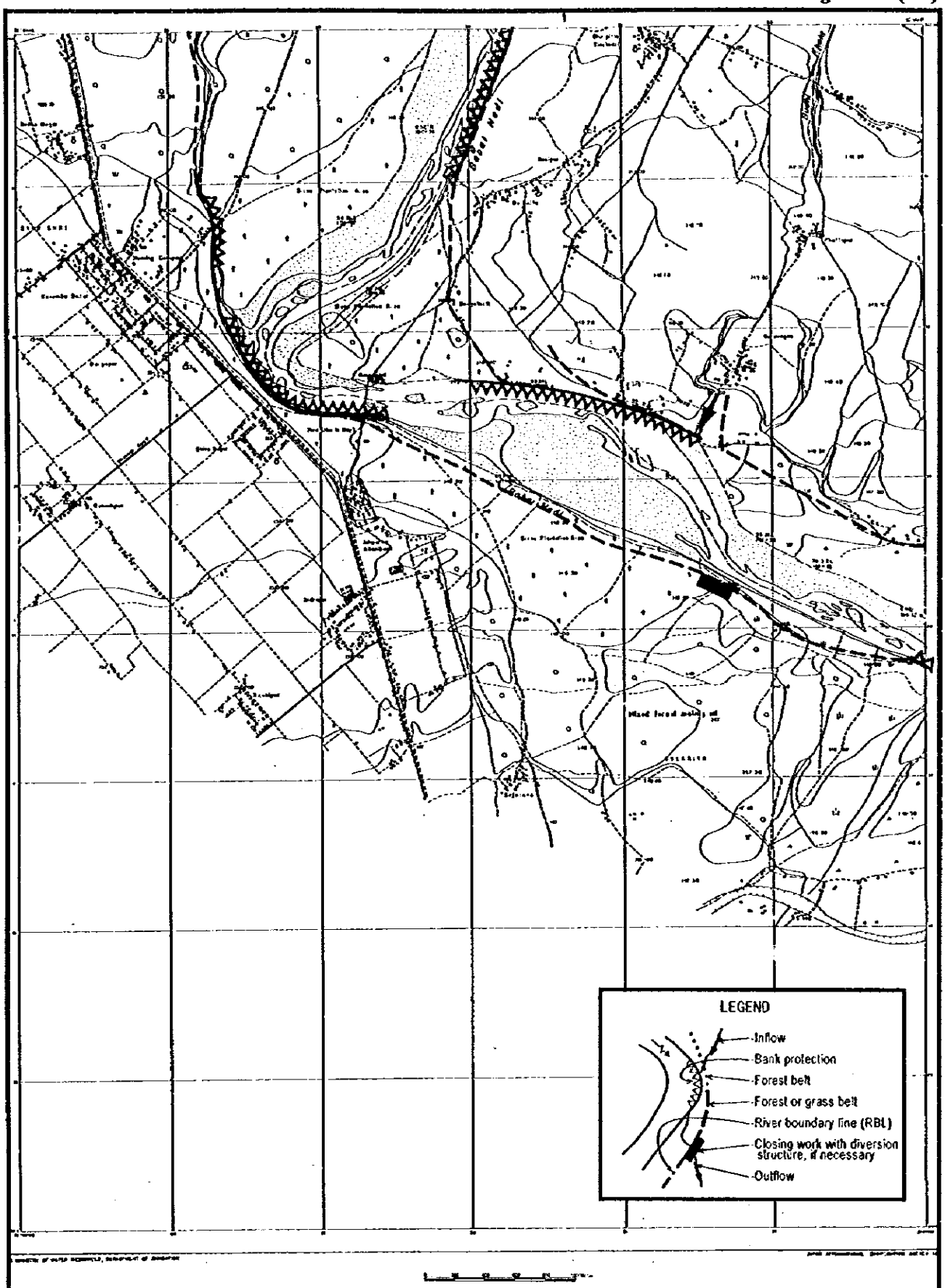


**LAYOUT PLAN FOR FLOOD MITIGATION**
**Babai River (4/7)**

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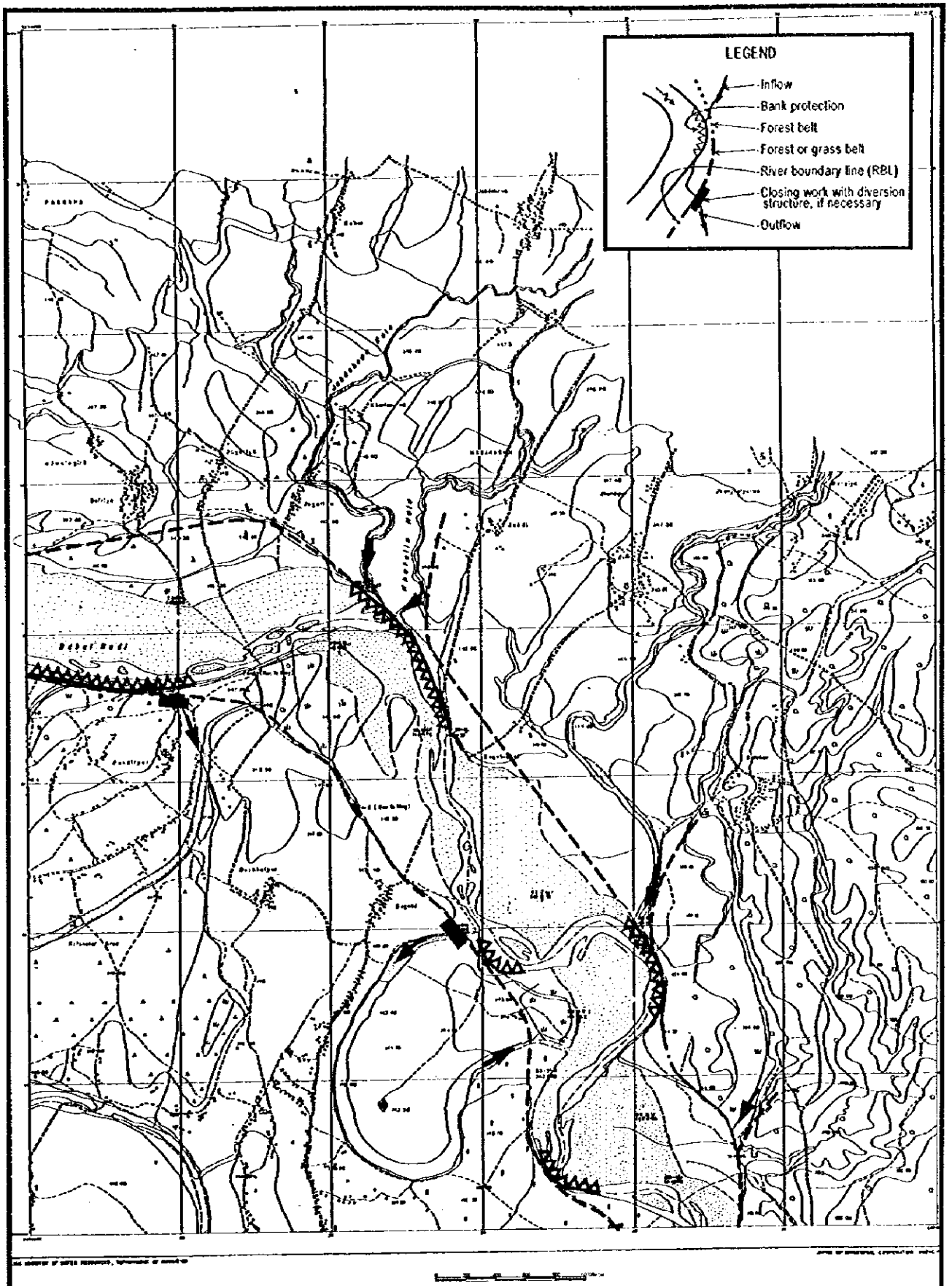
THE STUDY ON FLOOD MITIGATION PLAN FOR SELECTED RIVERS IN THE TERAI PLAIN IN THE KINGDOM OF NEPAL

*JAPAN INTERNATIONAL COOPERATION AGENCY*




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

*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

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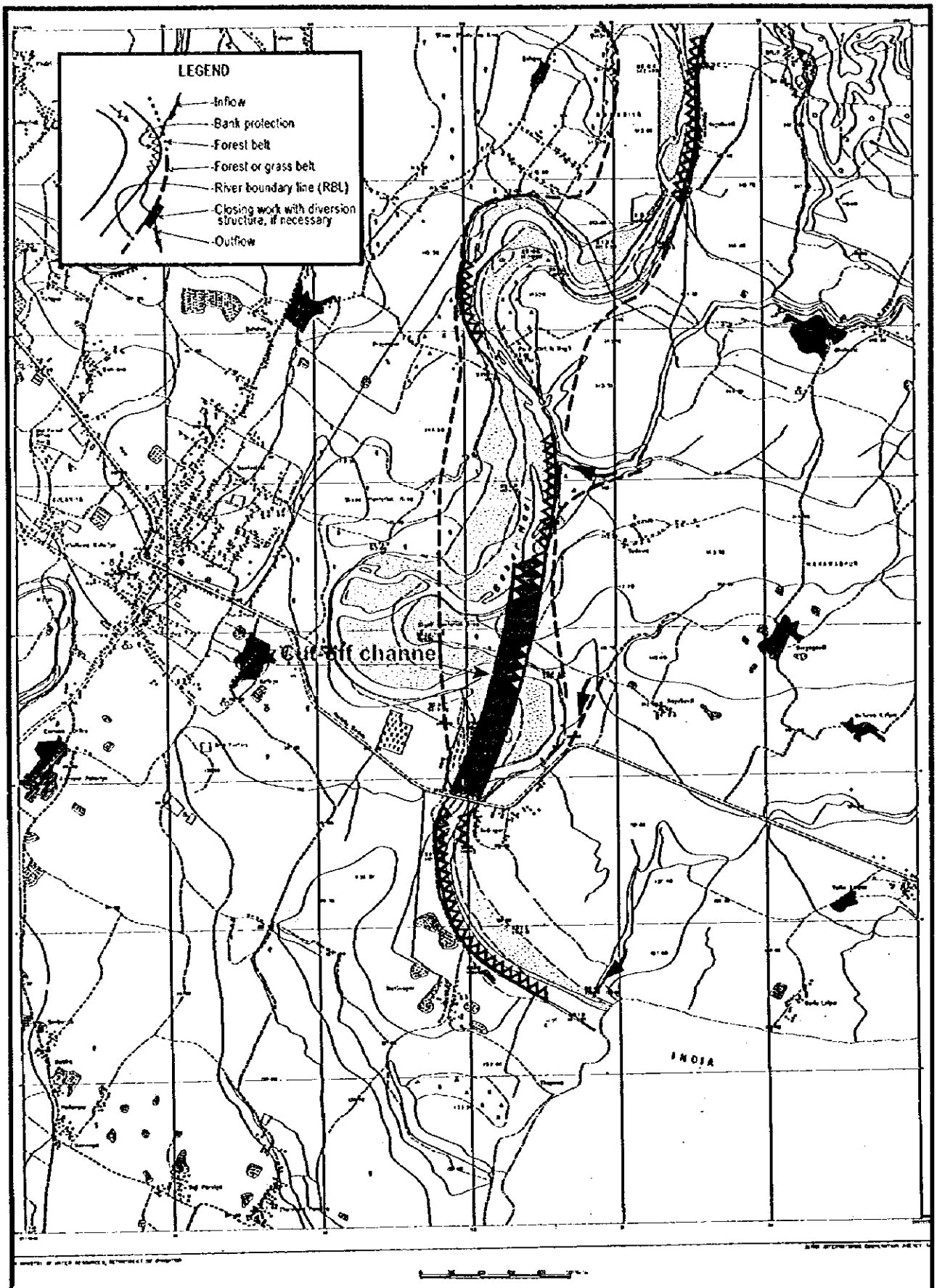


**LAYOUT PLAN FOR FLOOD MITIGATION**
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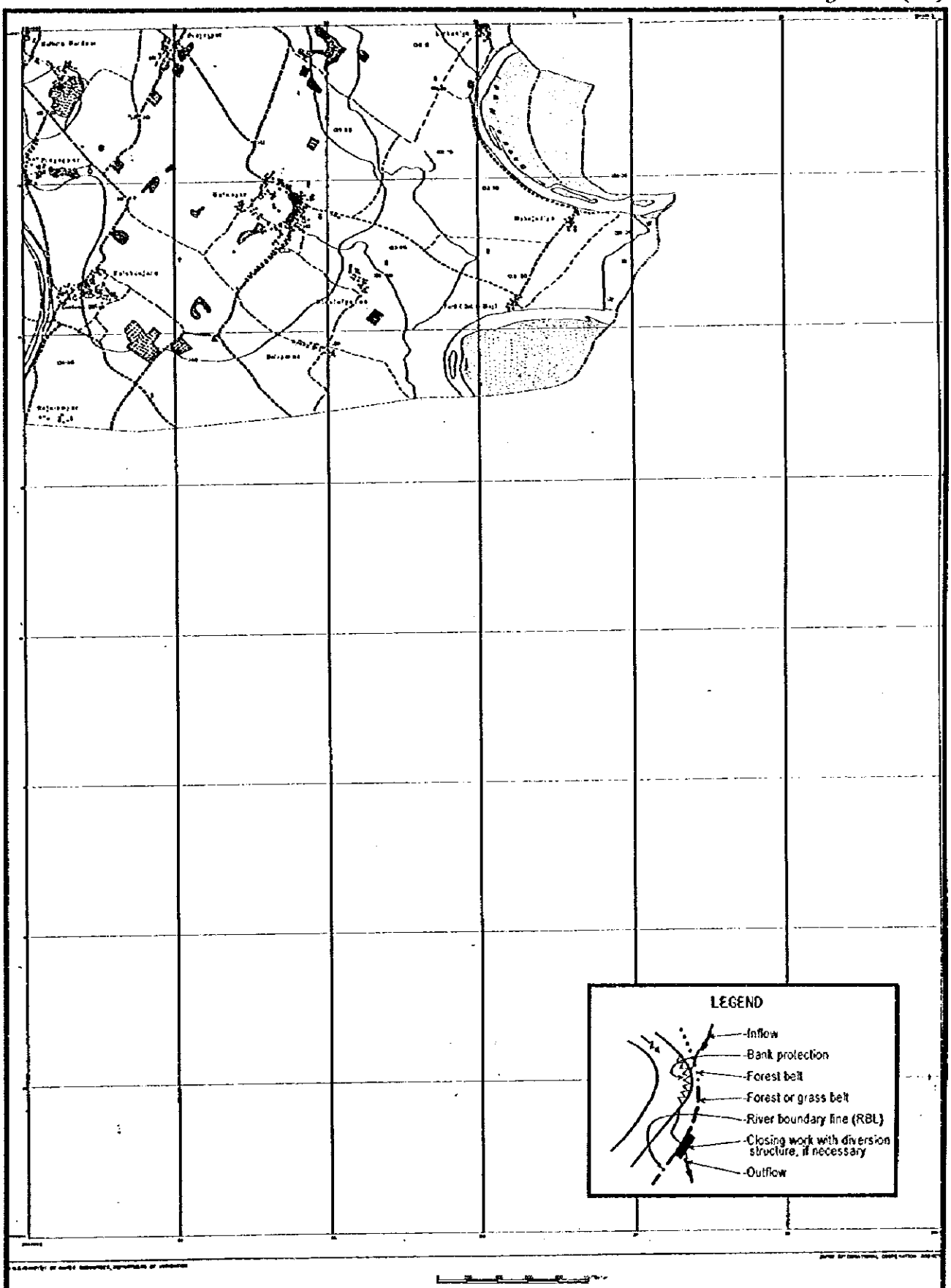


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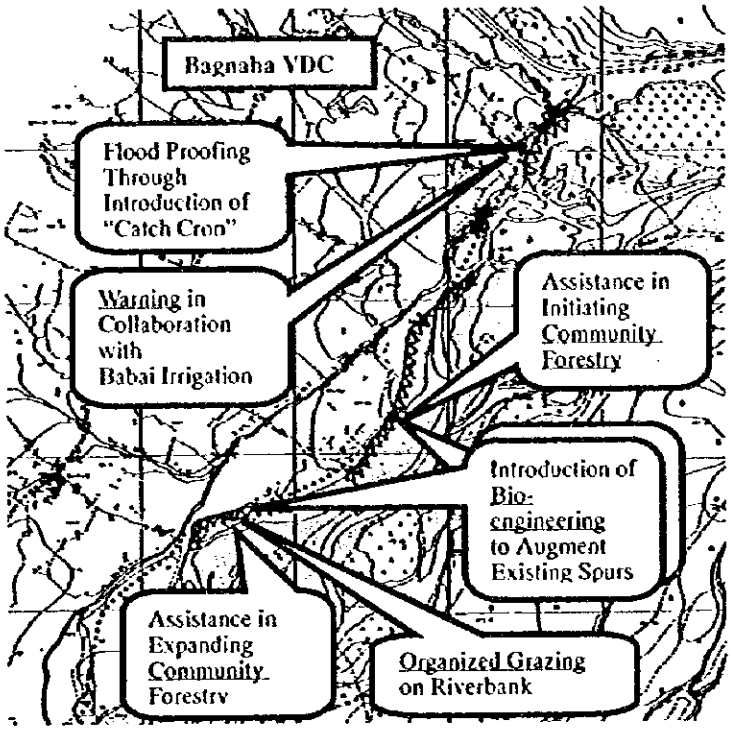


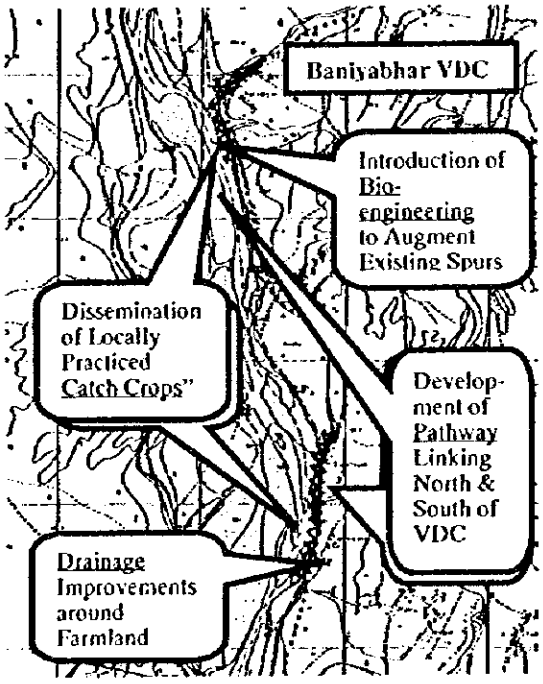


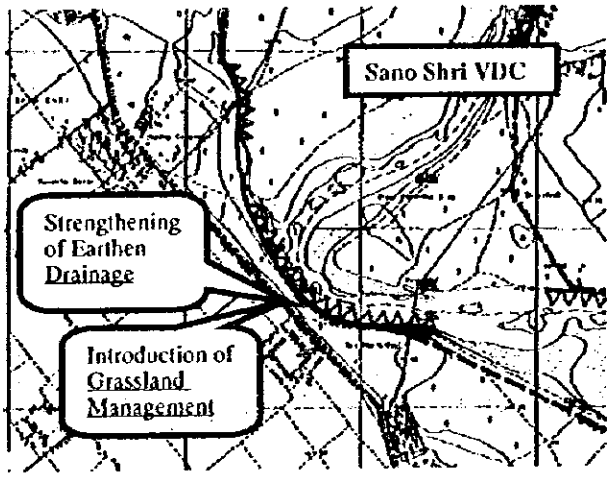


**COMMUNITY DEVELOPMENT COMPONENT (BABAI R.)**

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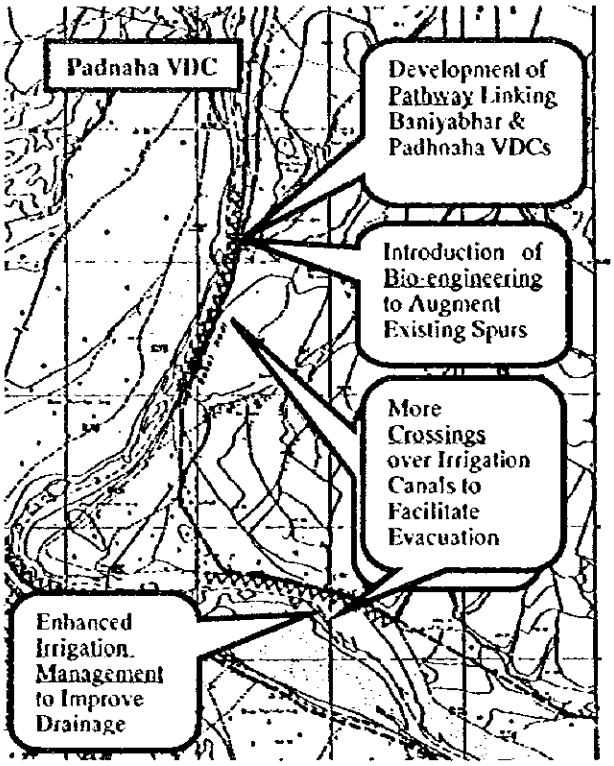


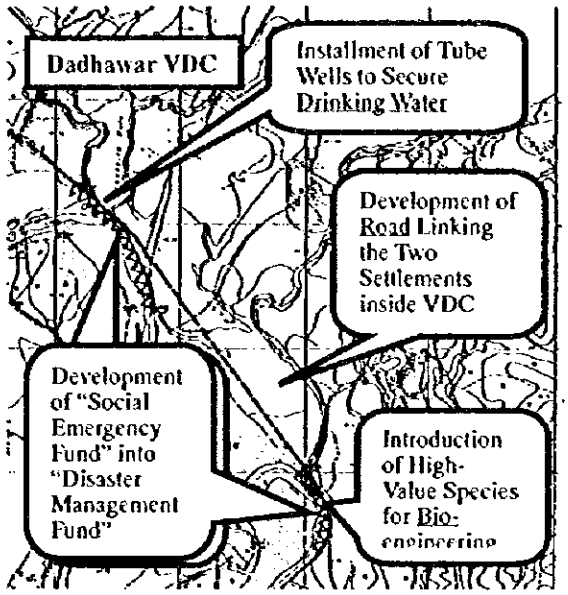


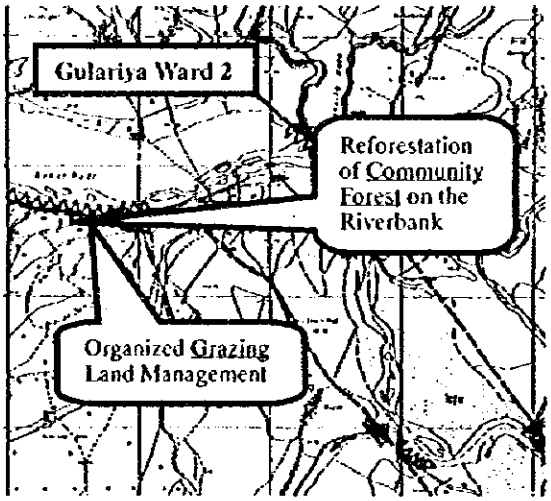


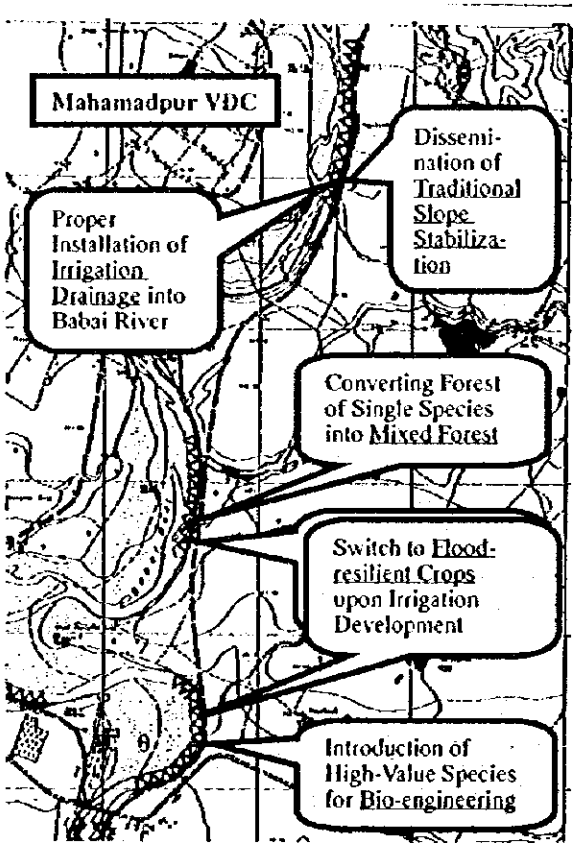


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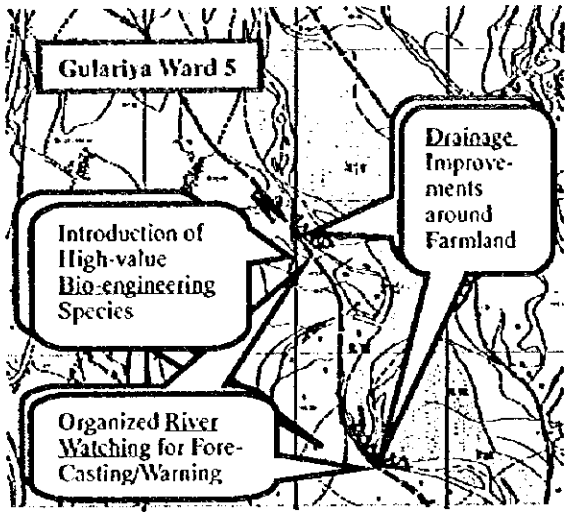


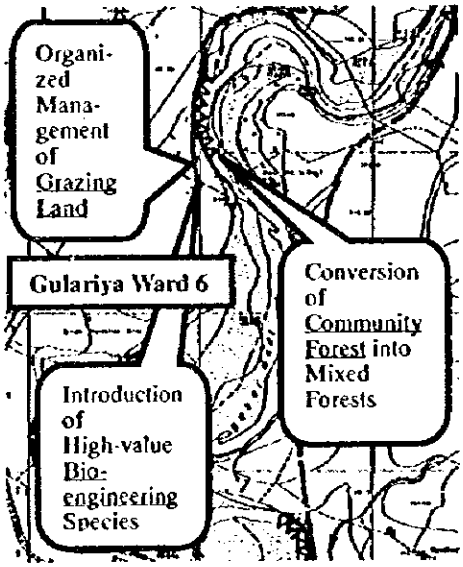


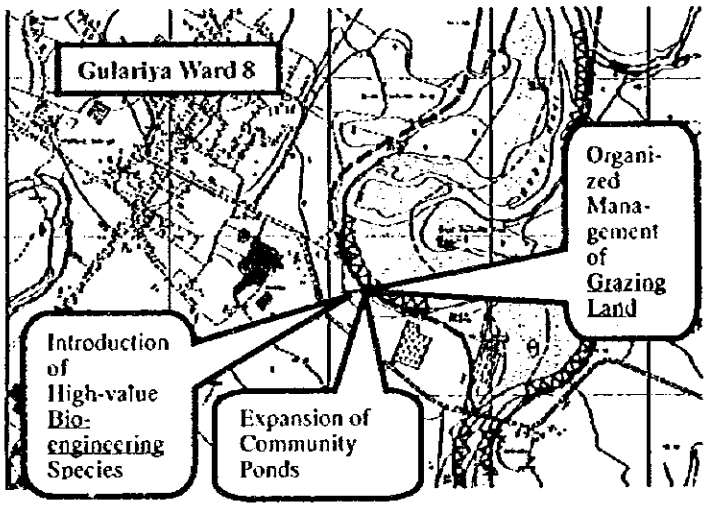


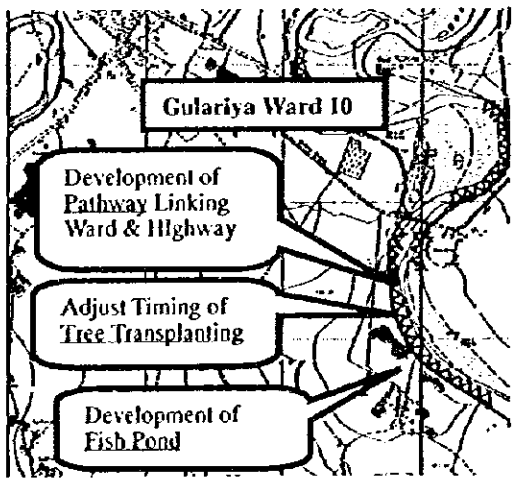


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| Work Component and Items | 1st.Phase(9th plan) (1997-2002) | | | | | 2nd.Phase(10th plan) (2002-2007) | | | | | 3rd.Phase (11-12th plan) (2007-2017) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1997/98 | 1998/99 | 1999/00 | 2000/01 | 2001/02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

**IMPLEMENTATION SCHEDULE: BABAI RIVER**

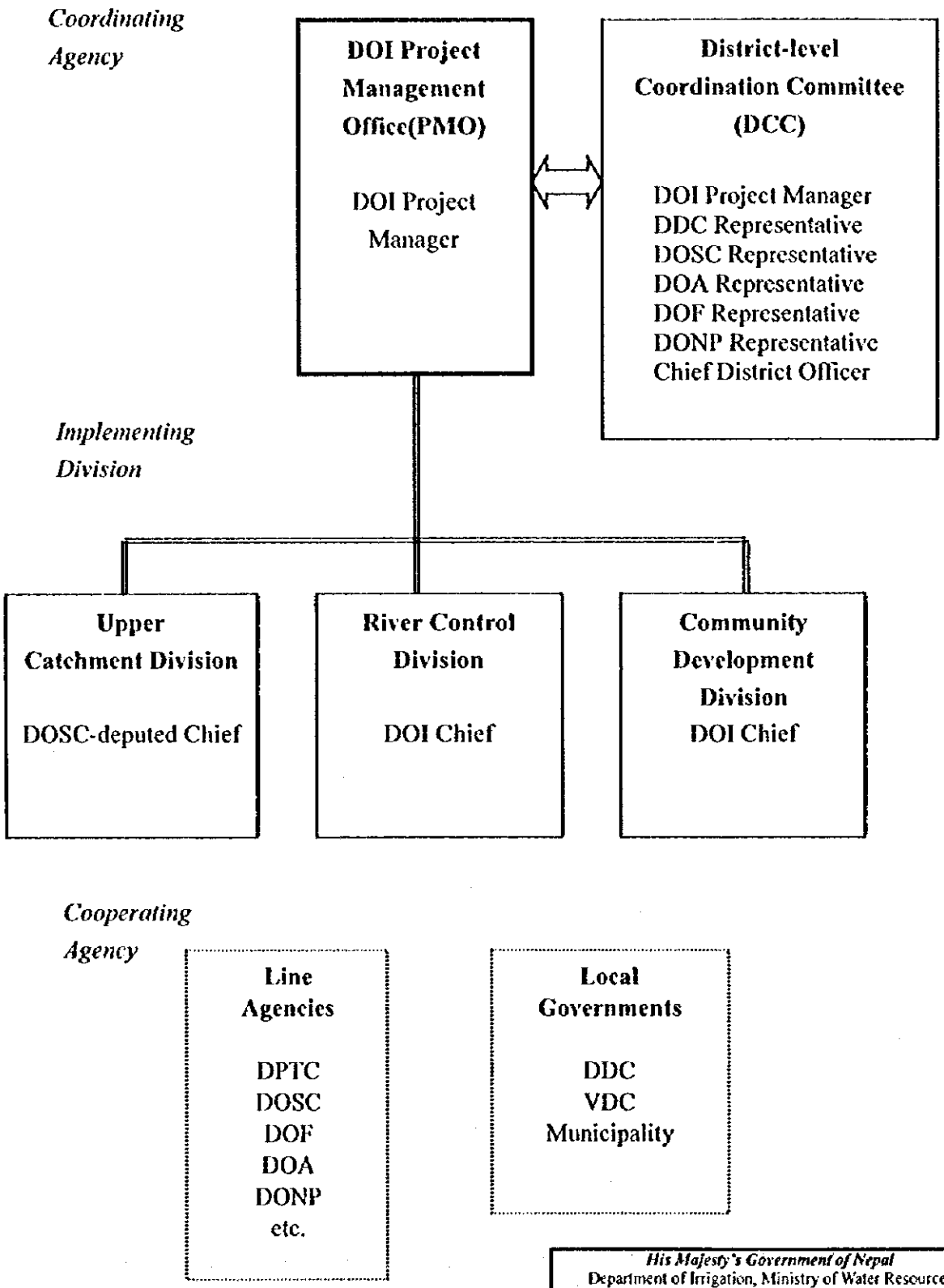
| Work Items | Central Government | | | | Local Government | | Local community |
|---|---|---|---|---|---|---|---|
| | DOI/DIO | DOSC | DPTC | Other agencies | DDC | VDC | |
| **Preparatory works** | | | | | | | |
| Feasibility study | ◎ | - | - | - | ○ | ○ | ○ |
| Fund arrangement | ◎ | - | - | ○ | ◎ | ◎ | ◎ |
| 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** | ○ | ◎ | ○ | - | ○ | ◎ | ○ |
| **Ferest 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

Fig. 6.16

# IMPLEMENTATION ARRANGEMENT FOR FLOOD MITIGATION IN TERAI

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