## CHAPTER 4 FLOOD MITIGATION MASTER PLAN

#### 4.1 Principles for Formulation of Master Plan

## (1) Basic Frame of Flood Mitigation

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The Ninth Plan: The Ninth Plan (1997-2002) focuses on poverty alleviation as the main objective of the plan. "The Access to Ninth Plan" prospects, as a long-term target, to bring the poverty level down to 10 % by the end of Twelfth Plan (2012 – 2017) from the present 45 %. This is to be achieved by keeping annual economic growth rate at 7.2 % for GDP and 5.1 % for per capita income over the 20 year period, though the targets are not final and are still under examination. The Ninth Plan states, in its policy sector of irrigation, the river control program as follows:

"The river control program shall be coordinated with agricultural, forest and soil conservation programs to make it more effective and its scope of work shall gradually be expanded."

**Population Flow:** The major pattern of the population flow in Nepal is from the mountain/hill regions to the Terai. As a result, the Terai saw a population growth rate nearly three times as rapid as that of the hills and mountains, and the percentage of the Terai's population increased from 37% of the whole country in 1971 to 46 % in 1991. The 1998-population of the Terai is about 11.0 million, (9.7 mill. in rural and 1.3 mill. in urban areas) sharing about 50 % of the country total. Because of migration into the area, the population of the Terai is anticipated to double in 20 years time. Thus by 2020, the Terai may contain 67% of Nepal's population.

Economic Activities: The GDP growth rate has been between 4 to 5% per annum during the past 10 years. Nepal is a predominantly agrarian economy. The share of the agriculture sector in Nepal's GDP has been between 40 and 50 %. In addition, more than 80 % of the labor force is dependent upon agriculture. Therefore, the development of agriculture is a key to enhance GDP and, accordingly, to alleviate poverty. The development of the agricultural sector impacts on non-agricultural sector and also promotes growth in opportunities for employment.

Terai Plain: The Terai plain is called the "granary of Nepal", because of the significant contributions the Terai makes to the overall agricultural production. Almost a half of the country's cultivated land is in the Terai and farmers in the Terai produce nearly

60 % of the country's food grain. A wide range of crops is produced, with major crops of paddy, maize, wheat, pulses, and oilseeds. Most of these major crops are grown during monsoon.

Flood Mitigation in Basic Frame: In order to meet the growing demand for food, agricultural productivity has to increase. This should be done by increasing unit production, rather than converting more forest land to agriculture as has been done previously and to a small extent is occurring today. Flood mitigation measures play an important role in this regard to support people's livelihood and the development of agriculture, reducing damages due to flood and sediment, reclaiming some of the sterile land, and enabling intensified cropping in the Terai plain.

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### (2) Concept of Flood Mitigation Master Plan

**Objective:** The Master Plan aims to direct or guide the flood mitigation activities that will be conducted by various agencies and organizations concerned. In the present study, flood mitigation always means the mitigation of damages due to flood and sediment induced disasters.

Master Plan: Flood mitigation measures generally needs long and continuos periods of efforts to accomplish. Therefore, all of these efforts must be directed in an orderly manner toward flood mitigation targets described in the Master Plan. The Master Plan includes the following contents:

- 1) Present conditions and problems
- 2) Flood mitigation measures: The measures consist of watershed management, river control and community development components.
- Master Plan: A conceptual plan for flood mitigation is proposed to cope with basin's flood and sediment disasters. Discussions on the technical details are left for future studies.
- 4) Action program: Activities to be performed by the target year are clarified and actions toward the target year are detailed. Execution methods and procedures of their implementation are also discussed.

## (3) Target Year

In line with the national development plan, target year was set at the end of Twelfth Plan in 2017 which is 20 years from now.

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# (4) Objects to be Protected

The flood mitigation will be discussed mainly for the Terai plain. As to the watershed area, recommendation will be made from watershed conservation viewpoint.

According to the investigation of flood and sediment disasters, the major causes of damage in the Terai plain are:

1) Bank erosion,

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- 2) Sedimentation in the riverine areas, and
- 3) Flooding and inundation.

Owing to these, the following objects in the flood prone area have been affected by damage:

- 1) Human being: Injury and loss of life;
- 2) Settlements: Houses and household effects, public buildings such as school and hospital, etc;
- 3) Public facilities: Highway and roads, bridges, electric cables, irrigation canals, river training works, etc; and
- 4) Farm lands and livestock: Paddy and other crops, livestock, etc.

Such people, land and facilities in flood prone areas, located along the rivers shall be protected from flood and sediment disasters.

# (5) Approach to Flood Mitigation

Considering the natural and social conditions of the Study Area and the financial situation of HMG/N, the following matters are taken into consideration in planning the flood mitigation of the rivers in Terai plain:

- 1) Maximum Use of Local Materials and Human Resources: The proposed plan should fit in with the financial situation of the country. The proposed project must be practical and sustainable, and low cost for both construction and maintenance. In this regard, consideration is given to the use of local materials in parallel with the participation of local residents as much as possible.
- 2) Provision of Safe Lands: Expansion of rural towns and isolated farm house is taking place due to migration and population increase in the Terai plain.

Some of the new residents live on the land which are flood prone. Provision of safe and productive land is one of the important tasks of the flood mitigation projects in the Terai plain. The prevention of loss of human life is a top priority.

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- 3) Comprehensive Measures: Flood mitigation measures should be inclusive adopting non-structural measures as well as structural measures..
- 4) Technical Model: The proposed flood mitigation plan should be a technical model for other river basins of similar nature.

### 4.2 Strategy for Flood Mitigation

#### (1) Conceivable Flood Mitigation Measures

In order to mitigate damage due to flood and sediment disaster, it is necessary to employ all the possible measures. The flood mitigation measures are broadly classified into four, according to their functions, as follows:

- 1) Erosion and sediment control by watershed management (Watershed area);
- 2) Storage or detention of flood water (Upper basin);
- 3) Smooth transport of floodwater and sediment (Flood prone area); and
- 4) Damage mitigation by flood plain management (Flood prone area).

These flood mitigation measures are shown in Fig. 4.1. Measures applicable to the rivers in the Terai plain are discussed in the following subsections considering the characteristics of the river and the existing situation of the basin and the country.

#### (2) Erosion and Sediment Control by Watershed Management

Forest Reserve and Land Use Regulation: The forest reserve and land use regulation will be the main activities in the watershed area to sustain and enhance the natural erosion control function of the forest, since the geological conditions in the Siwalik hills are very poor and intensive erosion control works in such areas are difficult technically and financially. The flood mitigation Master Plan is, therefore, formulated under the existing watershed conditions. The forest reserve includes reforestation and afforestation.

Local Erosion Control Works: Local erosion control works are also needed to protect the settlements as remedial measures.

#### (3) Storage or Detention of Floodwater

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Dam Reservoir: Dam reservoir to control flood and sediment flows is not proposed mainly for the following reasons:

- Dam is not recommended in the class-III river watersheds, because of poor geological conditions in the Siwalik hills. Furthermore, the dam reservoir will not be so effective, since the watershed of the class-III river shares only one third of the total basin area.
- As to class-I and class-II rivers in the Study Area, any multipurpose dam which can serves for flood mitigation as well has not been proposed. Considering the cost performance, single purpose dam for flood mitigation is not proposed.

**Retarding Basin:** In order to reduce flood peak in the downstream reaches, natural flood storage function should be conserved as a retarding basin.

### (4) Smooth Transport of Floodwater and Sediment

Conventional Measure: In order to ensure the smooth transport of floodwater and sediment, conventional measures such as channel treatment, bank protection, dike, channel excavation and cut-off channel works should be employed. Among these works, river dike is a primary facility to ensure the smooth flood flow, but at the same time it changes markedly flow conditions of floodwater and sediment in river channel. Adoption of diking system needs careful consideration to make the project economical and sustainable.

**Continuous Dike:** Continuous dike constructed along the river course is an effective measure to protect flood prone areas from floodwater and sediment, confining them within the river area. However, the continuous dike also induces some difficulties and problems as described below, especially in the river basin with much sediment yield from the watershed:

 Concentration of Floodwater and Sediment: The continuous dike induces concentration of floodwater and sediment in the lower reaches (see Fig. 4.2). Therefore, the continuous dike should be designed giving careful consideration on the continuation of floodwater and sediment flows.

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Otherwise the continuous dike may cause a remarkable rise of riverbed and, in consequence, a breach of the dike. For the sediment study, rivers in the Terai plain have two major problems. They are uncontrollable sediment yields in watershed and necessity of plan coordination with India.

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- 2) Uncontrollable Sediment Yields in Watershed: Sediment control in the watershed is difficult owing to the poor geological conditions and budgetary constrains. Moreover, the mechanism of the sediment yield in the Siwalik hills is not known and has to be investigated after this. Under such a situation, reliable sediment study for the plain river reaches is difficult, since the sediment supply from the upper watershed is uncertain.
- 3) Coordination of Plan with India: All the rivers in the Terai plain flow into the Ganges river in India. The river channel in India should have equivalent capacity for flood water and sediment transport so as not to cause flooding and sediment problems around the border. Therefore, the continuous dike will not be realized unless the plan is coordinated and agreed with India.
- 4) Difficulty in Maintenance: A continuous dike generally needs a sustainable maintenance and repair in order to keep the function properly for the whole length of the dike. Such maintenance activities require a large amount of budget. The damaged dike should be repaired immediately for coming floods. If the dike is left broken, the floodwater may breach the dike and bring about more serious damages than ever, since the continuous dike concentrates the floodwater in the lower reaches and the dike would induce the increase of houses and other properties near the dike. Considering the present financial constrain of the government, such a timely response is deemed difficult.

Low Dike Allowing Controlled Flooding: Instead of the continuous dike, low dike allowing controlled flooding can be considered, since the sheet flood flows in farmlands would not be so disastrous. If the flooding are allowed in some reaches, concentration of floodwater in the lower reaches would also be alleviated. However, it is difficult, in practice, to designate lands for flooding in an emergency. It is more practical to protect villages and other important properties locally by local dikes or ring dikes.

Forest and Grass Belt as River Dike: Considering the present tight budgetary situation, priority of flood mitigation should be given to bank protection and damage mitigation of villages. As for the protection against flooding and inundation, forest and grass belt should be proposed as river dike. The trees and grass planted along the riverbank will

trap the sediment and reduce the overflow of floodwater. The trapped sediment will form a natural dike along the belt. Moreover, the tree and grass will bring in income for the community, which make the flood mitigation activities sustainable.

Proposed Dike: Based on the above studies and consideration, the following types of dikes are proposed for the rivers in the Terai plain to make the project practical, low-cost and sustainable:

- 1) Local dike: Dike to protect properties locally. Ring dike around the settlement and dike road to be used as road and dike also fall in this category.
- 2) Forest and grass belt as river dike: Owing to the function of the belt, the flood prone area will be substantially protected from sedimentation, and the inundation will be reduced, though the area still suffers from controlled flooding. Owing to there, it is expected that a river channel of about 2-year return period will be formed.

Diversion Channel: The primary functions of a diversion channel are to divert all or a part of the river water to alleviate flood discharge in the lower reaches, or to keep the river course away from the objects and areas to be protected. However, appropriate sites for diversion channels are not found for the rivers in the Terai plain, since these rivers take routes in parallel to each other, in a south-east direction, and the trans-basin of the flood water may cause another problem in the receiving river.

### (5) Damage Mitigation by Flood Plain Management

The flood plain management should be incorporated with other flood mitigation measures, so as to accomplish the mitigation of substantial flood damages in the flood plain. Measures for the flood plain management include the following:

- 1) Conservation of channel storage;
- 2) Land use regulation in flood plain;
- 3) Flood proofing;

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- 4) Flood forecasting, warning and evacuation;
- 5) Flood fighting;
- 6) Promotion of public awareness; and
- 7) Disaster relief fund.

## (6) Project Components

In order to undertake the flood mitigation project in a practical and sustainable manner, it is important to implement the measures in combination with community development activities. Therefore, the flood mitigation efforts should be divided into three components, i.e., (1) watershed management, (2) river control, and (3) community development components.

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## 4.3 Watershed Management Component

Enhancement of living standard of the resident is the premise for preventing soil erosion and the watershed management. Therefore, it is preferable to adopt countermeasures for promotion of watershed conservation together with community development activities.

For the conservation of watershed, construction of erosion control facilities, encouragement of afforestation and land use control are recommended as primary measures. In order to materialize the measures, publicity activities mobilizing local community and governmental and non-governmental organizations are also essential. The Department of Soil Conservation and Watershed Management (DOSCWM) and Water-induced Disaster Prevention Technical Center (DPTC) are expected to take the teading role in this regard.

## (1) Erosion Control Facilities

As remedial measures, the following erosion control facilities, solely or in combination with bioengineering technology, can be applied considering topographical, geological and social situation of the site:

- 1) Construction of check dam.
- 2) Revetment works along riverbanks.
- 3) Protection of hillside slope by revetment work and small terracing with vegetation.
- Protection of small-scale channel with gully plugging and surrounding slopes by planting shrubs and grasses.

## (2) Afforestation/Reforestation and Land Use Regulation

Afforestation/reforestation and land use regulation aim to foster physical strength of the

watershed area against land erosion. The followings are the recommended measures for the watersheds under study:

- Promote afforestation and reforestation, and foster natural regeneration of trees.
- 2) Promote planting farm tree and shrub as commercial crops such as fruit trees, medicinal herbs, aromatic plants and natural dyes. Well-managed commercial crops prevent land erosion in watershed and promote sustainable watershed management activities through income generation. The cultivation of medicinal and aromatic plants has been one of the main programs of Nepalese forestry policy. Root crops should not be chosen.
- Plant fodder grasses on slopes and fodder trees on terraces, and restrict the number of livestock within permissible limits for sustaining the pasture and forest.
- 4) Conserve of wild medical herbs, by protecting from over-collect, thus allowing a sustained yield.
- 5) Reduce energy use through the improving stoves.
- 6) Train local leaders in land use and woodland management, and exchange know-how among other communities.

## (3) Publicity Activities

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Afforestation and reforestation have already been carried out in Nepal. However, public people have little knowledge on this matter. In order to promote watershed management, the understanding and cooperation of communities, local and central governments and other organizations are indispensable. In this regard, publicity activities should be extended employing all possible means as follows:

- Establish a specific date or dates for tree planting activities as a national and/or local level event, and conduct tree-planting campaign for afforestation, reforestation, farm tree planting and forest conservation.
- 2) Hold commemorative tree planting for any ceremonies and memorial events by residents, and local and national leaders.
- 3) Promote environmental education, tree nursery and small arboretums in school.
- 4) Enact a system of commendation for excellent tree planting projects, including agro-forestry, riverside plantings and other community activities.
- 5) Combine natural regeneration and/or afforestation project with tourism and

local development project.

- 6) Conduct a campaign by mass media for planting trees.
- 7) Establish foundations and solicit funds to encourage tree planting.
- 8) Organize tree-planting volunteer groups, and facilitate volunteers from the overseas countries to participate as well.

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9) Conduct study tours to on-going projects to learn from past initiatives.

## 4.4 River Control Component

## 4.4.1 Design Discharge

According to the result of study in runoff analysis of the previous chapter, probable flood discharge has been estimated at the major points of rivers in the Terai plain. Probable discharges at the lower end (Indian border) of respective river basins are shown below:

(Estimated Flobable Discharge)						
River	Catchment	Probable discharge (m <sup>3</sup> /s)				
	(km²)	Q,	Q,	Q <sub>10</sub>	Q <sub>20</sub>	Q <sub>50</sub>
1.Ratuwa	383	500	810	1,010	1,200	1,450
2.Lohandra	310	450	720	900	1,070	1,300
3.Lakhandei	300	440	710	880	1,050	1,280
4.Narayani	31,645	12,400	16,600	19,400	22,100	25,600
5.Tinau	1,081	830	1,340	1,670	1,990	2,420
6.West Rapti	6,418	2,320	3,680	4,590	5,420	6,530
7.Babai	3,425	2,500	4,300	5,500	6,660	8,160
8.Khutiya	325	460	740	920	1,100	1,330

(Estimated Probable Discharge)

## 4.4.2 River Segments and Channel Characteristics

The river is generally divided into four segments with similar characteristics mainly based on river slope and bed materials, i.e., Segment M for mountain reaches, Segment 1 for alluvial fan, Segment 2 for natural levee zone, and Segment 3 for delta.

Criteria of these segments are shown in Table 4.1. Segment 3 does not exist in the Terai plain rivers. The Segment 2 is divided further into Segments 2-1 and 2-2.

River channel can be divided into several reaches depending on the riverbed material, channel slope, river width and surrounding topography. River slope, representative grain size and average river width are worked out for respective reaches and shown in Table 4.2. River control measures should be discussed based on the channel

characteristics of respective segments.

#### 4.4.3 River Boundary Line (RBL)

**River Boundary Line:** Stabilization of river course is a fundamental task to achieve river control. As a reference datum for the river course stabilization, the river boundary line (RBL) should be first designated and authorized for the flood mitigation activities, identifying the lands and objects to be protected. The RBL must be fixed and protected from movements of the river courses.

Use of RBL: All the river-related facilities for flood mitigation and water use should be planned and designed in consideration of the authorized RBL. By so doing the efforts for flood mitigation to be carried out when the occasion demands would be accumulated and the safety level of the river would be enhanced gradually in line with a plan.

Setting RBL: The RBL should be set satisfying the following requirements:

- 1) Protection of properties: The RBL should be placed to protect important lands and objects from flood and sediment disasters.
- Enough channel capacity: The river width between the right and left RBLs should be more than average width of the existing river and enough to transport of flood water and sediment.
- Free from erosion: The RBL itself should be free from erosion keeping enough distance from riverbank or providing appropriate bank protection measures.

**Procedure of Setting RBL:** Therefore, the RBL is designed and authorized through the following procedures:

- 1) Study river width necessary to transport design floodwater and sediment.
- 2) Investigate erosion width along the both riverbanks. The erosion width discussed here is a total erosion width of riverbank throughout a flood season. Design crosion width  $(B_e)$  is determined as the maximum value for respective river reaches based on the investigated data.
- Draw initial RBL on both banks keeping distance more than B<sub>e</sub> from river bank. The RBL should be set on a smooth alignment for floodwater flow.
- 4) The initial RBL is examined from the viewpoints of property protection and channel capacity. The RBL will be revised partially, if the result of

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examination demands.

5) The RBL is fixed and authorized finally after getting consent of government authorities and local communities concerned.

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The RBL should be clearly marked in the field by permanent objects such as stakes, planted trees, dike road or dike embankment.

The design erosion width ( $B_e$ ) was assumed, tentatively for the present study, to be  $B_e = 50$  m based on the information obtained in the field.

## 4.4.4 Facility Plan

#### (1) Channel Treatment

Two types of channel treatment works are considered, namely, tributary works and branch/anabranch works.

- Tributary works: Treatment of tributaries (or incoming water), unifying tributary systems and controlling flows from other river systems, by diversion structure, closing dike, and connecting channel works, to fix the river system and catchment boundary.
- Branch/anabranch works: Treatment of branches and anabranches (or outgoing water) by closing dike works with diversion structure, if necessary, to prevent river course shifting and flood water spilling.

## (2) Bank Protection

Bank protection aims to protect the banks from erosion and accordingly to stabilize the river course. Various types of bank protection works have been developed empirically over the world, and the works should be selected considering the channel characteristics of the river.

- 1) Spur (or groin) works: A series of spurs prevents bank erosion primarily by two functions of spur, namely, to retard flow velocity near the bank and to change the flow direction away from the bank.
- 2) Revetment works: Revetment works prevent bank erosion by covering bank slopes and protecting their foundations. Spur and revetment works are the primary bank protection measures. These measures can be planed

independently or jointly.

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3) Preventive bank protection works: Grass and trees planted on the riverbanks resist and retard the erosion. These bioengineering technologies can be used as preventive measures against bank erosion, not as direct bank protection works.

**Design of Spur Works:** For the purpose of Master Plan study, spur works were tentatively selected for bank protection, since river section data were not available. The following assumptions were also introduced mostly based on the data in Japan:

- 1) Total length of a series of spurs (L):
  - L = X/4.0 for Segment 1
  - L = X/3.0 for Segment 2-1
  - L = X/2.0 for Segment 2-2

where X : Bank length to be protected

2) Crown height of spur  $(h_{sp})$  from bank level:

 $h_{sp} = 0.0 h_L$  for Segment 1

 $h_{sp} = 0.3 h_L$  for Segment 2-1

 $h_{so} = 0.5 h_L$  for Segment 2-2

where h<sub>L</sub>: Mean depth of low water channel

Type of spur:
 Gabion spur for Segments 1 and 2-1
 Pite groin for Segment 2-2

Types of Riverbank: Conditions of riverbank shall be monitored every year after the flood season and the necessity of protection works shall be examined depending on the conditions of riverbank. In order to identify the sites in critical conditions and prioritize the work sites for bank protection, riverbanks should be classified into several types (Fig. 4.3) based on the relationship between the distance from river bank to the river boundary line (B<sub>h</sub>) and design erosion width (B<sub>c</sub>). Types of riverbank and necessary measures to be taken are summarized below:

- 1) Type-A bank:  $B_b < B_e$  and bank erosion is active; Bank protection works are desirable as far as the fund is available. Preventive measures for bank erosion are needed immediately.
- 2) Type-A, bank:  $B_h < 0.5 B_e$  and bank erosion is active; Bank protection works are needed immediately.

- 3) Type-A<sub>ss</sub> bank:  $B_b < 3h_H$ ,  $7h_H$  and  $10h_H$  for Segment 1, Segment 2-1 and Segment 2-2, respectively, where  $h_H$ : design water depth in high water channel; Protection works of dike slope are needed.
- 4) Type-B bank:  $B_h \ge B_e$  and bank erosion is active; Preventive measures for bank erosion are needed.
- 5) Type-C bank:  $B_h \ge B_e$  and bank crossion is not active due to topographical and geological reasons; No bank protection works are needed.

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## (3) Dike Works

**Proposed Dike Works:** Dike works aim to prevent floodwater and sediment from spilling over the land. As was discussed in the Section: Strategy for Flood Mitigation, continuous dike will not be proposed for the rivers in the Terai.

**Forest and Grass Belts:** Tree and grass planted along the river course are not strictly dikes. However, these grass and tree belts would alleviate flood damages in the flood prone areas, retarding the flood flows and promoting the formation of a natural levee along the belt (Fig. 4.4). The forest belt consists of trees to cope with floating logs and other course materials and grasses to trap sediment. The grass belt is made of grass only to trap sediment. The forest belt can replace the grass belt as far as it is aligned on the RBL. These tree and grass will bring in income to the community. Generally speaking, grass yields products soon, while tree need long years to grow.

Local dike: A local dike is applicable to protect a specific area from flooding in such places as the confluence of tributaries, the bifurcation site of an old river course and other local sites of low elevation.

Dike road: Road embankment constructed along the river as rural road and flood dike as well. Even if the embankment height is lower than the design level, the road embankment would protect nearby lands from flooding and sedimentation most of the time.

**Ring dike:** A ring dike is applicable to protect sporadic important objects like settlements in flood prone areas. A facility for interior drainage is also required.

**Dike Alignment:** These dikes are aligned in principle on the river boundary line (RBL), except for the ring dike.

#### (4) Excavation of Low Water Channel

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Channel excavation works primarily aims to increase channel capacity and to normalize the river courses.

**Channel excavation:** Intensive channel excavation is not recommended for the rivers in the Terai plain, since the maintenance of the excavated channel would be difficult under the conditions that the sediment in the upper watershed is not controlled yet. Therefore, channel excavation may be executed only for channel normalization in extremely narrow sections and for earth dike materials.

**Collection of bed material:** Collection of riverbed material also contributes to the increase of the channel capacity, as far as the amount and places of collection are planned appropriately from a river control viewpoint. The collection can be undertaken on the coarse material bed such as in the alluvial fan.

**Channel Section:** Wide channel has large capacity for floodwater transport but small capacity for sediment transport, which may result in silting up of channel sections. The design width of low water channel should be examined in relation with friction velocity and representative bed material size. An empirical relationship developed by Dr. Koichi Yamamoto is shown in Fig. 4.5. This Figure indicates that, if the designed section satisfy the emperical relation, the section would be stable. This relationship was derived based on the river data in Japan. It is recommended to reproduce the relationship using data from Terai rivers in future.

(5) Realignment of Channel

**Cut-off Channel (COC):** This will ensure smooth flood/sediment flows by shortening and steepening the channel in meandering sections, and keep away the river course from the site to be protected. The COC may not be applicable to the channels in alluvial fan, since the river course is braided and unstable. The COC was planed at the severely meandering section considering the following:

- 1) Cut-off channel section shall be designed with the average width and depth of the existing river.
- 2) The head of the existing channel shall be closed by closing dike.

### (6) Storage or Detention of Flood Water

Retarding Basin: In order to reduce flood peaks in the downstream reaches, a retarding basin can be considered by conserving natural flood storage function. The retarding basin can be planned at the confluence of tributaries to reduce runoff peak by spilling floodwater into the retarding basin. The conservation of channel storage also function markedly for this purpose.

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### 4.5 Community Development Component

The community development component for flood mitigation will consist of three sets of activities (Fig. 4.6). The "community mobilization" intends to build up organizational bases for the plan implementation. The "local coping measures" will enable the communities to live with flooding. The "community-based sustainable flood mitigation measures" will motivate the local people to maintain and sustain the flood control structures.

This Master Plan will address both "hazards" (e.g., inundation, sedimentation, and bank erosion) and people's "vulnerability" (e.g., lack of awareness and motivation for flood mitigation, inadequate resources to adjust to flooding, lack of access to alternative sources of livelihoods) as shown in Fig. 4.6. The hazard control will be addressed by the river control component (and partly by community-based sustainable measures with some structural measures). The community development will promote vulnerability reduction in itself (by enhancing the people's capabilities to adjust to hazards, through local coping measures), and also will bring the river control component to impact on vulnerability (by linking the physical structures with community development, through community-based sustainable measures). In this way, the community development component will contribute towards comprehensive flood mitigation (tackling both hazards and vulnerability).

#### 4.5.1 Community Mobilization

The community development will start with the community mobilization, to strengthen the organizational bases for local flood mitigation initiatives (Fig. 4.7). Unlike the past practices in which the people are hastily organized primarily for the construction of physical facilities, more focus will be placed on awareness-raising and capacitybuilding of the communities themselves.

## (1) Workshops for Local Government Institutions (LGIs)

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There are specific set of community development activities that will be entrusted to the LGIs. Although the DIO even presently seeks the LGIs' cooperation in mobilizing the communities in flood control projects, the LGIs contribute only to labor hiring, with little regard to awareness-raising of the local people. In order to upgrade the LGIs' capacities to perform the full-fledged community mobilization tasks, a series of training workshop will be undertaken at the inception of the community development activities. The subjects to be taken up in the workshops are as follows:

- 1) Technicalities of Flood Control Measures (functioning of various measures)
- 2) Local Initiatives for Flood Mitigation (actions expected of communities)
- 3) Community Mobilization Processes (procedures for community mobilization)
- 4) Facilitative Roles by LGIs (roles and responsibilities of LGIs)

#### (2) Creation of Organizational Bases at the Community

#### Formation of Community Organizations (COs):

- 1) Step 1 Organize Settlement-wise Meetings: An initial meeting will be held in each settlement, inviting all the households.
- 2) Step 2 Dialogues with Communities: This step is to enable the communities to understand the potential benefits of the Plan through a) Presentation of "Flood Control" Component, and b) Relating "Flood Control" with Other Local Needs
- 3) Step 3 Establishment of COs for Forest/Grass Belts: To develop and maintain the forest/grass belts, settlement-wise COs will be established, through a) Formalization of COs, b) Preparation of Forest/Grass Belt Operational Plan, and c) Registration of CO with the District Authority.
- 4) Step 4 Strengthening of COs for Other Flood Control Works: Where additional structures (other than forest/grass belts) are proposed, the CO will be strengthened, through a) Formation of Inter-CO Groups, where necessary, and b) Formulation of "Community Development" Action Plans.
- 5) Step 5 Enter into Agreement with CO Groups: Finally, a formal agreement is signed with COs, which stipulates project activities, time-frames and budgets, as well as responsibilities of both sides.

Promotion of Public Awareness, Knowledge and Skills: Once the COs are formalized, formal training will be conducted on the following topics:

- 1) Technicalities of Flood Control Measures: to understand how various measures are to function and are to be maintained, and also why continuous dikes are not opted.
- Skills in Masonry and Gabion-netting: to gain employment during the construction stage, and also to obtain skill necessary for the maintenance activities.

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3) Community Participation in Flood Mitigation: to understand modalities of participation, e.g., tabor/in-kind/cash contributions, as well as local practice.

Generation of Financial Resources by COs: The COs can generate financial resources through (1) forest/grass belt products, (2) nursery products (in case the communities run nurseries), and (3) group savings. Savings will primarily be used as capital for regular maintenance and minor repair of flood control structures, and/or for undertaking community-based flood mitigation activities. At the same time, it is important to assist the COs in establishing a record keeping system, and in acquiring skills in running it in a transparent manner.

## 4.5.2 Local Coping Measures

Since it is not possible to contain all flooding through river control facilities alone, it is important for people also to take coping measures on their own, to complement the physical structures. The plan component for local coping measures will be undertaken on a community-by-community basis (Fig. 4.8). The following is a menu of support, in assisting local communities to enhance their local coping measures.

## (1) Land Use Management

The purpose of land use management is to ensure flood risks are not worsened by illconceived land uses, by conserving the land adjacent to the rivers. Along the target rivers, the following types of poor land use are observed.

- 1) Over cultivation: Farmers with land adjacent to the rivers cultivate right on the riverside. This exacerbates soil compaction, thus accelerating bank crosion.
- 2) Over grazing: Pastureland along the target rivers is usually used freely by herdsmen, which cause overgrazing problems. This leads to the reduction of vegetation cover, which also leads to the instability of riverbank.

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3) Deforestation: Not all the forests along the rivers are not properly managed. Some are being deforested, while others are maintained but not in a manner conducive to soil conservation.

Against this background, it is crucial for the local communities to agree on local rules and practices that will stop the above-mentioned poor land use management. Those with landholdings on the riverside will be encouraged to stop over cultivation. This can be promoted, through the introduction of high yield crops, or other incomegenerating activities, e.g., livestock raising. It is important for the farmers to gain alternative sources of income to compensate for the loss of cultivated land. To curb over grazing, more organized systems of pasture land management will be initiated, e.g., rotational grazing, and fodder plantation. Planting of trees near the rivers will be also promoted, both on community land as well as on private farmlands.

## (2) Flood Proofing

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The following are examples of flood proofing measures observed in the Terai plain.

### Agricultural Adjustments:

- Immediately after the summer crops are damaged, cultivate fast-growing crops (e.g., certain types of vegetables, Arun maize) which can even harvested in a few months' time - even in time for farmers to start winter crops;
- Grow sweet potatoes, if as a result of floods their farming lands are covered by thick sand, thus preventing them from cultivating other crops;
- 3) Where feasible, change from maize growing to rice cultivation which is less vulnerable to inundation, and in other words, more flood-resistant; and
- 4) Set aside rice secdlings, in order that they can re-plant paddies, even in case rice fields are destroyed due to flooding.

### **Housing Structures:**

- 1) Construct houses on plinths, so that flood water flows underneath;
- 2) Raise grain stores on stilts, while build escape areas under roofs for family members and other valuables; and,
- 3) Concentrate houses on higher grounds of the communities, to prevent residential shelters from being inundated during floods.

## Other Possible Flood Proofing Measures:

- Afforestation/reforestation on the riverbanks will serve to curtail the speed of overflow water in case of emergencies;
- 2) In low-lying areas, drainage will serve to reduce the level of inundation as well as to improve hygienic conditions during the monsoon; and,
- Small-scale reservoirs (e.g., creation/expansion of new/existing ponds) on community-owned barren land.

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Introduction to Other Localities: One modality of possible support is to introduce the above-mentioned practices to localities where they are feasible but sill unknown. Some communities may be facing the resource constraints, which can be supported with the supply of those lacking materials. Moreover, support will also be provided even to existing flood proofing efforts, when there is scope for further improvements.

## (3) Forecasting, Warning, & Evacuation

The following are some of such examples of local measures:

- 1) Forecasting and Warning: Some people anticipate floods when they observe:
  - Changes in the water flow (e.g., rising levels of water, river water mixed with mud, leaves floating on the water, increasing number of fish);
  - Unusual sound/smell of rivers (e.g. rumbling sounds coming from the river, muddy smells of the stream); and,
  - Continued rainfall in surrounding areas, or in the upper watersheds.
- 2) Evacuation:
  - Stay in under-roof areas/ on rooftops, until floodwater subsides;
  - Stay on trees (e.g., bananas, and mangoes) planted around houses;
  - Evacuate to neighbors' second-story houses, or to others' houses in surrounding areas on higher grounds; and,
  - Shift valuables (e.g., money, grain, and livestock) to safer areas, before the monsoon season starts.

For both "forecasting/warning" and "evacuation", a possible strategy is to improve upon local measures (e.g., it is fairly common that warning and evacuation are undertaken individually, which can be organized as joint efforts). More systematic approaches to forecasting/warning simply by utilizing existing facilities, such as P.C.O. (Public Call Office). In localities that find it difficult to secure suitable evacuation sites, support will be provided, e.g., in developing accessible roads to safer areas.

### (4) Flood Fighting

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The following are examples of local flood fighting measures:

- 1) Install bamboo piles as bank protection works;
- 2) Grow indigenous shrubs on the land-cutting sites;
- 3) Plant bamboo on river banks as protective works;
- 4) Construct temporary spurs made of logs;
- 5) Use sandbags with bamboo piles as guide bunds; and
- 6) Place boulders and tree trunks, where embankments are being breached.

However, such village-level measures often lack technical soundness. In such cases, the faults will be corrected with the provision of technical advice. Where certain materials are not available locally, support will be extended for the local communities themselves to procure or produce those materials locally. Only for those materials beyond the reach of the local populations will be donated to the local communities.

#### 4.5.3 Community-based Sustainable Measures

The "community-based sustainable measures" is to derive additional benefits from the physical facilities, and to motivate the beneficiaries to sustain the structures (Fig. 4.9). Forest/grass belts, and preventive bank protection works will derive tree/grass products out of the flood control measures, while access improvements and bed material collection will produce other additional benefits. These additional values will motivate the COs to sustain the physical structures, through operation and maintenance (O&M) of flood control structures, and land use management.

### (1) Bank Protection Works

Local Bank Protection Works: There are broadly two types of bank protection works that the local communities can undertake using their own resources. One is the construction of flood control works entirely relying upon local materials. In some cases, the communities attempt to contain bank erosion and/or flooding by installing revetments/spurs using local materials such as bamboo and sandbags. These will be disseminated where the velocities are not high. Local communities will also be assisted to generate their own resources, e.g., the plantation of bamboo, group savings to purchase sandbags themselves. The government agencies will also be encouraged to refrain from handing out those materials, to the extent possible.

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**Preventive Bank Protection Works:** Another modality of local bank protection works is the plantation of trees/shrubs/grass, usually to supplement engineering structures. Bioengineering will help derive at long-term stability of the river control measures, by stabilizing the land that adjacent to the engineering structures. It will be used to derive tree/grass products. As Table 4.3 shows, there exist two categories of income-earning opportunities, i.e., one emanates from sales of extra seeds and seedlings produced in nurseries, and the other from the supply of tree products, e.g., fuel wood, fodder, and timber. In addition to extension activities, support will also be extended to those localities that already practice bioengineering, but still have room for improvements (e.g., introduction of higher-value species).

### (2) Forest/Grass Belts as Dike Works

The flood mitigation plan envisages the development of forest/grass belts. Table 4.4 shows a list of potential candidate trees/shrubs/grass that can be used as part of the belts. The belts will also serve various necessities of the local residents. As illustrated in Table 4.3, there are various local trees, shrubs, and grass that are of multi-purpose (e.g., fuel, timber, roofing, etc). The COs can sell surpluses of forest products in the market. Moreover, in case the local communities choose those species that require nurseries, the COs can sell extra seeds/seedlings that are produced in their nurseries.

In addition to these direct opportunities, there are also multitude of indirect benefits that farmers can tap into. Certain trees/grasses can be used to promote livestock farming, i.e., as fodder for domestic animals (e.g., buffaloes, goats, and cows). In places where bioengineering strategies include forestry development, bee-keeping, ginger/turmeric farming, and coffee growing could also be initiated near/in the forests.

#### (3) Access Improvements using Flood Control Structures

Flood mitigation projects, when dikes are constructed, provide opportunities to simultaneously develop rural road networks. In some places, the dikes alone will be designed as access roads. In other areas, short-distance unpaved roads (gravel, or earthen) will be constructed, to link embankments with outside road networks. Where revetments will be constructed, it is expected that the riverbanks be also stabilized.

Therefore in places where access improvements are required, gravel and/or earthen roads will be developed along those banks.

In doing so, it is important to take into consideration a variety of expectation people may have concerning accessibility improvements, e.g., to transport agricultural products, to send children to school, to go to health clinics, or to attend village meetings. One critical issue, in the context of flood mitigation, is the damages to roads during flooding which prevent the people for evacuating to safer sites. In such places, support will be extended to link road development with the evacuation requirements.

Community-based approaches have been extensively tested for rural road construction at various locations in Nepal. Such approaches can encourage people to contribute their own resources to the rural road projects (e.g., land, labor, construction materials, and cash). This way, local road projects contain unit costs of road construction, usually ranging from 50,000 to 80,000 Rs/km for graveling roadways.

### (4) Bed Material Collection as Channel Excavation Works

Many rivers in the Terai are being mined for sand, gravel and boulder, which serves as one important source of revenues for many District Development Committees (DDCs). More importantly, sand/gravel/boulder collection from a riverbed can be part of a river training scheme, which serves to increase the transport capacity of a river. It can also provide employment opportunities for rural people in the Terai plain.

It is to be noted that bed material collection is not feasible in all the areas along the rivers. Certain localities face the constraints of (1) unavailability of sand/gravel, (2) low quality of sand /gravel, (3) lack of roadways from outside to excavation sites, (4) distance to transport to markets, (5) lack of flexible/clear-cut rules and regulations, and (6) objections from community members. However, efforts can be made to redress the above-mentioned constraints except (1) and (2).

Despite the high demands for sand/gravel/boulder, riverbed extraction should not be promoted *laissez-faire*. On the contrary, tighter control should be exercised over contractors, to minimize the extraction of sand/gravel/boulder in accessible locations (near riverbanks or bridges). Generally speaking, it is necessary to dig in the middle part of the river where the sediments are deposited and generally causes the diversion of river flow towards the banks.

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# (5) Operation and Maintenance of Flood Control Structures

The local communities will be responsible to constantly monitor the sites, and when necessary, seek external support for rehabilitation. For revetment works made of galvanized iron (G.I.) wire boxes, community will be instructed to monitor the river bed, and when it is scoured, to place stones and rubbles on the river bed. When the gabion wire is cut, the local residents will request the DIO, through the DDC/VDC, for additional nets. It is also necessary, on a regular basis, to remove objects which may be hooked to the G.I. wire boxes.

Gabion spurs and permeable types of pile spurs, similarly, require monitoring of the riverbeds. When the surface of the riverbeds are washed off, it is crucial to stabilize the foundation of the spurs by placing stones and rubbles on the riverbeds. Moreover, the local residents need to ensure that any objects hooked to the piles or the gabion should be removed. In case of gabion spurs, it is also desirable to plant grass or shrubs on the sand-deposit areas, to stabilize the land adjacent to the structures.

Dike works are subject to scouring of their slopes, given its objective to counteract the flood forces. It is therefore critical to ensure that the local communities undertake timely repairs of slope failures. Moreover, it is expected that the dikes be also used as rural roads throughout the year. In this respect, another maintenance task required is to watch the conditions, and whenever necessary to flatten the bumps of the dike roads. 60

#### 4.6 Flood Mitigation Plan

Based on the discussions and analyses made so far, Master Plan for flood mitigation activities by the target year 2017 was worked out for the respective river basins elected for the Study.

The Master Plan still remains at the concept level, since the planning was made on the topographic map basis (scale 1/25,000 and partly 1/50,000) and the river survey data were not available. In future the Master Plan should be upgraded based on a river survey to be conducted, in line with the flood mitigation concept described here.

# 4.6.1 Present Conditions and Principal Measures to be Taken

## (1) Ratuwa River

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## Present Conditions and Problems of Ratuwa River:

- 1) River basin:
  - Class-III river in Eastern Development Region
  - Basin area: 383 km<sup>2</sup> in total consisting of mountainous basin 133 km<sup>2</sup> and plain area 250 km<sup>2</sup>.
  - There exist Damak city and refugee camps by UNHCR in the riverine area.
- 2) River system: The Mawa river, a right tributary, is about to join the Nunsari/Bakra river near Madhumalla Bajar.
- 3) River channel: River is wide and braided for the whole stretch. Changes in riverbed material along the river are small ranging from medium to coarse sand. Gravel and other coarse materials are not found even in Segment 1.
- 4) River segments:
  - Segment 2-2: From 0.0 km (Indian border) to 13.0 km
  - Segment 2-1: From 13.0 km to 26.0 km
  - Segment 1 : From 26.0 km to 43.7 km (upper end of plain)
- 5) Flood and sediment disasters:
  - Major floods in past 10 years: 1988, 1995 and 1996 floods in the order of severity.
  - Kinds of damages: Bank erosion, sedimentation and flooding over farm lands.
  - Suffering areas: 7 villages in 3 VDCs and 4 wards of Damak municipality in Jhapa district, and 4 villages in 3 VDCs in Morang district.
  - Conditions and mechanism of flooding: Riverbed of the Ratuwa river is said to be agrading and widening. The Ratuwa river floods the riverine areas every year from June to August. In the lower reaches the floodwater spills and spreads over the old river courses and trails.

# Principal Measures to be Taken for Ratuwa River:

- 1) The Mawa river and the Nunsari river will be separated completely by a closing dike.
- 2) Branch and anabranch in Segments 2-2 and 2-1 will be closed securely with closing dike or controlled with diversion facilities if necessary.
- 3) Forest belt will be provided for Segment 1 and forest or grass belt in Segments

2-2 and 2-1.

- 4) Cut-off channel will be constructed at the severe bends.
- 5) An area at the confluence of the Ratuwa and Mawa rivers will be preserved as a retarding basin.
- 6) Bank protection works will be implemented at the critical riverbanks based on the monitoring. Preventive measures for bank erosion will also be undertaken adopting bioengineering measures.

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- 7) Watershed management will be carried out for erosion and runoff control by means of erosion control facilities, afforestation/reforestation, land use regulation, and publicity activities.
- Flood plain management will be carried out adopting all the possible measures for mitigation of damage due to flood and sediment disasters.

### (2) Lohandra River

#### Present Conditions and Problems of Lohandra River:

- 1) River basin:
  - Class-III river in Eastern Development Region
  - Basin area: 419(310) km<sup>2</sup> in total consisting of mountainous basin 140(31) km<sup>2</sup> and plain area 279 km<sup>2</sup>. Areas in () indicate those excluding mountainous basin of the Chisan river.
  - Middle and lower portions of the flood prone areas are the service areas of the Sunsari Morang (Kosi river) Irrigation Project.
- 2) River system: The Lohandra river is located between alluvial fans of the Chisan and Khadam rivers. The Lohandra river which itself is a branch river of the Chisan joins the Kesaula river from the Chisan and the Sukuna river from the Khadam.
- 3) River channel: River is wide and braided in the upper reaches and becomes narrow gradually toward lower reaches. Riverbed materials range from very coarse gravel in the upper reaches to fine sand in the lower reaches.
- 4) River segments:
  - Segment 2-2: From 0.0 km (Indian border) to 33.1 km (Kesaula R. jct.)
  - Segment 2-2: From 33.1 km to 49.6 km (Sukuna R. jct.)
  - Segment 1 : From 29.6 km to 67.5 km (upper end of plain)
- 5) Flood and sediment disasters:
  - Major floods in past 10 years: 1987, 1988, 1995 and 1996 floods in the order of severity.

- Kinds of damage: Sedimentation, bank erosion and flooding over farm lands.
- Suffering areas: 28 villages in 14 VDCs in Morang district
- Conditions and mechanism of flooding: Settlements and lands along the Lohandra river suffer from flood and sediment disasters almost every year. The riverbed is said to be aggrading markedly especially in the upstream reaches from Chatara canal. Bank crosion is active on the both sides of the river. Since the river channel is small in the lower reaches, flood water from the upstream areas frequently floods over the riverine farmlands.

## Principal Measures to be Taken for Lohandra River:

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- 1) The main Lohandra and the Kesaula rivers will be separated completely from the Chisan river by a closing dike or diversion facilities.
- 2) The Sukuna river will be separated from the Chisan river completely by closing dike.
- An anabranch at 46.7 km on the left bank will be closed securely with closing dike or controlled with diversion facility if necessary.
- 4) Forest belt will be provided for Segment 1 and forest or grass belt in Segments 2-2 and 2-1.
- 5) Cut-off channels will be constructed at severe bends. Cut-off channel from 27.8 km to 31.4 km aims to bypass dense settlement areas.
- 6) An area at the confluence of the Lohandra and Sukuna rivers will be preserved as a retarding basin.
- 7) Bank protection works will be implemented at the critical riverbanks based on the monitoring. Preventive measures for bank erosion will also be undertaken adopting bioengineering measures.
- 8) Watershed management will be carried out for erosion and runoff control by means of erosion control facilities, afforestation/reforestation, land use regulation, and publicity activities.
- Flood plain management will be carried out adopting all the possible measures for mitigation of damage due to flood and sediment disasters.

# (3) Lakbandei River

### Present Conditions and Problems of Lakhandei River:

- 1) River basin:
  - Class-III river in Central Development Region
  - Basin area: 300 km<sup>2</sup> in total consisting of mountainous basin 106 km<sup>2</sup> and plain area 194 km<sup>2</sup>.

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- Middle and lower portions of the flood prone areas are the service areas of the Bagmati Irrigation Project.
- 2) River system: Major tributaries are the Baune and Chapani rivers.
- 3) River channel: River is wide and braided in the upper reaches and becomes narrow gradually toward lower reaches. Riverbed materials ranges from very coarse gravel in the upper reaches to fine sand in the lower reaches.
- 4) River segments:
  - Segment 2-2: From 0.0 km (Indian border) to 21.0 km
  - Segment 2-1: From 21.0 km to 37.0 km
  - Segment 1 : From 37.0 km to 51.4 km (upper end of plain)
- 5) Flood and sediment disasters:
  - Major floods in past 10 years: 1997, 1993 and 1995 floods in the order of severity
  - Kinds of damages: Sedimentation, bank erosion and flooding over farm lands
  - Suffering areas: 27 villages in 11 VDCs in Sarlahi district
  - Conditions and mechanism of flooding: The Lakhandei river floods over the riverine area almost every year. The flood and sediment disasters are caused not only by the runoff from its own basin, but floodwater from the Bagmati river as well. The 1997-August flood inundated the lands as deep as 1.5 m for 3 to 7 days, causing extensive damages due to sedimentation and inundation over the farm lands. The 1997-flood also brought about diseases such as malaria, dysentery and typhoid, resulting in loss of 91 human lives in the whole Sarlahi district.

# Principal Measures to be Taken for Lakhandei River:

- 1) A branch and anabranches at 26.1 km, 16.3 km and 31.9 km will be closed securely with closing dike or controlled with diversion facilities if necessary.
- Forest belt will be provided along the river boundary line (RBL) for Segment 1 and forest or grass belt for Segments 2-2 and 2-1.

- 3) Cut-off channel will be constructed at severe bends.
- 4) An area at the confluence of the Lakhandei and Chapani rivers will be preserved for retarding basin.
- 5) Bank protection works will be implemented at the critical riverbanks based on the monitoring. Preventive measures for bank crosion will also be undertaken adopting bioengineering measures.
- 6) Watershed management will be carried out for erosion and runoff control by means of erosion control facilities, afforestation/reforestation, land use regulation, and publicity activities.
- 7) Flood plain management will be carried out adopting all the possible measures for mitigation of damage due to flood and sediment disasters.

# (4) Narayani River

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## Present Conditions and Problems of Narayani River:

- 1) River basin:
  - Class-I river in Central and Western Development Regions
  - Basin area: 35,780 km<sup>2</sup> in total consisting of mountainous basin 35,075 km<sup>2</sup> and plain area 705 km<sup>2</sup>.
  - The plain area is called as Inner Terai having a narrow gorge in the lower end near Indian border.
  - At the gorge section, the Narayani barrage is located and providing water for the Nepal Gandak Western Canal Project.
  - Bharatpur city is located in the riverine area near the upper end of the plain area.
- River system: Major tributaries in the inner Terai are the East Rapti and Rewa rivers. Numerous tributaries from the Siwalik hills also join to the Narayani in the plain.
- 3) River channel: River is braided in the plain area and has anabranches and islands in the river area. Grain size of the riverbed materials is coarse being distributed in a wide range from fine gravel to small cobbles. Changes in grain size along the river are not significant.
- 4) River segments:
  - Segment 2-1: From 18.4 km (Binai R. jct.) to 83.0 km (upper end of plain)
- 5) Flood and sediment disasters:
  - Major floods in past 10 years: 1988, 1993 and 1995 floods in the order of

severity.

- Kinds of damage: Bank crosion and flooding over farm lands.
- Suffering areas: 23 villages in 4 VDCs in Chitwan district, and 22 villages in 8 VDCs in Nawalparasi district.
- Conditions and mechanism of flooding: Bank erosion is the most serious problem in the basin. Frequent flooding occurs in the low-lying lands on the right bank in the lower reaches down from the East Rapti river junction

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## Principal Measures to be Taken for Narayani River:

- Forest or grass belts will be provided on one side of the river, i.e., right dike of the Narayani downstream from the confluence of the East Rapti river, left dike upstream from the confluence, and right dike for the East Rapti river.
- Bank protection works will be implemented at the critical riverbanks based on the monitoring. Preventive measures for bank erosion will also be undertaken adopting bioengineering measures.
- Watershed management will be carried out for erosion and runoff control by means of erosion control facilities, afforestation/reforestation, land use regulation, and publicity activities.
- 4) Flood plain management will be carried out adopting all the possible measures for mitigation of damage due to flood and sediment disasters.

## (5) Tinau River

## Present Conditions and Problems of Tinau River:

- 1) River basin:
  - Class-II river in Western Development Region
  - Basin area: 1,081 km<sup>2</sup> in total consisting of mountainous basin 669 km<sup>2</sup> and plain area 412 km<sup>2</sup>.
  - Butwal city is located in the riverine area near the upper end of the plain.
  - The flood prone area of the Tinau river is partly covered by the service areas of the Bhairahawa Lumbini Groundwater Project.
- 2) River system: The Dano river diverts from the Tinau river near Butwal city and joins again at about 13 km upstream from the Indian border. The main Tinau river convey flood water and sediment from the Mahabharat ranges, and the Dano river those from the Siwalik hills and the Tinau river.
- 3) River channel: River is wide and braided in the upper reaches and becomes

narrow gradually toward lower reaches. Riverbed materials along the river changes from small cobbles in the upper reaches to fine sand in the lower reaches.

4) River segments:

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- Segment 2-2: From 0.0 km (Indian border) to 31.0 km
- Segment 2-1: From 31.0 km to 41.0 km
- Segment 1 : From 41.0 km to 59.5 km (upper end of plain)
- 5) Flood and sediment disasters:
  - Major floods in past 10 years: 1996, 1995 and 1993 floods in the order of severity.
  - Kinds of damages: Bank erosion and sedimentation over farm lands
  - Suffering areas: 51 villages in 12 VDCs in Rupandehi district.
  - Conditions and mechanism of flooding: Almost every year the Tinau river floods over and causes damages in riverine villages and farmlands.
     1996-flood is the biggest in recent years and brought about epidemic disease such as cholera, dysentery, typhoid, etc., resulting in loss of 26 human lives in the whole Rupandehi district.

#### Principal Measures to be Taken for Tinau River:

- 1) A hydraulic control structure will be constructed for the Dano river at the diversion from the Tinau river.
- 2) Some drainage channels will be unified before joining the Dano river.
- A branch of the Dano river will be closed securely with closing dike or controlled with diversion facility if necessary.
- 4) Forest belt will be provided for Segment 1 and forest or grass belt for Segments 2-2 and 2-1.
- 5) Cut-off channels will be constructed at the severe bends.
- 6) Bank protection works will be implemented at the critical riverbanks based on the monitoring. Preventive measures for bank erosion will also be undertaken adopting bioengineering measures.
- 7) Watershed management will be carried out for erosion and runoff control by means of erosion control facilities, afforestation/reforestation, land use regulation, and publicity activities.
- 8) Flood plain management will be carried out adopting all the possible measures for mitigation of damage due to flood and sediment disasters.

## (6) West Rapti River

### Present Conditions and Problems of West Rapti River:

- 1) River basin:
  - Class-II river in Mid-Western Development Region
  - Basin area: 6,418 km<sup>2</sup> in total consisting of mountainous basin 5,800 km<sup>2</sup> and plain area 618 km<sup>2</sup>.

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- Sikta Irrigation Project was proposed in 1980. However, the project was not implemented due to faiture of coordination with India. India was constructing a barrage across the West Rapti near the border. The works are said to be suspended now.
- 2) River system: The West Rapti river can be divided into upper and lower basins by the narrow section upstream from Agaiya. The upper basin of the West Rapti is called as Dang valley surrounded by the northern slope of the Siwalik hills, southern slope of the Mahabharat ranges, and narrow gorge in the lower end. The lower basin of the West Rapti is a free meandering zone. The river course is changeable in the lower reaches near the Indian border.
- 3) River channel: River is wide and braided in the upper basin of the West Rapti river. In the lower basin of the West Rapti, river is wide and braided in the upper reaches and meandering in the lower reaches. Grain size of the riverbed materials changes clearly from gravel to sand. The gravel (coarse to very coarse) presents in the upper reaches of the both basins and the sand (fine to coarse) is found in the lower reaches of the both upper and lower basins.
- 4) River segments:

Lower basin

- Segment 2-2: From 0.0 km (Indian border) to 23.0 km (Jhijhari R. jct.)
- Segment 2-1: From 23.0 km to 53.0 km (Agaiya at upper end of plain) Upper basin (Dang valley)
- Segment 2-2: From 115.0 km (Bargaddi) to 132.0 km (Arjun R. jct.)
- Segment 2-1: From 132.0 km to 163.5 (upper end of valley)
- 5) Flood and sediment disasters:
  - Major floods in past 10 years: 1997, 1996 and 1993 floods in the order of severity.
  - Kinds of damages: Bank erosion, flooding over farmlands and sedimentation.
  - Suffering areas: 23 wards in 8 VDCs in Banke district, and 33 villages in 9 VDCs in Dang district.

 Conditions and mechanism of flooding: In the upper basin (Dang valley), bank crossion and flooding over the farm lands are limited in the areas along the edge of the braided riverbed and confluence of the tributaries. In the lower basin, riverbed is said to be rising especially in the lower reaches and flood water flows over the riverine areas frequently. The river course also changes actively near the Indian border. After the 1997-flood, epidemic disease attacked the flood suffering areas in Dang and Banke districts, though detailed data are not available.

## Principal Measures to be Taken for West Rapti River:

- 1) Confluence of the Dundawa river will be stabilized by river training works.
- Anabranches will be closed securely with closing dike or controlled with diversion facilities if necessary.
- Forest or grass belts will be formed in Segments 2-2 on both banks and in Segment 2-1 on left bank.
- 4) Bank protection works will be implemented at the critical riverbanks based on the monitoring. Preventive measures for bank crosion will also be undertaken adopting bioengineering measures.
- Watershed management will be carried out for erosion and runoff control by means of erosion control facilities, afforestation/reforestation, land use regulation, and publicity activities.
- 6) Flood plain management will be carried out adopting all the possible measures for mitigation of damage due to flood and sediment disasters.

## (7) Babai River

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## Present Conditions and Problems of Babai River:

- 1) River basin:
  - Class-II river in Mid-Western Development Region
  - Basin area: 3,425 km<sup>2</sup> in totał consisting of mountainous basin 3,054 km<sup>2</sup> and plain area 371 km<sup>2</sup>.
  - Babai barrage exists at the upper end of the plain area and supply water to the left bank (east side) areas including flood prone areas of the Babai.
  - There is a scheme to convey irrigation water from the east canal to west side area across the Babai by siphon. This scheme will be implemented soon upon funding.
  - A study is being carried out by JICA to divert a part of water from the

Bheli river to the Babai river for power generation and irrigation purposes. This scheme will not affect significantly the flood flows of the Babai river.

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- River system: There is no major right tributaries joining in the downstream reaches of the barrage, though there are some small tributaries joining from the left. It is said that the Babai river shifted to the present course about 40 years ago.
- 3) River channel: At downstream of the barrage the Babai river expands its width abruptly and forms a braided channel. In the lower reaches, river course meanders severely. Grain size of the riverbed materials changes ctearly from gravel (coarse to very coarse) in the upper reaches to sand (fine to medium) in the lower reaches.
- 4) River segments:
  - Segment 2-2: From 0.0 km (Indian border) to 30.0 km
  - Segment 2-1: From 30.0 km to 38.0 km
  - Segment 1 : From 38.0 km to 48.0 (Barrage at the upper end of plain)
- 5) Flood and sediment disasters:
  - Major floods in past 10 years: 1995, 1987 and 1996 floods in the order of severity.
  - Kinds of damages: Bank erosion, flooding over farm lands and sedimentation
  - Suffering areas: 7 wards in Gulariya municipality and 4 VDCs in Bardiya district.
  - Conditions and mechanism of flooding: Gulariya municipality and Mahamadpur VDC suffer from inundation almost every year. During the 1995-flood, about 470 families of Gulariya municipality were evacuated to the public facilities such as schools. After the flood, epidemic disease attacked the Gulariya municipality and two VDCs, 12 human lives were lost.

# Principal Measures to be Taken for Babai River:

- 1) Right bank from 42.5 km to 45 km will be protected securely to protect farmer's irrigation canal and further to prevent river course shifting toward the Karnali river.
- 2) Old Babai river at 19.5 km will be closed securely with closing dike.
- 3) Anabranches will be closed securely at 12.3 km, 22.0 km and 29.8 km with closing dike or controlled with diversion facilities if necessary.

- Forest belt will be provided in Segment 1 and forest or grass belt in Segments 2-2 and 2-1.
- 5) Alternative study should be carried out for the meander reaches near Kusumba Bazar and Indrapur bridge.
- 6) Bank protection works will be implemented at the critical riverbanks based on the monitoring. Preventive measures for bank erosion will also be undertaken adopting bioengineering measures.
- Watershed management will be carried out for erosion and runoff control by means of erosion control facilities, afforestation/reforestation, land use regulation, and publicity activities.
- 8) Flood plain management will be carried out adopting all the possible measures for mitigation of damage due to flood and sediment disasters.

# (8) Khutiya River

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## Present Conditions and Problems of Khutiya River:

- 1) River basin:
  - Class-III river in Far Western Development Region
  - Basin area: 325 km<sup>2</sup> in total consisting of mountainous basin 175 km<sup>2</sup> and plain area 150 km<sup>2</sup>.
  - Many forests cover the riverine areas of the Khutiya, and not many areas have been converted to agriculture.
- 2) River system: The Shiva Ganga river is the major tributary. The Khutiya river flows into the Mohana river which runs on the Indian border.
- 3) River channel: River in the upstream from the E-W highway flows through thick forest forming a wide and braided channel. In the lower reaches the river meanders severely. Riverbed materials along the river changes from large cobbles in the upper reaches to medium sand in the lower reaches.
- 4) River segments:
  - Segment 2-2: From 0.0 km (Indian border) to 11.5 km (Shiva Ganga R. jct.)
  - Segment 2-1: From 11.5 km to 27.0 km
  - Segment 1 : From 27.0 km to 35.0 km (upper end of plain)
- 5) Flood and sediment disasters:
  - Major floods in past 10 years: 1997, 1986 and 1983 floods in the order of severity.
  - Kinds of damages: Flooding over farm lands, bank erosion, and

sedimentation

- Suffering areas: 4 VDCs in Kailali district
- Condition and mechanism of flooding: In the lower reaches riverbed is said to silt up and floodwater frequently flows over the riverine areas. Bank erosion is active in the alluvial fan reaches. After the 1997-flood, encephalitis was infectious over the Kaiłali district. About 200 people over the district were attacked with the disease and half of them died.

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### Principal Measures to be Taken for Khutiya River:

- Branch channels will be closed securely with closing dike or controlled with diversion facilities if necessary.
- Forest belt will be provided for Segment 1 and forest or grass belt in Segments 2-2 and 2-1.
- 3) An area at the confluence of the Khutiya and Shiva Ganga rivers will be preserved for retarding basin.
- 4) Bank protection works will be implemented at the critical riverbanks based on the monitoring. Preventive measures for bank erosion will also be undertaken adopting bioengineering measures.
- 5) Watershed management will be carried out for erosion and runoff control by means of erosion control facilities, afforestation/reforestation, land use regulation, and publicity activities.
- 6) Flood plain management will be carried out adopting all the possible measures for mitigation of damage due to flood and sediment disasters.

#### 4.6.2 Layout Plan

Layout of the flood mitigation Master Plan is shown in Fig. 4.10 for the eight river basins. The Figures show the general layout of watershed, river control and community development components for the flood mitigation plan, whose details were presented in the previous sections of this chapter.

## 4.6.3 **Project Works and Cost**

Quantities of works for the Master Plan were estimated based on the standards and assumptions discussed in the previous sections, and preliminary cost required for the implementation of the Master Plan project was estimated under the following conditions: **Price Level:** The project cost and other related unit costs are expressed under the economic conditions prevailing in October 1998.

Exchange Rate of Currencies: Exchange rate of currencies are assumed as follows: US\$1.00 = NRs.67.93 = ¥115.14 (NRs.1.00 = ¥1.69)

Constitution of Project Cost: Project cost is composed of the following cost items;

- 1) Construction base cost: Unit cost basis
- 2) Compensation cost: Unit cost basis
- 3) Administration cost: 5% of [(1) + (2)]
- 4) Engineering service cost: Lump sum basis
- 5) Physical contingency: 10% of [(1) + (2) + (3) + (4)]
- Price contingency (Financial cost only): At annual escalation rate of 3 % for foreign currency, and 10 % for local currency portions

Quantity of work, standard unit work cost and amount of project cost are shown in Table 4.5.

### 4.7 Action Plan toward Target Years

### 4.7.1 Sequence of Works

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The Master Plan is proposed for implementation by the target year of 2017. The project works must be carried out effectively in orderly manner toward the target year. It is also important to realize the flood mitigation effects, even in the course of implementation, corresponding to the progress of work.

### (1) Preparatory Works

Feasibility Study: A Feasibility Study will be conducted immediately after this, mainly covering the following:

- 1) River Survey: To obtain topographic maps along the river with smaller contour intervals, longitudinal river profiles and cross sections.
- 2) Restudy of Master Plan: Based on the river survey result.
- 3) Feasibility Study: The study will cover discrete environmental studies as well in order to obtain approval for project implementation from MOPE.

Fund Arrangement: The project cost estimated in the Feasibility Study is allocated

among the central/tocal governments and local communities, taking into consideration the nature of work and the capability of funding.

**Definite Plan/Detail Design:** A definite plan of the flood mitigation works, including river boundary line (RBL), will be drawn up after getting consent of the concerned central/local government agencies and local communities. A detailed design will be prepared of the project facilities.

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Preservation of Lands: Population in the Terai is growing rapidly. Because of this, more and more people are living in flood prone areas close to the rivers. Therefore it is essential to preserve the lands for flood mitigation facilities. This should start immediately after the preparation of definite flood mitigation plan. Appropriate land use should also be encouraged as stated in the definite plan and detail design.

**Research and Investigation:** In parallel with implementation of the specific flood mitigation projects, research and investigation activities are needed to support the projects. The following are included among these, but not limited to:

- Flood and Sediment Runoff: Study and analysis on flood runoff and sediment yield especially for class III rivers originating at Siwalik hills are necessary. Observations on a designated model basin would serve this purpose.
- 2) Investigation of Bank Erosion characteristics: Characteristics of bank erosion in the Terai have yet to be investigated. Mechanisms of bank erosion, erosion speed and width, etc. should be investigated in relation with the river segment, riverbed and bank materials, river flow condition, etc.
- 3) Development of Bank Protection Works: Various types of bank protection works should be introduced in each of the river segment, considering the effectiveness, materials available, and cost-performance. Recommended bank protection work for rivers in the Terai should be made through hydraulic model tests in the laboratory and prototype models in field.
- 4) Research on Application of Bioengineering Technology: In order to introduce bioengineering technology as a component of flood mitigation, research works and accumulation of experience are necessary, among others on the selection of plant species, type and function of work applicable, growing techniques, and contribution to income generation.

### (2) Coordination For Flood Mitigation

Coordination to mobilize watershed management and flood plain management should be taken as soon as possible in combination with the community development activities.

### (3) River Works

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### **Channel Treatment Works:**

- Tributary Works: Tributary work to stop or control inflow/outflow from/to adjacent river basins will be implemented soon after the preparation of the definite plan.
- 2) Branch/Anabranch Work: Closing or control works of branches and anabranches will be carried out soon after the preparation of definite plan.

### **Bank Protection Works:**

- Spur/Revetment Work: River bank classified as Type-As bank needs protection works immediately and works are desirable for Type-A bank as well. The bank protection works will be executed continuously, primarily for Type-As banks, identified by periodic monitoring after every flood seasons.
- 2) Preventive Bank Protection Measures: Preventive bank protection measures by bioengineering is required immediately for Type-A bank and are desirable for all the river bank between river course and the river boundary line (RBL).

### Dike Works:

- Forest/Grass Belt: Forest belt will be provided on the RBL for Segment 1 (alluvial fan) in principle, while the forest or grass belt for Segments 2-1 and 2-2. The work can be carried out at any place and at any time after the preparation of definite plan, but for the purpose of marking the boundary, it is best to do it quickly.
- 2) Local dike, Dike Road and Ring Dike: These works for local dike, dike road and ring dike can be started after the preparation of definite plan from the places where the work is ready so as to realize the flood mitigation.
- 3) Retarding Basin: It is important to preserve the lands for the retarding basin, confining by forest belt, grass belt or earth dike.

### **Channel Excavation and COC Works:**

1) Channel normalization: Channel normalization and cut-off channel works will be executed after the preparation of definite plan.

2) Bed Material Collection: Bed materials can be collected for the use as construction materials soon after the preparation of definite plan according to a regulation to be prepared for bed material exploitation.

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### 4.7.2 Action Plan

Implementation of the Master Plan project is programmed, in principle, by the phases of the National Development Plan from the ninth through twelfth plans as follows:

### 1st Phase (Ninth Plan: 1997-2002):

- 1) Preparatory works such as feasibility study, fund arrangement, definite plan/detail design, and preservation of lands.
- Research and investigation, and coordination for watershed management and flood plain management in combination with community development activities.
- 3) Bank protection works at the critical sites.
- 4) Preventive bank protection works by bioengineering.
- 5) Bed material collection.

### 2nd Phase (Tenth Plan: 2002-2007):

- 1) Channel treatment works.
- 2) Forest and grass belts work in field.
- 3) Dike works such as local dike, dike roads and ring dike in critical sites.
- 4) Channel excavation works and cut-off channel.

### 3rd Phase (Eleventh and Tweifth Plans: 2007-2017):

- 1) Continuation of activities for research/investigation and coordination, and works for bank protection, dike, channel excavation.
- 2) All the works and activities targeted for the Master Plan will be completed.

General action program for the implementation of the Master Plan project is shown in Fig. 4.11.

### 4.7.3 Implementation Arrangement

**Principles:** In principle, beneficiaries should undertake the flood mitigation measures for their own protection. However, the following should be implemented by the central government:

- 1) Large scale works that local government and community cannot afford;
- 2) Basic flood mitigation facilities;

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- 3) Works requiring urgent implementation; and
- 4) Technical guidance, coordination and political arrangements to be taken from nation-wide viewpoint.

Watershed Management Component: Works and activities in the watershed areas are implemented by the central government. The watershed management component includes erosion control work, afforestation/reforestation and land use regulation, and publicity activities.

River control component: Works and activities in the plain area are implemented by the central government. The river control component includes channel treatment works, bank protection works, dike works, channel excavation works, and land use regulation.

**Community development component:** The community development activities for flood mitigation are carried out by the local community and VDC/DDC as well, for their own protection in the near-by area. The community development component includes activities for community mobilization, local coping measures, and community-based sustainable flood mitigation measures.

Associate activities: Aside from the above components project works, associate activities such as research/investigation and technical guidance regarding the project works are expected from the central government and other authorities concerned.

4.8 Economic Evaluation

### (1) Effects of Flood Mitigation

Implementation of the flood mitigation Master Plan will primarily safeguard the land and properties in the flood prone areas and also bring about other favorable effects to the Study Area. The potential benefits and effects expected to accrue from the Master Plan, including tangible and intangible ones, are listed below.

1) Reduction of damage due to flood and sediment: Inundation and sedimentation will be alleviated and reduce damages of village houses, crop production, public facilities, etc.

- 2) Protection of riverbank from crosion: Loss of lands due to riverbank erosion are averted, and villages and farmlands will be protected.
- 3) Indirect effects: Owing to the reduction in damages in flood prone area, social and economic activities in the surrounding areas will not be interfered.
- 4) Land enhancement: Flood mitigation project ensures the social and economic activities in the flood prone area which enable further investments for the development of the flood prone area and the surrounding areas.

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- 5) Land reclamation: Existing low-lying barren lands along the river turn to arable ones. Channel excavation and normalization at severely meandering section may create lands for agriculture and settlement.
- 6) Flood-free embankment: The earth embankment constructed as local dike and ring dike can be used as rural roads and flood-free areas in the flood prone area. The area will also serve for evacuation and flood fighting activities.
- Income generation: The forest belt and grass belt for flood mitigation will generate community's income. The trees from the forest belt could be used for flood mitigation as well.
- 8) Stabilization of residents' livelihood: Flood free land is the basis of the residents' livelihood in the flood prone areas. Only under such conditions, residents are encouraged to accumulate their immovable and other properties, and accordingly can stabilize their livelihood.
- 9) Community development: The Master Plan places emphasis on flood mitigation through community development. The community-based approaches will forge links among the resident people and may enable other community development activities.

### (2) Economic Evaluation for Master Plan Projects

Economic viability of the flood mitigation Master Plan was examined preliminarily. Out of the various effects listed in the previous section, (1) flood damage reduction benefit, (2) bank protection benefit, and (3) indirect benefit were considered as tangible benefit for the evaluation.

Flood Damage Reduction Benefit: Flood damage study by hydraulic analysis is difficult at this stage, since the river section data are not available and available topographic and hydrological data are limited. The flood damage reduction benefit was estimated preliminarily based on the damage data of recent large flood.

Bank Protection Benefit: Benefit accruing from bank protection works was estimated as a product of the land area to be protected from crosion and the amount of property on the unit land area to be protected.

Conditions and Result of Evaluation: Evaluation was made for the existing basin conditions and future basin conditions in target year (2017). The benefit in the target year was assumed in proportional to the population projected. Cash flows of the project cost, maintenance cost and benefit are shown in Table 4.6. With these cash flows, the economic internal rate of return (EIRR), cost-benefit ratio (B/C), and net present value (NPV or B-C) were worked out. The results are summarized below.

	I	Existing basi	n		Future basin	)
River	EIRR	B/C	NPV	EIRR	B/C	NPV
	(%)		(10 <sup>6</sup> Rs)	(%)		(10 <sup>6</sup> Rs)
Ratuwa	3.8	0.49	-121.3	9.6	0.97	-8.2
Lohandra	0.0	0.27	-204.6	2.8	0.42	-161.7
Lakhandei	3.6	0.47	-135.7	10.2	1.02	4.6
Narayani	4.0	0.50	-122.8	10.9	1.09	21.2
Tinau	2.8	0.42	-199.8	9.2	0.93	-24.5
W. Rapti	4.2	0.52	-47.9	11.8	1.18	17.7
Babai	9.3	0.94	-11.3	14.8	1.48	89.0
Khutiya	0.0	0.27	-36.2	4.8	0.56	-21.9

(Result of Economi	ic Evaluation)	ł
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(Note) B/C and NPV were calculated under the discount rate of 10%.

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Focusing on the future basin, the Babai river yields high EIRR value, while the value is low for the Lohandra and Khutiya river. Economic viability of the remaining 5 rivers is of same level ranging from 9.2 to 11.8. However, these evaluation results should be handled only as a rule of thumb, since the costs and benefits for the evaluation are estimated without topographic and river survey data.

(Further in-depth descriptions on the studies and analyses made in this chapter are compiled in SUPPORTING REPORT-C: BASIC INVESTIGATIONS AND STUDIES, and detailed discussions on the plan formulation for respective river basins are compiled in SUPPORTING REPORT-A (A1 through A8): FLOOD MITIGATION PLAN.)

### CRITERIA OF RIVER SEGMENT

	0	0	Segn	nent 2	
	Segment M	Segment 1	2-1	2-2	Segment 3
	<mountain)< td=""><td>► &lt; Alluvial fan&gt;</td><td></td><td></td><td></td></mountain)<>	► < Alluvial fan>			
Geomorphologie lype			Natural levce zo	al	
				◀	- Delta>
Representative bed materials size (d <sub>R</sub> )	Various	> 2 cm	3cm to 1cm	lem to 0.3 mm	< 0.3 mm
Riverbank materials	Exposed rocks are often seen	Same materials as those of river bed, occasionally covered with thin silt layer	Mixture sand, sili clay with material those of bed at th	t and h same s as	Silt and clay
Gradient of channel	Various	1/60 to 1/400	1/400 to	1/5,000	1/5,000 to level
Meandering	Various	Little meander	Severe meander S-shaped meander island ar in the ch with larg width-de	i and e seen annel	There are some large meanders and some others small meanders
Bank erosion	Very active	Very active	Medium active in channel farger be material	the with d	Not active and little river course change
Average channel depth	Various	0.5 to 3 m	2 to	8 m	3 to 8 m

(Remark) These criteria show general features of the segment which may

vary depending the specific conditions of the rivers

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	ver stretch		River	Ground	Grai	n size	River width
Reaches	From	То	segment	slope	đ <sub>60</sub>	d <sub>R</sub>	Bm (min-max)
	(km)	(km)	code	(1/)	(mm)	(സ്ന)	(m)
Ratuwa R.							
RA-1	0.0	13.0	2-2	1,180	0.30	0.30	356 (188-500)
RA-2	13.0	26.0	2-1	590	0.34	0.34	446 (275-638)
RA-3	26.0	36.2	1	320	0.43	0.43	516 (300-688)
RA-4	36.2	43.7	1	170	0.74	0.74	348 (225-425)
Lohandra R.							
LO-1	0.0	14.0	2-2	2,000	0.30	0.30	55 (25-100)
LO-2	14.0	33.1	2-2	970	0.27	0.27	89 (25-163)
LO-3	33.1	42.0	2.1	970	1.2	1.2	119 (75-238)
LO-4	42.0	49.6	2-1	320	2.4	2.4	200 (75-250)
LO-5	49.6	58.8	1 1	180	19	82	221 (138-350)
LO-6	58.8	67.5	1	80	23	81	178 (25-513)
Lakhandei R.							
LA-I	0.0	21.0	2-2	1,240	0.20	0.20	143 (38-375)
LA-2	21.0	37.0	2-1	520	0.31	0.31	326 (100-588)
LA-3	37.0	43.0	1 1	240	0.35	0.35	371 (200-588)
LA-4	43.0	51.4	1	240	4.3	4.3	547 (200-888)
Narayani R							
NA-1	(Natrow r	eaches)	-	•	-	-	226 (150-350)
NA-2	18.4	44.9	2-1	1,560	39	60	1,463 (400-2450)
NA-3	44.9	83.0	2-1	720	27	73	1,394 (300-2500)
Tinau R.							
<b>71-1</b>	0.0	12.7	2-2	3,180	0.18	0.18	163 (88-325)
71-2	12.7	31.0	2-2	2,030	0.39	0.39	79 (50-150)
TI-3	31.0	41.0	2-1	1,000	3.6	3.6	159 (63-325)
TI-4	41.0	53.0	I	430	17	42	557 (325-875)
T1-5	53.0	59.5	1	110	46	96	450 (88-925)
W.Rapti R.							
WR-1	0.0	23.0	2-2	1,920	0.29	0.29	417 (225-750)
WR-2	23.0	53.0	2-1	1,030	29	55	790 (238-1700)
	(Natrow r		-	-	0.28	0.28	224 (75-950)
WR-4	115.0	132.0	2-2	1,130	0.31	0.31	760 (350-1400)
WR-5	132.0	163.5	2-1	540	24	47	827 (125-1400)
Babai R.							
BA-I	0.0	30.0	2-2	2,310	0.26	0.26	427 (88-724)
BA-2	30.0	38.0 -	2-1	890	43	63	592 (338-700)
BA-3	38.0	48.0	1	320	38	71	858 (325-1325)
Khutiya R.							
KH-1	0.0	11.5	2-2	-	0.58	0.58	346 (175-650)
KH-2	- 11.5	27.0	2-1	-	5.9	15	167 (50-350)
KH-3	27.0	35.0	1	-	84	124	355 (175-650)

### CHARACTERISTICS OF RIVER CHANNEL

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### INCOME GENERATION OPPORTUNITIES THROUGH BIOENGINEERING

From:	Species Used	Income-generating Products
Nursery	Trces - Acacia catechu (Khayer) - Shorea robusta (Sal) - Bauhinia purpurca (Tanki) - Delonix regia (Gulmohar) - Leucaena species (Ipil Ipil) - Bamboo species	- saplings - saplings - saplings - seeds/saplings - seeds/saplings - roots
	Grasses - Desmodium intortu - Pennisetum purpureum (Napier) - Thysanolaena maxima (Amliso) - Stylo - Molasess grass	- seeds - cutting - seeds/cutting - seeds - seeds
Bio- Engincering Facility	Grasses - Desmodium intortum - Pennisetum purpureum (Napier) - Thysanolaena maxima (Amliso) - Stylo - Molasess grass - Arundo elonax (Narkato) - Cymbopogon microtheca (Khar) - Cymbopogon pendulus (Dangre Khar) - Cymodon daetylon (Dhubo) - Eulaliopsis ninanta (Babiyo) - Saecharum spontaneus (Kans) Shrubs - Adhatoda vasica (Assuro) Trees - Bamboo species - Bauhinia purpurea (Tanki) - Delonix regia (Gulmohar) - Leucaena species (Ipil Ipil) - Acacia catechu (Khayer) - Shorea robusta (Sal)	<ul> <li>fuel wood</li> <li>fodder/mutching</li> <li>fodder/broom</li> <li>fodder/seed</li> <li>fodder/seed</li> <li>fodder/seed</li> <li>fonder/seed</li> <li>feneing</li> <li>roof thatch</li> <li>roof thatch</li> <li>fodder</li> <li>rope</li> <li>roof thatch/rope</li> <li>green manure/medicine</li> <li>furniture/timber</li> <li>fodder/fuel wood</li> <li>fuel wood</li> <li>fuel wood</li> <li>timber/fuel wood/medicine</li> <li>leaf plate</li> </ul>

source: "Vegetation Structures for Stabilizing Highway Slopes", Dept. of Roads, 1991

### **CANDIDATE SPECIES FOR BIOENGINEERING WORKS IN TERAI**

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	Naturally Grown Species	Nursery Species
Grasses	<ul> <li>Arundo clonax (Narkato)</li> <li>Cymbopogon microtheca (Khar)</li> <li>Cymbopogon pendulus (Dangre Khar)</li> <li>Cynodon dactylon (Dhubo)</li> <li>Eulatiopsis ninanta (Babiyo, Sabai Grass)</li> <li>Neyraudia arundinacea (Sito)</li> <li>Neyraudia reynaudiana (Dhonde)</li> <li>Pennisetum clandestinum (Kikuyu, Thulo Dhubo)</li> <li>Pogonatherum paniceum (Musekharuki)</li> <li>Saccharum spontaneus (Kans)</li> </ul>	<ul> <li>Desmodium intortum</li> <li>Pennisetum purpureum (Napier)</li> <li>Setaria anceps</li> <li>Thysanolaena maxima (Amliso) - also in forests -</li> <li>Stylo</li> <li>Molasess grass</li> </ul>
Shrubs & Non- Plantation Trees	<ul> <li>Adhatoda vasica (Assuro)</li> <li>Butea minor (Bhujetro)</li> <li>Całatorpha giganteum (Aak)</li> <li>Colebrookea oppositifolia (Chusun)</li> <li>Ipomoea fistulata (Saruwa Behcu)</li> <li>Lantana camara (Phul Kanda)</li> <li>Phoenix humilis (Thakal)</li> <li>Trema orientalis (Kunyelo)</li> <li>Vitex negundo (Simati)</li> <li>Wedłandia species (Tilka)</li> <li>Woodfordia fruticosa (Dhanyero)</li> </ul>	
Trees	<ul> <li>Acacia catechu (Khayer) also in nursery</li> <li>Acacia auriculiformis</li> <li>Albizia julibrissin</li> <li>Ficus semicordata (Khasre Khayu, Khanayo)</li> <li>Shorea robusta (Sal) also in nursery</li> </ul>	- Bauhinia purpurea (Tanki) - Delonix regia (Gulmohar) - Leucaena species (Ipil Ipil) - Bamboo species

source: "Vegetation Structures for Stabilizing Highway Slopes", Dept. of Roads, 1991

RATUWA RIVER			un)	(unit: NRs1000)	LOHANDRA RIVER		
ltern	Unit	Quantity	Unit Cost	Amount	Item	Unit	Quantity
I. Construction Base Cost				310,842	I. Construction Base Cost		
1. Preparatory Works	L.S.	1.00		28,258	1. Preparatory Works	L.S.	1.00
2. Bank Protection Works				69,627	2. Bank Protection Works		
2-1 Pile Spur (Type-A)	ц,	2.40	5,301	12.722	2-1 Pile Spur (Type-A)	Ę	4.10
2-2 Gabion Spur (Type-A)	кт	6.90	8,247	56,904	2-2 Gabion Spur (Type-A)	k	2.20
3. Cannet Works				58,980	3. Cannel Works		
3-1 River Boundary Line	Ę	99.80	27	2.695	3-1 River Boundary Line	Ę	105.00
3-2 Tree Belt	ha	191.75	68	13.039	3-2 Tree Belt	ц	55.50
3-3 Grass Belt	ha	279.75	126	35,249	<b>3-3</b> Grass Belt	ъЧ	436.50
3-4 Cut-off Cannel	1000m3	62.50	93	5.813	3-4 Cut-off Cannel	1000m3	272.00
3+5 Closing Dike/strueture	place	1.00	2,185	2,185	3-5 Closing Dike/structure	place	4.00
4. Ring Dike Works				128,288	4. Ring Dike Works		
4-1 Dike Embankment	km	20.90	2,596	54,256	4-1 Dike Embankment	Ę	31.30
4-2 Drainage Sluice	place	40.00	1,275	51,000	4-2 Drainage Sluice	piace	47.00
4-5 Gravel Metaling	Ę	20.90	1,102	23,032	4-3 Gravel Metaling	ţ,	31.30
5. Miscellaneous Works	L.S.	1.00		25,689	5. Miscellancous Works	L.S.	1.00
II. Compensation Cost	L.S.	1.00		124.392	II. Compensation Cost	L.S.	1.00
III. Administration Cost	L.S.	1.00		21,762	III. Administration Cost	L.S.	1.00
IV. Engineering Service	L.S.	1.00	·	46,626	IV. Engineering Service	L.S.	1.00
V. Physical Contingency	L.S.	1.00		48,186	V. Physical Contingency	L.S.	1.00

Poject Cost

Note: \*1 Price Level in October 1998

\*2 Convertion Rate US\$ 1.00 = NRs 67.93, 1.00 Yen = NRs 0.59

\*3 Cost do not include Price Contingency and Value Added Tax \*4 Figures may not add up to totals due to rounding

\*2 Convertion Rate USS 1.00 = NRs 67.93, 1.00 Yen = NRs 0.59 \*3 Cost do not include Price Contingency and Value Added Tax

Note: \*1 Price Level in October 1998

Poject Cost

551.808

\*4 Figures may not add up to totals due to rounding

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### PROJECT COST FOR MASTER PLAN

175,672

2,185

81,255 59,925 34,493 31,119

2,596 1.275 1.102 135.792

25,617

56,482

56,882

376,545

(unit: NRs1000)

PROJECT COST FOR MASTER PLAN

Amount

Unit Cost

39,878 21.734 18,143 95,644 2.835 3.774 54,999 25,296 8,740

8,247

5,301

5 68 126 8

34,231

651.317

LAKHANDEI RIVER			(un)	(unit: NRs1000)	NARAYANI RIVER			(un)	(unit: NRs1000)
Item	Unit	Quantity	Unit Cost	Amount	Item	Unit	Quantity	Unit Cost	Amount
I. Construction Base Cost				348,680	I. Construction Base Cost	-	-		333.927
1. Preparatory Works	L.S.	1.00		31,698	1. Preparatory Works	L.S.	1.00		30,357
2. Bank Protection Works				131.417	2. Bank Protection Works				138.278
2-1 Pile Spur (Type-A)	Ę	6.90	5,301	36,577	2-1 Gabion Spur (Type-A)	Ę	1.80	8,247	14,845
2-2 Gabion Spur (Type-A)	<u>5</u>	11.50	8.247	94,841	2-2 Gabion Spur (Type-B)	Ŗ	1.40	10,296	14,414
3. Cannel Works				108,416	2-3 Gabion Spur (Type-C)	к	10.10	10,794	610,001
3-1 River Boundary Line	km	75.50	27	2,039	3. Cannel Works				50,692
3-2 Tree Belt	Ч	27.50	68	1.870	3-1 River Boundary Line	ка К	\$8.60	27	2.392
3-3 Gruss Belt	ең	350.00	126	44.100	3-2 Tree Belt	Ч	199.75	68	13.583
3-4 Channel Excavation	1000m3	461.59	93	42,928	3-3 Grass Belt	ha	199.75	126	25,169
3-5 Closing Dike/structure	place	8.00	2.185	17,480	3-4 Closing Dike/structure	place	4.00	2,387	9,548
4. Ring Dike Works				24,699	4. Ring Dike Works				87,003
4-1 Dike Embankment	Ę	5.30	2.596	13,759	4-1 Dike Embankment	Ĕ	18.70	2.596	48,545
4-2 Drainage Sluice	place	4.00	1.275	5.100	4-2 Drainage Sluice	place	14.00	1.275	17.850
4-5 Gravel Metaling	ки К	5.30	1,102	5,841	4-3 Gravel Metaling	Ę	18.70	1,102	20,607
5. Dike Road Works				23,632	5. Miscellaneous Works	L.S.	1.00		27,597
5-1 Dike Embankment	Ę	6.55	2,506	16,414					
5-2 Gravel Metaling	Ę	6.55	1,102	7,218	II. Compensation Cost	L.S.	1.00		117.963
6. Miscellaneous Works	L.S.	1.00		28,817					
					III. Administration Cost	L.S.	1.00		22.594
II. Compensation Cost	L.S.	1.00		120,771					
	, ,				IV. Engineering Service	L.S.	1.00		50.089
III. Administration Cost	L.S.	1.00		23,473					
W Ecclescics Service	U -	-		50 L C3	V. Physical Contingency	L.S.	1.00		50,198
		<b>N</b> .1		705.35	Dollard Court				122 823
V. Physical Contingency	L.S.	1.00		52,175					1//**/0
Poject Cost				597,401	Note: "1 Price Level in October 1998	366			
Note: "I Price Level in October 1998	8661				ř	.00 = NRS	67.93, 1.00 \	(en = NRs 0.5	•

### PROJECT COST FOR MASTER PLAN

Table 4.5 (2/4)

\*2 Convertion Rate USS 1.00 \* NRS 67.93, 1.00 Yen # NRS 0.59 \*3 Cost do not include Price Contingency and Value Added Tax \*4 Figures may not add up to totals due to rounding

\*2 Convertion Rate US\$ 1.00 = NRs 67.93, 1.00 Yen = NRs 0.59
\*3 Cost do not include Price Contingency and Value Added Tax
\*4 Figures may not add up to totals due to rounding

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PROJECT COST FOR MASTER PLAN

TINAUI RIVER			(un)	(unit: NRs1000)	WEST RAPTI RIVER			iun)
ltem	Unit	Quantity	Unit Cost	Amount	ltern	Unit	Quantity	Unit Cost
I. Construction Base Cost				408,143	I. Construction Base Cost			
1. Preparatory Works	L.S.	1.00		37,104	1. Preparatory Works	L.S.	1.00	
2. Bank Protection Works				117,336	2. Bank Protection Works			
2-1 Pile Spur (Type-B)	к	09.6	7,289	69,974	2-1 Pile Spur (Type-B)	<u>n</u>	2.90	7.289
2-2 Gabion Spur (Type-B)	к к	4.60	10.296	47,362	2-2 Gabion Spur (Type-B)	Ē	1.40	10.296
3. Cannel Works				122,808	3. Cannel Works			
3-1 River Boundary Line	km k	156.60	27	4,228	3-1 River Boundary Line	ŝ	64.70	27
3-2 Tree Belt	цц	91.75	68	6.239	3-2 Tree Belt	ha	63.00	68
3-3 Grass Belt	ha	691.25	126	87,098	3-3 Grass Belt	ъų	216.50	126
3-4 Cut-off Cannel	1000m3	43.10	93	13.308	3-4 Closing Dike/structure	place	1.00	2,387
3-5 Closing Dike/structure	place	5.00	2,387	11.935	4. Ring Dike Works			
4. Ring Dike Works				97,164	4-1 Dike Embankment	km	3.70	2.596
4-1 Dike Embankment	km	18.00	2,596	46.728	4-2 Drainage Sluice	place	2.00	1,275
4-2 Drainage Sluice	place	24.00	1.275	30,600	4-3 Gravel Metaling	k,	3.70	1.102
4-3 Gravel Metaling	k	18.00	1.102	19,836	5. Miscellancous Works	L.S.	1.00	
5. Miscellaneous Works	L.S.	1.00		33,731				
					II. Compensation Cost	L.S.	1.00	
II. Compensation Cost	r.s.	1.00		CCZ,152	III. Administration Cost	Ľ.S.	1.00	
III. Administration Cost	L.S.	00'1		31.970				
					IV. Engineering Service	L.S.	1,00	
IV. Engineering Service	L.S.	00.1		127,10	V. Physical Contingency	L.S.	1.00	
V. Physical Contingency	L.S.	1.00		70,062				
Poject Cost				802.651	roject Lost			

### **PROJECT COST FOR MASTER PLAN**

21,138 14,414 35.697 1,747 4,284 27.279 2.387 16,233 9.605 2.550 4,077

105.853 9.623 35,553

(unit: NRs1000) Amount

PROJECT COST FOR MASTER PLAN

8.748

80,712

9,328

15,878

20,244

Table 4.5 (3/4)

\*2 Convertion Rate US\$ 1.00 = NRs 67.93, 1.00 Yen = NRs 0.59
\*3 Cost do not include Price Contingency and Value Added Tax
\*4 Figures may not add up to totals due to rounding

Note: \*1 Price Level in October 1998

\*2 Convertion Rate US\$ 1.00 = NRs 67.93, 1.00 Yen = NRs 0.59 \*3 Cost do not include Price Contingency and Value Added Tax \*4 Figures may not add up to totals due to rounding

Note: \*1 Price Level in October 1998

232,016

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0

BABAI RIVER	-		(nn)	(unit: NRs1000)
ltem	Unit	Quantity	Unit Cost	Amount
I. Construction Base Cost				265,885
1. Preparatory Works	L.S.	1.00		24.171
2. Bank Protection Works				167,558
2-1 Pile Spur (Type-B)	Ē	13.10	7,289	95,486
2-2 Gabion Spur (Type-B)	Ę	7.00	10.296	72,072
3. Cannel Works				52,182
3-1 River Boundary Line	Ę	76.00	27	2,052
3-2 Tree Belt	ha	40.75	68	2,771
3-3 Grass Belt	ъц	243.25	126	30,650
3-4 Closing Dike/structure	place	7.00	2,387	16,709
4. Dike Road				0
4-1 Dike Embankment	km	0.00	2,506	0
4-2 Gravel Metaling	ţ	0.00	1,102	0
5. Miscellaneous Works	L.S.	1.00		21,974
II. Compensation Cost	L.S.	1.00		68,160
III. Administration Cost	L.S.	1.00		16,702
IV. Engineering Service	L.S.	1.00		39,883
V. Physical Contingency	L.S.	1.00		37,393

Note: \*1 Price Level in October 1998 \*2 Convertion Rate USS 1.00 = NRs 67.93, 1.00 Yen = NRs 0.59

Poject Cost

428,022

\*5 Cost do not include Price Contingency and Value Added Tax \*4 Figures may not add up to totals due to rounding

PROJECT COST FOR MASTER PLAN

0

KHUTIYA RIVER			iun)	(unit: NRs1000)
ltem	Unit	Quantity	Unit Cost	Amount
I. Construction Base Cost	-			60,048
1. Preparatory Works	L.S.	1.00		5,459
2. Bank Protection Works				29,571
2-1 Pile Spur (Type-A)	km	0.60	105,2	3,181
2-2 Gabion Spur (Type-A)	km	3.20	8,247	26,390
3. Cannei Works				20.056
3-1 River Boundary Line	km k	42.10	27	1.137
3-2 Tree Belt	ha	37.00	68	2.516
3-3 Grass Belt	ha	95.50	126	12.033
3-4 Closing Dike/structure	place	2.00	2,185	4.370
4. Miscellaneous Works	L.S.	1.00		4,963
II. Compensation Cost	L.S.	1.00		31,800
Ш. Administration Cost	L.S.	1.00		4,592
IV. Engineering Service	L.S.	00'1		9,007
V. Physical Contingency	L.S.	1.00		10,086
Poject Cost				115,534
	1998 1.00 = NRs	67.93, 1.00 )	/en = NRs 0.5	Ģ
*3 Cost do not include Price Contingency and Value Added Tax *4 Figures may not add up to totals due to rounding	ce Continger o to totals due	ncy and Value e to rounding	Added Tax	
		D		

PROJECT COST FOR MASTER PLAN

Car         Project and cont         Mannerandre cont         Total         Rat           2001         15,740         0         7,693         0         7,693         7,693           2001         15,740         0         7,693         0         7,693	Total         Total           Total         15,740           2004         7,093           21,740         0           21,740         0           21,740         0           21,740         0           21,740         0           21,740         4,400           21,740         4,400           21,740         2,440           21,970         2,143           21,970         2,143           21,970         2,143           21,970         2,143           21,970         2,143           21,970         2,143           21,970         2,143           21,970         2,143           21,970         2,143           21,970         2,143           21,970         2,143           2,443         5,4735           2,443         5,4735           2,443         5,4735           2,443         5,4735           2,443         5,4735           2,443         5,4735           2,443         5,4735           2,443         5,4735           2,443         5,4735	x x x x x x x x x x x x x x x x x x x x
17000         7,003         0         7,003         0         7,003         0         0         7,003         0 <th0< th="">         0         <th0< th=""> <th0< th=""></th0<></th0<></th0<>	0         0         7.093           115,740         7.093         8.492           120,202         115,740         0           120,703         115,740         0           121,740         115,740         0           121,770         211,77         115,740           140         115,740         4,440           140         21,77         21,995           144         21,995         11,192           21,995         21,995         11,192           21,995         21,995         11,192           21,996         29,527         29,696           21,995         29,540         11,192           21,995         29,540         29,443           21,995         29,540         29,443           21,996         29,433         24,735           21,997         21,997         21,995           21,997         21,997         21,995           21,997         21,997         21,995           21,997         21,997         34,755           21,997         21,997         34,755           21,997         21,997         34,755           21,997         21,997         34	7,005 5,540 4,086 4,086 4,086 7,5537 7,5537 7,5537 7,5537 7,5537 7,5537 7,5537 7,5537 7,5537 7,5
7.000         7.601         7.603         7.603         7.603         7.603         7.604         0         7.604         0	7.465 7.665 18.779 28.295 28.297 28.297 28.297 28.297 28.297 28.297 28.297 28.297 29.200 28.297 29.497 29.497 29.495 29.455 29.455 29.455 29.455 29.455 29.455 29.455 29.455 29.47555 29.47555 29.47555 29.4755 29.4755 29.47	7,007 27,008 810,17 810
2001         15,740         0         15,740         0           2002         34,065         20         34,465         4,400           2004         34,066         400         34,465         4,400           2004         37,638         1,199         38,465         13,440           2004         27,638         1,199         28,457         13,440           2004         27,638         1,199         28,457         34,467           2001         27,638         1,199         28,457         36,462           2011         27,638         1,199         28,457         36,462           2011         27,638         1,199         28,457         36,466           2011         27,638         1,499         28,457         36,466           2011         27,638         1,499         28,457         36,475           2011         27,638         1,499         28,473         36,475           2011         27,638         1,499         28,473         36,735           2011         27,638         1,496         28,473         36,735           2012         27,638         2,443         28,473         36,735 <td< td=""><td>15,740 15,740 28,239 28,239 28,537 28,537 28,537 28,537 28,537 28,537 28,537 28,537 29,896 29,537</td><td>11, 1, 10 11, 1, 10 11, 10</td></td<>	15,740 15,740 28,239 28,239 28,537 28,537 28,537 28,537 28,537 28,537 28,537 28,537 29,896 29,537	11, 1, 10 11, 1, 10 11, 10
2002         38,006         0         38,006         4,400           2004         27,638         1,1347         28,939         4,440           2004         27,638         1,1347         28,939         4,440           2004         27,638         1,1347         28,939         1,0462           2004         27,638         1,1347         28,939         1,9462           2011         27,638         1,1447         28,949         4,440           2011         27,638         1,1447         28,949         4,440           2011         27,638         1,1447         28,949         4,740           2011         27,638         1,1447         28,949         4,740           2011         27,638         1,1447         28,949         4,735           2011         27,638         1,1447         28,949         4,735           2011         27,638         1,1447         28,949         4,735           2011         27,638         1,1442         28,949         4,735           2012         27,638         1,1442         28,949         4,735           2013         27,638         2,443         28,475         28,475 <tr< td=""><td>28,200 28,207 28,307 28,307 28,307 28,307 28,307 28,307 29,207</td><td>080 xr 080 xr</td></tr<>	28,200 28,207 28,307 28,307 28,307 28,307 28,307 28,307 29,207	080 xr 080 xr
2000         36,000         26,000         36,000         26,000         36,000         26,000 <td>2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2</td> <td>27,651 27,651 27,651 27,653 27,653 27,653 27,653 27,653 27,653 27,654 27,7557 27,7557 27,7557 27,7557 27,7557 27,7557 27,7557 27,7557 27,7557</td>	2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2	27,651 27,651 27,651 27,653 27,653 27,653 27,653 27,653 27,653 27,654 27,7557 27,7557 27,7557 27,7557 27,7557 27,7557 27,7557 27,7557 27,7557
2004         2,400         2,400         2,400         2,400         2,400         2,400         2,400         2,400         2,400         2,400         2,400         2,400         2,400         2,1,40         2,400         2,1,40         2,400         2,1,40         2,400         2,1,40         2,400         2,1,40         2,400         2,1,40         2,400         2,1,40         2,400         2,1,40         2,400         2,1,40         2,400	28,495 28,495 28,495 28,495 28,496 28,496 28,496 29,427 29,477 29,4775 20,47755 20,47755 20,4775	7.0.57 7.0.77 7.0777 7.0777 7.0777 7.07777 7.07777 7.077777 7.077777777
2000         27,638         770         28,345         10,601           2000         27,638         1,199         28,495         10,602           2001         27,638         1,199         28,495         10,602           2001         27,638         1,199         28,495         10,602           2001         27,638         1,199         28,495         10,602           2001         27,638         1,199         28,495         10,602           2001         27,638         1,494         28,495         20,441           2011         27,638         1,494         28,495         20,441           2011         27,638         1,494         28,435         28,435           2011         27,638         1,494         29,56         28,435           2011         27,638         1,494         29,56         28,435           2011         27,638         2,443         2,433         28,4755           2012         2013         2,443         2,433         2,435           2013         2,443         2,443         2,433         2,433           2014         2,443         2,443         2,433         2,4735	28,835 29,935 28,835 29,935 29,935 29,935 29,935 29,935 29,935 29,935 29,935 29,935 29,935 29,839 29,839 29,839 29,839 29,839 29,839 2,485 2,47555 2,47555 2,47555 2,475555 2,475555 2,47555555555555555555555555555555555555	27,038 27,039 27,039 27,039 27,039 27,039 27,039 27,039 27,039 27,039 27,039 27
2.000         2.000 <th< td=""><td>2,8,475 2,8,477 2,8,477 2,8,477 2,9,447 2,9,475 2,9,475 2,9,475 2,9,475 2,9,475 2,9,475 2,9,475 2,9,475 2,9,4755 2,9,497 2,9,477 2,9,477 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,477555 2,9,477555 2,9,477555 2,9,477555 2,9,4775555 2,9,4775555 2,9,4775555555555555555555555555555555555</td><td>27,038 27,038 27,038 27,038 27,038 27,038 27,038 27,038</td></th<>	2,8,475 2,8,477 2,8,477 2,8,477 2,9,447 2,9,475 2,9,475 2,9,475 2,9,475 2,9,475 2,9,475 2,9,475 2,9,475 2,9,4755 2,9,497 2,9,477 2,9,477 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,47755 2,9,477555 2,9,477555 2,9,477555 2,9,477555 2,9,4775555 2,9,4775555 2,9,4775555555555555555555555555555555555	27,038 27,038 27,038 27,038 27,038 27,038 27,038 27,038
2000         27,638         1,999         28,943         29,193         20,193 <td>2,4,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,</td> <td>27,65,8 28,76,95,8 27,65,8 27,65,8 27,65,8 27,65,8 27,65,8 27,65,8 27,65,8 27,65,8 27,65,8 27,75,95,95,95,95,95,95,95,95,95,95,95,95,95</td>	2,4,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,	27,65,8 28,76,95,8 27,65,8 27,65,8 27,65,8 27,65,8 27,65,8 27,65,8 27,65,8 27,65,8 27,65,8 27,75,95,95,95,95,95,95,95,95,95,95,95,95,95
2000         77.638         1,199         28.357         26.443           2011         27.638         1,494         29,132         39,644           2011         27.638         1,444         29,132         39,644           2011         27.638         1,444         29,132         39,644           2011         27.638         1,444         29,132         39,644           2011         27.638         1,444         29,132         39,644           2011         27.638         1,444         29,325         39,644           2011         27.638         1,936         29,574         36,443           2011         27.638         1,946         29,574         36,443           2011         27.638         2,943         2,443         2,443         36,755           2020         2,443         2,443         2,443         2,443         36,755           2021         2,243         2,443         2,443         34,755           2020         2,243         2,443         2,443         34,755           2021         2,243         2,443         2,443         34,755           2022         2,243         2,443         2,443	24,857 29,827 29,827 29,827 29,827 29,827 29,827 29,829 29,829 29,829 29,829 2,485 2,475 2,485 2,485 2,485 2,485 2,485 2,485 2,485 2,485 2,485 2,485 2,485 2,485 2,485 2,485 2,485 2,485 2,475 2,485 2,47555 2,47555 2,47555 2,47555 2,475555 2,475555 2,47555555555555555555555555555555555555	77,658 7,658 7,658 7,658 7,658 19,591
2010         27,638         1,496         29,132         39,694           2011         27,638         1,496         29,132         36,196           2013         27,638         1,496         29,230         36,196           2014         27,638         1,496         29,230         36,196           2015         27,638         1,496         29,230         36,196           2016         27,638         1,496         29,230         36,196           2016         27,638         2,940         29,407         36,755           2016         27,638         2,940         29,732         45,996           2016         27,638         2,940         29,735         47,755           2017         2,443         2,443         2,443         24,755           2018         2,443         2,443         2,443         4,755           2019         2,443         2,443         2,443         4,755           2010         2,443         2,443         2,443         4,755           2011         2,443         2,443         2,443         4,755           2012         2,443         2,443         2,443         4,755	29,112 29,230 29,230 29,230 29,230 29,230 29,230 29,230 29,230 29,230 29,230 29,230 29,473 20,400 20	27,638 27,638 27,638 27,638 29,19
2011         27,638         1,494         29,112         32,305           2013         27,638         1,642         29,320         36,196           2014         27,638         1,642         29,320         36,196           2015         27,638         1,642         29,320         36,196           2016         27,638         1,642         29,320         45,946           2017         27,638         2,643         29,366         45,946           2018         27,638         2,643         29,430         47,355           2020         27,638         2,443         29,435         47,755           2021         29,491         2,443         2,443         47,755           2022         2,443         2,443         2,443         4,755           2020         2,443         2,443         2,443         4,755           2021         2,443         2,443         2,443         4,755           2020         2,443         2,443         2,443         4,755           2021         2,443         2,443         2,443         4,755           2021         2,443         2,443         2,443         4,755           20	29,132 29,342 29,342 29,342 29,342 29,342 29,859 29,859 29,859 29,859 29,859 2,443 2	27.63% 27.65% 27.65% 27.65% 29.1
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2014         27,638         1,936         29,869         42,698           2016         27,638         2,034         29,869         42,698           2016         27,638         2,034         29,869         42,698           2016         27,638         2,034         29,869         42,698           2016         27,638         2,034         2,443         2,443         54,735           2020         2,443         2,443         2,443         2,443         54,735           2021         2,443         2,443         2,443         2,443         54,735           2022         2,443         2,443         2,443         2,443         54,735           2022         2,443         2,443         2,443         2,443         54,735           2023         2,443         2,443         2,443         54,735         54,735           2023         2,443         2,443         2,443         54,735         54,735           2023         2,034         2,443         2,443         54,735         54,735           2023         2,033         2,443         2,443         54,735         54,735           2024         2,443         2,443	29,572 29,869 21,970 2,989 2,989 2,989 2,483 2,47355 2,47355 2,47355 2,473555 2,47355555555	27,63% 27,63% 29,591
2010         27,638         2,004         26,13         2,004         6,940         6,940           2011         2,7,638         2,004         27,638         2,004         26,13         2,004         6,940         6,941         6,940         6,940         6	29,859 29,859 29,859 2,483 2,4735 2,483 2,47355 2,47355 2,47355 2,473555555555555555555555555555555555555	27,63.8 27,63.8 29.1
2010         27,6.M         2.3.31         29,991         3.3.43         2.3.939         8.7.755           2001         2,7,6.M         2,3.43         2,3.43         2,3.43         2,4.43         5,4.735           2001         2,4.43         2,4.43         2,4.43         2,4.43         5,4.735           2002         2,4.43         2,4.43         2,4.43         5,4.735         5,4.735           2002         2,4.43         2,4.43         2,4.43         5,4.735         5,4.735           2002         2,4.43         2,4.43         2,4.43         5,4.735         5,4.735           2002         2,4.43         2,4.43         2,4.43         5,4.735         5,4.735           2002         2,4.43         2,4.43         2,4.43         5,4.735         5,4.735           2003         2,4.43         2,4.43         2,4.43         5,4.735         5,4.735           2004         2,4.43         2,4.43         2,4.43         5,4.735         5,4.735           2003         2,4.43         2,4.43         2,4.43         5,4.735         5,4.735           2004         2,004         2,4.43         2,4.43         5,4.735         5,4.735           2004 <td< td=""><td>29,809 21,970 2,485 2,4755 2,485 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,487 2,485 2,485 2,487 2,487 2,485 2,487 2,487 2,487 2,487 2,485 2,487 2,487 2,487 2,487 2,487 2,487 2,487 2,487 2,487 2,487 2,487 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,47755 2,47755 2,47755 2,47755 2,47755 2,47755 2,47755 2,47755 2,47755 2,477555 2,47755 2,477555 2,477555 2,47755555 2,47755555555555555555555555555555555555</td><td>22 (27 165 61</td></td<>	29,809 21,970 2,485 2,4755 2,485 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,487 2,485 2,485 2,487 2,487 2,485 2,487 2,487 2,487 2,487 2,485 2,487 2,487 2,487 2,487 2,487 2,487 2,487 2,487 2,487 2,487 2,487 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,4755 2,47755 2,47755 2,47755 2,47755 2,47755 2,47755 2,47755 2,47755 2,47755 2,477555 2,47755 2,477555 2,477555 2,47755555 2,47755555555555555555555555555555555555	22 (27 165 61
2017         19,991         2,1979         21,979         21,979         54,755           2001         2,001         2,445         2,445         2,445         54,755           2002         2,445         2,445         2,445         54,755         54,755           2002         2,445         2,445         2,445         54,755         54,755           2002         2,445         2,445         2,445         54,755         54,755           2002         2,445         2,445         2,445         54,755         54,755           2003         2,445         2,445         2,445         54,755         54,755           2003         2,445         2,445         2,445         54,755         54,755           2003         2,445         2,445         2,445         54,755         54,755           2004         2,445         2,445         2,445         54,755         54,755           2004         2,445         2,445         2,445         54,755         54,755         54,755         54,755         54,755         54,755         54,755         54,755         54,755         54,755         54,755         54,755         54,755         54,755         54,755	2,483 2,4735 2,483 2,4735 2,4735 2,4735 2,4735 2,4735 2,483 2,4735 2,483 2,4735 2,483 2,47355 2,47355 2,47355 2,473555 2,47355555	
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2020         2.483         2.483         2.483         2.483         2.483         5.4755           2020         2.483         2.483         2.483         5.4755         5.4755           2030         2.483         2.483         2.483         5.4755         5.4755           2031         2.483         2.483         2.483         5.4755         5.4755           2033         2.483         2.483         2.483         5.4755         5.4755           2033         2.483         2.483         2.483         5.4755         5.4755           2034         2.483         2.483         2.483         5.4755         5.4755           2035         2.483         2.483         2.483         5.4755         5.4755           2034         2.483         2.483         2.483         5.4755         5.4755           2034         2.483         2.483         2.433         5.4755         5.4755           2034         2.483         2.483         2.433         5.4755         5.4755           2034         2.483         2.483         2.433         5.4755         5.4755           2041         2.483         2.483         5.4755         5.4755	2,443 2,443	
2027         2.483         2.483         2.483         2.433         5.4735           2020         2.483         2.483         2.483         5.4735         5.4735           2020         2.483         2.483         2.483         5.4735         5.4755           2020         2.483         2.483         2.483         5.4755         5.4755           2031         2.483         2.483         2.483         5.4755         5.4755           2033         2.483         2.483         2.483         5.4755         5.4755           2034         2.483         2.483         2.483         5.4755         5.4755           2035         2.483         2.483         2.483         5.4755         5.4755           2036         2.483         2.483         2.483         5.4755         5.4755           2036         2.483         2.483         2.483         5.4775         5.4755           2041         2.483         2.483         2.4735         5.4755         5.4755           2042         2.483         2.483         2.4735         5.4755         5.4755         5.4755           2043         2.483         2.483         2.4735         5.47755 <td>2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.</td> <td></td>	2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.	
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		Maintenance Total	l otal	Benefit	) j	(E) Remerit
1000	7.643		7,693	5	7,693	0
1000	7.693	0	7,693	6	100.0	0
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- 00	38.066	0	3X, UK6	¢	24,615	0
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2005	27.63%		28.247	6.7X8	15,945	3.832
X 2006	27.638		28,395	X,430	14,5,41	4,326
2002 0	27.638	\$	115 21	10.071	12,215,21	1,698
	27.638	-	28,690	11,713	12,167	196
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12 2010	27.638	-	28.985	14,997	10,159.	5.256
100	27.638	-	20,132	16,639	9,282,	5,302
	27.638	-	29,280	18,281	181°X	5,295
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10 2014	27.638	-	725762	21,565	7,080	5,162
	27.638	"	20.77	23,206	6,468	5,050
	27.638	**	29,869	24,848	5,000	4.916
	165'61		21,970	26.490	3,951	4,764
		2.483	2,483.	27,654	106	22.1
	•	2,483	187	27,654	369	1117
		2,483	2,483	27.654	336	3, 737
	-	2,483	2,483	27,654	305	<b>19</b> 5.0
		2,483	1344	27,654	Ę.	3,088
2023		2,483	2,483	27.654	232	2,808
		2,483	2,483	27.654	677	2.55
		2,483	2,483	27,654	208	2,32(
•••		2.483	2,483	27,654	681	8
		2,483	2,483	27,654	11	1,918
30 2028	-	2,483	2,483	123,034	157	1.743
-		2,483	124-12	27,654	42	1,545
		2	1917	27,654		4
		2.483	2,464	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
		2.48.5	1044,2	+2017	2	1.1.1
		2483	2442	401/7	10	100.1
		122422	154.4	900'/7	6	10
				10.12	7 F	
000 00		104 <sup>1</sup> 4	1.51	17 644	2	1
		191.6	LAP C	1.9 4.4	5	ŕ
		2 483	2.483	27.654	5	611
		2.483	2.483	27,654	8	\$55
• • •		2,483	2483	27,654	45	5
		2,483	2,483	27,654	41	651
45 2043		2,483	2,483	27.654	12	417
		2,483	2,483	27,654	3	51 179
		2483	2,483	27,654	5	
		2,483	2.443	407.2		
102 61		() 1 1 1 1 1	0.84	1937 LLL	9 5	8 9 C
		NT-17				

Table 4.6(1/8)

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1	<b>FREEDER FLOW FOR MASTER PLAN</b>	(Existing Busin)
	COST BE	

River: Lohadra	ruba	Ÿ	(Existing Busin)	\$	(I)nit	(Linic NRs. 1,000)
		Economic cost/benefit	subenetit		Discontined (10%)	1 (1(1%))
Ycbr	Project	Maintenance	Total	Benefit	5 <u>5</u>	(B) Renerin
<b>11</b> 51	615.6	0	616.6	5	611.6	•
0007 4	915.9	0	916.9	0	\$27.9	0
1002 0	13,104	ò	18,104	ò	14,962	•
1 2002	45,173	0	121.21	0	33.939	0
2 2003	45.173	7	111'51	1,478	31,018	1,010
1007 9	12,12	ų,	45,655	2,957	35,348	1.836
C007 1	010.10	24	60.01	427'T	18,762	100.2
000.0		040		1677 C	0+1'/1	2797
			080.00	10000	100°C	2001
	01770 918 CL		40/ PC	170'	101	C17.0
	12120	50		0.755	CON*C1	100.0
	12 216	2.1		0.24 01	100 01	741.5
÷.,	12 416	510 1	LAL AL	1476 I I	030 6	
	32.516	2.111	14.627	340 21	11.6	10171
	32.516	1477	008.44	110.41	122.8	3.354
	32,516	2.457	510.00	15.076	7.611	3.281
18 2016	32.516	2,631	35,147	16,140	6,954	3,193
19 2017	23.732	2,804	26.536	102.11	5.4	3.094
		169.5	1662	126.71	4.4	2,940
		2,931	12672	136"21	436	2.673
		1167	2,931	17,981	38	2,430
		1.09.2	2,931	186.71	360	2.209
		2,931	156.2	126721	327	2,008
		2,931	2,931.	17,981	298	1.826
2024		2,931	2,931	17,981	1.1	1,660
		1001	101	17,981	911	60 1
9202 NZ		2,931	2,931	17.9%1	224	<u>ј</u> К
770 A		1067	Ē.	136.1	107	1.247
2707 00		2,931	2,931	136'21	22	
			166.2	196'21	NO S	010,1
		104		1.90.01	2	164
		116.6		17.081		Ĩ
		2.931	110 0	17 981		201
		2,931	16672	17,981	4	040
37 2035		1067	2,931	17,981	\$	582
38 2036		2,931	166,2	17,981	86	529
29 2037		166'2	2,931	12,981	8	127
_		2,931	2.931	17,981	71	437
		2.931	2,931	12,981	65	79E
		2,931	2.931	17,981	¢.	361
		1667	12672	186'21	3	ž.
• • •	•	110 0	110 4	130.71	1	957
	•			106	1 9	
		1007	2.931	120.11	212	ŝ
		106.2	166.2	17.981	1	Ś
19 2047		166.2	2.931	12, 981	, ġ	185
XNOT OS		166.2	2.931	17.931	£	168
1005	SKI YAS	114,509	100.001	702.502	279,675	75,115
				CIDD.	240.0	
				, DA	0.27	
				NPV(I)-C):	2	(NRA.1.000)

7 7 7 7 7 7 7 7 7 7 7 7 7 7	Project 2051 9,319					
	9.5.9	Maintenance Total cost cost	Total	Benefit	(C) (B)	(B) Reactiv
Q - 0 0 3 9 9 5 8 4 0 - r	<u>.</u>		615.6	0	612.6	
N N N N N N N N N N N N N N N N N N N		0	615.6	Ō	8,472	0
22265240-1		S¢	44 171	576	100.4	00
7285389=1	13.173	142	15,414	2.321	31.018	285
285289-1	45,173	182	45,655	213.4	28.148	282
8538955	32,516	3	33,239	6 96 9	18,762	3.930
539921	32.516	898	33,412	¥.634	17, 146	1,430
88951	32,516	1,070	33,586	10,304	15.668	1.807
<u> </u>	32.516	1,243	33,759	11,975	11.11	5.079
221	32.516	1.417	11.933	13,646	13,083	5.261
÷ :	32,516	1.590	71,100	15.316	156,11	5.268
ŗ	32,516	1,764	34,280	14.987	10.92	5.413
	32,516	700.1	34,453	18,658	9.980	104.2
20131	32,516	2,111	24.627	20.328	9.11X	5.151
2014	32.516	2.284	34,800	21,999	8,331	200
2015	32.516	22.457	10.11	21.670	141	141 4
2016	37.516	1000	471 94	25.340.	710 Y	
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		1642	166.7	007.87	8	7.45×
ti i		2,931	2,931	28.230	ĥ	3.153
57		2,931	2,931	28,230	298	2,866
2024		2,931	166.7	28,230	ā	909
2025		1:657	2,931	24,230	140	2,369
2026		2,931	2.931	28,230	224	2,153
2027		2,931	2.931	28,230	203	1,958
2028		2.931	2,931	28,230	185	1 780
2029		2.931	2.931	28.230	201	1 618
0100		110 -	1100	016 36	5	
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		1000	100	000000	<u>0</u>	6 · ·
		1.0.7	10.7	26,2,30	5	600
2007		164.7	164.2	002.83	\$	E IA
		1067	164.7		8	830
			1.43.	28,230	81	755
2010		1567	166.2	28,230	11	980
		14.7	17.7	28,250	5	624
010		2,931	2,931	027,92	- \$	567
10		16672	2.931	28,230	3	515
10		2,931	1(6)2	28,230	64	469
3		1.931	2.931	28.230	1	224
1014		2.931	156.2	28,230	9	782
2045		1167	12672	28,230	37	352
-	~	2,931	1.82	017,82	5	020
1013		2,931	2.931	017,82	8	162
2048		2,931	1156.2	1012.X2	27	265

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FLOW FOR N

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### Table 4.6(2/8)

2,8% 0.42 -161,743 (NRs.1,000)

EIRR: BVC: NPV(B-C):

4.53

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TER PLAN		~
COST BENEFIT FLOW FOR MASTER PLAN	(Future Basin)	

Benkfi 0 5,148 15,140 1	(C) Cont 2,845 7,845 13,558 13,176 25,009 15,176 13,175 15,196 15,196 15,196 15,196 15,196 15,196 11,196 11,196 11,196 11,196 12,199 12	(B) Thenefit 0 0.0 3.516
2000 2000 2000 2000 2000 2000 2000 200	7,845 7,845 13,558 13,558 13,176 25,049 15,106 15,106 15,106 15,106 15,106 15,106 15,106 15,106 15,106 15,106 16,007 10,952 10,007 10,952 10,955 10,9	3.510
22,485 22,445 22,530 20,530 21,00 21,00 21,00 22,00 22,00 22,00 22,00 22,00 23,00 23,00 23,00 23,00 23,00 23,00 23,00 24,00 25,00 25,00 25,00 25,00 25,00 25,00 25,00 25,00 25,00 25,00 25,00 25,00 25,00 20,000 20,0000 20,0000 20,0000 20,00000000	7,845 13,845 28,502 28,502 17,196 17,199 18,154 11,197 11,196 11,197 11,196 11,197 11,196 11,197 11,196 11,197 11,	3.5 0 0
0 5,1,45 10,297 10,297 10,297 20,253 20,253 20,253 20,253 20,253 20,253 20,253 20,253 20,253 20,253 20,253 20,293 20,200 20,203 20,200 20,203	13,548 31,146 25,502 26,649 26,649 17,199 14,754 11,147 11,146 11,246 11	3.516.0
0 5,148 15,445 15,445 15,445 22,835 22,835 22,835 20,234 11,019 21,019 21,019 21,019 21,009 22,003	21,1% 28,602 26,649 17,108 14,354 14,354 11,2,117 11,2,117 11,2,117 11,2,128 14,354 9,143 9,2,143 7,5,12	3.516
5,148 15,445 15,445 25,530 25,530 25,530 25,530 21,946 21,209 21,930 22,933	28,502 26,049 17,190 15,798 15,117 15,147 10,097 10,097 10,097 10,097 11,986 10,097 10,097 11,986 11,986 10,097 10,077 11,077 10	3.516
10,297 19,146 20,530 20,530 20,530 21,919 21,919 21,009 48,500 22,933	26,049 17,190 14,5708 14,5708 11,1986 11,986 11,986 11,986 11,986 11,986 11,986 11,986 11,986 11,986 11,986 11,986 11,986 11,986 11,786 12,649 12,708	
15,445 22,5435 26,5336 26,5336 31,919 41,7614 45,003 445,003 45,003 52,393	17,190 15,708 14,354 11,9%6 11,9%6 10,097 9,143 9,143 7,632	6.394
19,140 20,234 30,234 30,234 31,919 41,009 44,003 48,6903 52,393	15,708 14,354 13,117 11,986 11,986 10,007 9,143 7,632 7,632	8,719
22,835 26,530 13,919 17,919 41,309 44,300 44,300 44,300 44,300 37,393	14.354 13.117 11.986 10.007 9.143 7.632 7.632	12×6
26.530 31,919 31,919 31,614 41,509 48,608 48,608 52,393	13.117 11.986 10.952 9.143 9.143 7.532	10,653
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11,919 37,614 45,003 45,603 48,698 52,393	10,952 10,007 9,143 8,354 7,532	11.653
37.614 41.309 45.003 48.698 52.393	10.007 9,143 8,354 7,632	11,588
41.309 45.003 48.698 52.393	9,143 8,354 7,632	11.985
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Ref. 700 2001 2000 2000 2000 2000 2000 2001 2000 2001 200000 2000000						V
(1994) 2000 2000 2000 2000 2000 2001 2000 2001 2000 200100000000	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Muntenance	Total	Benetît	() () ()	(B) Renefit
2000 2001 2002 2004 2005 2004 2015 2016 2016 2016 2016	2000 2000 2000 2000 2000 2000 2000 200	ō	8,630	10	K.63U	0
2001 2002 2003 2005 2005 2005 2001 2005 2011 2005 2011 2010 2011 2010	11 22 22 22 22 22 22 22 22 22 22 22 22 2	0	X.630	0	512.7	0
2002 2003 2004 2005 2005 2005 2011 2011 2011 2011 2011	600 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	0	16,442	5	13,5%8)	
2003 2004 2009 2015 - 2009 2015 - 2009 2015 - 2016	600 888 888 888 888 888 888	0	1,509	0	31,186	
2000 2000 2011 2010 2011 2010 2011 2011	222 222 222 222 222 222 222 222 222 22	<b>a</b> :	41,730	191	205.62	0701
2005 2009 2007 2010 2011 2012 2012 2013	22 X X 2 X 2 X 2 X 2 X 2 X 2 X 2 X 2 X	111	11,952	- 10/ H	610.01	
2009 2009 2013 2013 2013 2014	22 X X X X X X X X X X X X X X X X X X	ž	30,452	161,7	0611/	070' <del>1</del>
2007 2008 2010 2013 2013 2013	8 8 8 8 8	ភ្ល	30.611	8,861	15,708	4,547
2008 2010 2011 2013 2013	<b>X</b> X X	226	30,770	10.572	14.0.41	4, 432
2011 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	784	1.141)	30.929	12,2%2	11,117	2,10
2013 - 102	288	0001	31,088	13.993	11,986	545.5
2015 2015 2014		1,459	51,247	15,703	766.01	5,504
2012	29,788	1.618	11, 406	117.11	10,007	512.5
2013	29,78N	1.1	31.565	19,124	0.143	5,540
2014	788	1,935	51.723	20,835	8,354	5,486
	788	2094	31.882	1345	7,632	5,297
2.67 0102 11	29,788	2,253	32,041	24,256	6,973	5.279
18 2016 29.788	783	1412	32,200	23,967	57	5,137
2017	976	2.571	24.547	27.677	4,415	7,978
2018		7 688	2,683	28.939	440	4,732
-		2.688	2,688	23,939	007	4,302
2 2020	_	2.688	2.688	28,939	363	3,911
21 2021		2.688	2.683	28,939	000	3,555
		2.688	2.688	28,939	80	3,232
2023		2.688	2.683	28,939	273	2,938
		2.688	2.683	28,939	248	2,671
27 2024		2 688	2.688	28.910	116	2,428
		2.688	2 AKK	28.930	205	2.20
		2 688	2.688	28,939	186	2,007
		1 688	2 AUX	28,939	160	1.824
		29.4	7 428	010 80	151	1.658
		100	287 6	010 80	97	1.50%
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		2,688	2,638	28,939	62	X51
		2.688	2,688	28,939	1	114
		2,688	1,688	28,939	\$9	CO.
		2,688	2.683	28.939	\$	634
42 2040		2,688	2,688	28,939	4	581
		2,688	2,688	28.939	01	826
		2,688	2.688	28,939	57	480
		2,688	2.688	28,939	4	151
		2.688	1,688	28,939	10	-6£
		1.043	2.038	28,939	<b>4</b> , 2	101
18 2046		2,683	.688	28,939	21	975 1975
		2.65%	NBO T	1010 m		i.
ž	-	2,688	2.6KX	N'N X2	Ģ	1.7
Total 537,661	÷.	105,031	642,692	1,130,640)	256.5Kb	120,915

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		Economic cost/benefit	subenetit	1	Discounted (10%)	(10, 1)
, ¥	Project	Maintenance cost	Fotal Cotal	Benetit	(C) (C)	(B) Benyfil
0061	8.205	3	8.265	0	X.265	-
0007	K.265	00	X.265	6 6	4107	s c
80	100 01	0	106.65	0	29.978	• 0
000	106'60	102	101114	5,279	XPC.72	3,605
9 9 9	39,901	426	40,327	10,557	25.040	6,555
	28.677	639	10.02	15,836	16,548	K,939
	24,677	792	644.02	19,610	15,122	10.071
	28,677	776	25 25	23,424	13.819 13.877	124.01
1000	24.077	140.1	20 00	11011	1.538	1.956
	1.0.9.1	9	10.080	34,805	10.543	218
	28.677	1.556	50,233	38,599	9,633	6, 1
	28.677	1,709	30,386	12,392	8,802	0%2"21
	779.82	1,862	30,539.	46.186	X,042.	12,162
	28,677	2.015	30,692	086'67	7.047	596
	2X,677	2, 16K	30,845	52.774	6,713	11,703
	28.677	127.2	30.998	57.567	6.133	4X5.11
	21,046	2,474	21,520	105.10	0.2.4	9(0)11
		1046.7	000013	2 3 2 3	1.3	944 D
		2.586	1586	94   49	130	200.8
		2.586	2.586	64,146	318	7,880
		2,586	2.586	64,146	289	7,164
25 2023		2.586	2.586	64,146	265	6.512
		2,5%	2,586	64.146	526	026.3
202 1		08C 14	108C"7	9 1 1 1 1	101	200'r
1070- 07		2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		641.146	179	4.448
		2857	2.586	64,146	163	4,044
		2,586	2,586	64,146	148	3,676
32 2030		2,586	2,586	64,146	135	345.0
		2,586	2.586	041,140	<u>2</u>	3.03%
		2.586	1,586	9		1.762
		00077	DUC'N	145	2 5	124
		222	2.5%6	64,146	12	2.075
		2.586	2.586	64,146	76	1,836
		2.586	2.586	64, 146	69	1,715
		2,586	2.586	64,146	63	1,559
		2,586	1.586	97 F	5	1417
		985 T	0251	46 146 147	25	121
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10.14		2.586	2.5%6	Gel. 146	7 E	896
		2.586	2.586	64,146	52	280
47 2045		2,586	2.586	64, 146	R	800
		2,586	2.586	64.146	2	111
		2.586	25%	64, 146 21 146	5	198
20 7043		LOWC /		.)		

Year         Project         Manternunve         Tout         Denetit           1         1000         3.5001         9.5001         9.5001         9.601         0.001           2         2000         3.5001         9.5001         9.5001         9.5001         7.205         0         7.205           6         2000         39.601         19.4001         0         15.805         0         7.7.205           7         2000         39.901         2.10         9.901         10.114         7.7.           7         2000         28.677         1.001         7.0         29.469         9.911           10         2001         29.607         0         15.50         9.911         17.1           11         2000         28.677         1.001         7.20         29.469         19.7           11         2011         28.677         1.100         20.000         19.7         11.1           11         2011         28.677         1.100         20.000         10.114         17.1           12         2010         28.677         1.100         20.000         10.114         17.1           12         2011         2012		Discounted (10%s)
TOTOL         TOTOL         Dens           001         1,3,895         0         3,5,895         0           001         3,5,901         0         3,5,895         0         3,5,895           001         3,5,901         10         3,5,901         2,505         0         3,5,901           001         3,5,901         2,105         0         3,5,901         2,105         3,011           001         3,5,901         2,105         0         3,5,901         2,105         3,011           001         3,5,901         2,10         3,0,901         2,10         3,0,901         4,117           001         2,5,677         1,007         2,10         3,0,301         1,14         2,0,11           001         2,5,677         1,1402         3,0,301         2,0,11         2,0,02           0101         2,5,677         1,1402         3,0,301         2,0,01         2,0,01           0101         2,5,677         1,1402         3,0,301         2,0,01         2,0,01           0101         2,5,66         3,0,59         3,0,301         2,0,01         2,0,01           0101         2,5,66         2,1,14         1,1402         2,0,01	Q	(11)
(Value)         (V.26)         (V.26)         (V.26)         (V.26)           20001         39,901         213         0         19,901           2001         39,901         213         0         19,901           2001         39,901         213         0         11,405           2001         29,901         213         0         11,405           2001         28,677         1,1067         29,401         21,10           2001         28,677         1,1067         29,421         0           2001         28,677         1,1067         29,421         0,114           2001         28,677         1,1067         29,421         0,127           2001         28,677         1,1269         20,290         20,116           2011         28,677         1,1269         20,290         20,290           2011         28,677         1,1269         20,290         20,290           2011         28,677         1,1269         20,290         20,290           2013         28,677         1,1269         20,290         20,290           2014         21,160         2,136         2,236         2,236           2015 <th>Ő</th> <th>2</th>	Ő	2
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2002         39,901         0         90,101           2003         39,901         21         90,114           2004         29,901         21         90,114           2005         24,677         0,114         29,116           2006         24,677         0,114         29,116           2007         24,677         0,441         29,216           2008         24,677         1,1907         29,216           2011         24,677         1,1907         29,216           2011         24,677         1,1902         20,230           2011         24,677         1,1902         20,230           2011         24,677         1,1902         20,394           2013         24,677         1,1902         20,396           2014         24,677         1,1902         20,396           2015         24,677         1,1902         20,396           2015         24,677         1,1902         20,396           2015         24,677         1,1902         20,396           2015         24,677         2,1936         2,236           2015         24,677         2,1936         2,396           2016 <td></td> <td>15,156</td>		15,156
2003         9.9,901         2.13         -0.112           2004         2.6,677         -0.212         -0.112           2005         2.6,677         -0.212         -0.112           2006         2.6,677         -0.212         -0.112           2006         2.6,677         -0.212         -0.112           2001         2.6,677         1.403         20,104           2011         2.6,677         1.403         20,221           2011         2.6,677         1.403         20,221           2011         2.6,677         1.403         20,234           2011         2.6,677         1.403         20,234           2011         2.6,677         1.403         20,39           2013         2.6,677         1.256         2.2,56           2014         2.6,677         1.266         2.2,56           2015         2.6,677         1.268         2.2,56           2016         2.7,667         2.1,68         2.2,56           2013         2.7,56         2.2,56         2.2,56           2014         2.7,56         2.2,56         2.2,56           2015         2.6,677         2.2,56         2.2,56 <t< td=""><td></td><td></td></t<>		
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2007         20,677         0-11         20,621           2008         20,677         1,097         20,774           2011         20,677         1,129         20,213           2011         20,677         1,129         20,213           2011         20,677         1,129         20,213           2011         20,677         1,129         20,213           2011         20,677         1,129         20,213           2011         20,677         1,126         20,213           2011         20,677         1,126         20,213           2011         20,677         2,166         20,213           2011         20,677         2,166         20,213           2011         2,166         2,1386         2,1386           2012         2,166         2,2386         2,2386           2022         2,236         2,2386         2,246           2023         2,386         2,2386         2,246           2024         2,386         2,246         2,246           2025         2,386         2,246         2,246           2036         2,386         2,246         2,346           2031		
2000         20,677         1,007         20,774           2011         20,677         1,256         20,231           2011         20,677         1,256         20,231           2011         20,677         1,256         20,231           2011         20,677         1,256         20,231           2011         20,677         1,556         20,231           2011         20,677         1,556         20,231           2011         20,677         1,556         20,231           2011         20,677         1,556         20,231           2011         20,677         2,105         20,231           2011         20,677         2,105         20,231           2011         20,677         2,105         2,156           2013         2,106         2,156         2,156           2020         2,105         2,156         2,156           2021         2,156         2,156         2,156           2022         2,050         2,156         2,156           2023         2,056         2,156         2,156           2024         2,156         2,156         2,156           2024 <t< td=""><td></td><td></td></t<>		
2000         25,677         1,250         29,27           2011         26,677         1,365         20,251           2013         26,677         1,365         20,251           2014         26,677         1,365         20,251           2015         26,677         1,365         20,251           2016         26,677         1,365         20,251           2017         27,6677         1,365         20,251           2018         27,6677         2,168         20,251           2019         27,6677         2,168         20,394           2019         27,667         2,174         21,326           2019         27,66         2,174         21,326           2019         2,766         2,174         21,326           2019         2,756         2,136         2,356           2021         2,166         2,136         2,366           2022         2,030         2,366         2,366           2023         2,366         2,366         2,366           2024         2,366         2,366         2,366           2023         2,366         2,366         2,366           2024         <		
2010         26,677         1,403         20,000           2011         26,677         1,556         30,539           2013         26,677         1,556         30,539           2014         26,677         1,556         30,539           2015         26,677         1,556         30,539           2016         26,677         1,556         30,539           2017         2,105         30,598         30,539           2019         2,106         2,106         30,539           2019         2,2166         2,1366         2,1366           2019         2,108         2,1366         2,1366           2019         2,108         2,1366         2,1366           2010         2,1366         2,1366         2,1366           2022         2023         2,1366         2,1366           2023         2,2366         2,2366         2,2366           2020         2,2366         2,2366         2,2366           2030         2,2366         2,2366         2,2366           2031         2,2366         2,2366         2,366           2030         2,2366         2,2366         2,366           2031		
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2012         26.677         1.70%         30,39%           2013         26.677         1.882         30,445           2014         26.677         1.882         30,445           2015         26.677         2.161         30,53%           2016         26.677         2.161         30,53%           2017         2.166         2.161         30,445           2018         2.166         2.151         30,54%           2019         2.166         2.151         30,54%           2010         2.166         2.151         30,54%           2011         2.166         2.1586         2.1586           2022         2.236         2.1586         2.1586           2023         2.1586         2.246         2.1586           2033         2.5386         2.236         2.1586           2034         2.5386         2.236         2.546           2035         2.5386         2.236         2.546           2036         2.5386         2.236         2.546           2035         2.5386         2.246         2.546           2036         2.5386         2.246         2.546           2036		
2013         26.677         1.462         30.579           2014         20.677         2.105         30.692           2015         2.6677         2.105         30.692           2016         2.6677         2.105         30.692           2018         2.574         2.1356         30.692           2019         2.576         2.5786         2.5366           2020         2.5366         2.5366         2.5366           2021         2.5366         2.5366         2.5366           2022         2.5366         2.5366         2.5366           2023         2.5366         2.5366         2.5366           2024         2.5366         2.5366         2.5366           2023         2.5366         2.5366         2.5366           2024         2.5366         2.5366         2.5366           2023         2.536         2.5366         2.5366           2033         2.5366         2.5366         2.5366           2034         2.5366         2.5366         2.5366           2035         2.5366         2.5366         2.5366           2036         2.5366         2.5366         2.5366		
2014         20.677         2.0.15         20.69           2015         20.677         2.0.15         20.847           2019         2.0.84         2.474         2.0.15           2019         2.0.86         2.474         2.0.39           2019         2.0.84         2.474         2.1.046           2019         2.586         2.536         2.536           2021         2.586         2.536         2.536           2022         2.536         2.536         2.536           2023         2.536         2.536         2.536           2024         2.536         2.536         2.536           2023         2.536         2.536         2.536           2024         2.536         2.536         2.536           2023         2.536         2.536         2.536           2033         2.536         2.536         2.536           2034         2.536         2.536         2.536           2033         2.536         2.536         2.536           2034         2.536         2.536         2.536           2033         2.536         2.536         2.536           2034         2.536 <td></td> <td></td>		
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Total

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EIRK: B/C: NPV(B-C):

-		Economic cost/benefit	scheneta	_	Discounted (10%)	
ı	Project	Maintenance	Total Jost	Benclit	õŝ	(B) Renefit
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2006	CN9.01	1.088	1.77.14	23,058	21,435	11.832
9 2007	40,683	505,1	41,988	27,659	19,588	12,901
X00: 0	40,6K3	1.522	12,205	32,260	17. × 99	189,61
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	1134 UT		11 507	59,865	10,415	162.41
100	10.683	1001	43.724	04,400	9.516	14,030
	10.683	3.258	43.94	69,067	8,693	13,664
	25,773	3,475	29.198	73,668.	5.251	13,250
		3,612	3.612	75.07	291	125'21
21 2019		3,612	3.612	75.47	537	11.185
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18	722,390	2	863,476	2,001,145	343,6081	319,156
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COST BENEFIT FLOW FOR MASTER PLAN (Existing Basin)

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5	,	l'ruject	Maintenance	Total	Benefit	5 2	(o) Benefil
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6.20	100	54,402	3X0	286'75	5,543	1071.42	144.0
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		10.683	1.0XX	11.771	10.347	204,15	5,330
57 c <	\$	10401	110	41.988	12,459	19.588.	5,812
	è :		100	100.01	14.53	17,899	6,16]
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ц Х	2010	40,683	1,956	510.14	10.0/0		1177
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	2012	40,683	2.390	13,073		7417	110*0
	1100	40.683	2,607	43,290	24,894	11,400	6.00
	F100	289.07	2.824	43,507	26,966	10,415	6,455
-		LAYOT	101	43.724	29,039	915.6	6,320
		107 01	A	1.001	31,111	8,693	6,155
				101 04	11.184	5.251	5,968
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61 21	1.00		3,612	3,612			
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			3 612	1.612	34.494	171	1,63,1
22			0.9 0	1 617	14,494	36	1,485
				1412	14 404	141	1,350
	202				14 404	92	1 227
•••	2034		1.01.	1000		1	-
	60		3,612	10.0			
38.2	2036		3,612	3,612	34,494	8	2
	2037		3.612	3,612	34,494	5	776
	2018		3.612	3,612	34,494	58 58	808
	010		1.612	3.612	367.45	08	76.2
•••			1.1.4		34,494	2	69
	,				14 404	\$	630
	ð		710.0	10.0		Ş	17
	2023		210.0	110.1			5
•••	7		3.612	10.0			
	ş		3,612	1.612	***	2 :	
4	2045		3,612	3,612	101-10	<del>;</del> :	fi
\$	010		3.612	3.612	34,494	4	2
9	2047		3,612	121915	367.70	37	22
	X VO		3,612	3.612	34,494	7.	323
17	5	1001 000		X63.476	1,347,363	X04 616	143,764
8		W (177/		1111111111			
					EIRR.	2.8%	

### Table 4.6(5/8)

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6

COST BENEFIT FLOW FOR MASTER PLAN

C.C.C.C.C.C.C.C.C.C.C.C.C.C.C.C.C.C.C.	Year 2000 2000 2000 2001 2005 2005 2005 2005	Project	Unintered and				
WWW         Condition         Condition <thcondition< th=""> <thcondit< th=""><th></th><th>100</th><th></th><th>Total</th><th>Benefit</th><th><u>0</u>{</th><th>(i)</th></thcondit<></thcondition<>		100		Total	Benefit	<u>0</u> {	(i)
2001         7.841         0         2.670         0         2.670         0         2.670         0         2.670         0         2.670         0         2.670         0         2.670         0         2.670         0 <th0< th="">         0         <th0< th=""> <th0< th=""></th0<></th0<></th0<>	•••••••••••••••••••••••••••••••••••••••	0.7 -		100 0	2	2 630	
2000         7.841         0         7.841         0         6.400           2001         7.841         0         7.841         0         6.400           2002         15.451         52         10.1007         6.647         6.647           2003         11.393         314         12.204         8.555         6.555           2004         11.393         314         12.204         8.557         6.557           2004         11.393         564         12.204         8.557         5.253           2011         11.393         564         12.204         8.573         5.253           2011         11.393         564         12.204         8.573         5.253           2011         11.393         564         12.204         8.573         5.253           2011         11.393         564         12.204         5.253         5.253           2011         11.393         564         12.443         5.753         5.753         5.753           2011         11.393         564         12.244         2.2405         5.753         5.753           2013         11.393         565         12.244         2.2405         5.754	• • • • • • • • • • • • • • • • • • • •	0.00	53	0104	Ċ	Cat 6	
2002         15,451         0         15,451         0         10,000           2003         15,451         52         55,451         6,651         6,661           2004         11,393         2,216         6,661         6,661           2004         11,393         2,411         6,563         6,563           2004         11,393         2,41         6,563         6,563           2004         11,393         2,61         11,393         6,534         6,553           2004         11,393         561         12,234         11,393         6,534           2011         11,393         663         12,234         11,393         6,534           2013         11,393         663         12,234         21,313         13,311           2014         11,393         863         12,234         21,313         13,413           2015         11,393         863         12,244         20,463         13,113           2015         11,393         863         12,244         20,463         13,111           2016         11,393         863         12,244         20,463         13,111           2016         11,393         864		1 2 2	5.6		5 0	1	>~<
2001         15.451         FC         15.333         2.2.16         16.010           2004         118.93         2.14         1.2.56410         4.4311         9.666           2004         118.93         2.14         1.2.56410         4.4311         9.666           2004         118.93         2.14         1.2.5641         4.4311         9.666           2004         11.893         2.13<1		140.1	5.0	155.21	50	00411	» c
2000         15341         103         55410         4-31         9000           2000         11393         711         12300         4-31         9000           2000         11393         711         12300         4-31         9000           2001         11393         711         12300         6-37         5.253           2011         11393         541         12,311         11,562         5.773           2011         11393         541         12,313         13,473         5.726           2011         11393         541         12,313         13,473         5.726           2011         11393         541         13,773         5.736         5.736           2011         11393         541         13,773         5.736         5.736           2011         11393         541         13,773         5.736         5.736           2011         11393         541         13,473         5.736         5.736           2011         11393         541         13,473         5.736         5.736           2011         11393         541         13,444         5.746         5.746           2011		15151	- C	115 21	9100	019.01	15
2000         11,900         2.47         2.301         0.507         5.502           2000         11,900         3111         12.206         8,535         5.230           2000         11,900         301         11,755         5.526         6.557         5.523           2001         11,900         501         12,301         11,755         5.233         5.233         5.233           2011         11,900         501         12,301         11,756         5.233         5.234           2011         11,900         501         12,331         11,756         5.234         5.246           2011         11,900         501         12,331         11,756         5.234           2011         11,900         72,511         2,1500         2,340         3.131           2011         11,900         72,511         2,1500         2,340         3.131           2011         11,900         72,511         10,44         2,4007         111           2011         10,44         10,44         2,4007         111         111           2011         10,44         10,44         2,4007         111         111           2011         10,44 <td></td> <td>15751</td> <td></td> <td>15,616</td> <td>1277</td> <td>9.600</td> <td>2.7</td>		15751		15,616	1277	9.600	2.7
2000         11,193         311         12,204         8,335         5229           2001         11,893         301         12,304         13,455         5229           2001         11,893         501         12,304         13,455         5229           2001         11,893         501         12,304         13,455         5229           2011         11,893         501         12,304         13,455         5239           2013         11,893         501         12,304         13,455         5239           2014         11,893         501         12,304         13,455         53,405         53,405           2015         11,893         502         12,548         23,607         13,415         53,405         14,41           2016         11,893         505         12,644         10,444         24,607         17,11           2016         11,893         506         7,560         2,3407         17,11           2016         10,444         10,444         24,607         17,11         17,11           2017         10,444         10,444         24,607         17,11         17,11           2017         10,444		104 1	245	UFL .	6.647	137.9	
2000         11,309         77.4         12.35/1         10,077         5.730           2001         11,899         5.31         11,762         5.239           2001         11,899         5.31         11,762         5.239           2001         11,899         5.31         11,762         5.239           2012         11,899         5.31         15,473         15,473         5.739           2013         11,899         5.31         15,433         3.1061         5.739           2014         11,899         845         12,344         2.1,944         3.1011           2015         11,899         845         12,349         3.1,311         1.1,361           2016         11,899         845         12,349         3.1,311         1.1,361           2016         11,899         845         12,349         3.1,311         1.1,361           2017         12,340         12,444         10,444         2.3,607         1.3,615         1.1,11           2018         10,444         10,444         2.4,607         1.1,11         1.1,11         1.1,11           2017         10,444         10,444         2.4,607         1.1,1,11         1.1,11		108 11		10, 21	2.352	6 762	×2.1
2000         11,893         438         2.331         11,762         5.239           2011         11,893         634         12,394         15,173         4,778           2011         11,893         634         12,394         15,173         4,778           2011         11,893         634         12,394         15,173         4,796           2011         11,893         644         12,394         15,647         12,944         2,1311           2013         11,893         887         12,244         20,238         3,043         3,043           2014         11,893         887         12,744         10,444         21,044         1,644         21,667         4,778           2019         5,044         1,044         1,044         21,667         1,131         1,131           2019         1,044         1,044         21,667         1,131         1,131         1,131           2019         1,044         1,044         21,067         1,131         1,131         1,131           2011         1,044         1,044         23,067         1,131         1,131         1,131           2011         1,044         1,044         24,067		10%	721	292 61	10.057	i i i	1 60
2000         11,803         501         12,304         13,473         4,376           2011         11,393         564         12,311         15,173         4,366           2013         11,393         601         12,331         15,173         4,366           2013         11,393         601         12,331         15,173         4,366           2014         11,393         601         12,331         3,643         3,131           2015         11,393         845         12,371         21,944         3,143           2016         11,393         845         12,371         21,944         3,143           2016         11,393         845         12,371         21,346         2,346           2016         11,393         845         12,341         2,466         1,345           2016         11,361         12,341         12,444         2,466         1,345           2016         11,361         12,444         1,444         2,466         1,41           2016         1,044         1,044         2,466         1,41         1,41           2003         1,044         1,044         2,466         2,466         1,41		11.893	2017	12.331	11.262	5.229	86 7
2010         11,890         564         7.2,471         15,173         4,366           2011         11,890         623         12,331         15,645         3,960           2013         11,890         633         12,331         15,645         3,564           2014         11,890         843         12,344         3,564         3,564           2015         11,890         843         12,344         3,564         3,564           2016         11,890         843         12,344         3,564         3,564           2016         11,890         843         12,344         3,564         3,564           2016         11,890         843         12,344         3,564         3,564           2016         1,044         1,044         2,4,067         1,181         1,111           2023         1,044         1,044         2,8,067         1,11         1,123           2023         1,044         1,044         2,8,067         1,11         1,123           2023         1,044         1,044         2,8,067         1,11         1,123           2023         1,044         1,044         2,8,067         1,123         1,123      <	12 2010	10.811	105	12 394	X97 E1	4.77K	61.5
2011         11.899         6.25         12.211         16.873         2.960           2014         11.899         641         12.514         21.544         2.540         2.540           2014         11.899         882         12.711         21.944         3.041           2015         11.899         882         12.711         21.944         3.041           2016         11.899         882         12.713         21.944         3.041           2017         11.899         882         12.713         21.944         3.041           2018         11.899         882         12.444         2.4667         1.344           2019         11.899         882         10.444         1.044         2.8667         1.341           2020         1.044         1.044         2.8667         1.351         1.341           2020         1.044         1.044         2.8667         1.351         1.341           2020         1.044         1.044         2.8667         1.351         1.342           2020         1.044         1.044         2.8667         1.351         1.342           2020         1.0444         1.044         2.8667 <td< td=""><td></td><td>102 1</td><td></td><td></td><td></td><td>4 14</td><td></td></td<>		102 1				4 14	
2013         11.399         691         12.3544         30.2594         3.645           2014         11.399         818         12.3179         3.045           2015         11.399         818         12.371         2.1794         3.1645           2016         11.399         818         12.371         2.1794         3.1645           2019         6.671         10.000         7.560         2.3466         3.1645           2019         6.671         10.004         10.044         28.067         3.1645           2010         10.044         10.044         28.067         117         117           2011         10.044         10.044         28.067         117         117           2011         10.044         28.067         117         117         117           2011         10.044         28.067         117         117         117           2011         10.044         28.067         116         117         117           2011         10.044         28.067         116         117         117           2011         10.044         28.067         116         117         117           2011         10.		106 11			223.41	8.8	
2012         11.1393         753         12.448         20.239         3.131           2014         11.1393         813         12.1394         3.101           2015         11.1393         813         12.1394         3.131           2016         11.1393         813         12.1394         3.043           2015         11.1393         813         12.1394         3.043           2016         11.1393         813         12.1394         3.043           2017         0.11.1393         813         12.1394         3.043           2018         0.11.1393         813         12.1494         3.0467         1311           2019         1.044         1.044         3.0677         1311         131           2023         1.044         1.044         3.0677         131         131           2023         1.044         1.044         3.0677         131         131           2023         1.044         1.044         3.0677         131         131           2023         1.044         1.044         3.0677         131         131           2023         1.044         1.044         3.0667         141         131     <		100			1.0.01		
2011         11,000         770         12,004         20,044		660.11	140				į
2014         11,399         81N         12,771         21,794         2040           2019         11,1399         945         7,237         23,770         2,790           2019         0,671         1,044         23,607         1,131           2021         0,641         1,044         23,607         1,131           2021         1,044         1,044         23,607         1,131           2021         1,044         1,044         23,607         1,131           2022         1,044         1,044         23,607         1,131           2023         1,044         1,044         23,607         1,131           2023         1,044         1,044         23,607         1,133           2023         1,044         1,044         23,607         1,131           2023         1,044         1,044         23,607         1,131           2023         1,044         1,044         23,607         1,131           2023         1,044         1,044         23,607         1,131           2023         1,044         23,607         2,40         2,40           2024         1,044         23,607         2,40         2,40		(42.1)	2	0101	V82-02		
2015         11,399         860         12,773         23,700         23,600           2016         11,499         860         72,110         1,311           2019         6,671         1,004         28,067         1,311           2019         1,1,499         8,67         1,004         28,067         1,311           2019         1,044         1,044         28,067         1,311           2021         1,044         1,044         28,067         1,311           2021         1,044         1,044         28,067         1,311           2021         1,044         1,044         28,067         1,311           2022         1,044         1,044         28,067         1,311           2023         1,044         1,044         28,067         1,31           2024         1,044         1,044         28,067         3,31           2023         1,044         1,044         28,067         3,31           2024         1,044         28,067         3,40         3,40           2025         1,044         28,067         3,69         3,1           2026         1,044         1,044         28,067         3,6 <td></td> <td>11,893</td> <td>818</td> <td>12.71</td> <td>21,994</td> <td>3.043</td> <td>5,26</td>		11,893	818	12.71	21,994	3.043	5,26
2016         11.892         945         12.838         23.403         2.340           2019         6.671         1,000         7,000         7,000         1,331           2019         1,044         28,067         1131           2022         1,044         28,067         1131           2023         1,044         28,067         1131           2023         1,044         28,067         1131           2023         1,044         28,067         1131           2023         1,044         28,067         1131           2023         1,044         28,067         1131           2023         1,044         28,067         1131           2023         1,044         28,067         1131           2024         1,044         28,067         1131           2023         1,044         28,067         1131      2023         2031         1,044         28,067         1131           2031         1,044         28,067         1131         1131           2032         1,044         28,067         141         1131           2033         1,044         28,067         141         121      2		11,893	238	12,775	23,700	1,780	515
2017         6.671         1,000         7,550         27,110         1,381           2019         1,044         24,007         133           2021         1,044         24,007         133           2022         1,044         24,007         133           2023         1,044         24,007         133           2023         1,044         24,007         133           2023         1,044         24,007         133           2023         1,044         24,007         133           2023         1,044         24,007         133           2023         1,044         24,007         133           2023         1,044         24,007         133           2024         1,044         24,007         133           2023         1,044         24,007         133           2033         1,044         24,007         133           2034         1,044         24,007         133           2033         1,044         24,007         133           2033         1,044         24,007         134           2033         1,044         24,007         134           2033		11,893	945	12.838.	25,405	222	5,02
2018         1,044         1,044         2,8,067         1,13           2000         1,044         2,8,067         1,13           2001         1,044         2,8,067         1,13           2002         1,044         2,8,067         1,13           2003         1,044         2,8,067         1,13           2003         1,044         1,044         2,8,067         1,13           2003         1,044         1,044         2,8,067         1,13           2003         1,044         1,044         2,8,067         1,13           2003         1,044         1,044         2,8,067         1,13           2003         1,044         1,044         2,8,067         1,13           2003         1,044         1,044         2,8,067         1,13           2003         1,044         1,044         2,8,067         1,13           2003         1,044         1,044         2,8,067         1,13           2003         1,044         1,044         2,8,067         3,14           2003         1,044         2,8,067         3,14         1,17           2003         1,044         2,8,067         3,14         1,17		6,671	600'1	7.680	27.110	135.1	4, 87,
2019     1,044     1,044     28,067     113       2021     1,044     1,044     28,067     113       2022     1,044     1,044     28,067     113       2023     1,044     1,044     28,067     113       2023     1,044     1,044     28,067     13       2023     1,044     1,044     28,067     13       2023     1,044     1,044     28,067     16       2023     1,044     1,044     28,067     16       2023     1,044     1,044     28,067     73       2023     1,044     1,044     28,067     73       2023     1,044     1,044     28,067     73       2023     1,044     1,044     28,067     73       2033     1,044     1,044     28,067     73       2034     1,044     1,044     28,067     73       2033     1,044     1,044     28,067     73       2034     1,044     1,044     28,067     73       2033     1,044     28,067     73     11       2034     1,044     28,067     73     23       2034     1,044     28,067     73       2034 <td< td=""><td></td><td></td><td>1.044</td><td>101</td><td>28,067</td><td>121</td><td>4.58</td></td<>			1.044	101	28,067	121	4.58
20201         1.044         2.8,007         1.1           20202         1.044         2.8,007         2.8,007         1.1           20203         1.044         2.8,007         2.8,007         2.8           20203         1.044         2.8,007         2.8         2.9         2.9           20203         1.044         2.8,007         2.8         2.9         2.9         2.9           20203         1.044         2.8,007         2.8         2.9			1.044	1.044	28,067	151	4
2002         1044         1044         23,007         117         24,007         117           2003         1,044         23,007         1,044         23,007         117         24,007         106           2003         1,044         1,044         23,007         117         23,007         117         24,007         25,007         106         23,007         117         24,007         25,007         26,007<			THE	1 014	24.047		1 70
2022         1044         1044         23,007         1044         23,007         104         23,007         104         23,007         106         106			1.40	104	740.94	2	
2002 2003 2003 2003 2003 2003 2003 2003					100,04	1	
2002 2003 2003 2003 2003 2003 2003 2003 2003 2003 2003 2003 2004 2005 1,044 2007 1,044 2007 1,177 1,1					100,000		
2002 2002 2002 2003 2003 2003 2003 2003 2003 2003 2003 2003 2003 2004 2005 2004 2005 2004 2005 2004 2005 2004 2005 2004 2005	• •					<u>ş</u> a	
2003 2003 2003 2003 2003 2003 2003 2003			5	5	100'87	Ř.	
2002 2002 2002 2003 2003 2003 2003 2003 2003 2003 2003 2004 2005 2004 2005 2004 2005 2004 2005 2004 2005 2004 2005 2004 2005 2004 2005 2004 2005 2004 2005 2005 2004 2005 2005 2004 2005					100,82	22	
2002 2003 2003 2003 2003 2003 2003 2003 2003 2003 2003 2003 2004 2007 2014 2007 201 2014 2007 201 2014 2007 201 2014 2007 201 2014 2007 201 201 2014 2007 201 2014 2014 2007 2014 2007 2014 2014 2007 2014 2014 2007 2014 2007 2014 2014 2007 2014 2014 2007 2014 2014 2007 2014 2014 2007 2014 2014 2014 2007 2014 2014 2007 2014 2014 2007 2014 2014 2007 2014 2014 2007 2014 2014 2007 2014 2014 2007 2014 2014 2007 2014 2014 2014 2007 2014 2				1.044	28,067	ġ:	2,14
2003         1,044         1,044         28,007         60         1,1           2003         1,044         1,044         28,007         60         1,1           2003         1,044         1,044         28,007         56         1,1           2003         1,044         1,044         28,007         56         1,1           2003         1,044         28,007         56         1,1         1,1           2003         1,044         1,044         28,007         31         1,1           2003         1,044         1,044         28,007         31         1,1           2003         1,044         1,044         28,007         31         1,1           2004         1,044         28,007         31         1,1         1,1           2004         1,044         28,007         1,1         1,1         1,1           2004         1,044         28,007         1,1         1,1         1,1         1,1         1,1           2004         1,044         28,007         1,0         1,1         1,1         1,1         1,1         1,1         1,1         1,1         1,1         1,1         1,1         1,1		_	440,1	49	28,067	4	8
2000         1,044         1,044         23,007         60         1,           20031         1,044         1,044         23,007         54         1,           20031         1,044         1,044         23,007         54         1,           20032         1,044         1,044         23,007         54         1,           20033         1,044         1,044         23,007         54         1,           20034         1,044         1,044         23,007         54         1,           20035         1,044         1,044         23,007         31         1,         1,           20037         1,044         1,044         23,007         31         1,         1,         1,         23,007         31         1,         1,         23,007         31         1,         1,         1,         23,007         31         1,         1,         1,         1,         23,007         31         1,         1,         1,         1,         1,         1,         1,         23,007         31         1,         1,         1,         1,         1,         1,         1,         1,         1,         1,         1,         1,	• •		1.044	1	28,067	\$	92.1
2000 1.044 2.8.067 54 1. 2001 1.044 2.8.067 54 1. 2003 1.044 2.8.067 54 1. 2003 1.044 2.8.067 54 1. 2003 1.044 2.8.067 31 1. 2004 1.044 2.8.067 31 1. 2004 1.044 2.8.067 31 1. 2004 1.044 2.8.067 31 2. 2004 1.044 2.8.067 31 2. 2004 1.044 2.8.067 31 2. 2004 1.044 2.8.067 1. 2004 1.044 2.8.067 1. 2004 1.004 2.8.067 1. 2004 1.004 2.8.067 1. 2004 1.			1.044	1,044	28,067	38	1,60
2001         1,044         1,044         28,067         49         1, 1,044         28,067         49         1, 1,044         1,044         28,067         49         1, 1,044         1,044         28,067         31         1, 1,044         28,067         31         1, 1,044         28,067         31         1, 1,044         28,067         31         1, 1,044         28,067         31         1, 1, 1,044         28,067         11         1, 1, 1, 1,044         28,067         11         1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1			140,1	1,044	28,067	3	4
2022         1.044         1.044         2.8,067         45         1, 2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8,067         12         2.8         1.7         2.8         2.8         2.8         1.7         2.8         2.8         2.8         2.8         1.7         2.8         2.8         2.8         2.8         2.8			1.044	1,044	28,067	67	1,32
2003     1,044     1,044     28,007     41     41       2003     1,044     1,044     28,007     31       2003     1,044     1,044     28,007     31       2003     1,044     28,007     31       2003     1,044     28,007     31       2004     1,044     28,007     31       2004     1,044     28,007     31       2004     1,044     28,007     31       2004     1,044     28,007     17       2004     1,044     28,007     17       2004     1,044     28,007     17       2004     1,044     28,007     17       2004     1,044     28,007     17       2004     1,044     28,007     17       2004     1,044     28,007     17       2004     1,044     28,007     17       2004     1,044     28,007     17       2004     1,044     28,007     11       2004     1,044     28,007     11       2004     1,044     28,007     11       2004     1,044     28,007     11       2004     1,044     28,007     11       2004     1,			1.044	1.044	28.067	45	120
2034 1.044 2.8,007 37 2035 1.044 2.8,007 37 2038 1.044 2.8,007 31 2039 1.044 2.8,007 31 2040 1.044 2.8,007 23 2040 1.044 2.8,007 17 2041 2.8,007 17 2041 1.044 2.8,007 17 2044 1.044 2.8,007 11 2044 2.8,007 110 2044 2.8,007 110 2044 2.8,007 110 2044 2.8,007 110 2044 2.8,007 110			1.044	- Pro-	28.067	4	8
2003         1.044         1.044         28.067         34           2003         1.044         1.044         28.067         34           2003         1.044         28.067         31           2003         1.044         28.067         31           2004         1.044         28.067         23           2004         1.044         28.067         21           2004         1.044         28.067         21           2004         1.044         28.067         11           2041         1.044         28.067         11           2041         1.044         28.067         11           2043         1.044         28.067         11           2044         1.044         28.067         11           2045         1.044         28.067         11           2045         1.044         28.067         11           2045         1.044         28.067         11           2045         1.044         28.067         11           2045         1.044         28.067         11           2045         1.044         28.067         11           2045         1.044			1 044	244	24.047	: :	8
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2042) 1.044 28,007 1.0 2044 28,067 1.0 2045 1.044 28,067 1.1 2046 1.044 28,067 1.1 2047 1.044 28,067 1.1 2048 1.044 28,067 1.1004			HT-0'1	1.044	28,067	2	<b></b>
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2047 1.044 28.007 1.1 2048 1.044 1.044 28.007 1.0 1.044 1.044 1.044 28.007 1.0 1.044 1.047 249.549 1.047 1.0 E.R.R. 11.8% R.G. 1.1.8%				440.1	28,067	1	'n
204.81 2.08.821 1.044 1.044 2.85.0671 101 Mai 2.08.821 4.0.773 2.49.594 1.056 99.098 1.16, E1RR: 11.8% RAC: 1.1.8%			10.1	1,044	28,067	=	N.
200,82.11 40.7771 249,598() 1,096,1361 99,098) EJRR: 11,8% AG: 1.18			4		12 90 X.2	0	
	Total	208,821	40,777	249, SWK	1,096,136	800,00	116.772
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064 1.207 1.207 1.207 1.207 1.207 1.207 1.208 1.20 (Unit: NRs, 1,000) Preconned (10°) 227399 227399 0.045 0.331 0.331 0.43 0.43 99K 0,610 Ξ 969 (SS) 3 200 8 4.2% 0.52 47.XK2 COST BENEFIT FLOW FOR MASTER PLAN ្ទរូខ្ល 000 972 1,943 3,663 5,915 5,915 5,915 5,915 7,463 7,463 7,463 7,463 7,463 7,463 7,463 7,463 7,463 7,463 7,463 2,310 2222 EIRR: BVC: ື່ 010,51 Benetic (Existing Busin) 10,2457 12,5521 12,5521 12,554 12,554 12,554 12,554 12,554 12,554 12,554 12,554 12,554 12,554 12,554 12,554 12,554 12,554 12,554 12,554 12,554 12,555 7,841 8 5.616 2.2 ş 22 Economic cost/hene/it dam/enance fotal cost cost Maintenunce 11,893 11,893 11,893 11,893 11,893 11,893 11,893 11,893 11,693 20%,871 1,893 11,893 550 191 5451 5.45 58 80 2 Project River: West Rupti 505 - 1989 - 1989 - 1989 - 1989 - 1989 - 1989 - 1989 - 1989 - 1989 - 1989 - 1980 2.2 Yar Total Ş,

(NKs.1,000)

NPV(B-C):

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Hendit         (C)         (C)         (B)           331         0         0         5,943         (C)           341         0         0         5,943         (D)           344         0         0         5,943         (D)           345         5,444         0         5,943         (D)           345         5,444         0         20,613         11,147         (D)           345         5,444         0         20,613         11,147         (D)         11,147           345         11,146         11,147         11,147         11,147         11,147         11,147           345         5,433         11,147         11,147         11,147         11,147           345         34,345         11,147         11,147         11,147         11,147           345         5,433         11,147         11,147         11,147         11,147         11,147           344         5,433         11,147         11,147         11,147         11,147         11,147           345         5,433         5,433         11,147         11,147         11,147         11,147         11,147         11,147         11,147	Year 1 1999		Economic d	Economic cost/benefit		("ALL DATION OF A	( 10~a)
WW         MAIL         0         MAIL         MAIL <th< th=""><th>0000 c</th><th>Project</th><th>Maintenance</th><th>l'otal Cost</th><th>Benefit</th><th><u></u> 0 8</th><th>(B) Benefit</th></th<>	0000 c	Project	Maintenance	l'otal Cost	Benefit	<u></u> 0 8	(B) Benefit
2000         5.581         0         6.581         0         5.901           2001         0.0000         0         0.0000         0         0.0000         0         0.0000           2001         0.0000         0         0.0000         0         0.0000         0.0000         0         0.0000           2000         21.057         955         21.0425         0.0104         0         20.013           2000         21.057         955         21.0425         0.0134         11.197         0.013           2000         21.057         955         21.0425         10.0400         0         22.061           2001         21.057         955         21.045         10.1137         22.13.061         11.197         10.137           2001         21.057         951         12.195         11.197         12.197         12.197           2001         21.057         12.195         22.196         12.197         12.197         12.197           2001         21.057         12.197         12.197         22.196         12.197         12.197           2001         21.057         22.196         12.195         22.196         12.197         12.197 <td>0000 -</td> <td>6.5X1</td> <td></td> <td>185.0</td> <td>0</td> <td>6.5XI</td> <td></td>	0000 -	6.5X1		185.0	0	6.5XI	
2001         10,000         0         10,000         0         2003         2014         2015         21         2014         2015         21         21	12/12/1	6.5X1	6	6.581	ò	5.983	ē
2002         20104         0         20104         0         2004           2004         21167         321         3444         3444         3067           2004         21167         321         30,255         30,194         11,167         11,167           2004         21167         708         21,752         20,158         11,167         13,251           2004         21,167         708         21,752         20,158         11,167         14,252           2004         21,167         1,167         71,18         21,752         20,158         11,167           2014         21,167         1,199         22,210         31,264         7,759           2015         21,167         1,199         22,210         31,264         1,1167           2016         1,167         1,199         22,210         31,264         1,1167           2017         1,167         1,199         22,210         31,264         1,1167           2016         1,167         1,199         22,210         31,264         1,1167           2017         1,167         1,199         22,210         31,264         1,1270           2016         1,177 <t< td=""><td>1002 (</td><td>10,990</td><td>0</td><td>10.900</td><td>0</td><td>9.083</td><td>3</td></t<>	1002 (	10,990	0	10.900	0	9.083	3
2000         30,104         101         30,255         5,444         20,671         20,671           2000         21,167         452         21,647         10,307         11,167         11,167           2000         21,167         395         21,752         20,158         11,167         11,167           2001         21,167         913         21,677         11,349         7,344         7,344           2001         21,167         1,197         121,87         21,647         11,169         11,167           2011         21,167         1,197         22,108         3,344         7,7144         11,277           2011         21,167         1,197         22,108         3,1344         7,7144         11,277           2011         21,167         1,197         22,213         3,446         4,597         7,7144           2011         21,167         1,197         22,213         3,446         7,7144         11,272           2011         21,167         1,197         22,213         3,446         4,597         7,7144           2011         21,167         1,197         22,213         3,446         4,597         7,7144           2011	4 2002	30,104	0	30.104	0	23,618	¢
2004         20,104         221         30,425         10,487         18,892           2007         21,167         345         21,784         12,2320         11,2320           2008         21,167         345         21,873         23,946         10,331         11,2320           2009         21,167         345         21,167         345         7,746         3,123           2001         21,167         1,139         22,1373         23,1948         7,746         3,123           2011         21,167         1,139         22,1373         22,1373         23,448         7,746           2011         21,167         1,139         22,1373         23,136         11,14         2,233           2011         21,167         1,139         22,130         3,134         7,114           2013         21,167         1,173         22,130         4,539         7,114           2013         21,167         1,173         22,230         10,205         7,114           2013         21,167         1,173         22,230         10,205         7,114           2013         21,167         1,173         22,240         10,125         4,539	5 2003	30,104	191	30.265	5.444 S	20,671	3.715
2006         21,167         442         21,691         10,311         12,200           2006         21,167         395         21,732         21,906         3,136         7,321           2006         21,167         708         21,732         21,906         3,136         7,331         9,325           2001         21,167         1,199         22,100         31,166         1,139         2,336         7,334           2011         21,167         1,139         22,210         31,346         7,346           2011         21,167         1,139         22,210         31,346         7,346           2012         21,167         1,139         22,210         31,346         7,346           2013         21,167         1,139         22,210         31,346         7,346           2013         21,167         1,139         22,210         31,346         7,346           2013         21,167         1,139         22,220         31,346         5,436           2014         21,167         1,139         22,230         4,937         5,436           2015         1,132         22,230         1,236         5,436         5,436         5,436 <t< td=""><td>6 2004</td><td>30,104</td><td>321</td><td>30,425</td><td>10,887</td><td>18,892</td><td>6.760</td></t<>	6 2004	30,104	321	30,425	10,887	18,892	6.760
2006         21,167         395         21,762         20,168         11,167           2007         21,167         713         21,167         713         9,125           2009         21,167         713         21,167         713         9,125           2010         21,167         1,139         22,213         9,126         7,144           2011         21,167         1,139         22,213         9,129         7,144           2011         21,167         1,139         22,213         9,295         7,144           2011         21,167         1,139         22,213         9,295         7,144           2011         21,167         1,139         22,213         9,295         7,144           2011         21,167         1,139         22,213         9,132         7,144           2011         21,167         1,137         22,213         9,132         7,144           2011         21,167         1,137         22,213         9,132         7,144           2011         21,167         1,173         22,243         4,133         4,539           2011         21,167         1,173         1,183         2,336         1,144	7 2005	21,367	1287	579.12	1100.01	12,220	9,218
2007         21,107         708         21,873         23,396         10,205           2008         21,107         11,119         22,311         31,546         7,736           2011         21,107         11,119         22,311         31,546         7,736           2011         21,107         1,119         22,211         31,546         7,736           2011         21,107         1,119         22,211         31,546         7,736           2011         21,107         1,119         22,211         31,546         7,736           2011         21,107         1,119         22,211         31,546         7,736           2011         21,107         1,179         22,213         31,546         7,736           2011         21,1167         1,179         22,213         31,546         7,736           2011         21,1167         1,178         22,223         31,346         31,346           2011         21,117         1,736         54,356         54,356         54,356           2011         1,726         1,726         52,306         11,36         31,346           2011         1,926         1,926         1,926         65,236	8 2006	21,167	395	21.762	20,158	11,167	10.344
2008         211.07         21.04         27.31         21.040         27.31         9.32           2009         21.107         11.067         10.31         27.31         9.326         7.746           2011         21.107         11.067         10.31         22.100         31.466         7.746           2012         21.107         1.139         22.210         31.466         7.746           2013         21.107         1.436         22.210         31.466         7.746           2014         21.107         1.436         22.210         31.466         7.746           2015         21.107         1.436         22.216         31.456         5.433         4.457           2015         21.107         1.436         22.266         13.266         5.5.296         31.45           2016         1.2026         1.926         1.926         5.5.296         31.45         4.557           2017         1.1272         22.2189         5.5.296         31.45         4.557         4.557           2016         1.926         1.926         1.926         5.5.296         31.45         4.557           2017         1.926         1.926         1.926 <t< td=""><td>9 2007</td><td>21,167</td><td>708</td><td>21,875</td><td>23,986</td><td>10.205</td><td>11,189</td></t<>	9 2007	21,167	708	21,875	23,986	10.205	11,189
2009         211.05         913         Z2100         31.640         8.231           2011         211.07         11.946         22.213         32.646         7.786           2013         211.06         1.1946         22.213         32.646         7.786           2014         211.06         1.2773         22.243         9.4,123         5.436           2014         211.06         1.2773         22.243         9.4,123         5.436           2014         211.06         1.2723         22.243         9.4,123         5.436           2014         211.06         1.2724         22.841         4.453         4.453           2015         1.2026         1.926         6.5,296         2.166         2.166           2016         1.926         1.926         6.5,296         2.166         2.166           2011         2026         1.926         6.5,296         2.166         2.166           2015         1.926         1.926         6.5,296         2.166         2.166           2016         1.926         1.926         6.5,296         2.166         2.166           2017         1.926         1.926         6.5,296         2.166 <td< td=""><td></td><td>21,167</td><td>Ę</td><td>21.94X</td><td>27,813</td><td>9,325</td><td>11,795</td></td<>		21,167	Ę	21.94X	27,813	9,325	11,795
2010         71,1,167         1,046         22,213         33,468         7,786           2011         21,167         1,138         22,332         9,295         7,114           2012         21,167         1,138         22,332         9,295         7,114           2013         21,167         1,138         22,332         9,295         5,496         5,496           2014         21,167         1,283         22,332         9,256         5,290         3,433           2019         21,167         1,284         22,866         5,290         3,433         4,459           2019         1,2926         1,926         6,5290         13,4459         5,230         13,4459           2021         1,926         1,926         1,926         6,5290         13,4459         5,230           2022         1,926         1,926         6,5290         13,459         5,230         13,4459           2023         1,926         1,926         6,5290         13,459         5,230         14,59           2023         1,926         1,926         6,5290         13,6         14,59         14,59           2023         1,926         1,926         1,926         6,	11 2009	21,167	1000	22.18	31,640	<b>X,52</b> 1	12,199
2011         211.07         1.159         22.326         39.239         7.114           2013         21.107         1.478         22.430         41.123         6.500           2014         21.107         1.478         25.240         41.123         6.500           2014         21.107         1.478         25.240         41.123         6.500           2015         21.107         1.478         25.240         31.344         4.557           2016         21.107         1.478         25.240         31.344         4.557           2017         1.6,778         25.240         31.344         4.557         4.557           2017         1.6,778         25.240         1.326         5.2.260         31.344           2018         1.926         1.926         0.5.290         31.34         4.557           2021         1.926         1.926         0.5.290         31.34         4.557           2022         1.926         1.926         0.5.290         31.34         4.557           2021         1.926         1.926         0.5.290         31.34         4.557           2022         1.926         1.926         0.5.290         1.57	12 2010	21,167	1,046	22,213	35,468	7,786	12,431
2012         21.167         1.277         22.439         4.1.123         6.500           2014         21.167         1.485         22.532         4.690         5.005           2014         21.167         1.418         22.543         5.405         4.937           2014         21.167         1.418         22.543         5.405         4.937           2014         21.167         1.411         22.773         5.405         5.436           2019         1.724         22.601         2726         6.5290         2.945           2019         1.926         1.926         1.926         6.5290         2.945           2011         21.67         1.417         22.260         1.946         2.945           2011         1.926         1.926         6.5290         2.946         2.945           2011         1.926         1.926         6.5290         1.976         1.976           2011         1.926         1.926         1.926         6.5290         1.976           2012         1.926         1.926         6.5290         1.976         1.976           2013         1.926         1.926         6.5290         1.976         1.976 </td <td>11 2011</td> <td>21,167</td> <td>1,159</td> <td>22,326</td> <td>39.295</td> <td>7,114</td> <td>12,521</td>	11 2011	21,167	1,159	22,326	39.295	7,114	12,521
2013         211.07         1,3.85         22.5.52         46.996         5,393           2014         211.07         1,4.81         2.2.65         50.778         5.4.40         4.997           2014         211.07         1,7.81         2.2.65         50.778         5.4.40         4.997           2014         211.07         1,7.81         2.2.65         50.778         5.4.40         4.997           2019         1,7.96         1,7.91         1,7.91         1,7.91         1,7.92         4.5.290         2.2.66           2019         1,9.26         1,926         1,926         6.5.290         2.2.66         2.2.66           2001         1,926         1,926         1,926         6.5.290         2.2.66         2.2.66           2002         1,926         1,926         1,926         6.5.290         1.9.76         1.9.76           2003         1,926         1,926         1,926         6.5.290         1.9.76         1.9.76           2003         1,926         1,926         1,926         6.5.290         1.9.76         1.9.76           2003         1,926         1,926         1,926         6.5.290         1.9.76           2003         1,9		21167	1.13	22,430	13.123	6,500	191.21
2014         21.167         1,498         2.2.73         5,466         5,456           2013         21.167         1,611         2.2.73         5,466         4,977           2014         21.167         1,611         2.2.73         5,466         4,977           2013         21.167         1,611         2.2.73         5,466         4,977           2014         1,611         2.2.73         5,466         5,239         2.2.66           2019         1,926         1,926         6,5.290         2.1.6         1.3.4           2012         1,926         1,926         6,5.290         2.1.7         4.529           2012         1,926         1,926         6,5.290         1.178         4.529           2012         1,926         1,926         6,5.290         1.178         4.529           2012         1,926         1,926         6,5.290         1.178         4.529           2013         1,926         1,926         6,5.290         1.178         4.529           2014         1,926         1,926         6,5.290         1.178         4.529           2013         1,926         1,926         6,5.290         1.178         4.529		11147	1.385	22 552	46.950	5.939	12.363
2015         211.167         1,171         227.38         54,463         4,957           2017         16,758         1,774         22.891         58,433         4,529           2018         1,677         1,774         22.891         58,433         4,529           2019         1,926         1,926         65,290         23.64           2010         1,926         1,926         65,290         23.64           2011         1,926         1,926         65,290         23.7           2012         1,926         1,926         65,290         13.6           2013         1,926         1,926         65,290         13.6           2014         1,926         1,926         65,290         13.6           2015         1,926         1,926         65,290         13.6           2016         1,926         1,926         65,290         13.6           2018         1,926         1,926         65,290         13.6           2019         1,926         1,926         65,290         13.6           2020         1,926         1,926         65,290         13.6           2021         1,926         1,926         65,290	T10. 9	71157	NOT 1	ž v	50.778	424.1	12.156
2010         211.07         1.724         22.801         58.433         4.529           2019         16,758         1.877         18.595         6.2.260         3134           2019         16,758         1.877         18.956         6.5.290         2566           2022         1.926         1.926         6.5.290         2566         2579         2566           2022         1.926         1.926         6.5.290         279         256         2579         2566           2022         1.926         1.926         6.5.290         126         215         256         2579         256         2579         256         2576         215         256         2579         216         21			1191	i F	207 12	1 057	1 53
COUNT         16,758         1,873         1,873         1,873         1,873         1,873         1,873         1,873         1,873         1,874         1,874         1,874         1,874         1,874         1,874         1,874         1,874         1,874         1,874         1,874         1,874         1,976         1,976         1,976         1,976         1,976         2,296         2,296         2,296         2,296         2,296         2,296         2,296         2,296         2,197         2,996         2,197         2,996         1,976         2,197         2,996         1,976         6,5,296         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         1,197         2,996         2,996         2,996         2,996         2,996         2,996         2,996         2,996         2,996         2,996         2,996         2,996         2,996         2,996         2,996			1.1	103 5	117 8¥	005 1	<b>3</b>
0000         1970         65.290         213           2001         1926         1976         65.290         213           2001         1926         1926         65.290         213           2001         1926         1926         65.290         213           2001         1926         1926         65.290         213           2001         1926         1926         65.290         214           2001         1926         1926         65.290         215           2001         1926         1926         65.290         116           2003         1926         1926         65.290         117           2003         1926         1926         65.290         121           2003         1926         1926         65.290         121           2003         1926         1926         65.290         121           2003         1926         1926         65.290         121           2003         1926         1926         65.290         121           2003         1926         1926         65.290         121           2003         1926         1926         65.290         121 </td <td></td> <td>101-17</td> <td>1 2 2 1</td> <td>202</td> <td>0000</td> <td>ALL L</td> <td></td>		101-17	1 2 2 1	202	0000	ALL L	
2001         1,726         1,926         6,5290         266           2002         1,926         1,926         6,5290         266           2002         1,926         1,926         6,5290         266           2002         1,926         1,926         6,5290         266           2002         1,926         1,926         6,5290         279           2003         1,926         1,926         6,5290         136           2004         1,926         1,926         6,5290         134           2003         1,926         1,926         6,5290         134           2004         1,926         1,926         6,5290         134           2003         1,926         1,926         6,5290         134           2004         1,926         1,926         6,5290         134           2003         1,926         1,926         6,5290         134           2004         1,926         1,926         6,5290         134           2003         1,926         1,926         6,5290         134           2004         1,926         1,926         6,5290         131           2004         1,926 <t< td=""><td></td><td></td><td>4.0</td><td>0.1</td><td>100.34</td><td></td><td>10.57</td></t<>			4.0	0.1	100.34		10.57
2001         1,326         1,326         1,326         1,326         2,256         2,157         2,15 <th2,15< th="">         2,15         2,15         &lt;</th2,15<>			1.124	740	No. 33	100	
XXXXX         XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			074.1	074	04-100	097	
2021         1,926         1,926         0.5,290         2,37           2022         1,926         1,926         0.5,290         215           2023         1,926         1,926         0.5,290         215           2024         1,926         1,926         0.5,290         136           2025         1,926         1,926         0.5,290         137           2026         1,926         1,926         0.5,290         137           2021         1,926         1,926         0.5,290         137           2023         1,926         1,926         0.5,290         137           2024         1,926         1,926         0.5,290         131           2023         1,926         1,926         0.5,290         131           2031         1,926         1,926         0.5,290         131           2033         1,926         1,926         0.5,290         131           2034         1,926         1,926         0.5,290         131           2035         1,926         1,926         0.5,290         131           2034         1,926         1,926         0.5,290         131           2034         1,926	0202 77		0761	074.1	0.7 00	3	
2022         1926 <th< td=""><td></td><td></td><td>1.926</td><td>0.26.1</td><td>02.2.00</td><td>137</td><td>20.8</td></th<>			1.926	0.26.1	02.2.00	137	20.8
2023         1,926         1,926         0,5290         196           2024         1,926         1,926         6,5290         138           2028         1,926         1,926         6,5290         134           2028         1,926         1,926         6,5290         134           2028         1,926         1,926         6,5290         134           2029         1,926         1,926         6,5290         134           2020         1,926         1,926         6,5290         134           2021         1,926         1,926         6,5290         134           2023         1,926         1,926         6,5290         134           2024         1,926         1,926         6,5290         134           2023         1,926         1,926         6,5290         134           2024         1,926         1,926         6,5290         51           2024         1,926         1,926         6,5290         51           2024         1,926         1,926         6,5290         51           2024         1,926         1,926         6,5290         51           2024         1,926         1,			1,926	1.926	65.290	512	67.1
2003         1,926         1,926         65,230         178           2003         1,926         1,926         65,230         131           2003         1,926         1,926         65,230         131           2003         1,926         1,926         65,230         131           2003         1,926         1,926         65,230         131           2003         1,926         1,926         65,230         131           2003         1,926         1,926         65,230         131           2003         1,926         1,926         65,230         134           2003         1,926         1,926         65,290         100           2003         1,926         1,926         65,290         65,290         10           2003         1,926         1,926         65,290         65,290         10           2003         1,926         1,926         65,290         65,290         10           2003         1,926         1,926         65,290         10         10           2003         1,926         1,926         65,290         51         55           2004         1,926         1,926	•••		1,926	926'1	65,290	8	6,623
2002         1,926         1,926         65,290         182           2008         1,976         1,976         65,290         187           2008         1,976         1,976         65,290         187           2009         1,976         1,976         65,290         187           2009         1,976         1,976         65,290         134           2001         1,976         1,976         65,290         134           2003         1,976         1,976         65,290         110           2011         1,926         1,926         65,290         121           2003         1,926         1,926         65,290         121           2004         1,926         1,926         65,290         57           2003         1,926         1,926         65,290         57           2004         1,926         1,926         65,290         57           2004         1,926         1,926         65,290         57           2004         1,926         1,926         65,290         57           2004         1,926         1,926         65,290         57           2004         1,926         1,92	•••		1,926	926	65.290	178	<b>6.026</b>
2025         1,926         1,926         1,926         6,5,290         147           2023         1,926         1,926         6,5,290         134           2023         1,926         1,926         6,5,290         134           2023         1,926         1,926         6,5,290         134           2023         1,926         1,926         6,5,290         134           2024         1,926         1,926         6,5,290         134           2023         1,926         1,926         6,5,290         134           2024         1,926         1,926         6,5,290         134           2023         1,926         1,926         6,5,290         51           2024         1,926         1,926         6,5,290         51           2035         1,926         1,926         6,5,290         51           2036         1,926         1,926         6,5,290         51           2039         1,926         1,926         6,5,290         51           2039         1,926         1,926         6,5,290         51           2044         1,926         1,926         6,5,290         22           2044	• •		1,926	1,926	65.290	162	5,473
2027         1,92.b         1,92.b         65.290         134           2029         1,92.b         1,92.b         65.290         101           2021         1,92.b         1,92.b         65.290         101           2022         1,92.b         1,92.b         65.290         101           2023         1,92.b         1,92.b         65.290         101           2021         1,92.b         1,92.b         65.290         101           2023         1,92.b         1,92.b         65.290         91           2024         1,92.b         1,92.b         65.290         91           2025         1,92.b         1,92.b         65.290         91           2026         1,92.b         1,92.b         65.290         91           2021         1,92.b         1,92.b         65.290         91           2022         1,92.b         1,92.b         65.290         91           2023         1,92.b         1,92.b         65.290         91           2024         1,92.b         1,92.b         65.290         91           2041         1,92.b         1,92.b         65.290         91           2042			1,926	1,926	65,290	147	4,980
2028         1.926         1.926         1.926         65.290         121           2030         1.926         1.926         1.926         65.290         110           2011         1.926         1.926         1.926         65.290         10           2011         1.926         1.926         1.926         65.290         10           2011         1.926         1.926         65.290         51         7           2012         1.926         1.926         65.290         51         7           2013         1.926         1.926         65.290         51         7           2014         1.926         1.926         65.290         51         7           2015         1.926         1.926         65.290         51         7           2014         1.926         1.926         65.290         51         7           2014         1.926         1.926         65.290         51         7           2012         1.926         1.926         65.290         51         7           2012         1.926         1.926         65.290         51         7           2040         1.926         65.290 <td></td> <td></td> <td>1,926</td> <td>1,926</td> <td>65,290</td> <td>134</td> <td>4,527</td>			1,926	1,926	65,290	134	4,527
2029         1,926         1,926         65,290         110           2021         1,926         1,926         65,290         100           2021         1,926         1,926         65,290         100           2023         1,926         1,926         65,290         100           2024         1,926         1,926         65,290         10           2023         1,926         1,926         65,290         51           2024         1,926         1,926         65,290         51           2024         1,926         1,926         65,290         51           2024         1,926         1,926         65,290         51           2024         1,926         1,926         65,290         51           2041         1,926         1,926         65,290         51           2041         1,926         1,926         65,290         51           2041         1,926         1,926         65,290         51           2041         1,926         1,926         65,290         51           2041         1,926         1,926         65,290         51           2041         1,926         1,926 <td></td> <td></td> <td>1,926</td> <td>1,926</td> <td>65.290</td> <td>121</td> <td>4,116</td>			1,926	1,926	65.290	121	4,116
2000         1,926         1,926         65,290         100           2011         1,926         1,926         65,290         91           2012         1,926         1,926         65,290         83           2013         1,926         1,926         65,290         81           2014         1,926         1,926         65,290         83           2015         1,926         1,926         65,290         81           2016         1,926         1,926         65,290         81           2019         1,926         1,926         65,290         81           2019         1,926         1,926         65,290         81           2019         1,926         1,926         65,290         31           2019         1,926         1,926         65,290         31           2019         1,926         1,926         65,290         32           2010         1,926         1,926         65,290         32           2011         1,926         1,926         65,290         32           2011         1,926         1,926         65,290         32           2011         1,926         1,926		•	1,926	1.926	65.290	110	3,743
2021         1,92.6         1,92.6         65,290         91           2023         1,92.6         1,92.6         65,290         75           2033         1,92.6         1,92.6         65,290         75           2034         1,92.6         1,92.6         65,290         75           2035         1,92.6         1,92.6         65,290         75           2034         1,92.6         1,92.6         65,290         75           2035         1,92.6         1,92.6         65,290         75           2034         1,92.6         1,92.6         65,290         75           2039         1,92.6         1,92.6         65,290         75           2039         1,92.6         1,92.6         65,290         75           2040         1,92.6         1,92.6         65,290         75           2041         1,92.6         1,92.6         65,290         75           2042         1,92.6         1,92.6         65,290         75           2043         1,92.6         1,92.6         65,290         75           2044         1,92.6         1,92.6         65,290         75           2044         1,92.6		_	1,926	926	062*59	8	3,402
2002         1,926         1,926         65,290         55           2004         1,926         1,926         65,290         75           2004         1,926         1,926         65,290         75           2005         1,926         1,926         65,290         75           2005         1,926         1,926         65,290         75           2005         1,926         1,926         65,290         75           2004         1,926         1,926         65,290         75           2004         1,926         1,926         65,290         75           2004         1,926         1,926         65,290         75           2004         1,926         1,926         65,290         75           2004         1,926         1,926         65,290         75           2004         1,926         1,926         65,290         75           2004         1,926         1,926         65,290         75           2004         1,926         1,926         65,290         75           2004         1,926         1,926         65,290         75           2004         1,926         1,926			1,926	1.926	65,290	5	8
2003         1,926         1,926         6,5200         75           2003         1,926         1,926         6,5290         75           2003         1,926         1,926         6,5290         65           2003         1,926         1,926         6,5290         65           2003         1,926         1,926         6,5290         57           2004         1,926         1,926         6,5290         57           2004         1,926         1,926         6,5290         57           2004         1,926         1,926         6,5290         73           2004         1,926         1,926         6,5290         73           2004         1,926         1,926         6,5290         73           2004         1,926         1,926         6,5290         73           2004         1,926         1,926         6,5290         73           2004         1,926         1,926         6,5290         74           2004         1,926         1,926         6,5290         74           2004         1,926         1,926         6,5290         74           2004         1,926         1,926		*	1.926	1.926	65,290	3	122
2004         1,926         1,926         6,5290         6           2005         1,926         1,926         6,5290         5           2005         1,926         1,926         6,5290         5           2005         1,926         1,926         6,5290         5           2009         1,926         1,926         6,5290         5           2009         1,926         1,926         6,5290         5           2000         1,926         1,926         6,5290         5           2001         1,926         1,926         6,5290         3           2004         1,926         1,926         6,5290         3           2004         1,926         1,926         6,5290         3           2004         1,926         1,926         6,5290         3           2004         1,926         1,926         6,5290         3           2004         1,926         1,926         6,5290         3           2004         1,926         1,926         6,5290         3           2004         1,926         1,926         6,5290         2           2004         1,926         1,926         6,529			1,926	1.926	65,290	3	2,356
2003 1926 1926 05.290 62.200 52 2003 1926 1926 05.290 51 2004 1926 1926 65.290 51 2004 1926 1926 65.290 51 2004 1926 1926 65.290 51 2004 1926 1926 65.290 20 2004 1926 1926 1926 1926 65.290 20 2004 1926 1926 1926 1926 1926 1926 1926 1926			1.926	1.926	65,290	66	2,323
2006 1926 1926 1926 65.290 77 2007 1976 1926 65.290 77 2008 1926 1926 65.290 77 2009 1926 1926 65.290 73 2001 1926 1926 65.290 23 2002 1926 1926 65.290 23 2004 1926 1926 1926 65.290 23 2004 1926 1926 1926 1926 65.290 23 2004 1926 1926 1926 1926 65.290 23 2004 1926 1926 1926 1926 1926 1926 1926 1926			1,926	1,926,1	65,290	62	22
2007         1,926         1,926         6,5200         51           2009         1,926         1,926         6,5200         51           2009         1,926         1,926         6,5200         51           2004         1,926         1,926         6,5200         31           2004         1,926         1,926         6,5200         33           2004         1,926         1,926         6,5200         33           2004         1,926         1,926         6,5200         33           2004         1,926         1,926         6,5200         33           2004         1,926         1,926         6,5200         34           2004         1,926         1,926         6,5200         34           2004         1,926         1,926         6,5200         34           2004         1,926         1,926         6,5200         34           2004         1,926         1,926         6,5200         26           2004         1,926         1,926         6,5200         26           201         1,926         1,926         6,5200         26           201         1,926         1,926	•••		1.926	1.926	65.290	57	1.920
2038         1,926         1,926         65,290         47           2009         1,926         1,926         65,290         43           2004         1,926         1,926         65,290         33           2004         1,926         1,926         65,290         33           2004         1,926         1,926         65,290         33           2004         1,926         1,926         65,290         33           2004         1,926         1,926         65,290         32           2004         1,926         1,926         65,290         32           2004         1,926         1,926         65,290         32           2004         1,926         1,926         65,290         24           2004         1,926         1,926         65,290         22           2004         1,926         1,926         65,290         24           2004         1,926         1,926         65,290         22           204         1,926         1,926         65,290         22           204         1,926         1,926         65,290         22           204         1,926         1,926			1,926	1,926	65,290	5	1.746
2039         1,950         1,926         1,926         45           2040         1,926         1,926         65,290         45           2041         1,926         1,926         65,290         35           2042         1,926         1,926         65,290         35           2043         1,926         1,926         65,290         35           2044         1,926         1,926         65,290         32           2044         1,926         1,926         65,290         32           2044         1,926         1,926         65,290         32           2044         1,926         1,926         65,290         32           2044         1,926         1,926         65,290         24           2044         1,926         1,926         65,290         26           2044         1,926         1,926         65,290         26           2044         1,926         1,926         65,290         26           2044         1,926         1,926         65,290         26           2044         1,926         1,926         65,290         26           2044         1,926         1,926			1,926	1,926	65,290	17	1,587
2040         1,926         1,926         6,5290         39           2041         1,926         1,926         6,5290         39           2042         1,926         1,926         6,5290         35           2044         1,926         1,926         6,5290         35           2044         1,926         1,926         6,5290         35           2045         1,926         1,926         6,5290         36           2046         1,926         1,926         6,5290         26           2044         1,926         1,926         6,5290         26           2044         1,926         1,926         6,5290         26           2044         1,926         1,926         6,5290         26           2044         1,926         1,926         6,5290         26           2044         1,926         6,5290         26         22           2044         1,926         1,926         6,5290         20           2044         1,926         1,926         6,5290         20           2044         1,926         1,926         6,5290         22           2041         1,926         1,926	•••		1,926	1,926	65.290	43	4
2041         1,926         1,526         65,290         35           2042         1,926         1,926         65,290         35           2044         1,926         1,926         65,290         32           2045         1,926         1,926         65,290         32           2045         1,926         1,926         65,290         26           2045         1,926         1,926         65,290         26           2045         1,926         1,926         65,290         26           2045         1,926         1,926         65,290         26           2048         1,926         1,926         65,290         27           2048         1,926         1,926         65,290         28           2048         1,976         1,926         65,290         28           2048         1,976         1,926         65,290         28           204         1,976         1,926         65,290         28           204         1,976         1,976         1,976         18           204         1,976         1,976         1,976         18			1,926	1.926	65,290	39	1
2042 1976 1.726 65.290 32 2043 1.926 1.926 65.290 22 2044 1.926 1.926 65.290 28 2046 1.926 1.926 65.290 28 2046 1.926 1.926 65.290 28 2047 1.926 1.926 65.290 28 2047 1.926 1.			1,926	1.926	65,290	5	.192
2044         1,926         1,926         0,229         29           2044         1,926         1,926         65,290         26           2045         1,926         1,926         65,290         26           2045         1,926         1,926         65,290         26           2047         1,926         1,926         65,290         26           2047         1,926         1,926         65,290         22           2048         1,926         1,926         65,290         22           2041         1,926         1,926         65,290         20           2041         1,926         1,926         65,290         22           2041         1,926         1,926         65,290         20           2041         1,926         1,926         1,84         18           201         36,230         26         18/C         14,8%			1,926	1,926	65.290	22	108
2044 1.926 1.926 0.5290 26 2045 1.926 1.926 0.5290 24 2049 1.926 1.926 0.5290 24 2041 1.926 1.926 0.5290 24 2041 1.926 1.926 0.5290 18 2041 1.926 1.926 1.926 1.926 2041 1.926 1.926 1.926 1.926 2041 1.926 1.926 1.926 1.926 1.926 2041 1.926 1			1,926	1,926	65.290	29	X6
2045 1.975 1.975 0.975 0.5290 22 2047 1.976 1.976 0.5290 20 2048 1.976 1.976 5.290 20 2048 75.562 460.488 2.551.172 144.142 BJC 1.48%			9261	926.1	047.69	27	
2047 1,926 1,926 65,290 20 2048 1,926 1,926 65,290 18 101 385,226 75,262 460,488 2,551,172 144,142 BJC 1,48%			1.926	1.926	65.290	ន	074
204.81 1.926 1.926 46.290 1.8 001 9.53226 75.262 460.4X8 2.551.172 1.84.142 5.18.172 1.48 8.02 1.48		n	1.926	926	65,290	20	673
1 255.226 75.262 460.488 2.551.172 184.142 51RR: 14.8% B/C: 1.48			1,926	1.926	AS.290	18	612
	Total	385.226	75.262	440.4XK	2.551,172	184,142	273.142
					F12.2	200 P.	
					B/C	1.48	

COST BENEFIT FLOW FOR MASTER PLAN

	COST	L BENEFIT	FLOW FOI	COST BENEFIT FLOW FOR MASTER PLAN	PLAN	-
River: Babai	ī		(R.XISUPG DESIR)	(e	(Un	(Unic NRs. 1,000)
		Peonomic cost/benefit	osi/benefit		Discounted (10 <sup>m</sup> a)	( ()n() )
Year	Polect	Maintenunce	l'otal	Benetüt	ŷ	(f)
	COST	CONT	cost	112000	Cont	Renefit
1161	185'9	o	6.581	0	1,5%	5
2 2000	6,581	0	6.581	0	5,983	0
3 2001	0000101	0	10.990	6	6,0,9	0
1 2002	20.104	0	30,104	•	17.61X	0
5 2003	30.104	161	30.265	3,445	20.671	515
7007	10.104	ĩ	30,425	168'9	18.892	4.279
2001	21,167		21.649	10,336	12,220	5,834
X 2004	1.167		21,762	12,758	11,167	6.547
9 2007	21,167		21.875	15,181	10.205	7,082
10 2008	21.167		21,988	17.603	525.9	7,465
6007 11			22,100	20,026	8.521	121.1
12 2010			22.213	22,448.	7,7%6	7.868
1102 11	21.167		3272	24,871	111.7	1926
202 14	21.167		22,439	27,293	6,500	1.906
15 2013	21.167	1,385	22.552	29,715	5,939	7.825
16 2014	21.167		20,665	32,138	5.426	7,694
17 2015	21.167	_	12.7%	34,560	1.957	7,521
18 2016		_	22,841	36,983	625.4	710.7
102 01			18,595	30,405	3,344	7,087
			1,926	1,22	315	6,757
				L	186	CP1 9

100	101 1		3	0	6,5XI	þ
<u>}</u>				- 2	5 083	ē
2000		2	140.4	5-4	1000	, c
3 2001	000001	0	10.990	5	CW0'X	5.
1 2002		0	30,104	•	22.618	ō
2003		161	30.265	3,445	20.671	1212
1001		ន	30,42.5	168'9	18,892	4.279
2,005	•	787	21,649	10,336	12,220	5,834
105		\$65	21,762	12,758	11,167	6.547
0010		708	21,875	15,181	10,205	7,082
1004 VI		10,8	21 988	17.603	5.22.6	7,465
0002 01			100	20.026	\$.521	1.11
f 00.7					7 746	7 444
		1,046	117777	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
1102 EI	21.167	1,159	នុះអ	24,871	1117	
14 2012		1,272	564.11	27,293	6.500	1.900
102 21		1,385	22,552	29,715	5,939	7,825
10.0		1 108	5 V9 CC	32,138	5,426	7,694
			1	071 71	1,957	7.521
		10.1		200.20	0.00	1111
18 2015		1.14	148-22	0000		140 1
102 61	16,758	1, 837	18,595	COF.96		1901
20 2018		1,926,1	1,926	125,14	315	6,757
21 2019		1.926	1.926	122,14	286	6, 142
1000		YCD I	926	11,23	97	5,584
		1 024	976	41.323	5	5,076
			7.0		515	4.615
10.1		1.740	044.1		10	201 2
1202		076'1	1,940	;;;		
26 2024	-	0761	0			
27 2025		926	926		8	10+10
28 2026		1,926	1.926	1,12	41	3.132
29 2027	F	1,926	1,926	41,323	134	802
30 2028		1.926	1.926	41,323	2	2,605
31 2029		1,926	1,926	22.14	110	2,368
32 2030		1.926	1,926	1,323	100	2,153
102 25		1,926	1,926	10011	16	1,957
34 2032		1,926	1,926	25,12	3	1.73
35 2033		1,926	1,926	41,323	75	1.617
36 2034	-	1,926	1,926	11,323	69	470
		1,926	1.926	41,323	78	1.237
38 2036	\$	1,926	1,926	41,220	57	517
	-	1,926	1,926	11,222	5	1,105
40 2038		1.926	1,926	41,323	47	1,004
41 2039		1.926	1,926	11,323	7	616
42 2040		1.926	1,926	22.14	39	30
11 2041		1.926	1,926	41,323	35	755
44 2042		926	1,926	41,323	দ	686
45 2043		1,926	1.926	41,323	2	624
46 2044		1,926	1,926	41,323	26	202
47 2045		1.926	1.926	41,323	4	515
48 2046		1.926	1.926	41,323	ធ	691
		1.926	926.1	1,223	20	126
		1,926		11,325	12	3N7
	Arr 241	CAF 25		1 61.1 60.6	271 7X1	1 CA 664

Table 4.6(7/8)

6

0

(NRs.1,000)

EIRR: 9.3% D/C: 0.94 NPV(B-C): -11,268

(U) (J.) (	Ycar		Economic con/henet/i	authenetit		Discounted (10%)	1 ( 1()***)
Tww         Table         0         Lable         0         Lable         0         Lable           2000         1.446         0         1.446         0         1.446         0         2.031           2001         1.446         0         1.446         0         1.446         0         2.031           2001         7.446         0         1.446         0         3.44         1.066         3.343           2001         7.460         4.2         7.944         1.066         3.343         3.364         3.343           2001         5.842         1315         5.946         1.066         3.343         3.344         3.344           2001         5.842         3.135         6.0131         1.066         3.346         3.344           2001         5.842         3.135         6.0131         1.066         3.346         3.346           2001         5.842         3.136         1.166         1.066         3.346         1.166           2001         5.842         3.135         6.0131         1.066         3.346         1.166           2001         5.842         3.136         1.166         1.166         1.166         1.16		Project	Maintenance	Tutat	Benetit	Û Û	(U) Remefit
2000         1,446         0         1,446         0         1,446         0         1,446           2000         7,540         0         1,446         0         1,446         0         1,146           2000         7,540         4         7,544         0         1,446         0         2,937           2000         5,842         126         0         1,646         1,006         1,146           2001         5,842         126         0         1,646         1,006         1,106           2001         5,842         126         0         2,546         1,006         1,106           2001         5,842         1317         5,946         1,006         1,006         1,106           2001         5,842         1317         5,946         1,006         1,006         1,106           2001         5,842         1317         5,946         1,006         1,106	33		_	_	0	1.4X6	
2000         7.440         0         7.640         0         7.640           2000         7.840         10         7.840         10         5.840           2000         5.842         137         5.944         1.906         1.400           2000         5.842         137         5.944         1.906         1.400           2000         5.842         137         5.944         1.906         1.400           2001         5.842         137         5.944         1.906         1.400           2001         5.842         137         5.944         1.906         1.400           2001         5.842         137         5.944         1.906         1.400           2001         5.842         137         5.944         1.906         1.400           2001         5.842         137         5.944         1.906         1.416           2001         5.842         137         1.416         1.416         1.416           2001         5.842         137         1.416         1.416         1.416           2001         5.842         137         1.416         1.416         1.416           2001         5.842 <td>2000</td> <td>1,4186</td> <td>ō</td> <td>1.486</td> <td>ō,</td> <td>160.1</td> <td></td>	2000	1,4186	ō	1.486	ō,	160.1	
2000         7,000         4         7,000         5,14         7,000         5,14         7,000         2,13         7,13         1,13         7,13         1,13         7,13         1,13         7,13         1,13         7,13         1,13         7,13         1,13         7,13         1,13         7,13         1,13         7,13         1,13         7,13         1,13         7,13         1,13			0	10.1	5-6	1. V. A.	
2000         7,000         4         7,000         1,00	8	008*/	<u> </u>	100. C	1414	101.4	
2000         5,842         12         5,844         1,002         1,003         1,0	3	098.1	173	TTO C	1.068	4,933	
2000         5,440         157         5,440         1,094         3,003         2,441         1,004         3,003           2000         5,442         1,181         5,440         1,181         5,440         1,094         3,003           2001         5,442         1,181         6,010         2,793         2,711         1,944	200	5.842	26	5.968	1,602	3,369	1. Se
2001         5,442         118         6,000         2,196         2,413         2,413           2003         5,842         220         6,001         2,196         2,413           2011         5,842         220         6,001         2,196         2,403           2011         5,842         220         6,001         2,196         2,196           2011         5,842         270         6,115         1,196         2,196           2011         5,842         270         6,118         4,196         1,196           2011         5,842         270         6,118         4,196         1,196           2011         5,842         270         6,118         4,196         1,196           2011         5,842         240         6,118         4,196         1,196           2011         5,842         240         6,211         4,178         1,296           2011         5,842         240         6,211         4,178         1,296           2011         5,842         240         6,111         5,173         1,296           2011         5,842         5,902         5,003         5,173         1,296	2000	5.842	157	100	1,909	3,078	1,026
2000         5,842         219         6,061         2.773         2.273           2001         5,842         210         6,135         3,187         2,146           2011         5,842         210         6,135         3,187         2,146           2012         5,842         3,13         6,135         3,187         2,146           2013         5,842         3,13         6,135         3,187         2,146           2014         5,842         3,13         6,135         3,187         1,177           2015         5,842         4,16         6,135         3,187         1,1672           2015         5,842         4,16         6,135         3,173         1,177           2016         5,842         4,16         6,211         5,175         1,1762           2017         5,842         4,17         4,771         1,177           2018         5,842         4,196         6,213         5,175         1,166           2017         5,742         5,042         4,177         1,177         1,77           2018         5,042         5,045         5,045         1,266         1,177           2018         5,045 <td>9 2007</td> <td>5.842</td> <td>18.8</td> <td>0.030</td> <td>2,3%</td> <td>2,813</td> <td>1,118</td>	9 2007	5.842	18.8	0.030	2,3%	2,813	1,118
2000         5,442         200         6,062         5,190         2,346         1           2011         5,842         312         6,134         3,984         1,961         1,961           2011         5,842         312         6,134         3,984         1,961         1,961           2011         5,842         317         6,134         3,984         1,961         1,961           2013         5,842         317         6,134         3,984         1,961         1,961           2014         5,842         3175         6,134         3,984         1,961         1,771           2015         5,842         300         520         6,523         3,986         1,773         1,961           2016         5,842         300         520         6,523         1,196         1,196           2017         1,773         5,842         520         520         5,842         1,196         1,196           2018         5,842         5,842         520         520         520         520         520         520         520         520         520         520         520         520         520         520         520         520		5,842	219	6,061	2,793	2.571	-
2010         5,842         302         6,134         3,487         3,466         1           2011         5,842         313         6,135         3,135         1,361         1,772           2013         5,842         313         6,135         3,135         1,361         1,366           2013         5,842         313         6,135         3,173         1,773         1,773           2014         5,842         313         6,135         5,373         1,001         1,773           2015         5,842         400         6,213         5,173         1,001         1,773           2016         5,842         400         6,213         5,173         1,001         1,001           2016         5,842         400         6,213         5,173         1,001         1,001           2017         5,842         5,00         5,00         5,00         1,173         1,001           2018         5,842         5,00         5,00         5,00         5,00         1,136           2019         5,842         5,00         5,00         5,00         5,00         1,136           2010         5,00         5,00         5,00         <	1 2009	5,842	250	6.092	3,190	57246	ä
2011         5,842         313         6,133         5,994         1,961           2012         5,842         314         6,133         5,994         1,961           2013         5,842         314         6,133         5,134         1,173           2014         5,842         317         4,174         1,773         1,496           2015         5,842         406         6,234         5,173         1,406           2015         5,842         406         6,234         5,173         1,406           2016         5,842         406         6,234         5,173         1,406           2017         3,773         1,273         6,023         5,966         7,11           2018         5,842         300         5,203         5,963         7,17           2019         5,842         300         5,203         5,963         7,17           2013         300         5,203         5,203         5,963         7,17           2014         5,203         5,203         5,203         5,203         5,203           2014         5,203         5,203         5,203         5,203         5,203           2014         <	2010	5,842	X	6.124	3.347	2,146	ū
2012         5,842         144         6,18         4,181         4,181         1,792           2013         5,842         173         4,011         5,173         1,195           2014         5,842         446         6,211         5,173         1,196           2015         5,842         446         6,211         5,173         1,196           2014         5,842         446         6,211         5,173         1,196           2015         5,842         446         6,111         5,173         1,196           2016         5,842         200         4,218         6,111         5,173         1,196           2017         1,778         500         4,211         5,173         1,196         771           2018         5,003         500         4,503         500         4,503         517         1,196           2019         5,003         500         5,003         500         4,503         517         1,196           2014         5,003         500         5,003         500         5,003         517         1,197           2014         5,003         5,003         5,003         5,003         5,003	2011	5,842	313	6.155	3,984	1.961	끋
2013         5.842         773         4.773         1.057           2014         5.842         473         4.773         1.057           2015         5.842         473         5.713         1.496           2016         5.842         473         5.713         1.496           2017         1.785         5.60         4.385         5.773         1.496           2018         5.842         473         6.211         5.966         771         1.496           2019         5.842         449         6.211         5.966         7.713         1.496           2010         5.842         200         5.20         5.20         5.20         5.773         1.496           2010         5.842         200         5.20         5.20         5.20         5.20         5.773         1.496           2010         5.20		5,842	Ŧ	6.186	180.4	1.792.1	2
2014         5,442         400         6,244         5,113         1,490           2013         5,542         441         5,113         1,490           2014         5,542         440         5,111         5,943         1,490           2015         5,542         440         6,111         5,946         771           2015         5,542         440         6,111         5,946         771           2016         5,542         440         6,111         5,946         771           2001         5,542         440         6,111         5,946         771           2002         5,003         520         520         4,033         70           2003         2004         5,043         1,136         1,136         1,136           2004         5,043         520         520         6,053         35           2004         5,044         520         520         6,053         35           2004         520         520         520         5,053         35           2004         520         520         5,053         35         35           2004         5204         520         520		5.842	375	112.4	4,778	1.637	ū
2015         5.842         4.11         6.779         5.573         1.067           2017         3.784         4.61         5.944         4.51         7.73           2018         5.842         4.61         5.944         4.51         7.73           2019         5.842         4.61         5.944         4.51         7.74           2019         5.842         4.61         5.944         4.51         7.74           2011         3.775         5.00         5.542         4.61         7.74           2012         2012         201         5.00         5.50         7.74           2012         2014         5.00         5.00         5.00         7.74           2012         2014         5.00         5.00         5.00         5.00         7.74           2013         2014         5.00         5.00         5.00         5.00         5.00         7.74           2014         2000         5.00         5.00         5.00         5.00         7.74           2014         2004         5.00         5.00         5.00         5.00         5.00         7.74           2004         2004         5.00		5,842	90 <del>1</del>	6.248	5,175	S67"I	Ģ
2016         5,842         666         6,511         5,966         1,246           2018         31,793         500         4,285         6,611         5,966         771           2019         31,793         500         4,285         6,051         77         77           2020         5201         5201         5201         6,651         77         77           2021         3201         5201         5201         5201         5021         77         77           20201         3201         5201         5201         5201         5201         56521         77           20202         5201         5201         5201         5201         6,621         77           20203         5201         5201         5201         6,621         77         70           20204         5201         5201         5201         6,621         77         70           20203         5201         5201         6,621         77         70         70           20204         5201         5201         6,661         77         70         70           20203         5201         5201         5201         6,661	7 2015	5.842	137	6.2.79	5.572	1.367	512.1
2017         3.7%         500         4.2%         6.30%         771           2019         2020         2020         520         4.2%         6.30%         771           2020         2021         270         270         270         770         770           2021         270         270         270         270         770         771           2022         2023         270         270         270         270         770         771           2022         2023         270         270         270         270         270         771         771           2023         270         270         270         270         270         270         271         171           2024         270         270         270         270         272         272         171         171           2024         270         270         270         270         272         272         273         273         273         273         273         273         273         273         273         274         274         274         274         274         274         274         274         274         274         27		5.842	494	110.0	5,969	64.2.1	-
2018         510         520         6.623         73           2019         201         201         500         500         500           2011         201         200         500         6.623         73           2011         2011         200         500         6.633         73           2011         2011         200         500         6.633         73           2011         2011         200         500         6.633         73           2011         2011         200         500         6.633         73           2003         500         500         6.633         73         73           2004         500         500         500         6.633         73         73           2003         500         500         500         5.633         74         73           2004         5003         500         5.633         73         74         74           2004         5004         5003         500         5.633         74         74           2004         5004         500         5.50         5.633         74         74           2004         5004<		CN7.E	8	4,285	6.300	1	3
2019         520         520         520         6.623         77           2002         2002         500         500         6.623         77           2002         2002         500         500         6.623         77           2002         2002         500         500         6.633         70           2002         2003         500         500         6.633         70           2003         2004         500         500         6.633         70           2004         500         500         500         6.633         70           2003         500         500         500         6.633         70           2004         500         500         500         6.633         70           2004         500         500         500         6.633         70           2004         500         500         500         6.633         70           2004         500         500         500         500         70           2004         500         500         500         500         70           2004         500         500         500         500         70 <td></td> <td></td> <td>520</td> <td>220</td> <td>6,623</td> <td>\$5</td> <td>1.0</td>			520	220	6,623	\$5	1.0
2021         2021 <th< td=""><td>•••</td><td></td><td>065</td><td>620</td><td>6.623</td><td>1</td><td>786</td></th<>	•••		065	620	6.623	1	786
2022         2023         2024         2025         2024         2025 <th< td=""><td></td><td></td><td>0</td><td>ç</td><td>4 6.1</td><td>101</td><td>20X</td></th<>			0	ç	4 6.1	101	20X
2002 2003 2003 2004 2005 2005 2005 2005 2005 2005 2005			00	000	4.623	2	
2002 2002 2003 2004 2005 200 200		-	Ş		14.4.4	ž	OVE
2021         2021 <th< td=""><td></td><td></td><td>0.20</td><td>040</td><td>1.1.1</td><td>95</td><td>ξĘ</td></th<>			0.20	040	1.1.1	95	ξĘ
2023         2024         2024         2024         2025           20201         20202         2020         2020         2020         2020           20202         20203         2020         2020         2020         2020         2020           20203         2020         2020         5200         5200         6.652         203           20203         20201         5200         5200         6.652         203         203           20203         5200         5200         5200         6.652         203         203           20203         5200         5200         5200         6.652         203         203           20203         5200         5200         6.652         203         203         203           20303         5200         5200         6.652         203         203         203           20304         5200         5200         6.652         203         <							
2003         520         520         520         520         520           2003         2003         520         520         520         663         50           2003         520         520         520         663         30           2003         520         520         663         30           2003         520         520         663         30           2003         520         520         663         30           2004         520         520         520         663         30           2004         520         520         520         663         30           2004         520         520         520         663         30           2004         520         520         520         663         30           2004         520         520         520         663         11           2004         520         520         520         663         11           2004         520         520         663         11         11           2004         520         663         11         11         11           2004         520							777
2000         500         500         500         6.623         50           2001         2002         500         500         6.633         55           2003         500         500         6.633         55         50         55           2004         500         500         6.633         55         50         55         55           2003         500         500         500         6.633         23		_	DZC	22		j :	~ '
2027         2027         202         203 </td <td></td> <td></td> <td></td> <td></td> <td>0.040</td> <td>3</td> <td>S.</td>					0.040	3	S.
2020         2020         6.623         203           2001         2001         500         6.623         20           2001         2001         500         500         6.623         20           2001         2001         500         500         6.623         20           2001         2001         500         500         6.623         20           2001         2001         500         500         5.623         20           2001         2001         500         5.00         5.623         20           2001         2001         500         5.00         5.623         20           2001         500         500         5.623         20         20           2001         500         500         5.623         11         11           2004         500         5.00         5.00         5.623         11           2004         500         5.00         5.00         5.00         5.00           2004         5.00         5.00         5.00         5.00         5.00           2004         5.00         5.00         5.00         5.00         5.00           20			074	070	0,043	\$	6C4
2020         520         520         6.621         27           2001         200         520         6.621         27           2001         200         520         520         6.621         27           2001         200         520         520         6.621         27           2001         200         520         520         6.621         27           2001         200         520         6.621         27         27           2001         200         520         6.621         27         27           2003         200         520         6.621         17         27           2004         2003         220         520         6.621         17           2004         520         6.621         17         17           2004         520         520         6.621         16           2004         520         520         6.621         17         17           2004         520         6.621         17         17         16           2004         520         6.621         16         17         17           2004         520         6.621			\$20	220	0.00	55	4
2000         520         520         6.623         27           2001         200         6.633         20         6.633         27           2003         2004         520         520         6.633         27           2004         520         520         6.633         27         27           2005         520         520         6.633         27         27           2005         520         520         6.633         27         27           2005         520         520         6.633         27         27           2005         520         520         6.633         17         17           2005         520         520         6.633         17         17           2005         520         520         6.633         17         17           2004         520         520         6.633         17         17           2004         520         520         6.633         17         17           2004         520         5.633         7         7         7         7           2004         520         6.633         7         7         7         7 </td <td>1 2029</td> <td></td> <td>520</td> <td>520</td> <td>6.623</td> <td>or i</td> <td>085</td>	1 2029		520	520	6.623	or i	085
2001         200         6.623         22           2003         200         5.00         6.623         23           2004         520         520         6.633         23           2005         520         520         6.633         23           2005         520         520         6.633         23           2005         520         520         6.633         23           2005         520         520         6.633         11           2005         520         520         6.633         13           2005         520         520         6.633         14           2005         520         520         6.633         13           2004         520         520         6.633         13           2004         520         520         6.633         13           2004         520         520         6.633         13           2004         520         520         6.633         13           2004         520         520         6.633         13           2004         520         6.633         13         14           2004         520 <td></td> <td></td> <td>520</td> <td>520</td> <td><b>1</b>,0,0</td> <td>12</td> <td>-</td>			520	520	<b>1</b> ,0,0	12	-
2002         220         520         520         6.623         22           2004         200         520         520         6.633         23           2004         200         520         520         6.633         23           2004         520         520         520         6.633         23           2004         520         520         6.633         17           2004         520         520         6.633         17           2004         520         520         6.633         17           2004         520         520         6.633         17           2004         520         520         6.633         17           2004         520         520         6.633         17           2004         520         520         6.633         17           2004         520         520         6.633         17           2004         520         520         6.633         17           2004         520         6.633         10         17           2004         520         6.633         17         17           2004         520         6.633 <td></td> <td></td> <td>220</td> <td>520</td> <td>6.623</td> <td>23</td> <td>14</td>			220	520	6.623	23	14
2003         520         520         6.653         20           2004         520         520         6.653         1           2004         520         520         6.633         1           2004         520         520         6.633         1           2005         520         520         6.633         1           2004         520         520         6.633         1           2004         520         520         6.633         1           2004         520         520         6.633         1           2004         520         520         6.633         1           2004         520         520         6.633         1           2004         520         520         6.633         1           2004         520         520         6.633         7           2004         520         520         6.633         7           2004         520         520         6.633         7           2004         530         520         6.633         7           2004         530         520         6.633         7           2004			520	520	6,623	ដ	
2034     520     520     520     6.623     19       2003     520     520     6.623     17       2004     520     520     6.623     17       2005     520     520     6.623     17       2004     520     520     6.623     17       2009     520     520     6.623     13       2009     520     520     6.623     13       2004     520     520     6.623     13       2041     520     520     6.623     13       2042     520     520     6.623     13       2044     520     520     6.623     13       2044     520     520     6.623     13       2045     520     520     6.623     13       2047     520     520     6.623     7       2047     520     520     6.623     7       2047     520     520     6.623     7       2047     520     520     6.623     7       2047     520     520     6.623     7       2047     520     520     6.623     7       2047     520     520     6.623     7			520	520	6.623	8	~
2005         520         520         6.623         17           2007         520         520         6.623         17           2008         520         520         6.623         16           2009         520         520         6.623         16           2009         520         520         6.623         16           2009         520         520         6.623         11           2009         520         520         6.623         11           2004         520         520         6.623         11           2004         520         520         6.623         11           2004         520         520         6.623         7         7           2004         520         520         6.623         7         7           2004         520         520         6.623         7         7           2004         520         520         6.623         7         7           2004         520         520         6.623         5         7         7           2014         101,000         124,300         2000         5.663         5         5			520	520	6,623	6	236
2003         520         520         520         6.623         15           2003         520         520         520         6.623         15           2004         520         520         520         6.623         15           2004         520         520         6.623         13           2004         520         520         6.623         13           2004         520         520         6.623         14           2004         520         520         6.623         13           2004         520         520         6.623         14           2004         520         520         6.623         13           2004         520         520         6.623         7         7           2004         520         520         6.623         7         7           2004         520         520         6.623         7         7           2004         520         520         6.623         6         7         7           2004         520         520         6.623         6         7         7         5           2004         520         6.623<			520	520	6.623	17	•
2007         520         520         520         6.623         14           2008         530         520         6.623         14           2009         520         520         6.623         11           2004         520         520         6.623         11           2004         520         520         6.623         11           2004         520         520         6.623         11           2004         520         520         6.623         11           2004         520         520         6.623         7         7           2004         520         520         6.623         7         7         7           2004         520         520         6.623         7         7         7         7           2004         520         520         6.623         6         7         7         7           2004         520         520         6.623         7         7         7         7           2004         520         520         6.623         7         7         7         7           2004         520         520         6.623 <t< td=""><td></td><td></td><td>520</td><td>520</td><td>6,623</td><td>15</td><td>195</td></t<>			520	520	6,623	15	195
2008         520         5623         13           2009         520         5633         11           2004         520         520         6.633         11           2041         520         520         6.633         10           2042         520         520         6.633         10           2043         520         520         6.633         10           2044         520         520         6.633         10           2045         520         520         6.633         1         1           2045         520         520         6.633         1         1           2044         520         520         6.633         7         7         1           2045         520         520         6.633         7         7         7         7           2047         520         520         6.633         5			520	520	6.623	4	171
2030         520         520         520         6.623         111           2040         520         520         520         6.623         11           2041         520         520         520         6.623         10           2042         520         520         520         6.623         9           2043         510         520         6.623         9           2044         520         520         6.623         9           2045         520         520         6.623         7           2044         520         520         6.623         7         7           2044         520         520         6.623         6         7         7           2044         520         520         6.623         6         7         7         7           2047         530         520         520         50.633         5			\$20	ŝ	6,623	5	161
2000         520         520         520         6.623         10           2041         2042         520         520         6.623         10           2042         520         520         6.623         9         9           2043         520         520         6.623         9         9           2044         520         520         6.623         9         9           2045         520         520         6.623         9         9           2045         520         520         6.623         9         9         20           2046         520         520         6.623         6         6         7         7           2044         530         520         6.623         6         6         6         7           2044         530         520         6.623         5         5         5         7 <td></td> <td></td> <td>520</td> <td>320</td> <td>6.623</td> <td>-</td> <td></td>			520	320	6.623	-	
2041 520 520 6,623 9 9 2042 520 5,623 9 9 2042 520 520 6,623 7 7 2044 520 520 6,623 7 7 2044 520 520 6,623 7 7 2045 2045 520 520 6,623 6 6 6,23 2047 520 520 6,623 6 6 6,23 2047 520 520 6,623 6 6 6,623 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7			520	\$20	6.623	07	133
2042 204 204 20 204 6.623 204 2.623 204 2.623 204 2.623 204 2.520 2.520 5.521 7 7 2.520 2.520 5.623 6.623 7 7 2.520 2.520 5.623 6.623 7 7 2.520 2.520 5.623 6.623 6.623 7 7 2.520 2.520 5.623 6.623 7 7 2.520 2.520 5.623 7 7 7 7 2.520 5.623 7 7 7 7 7 7 7 2.520 5.623 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7			1065	000	109.9	9	1.5
2043         520         520         6.623         K           2044         520         520         6.623         K           2044         520         520         6.623         K           2045         520         520         6.623         K           2045         520         520         6.623         K           2048         520         520         6.623         6           2048         530         520         6.623         6           2048         530         520         6.623         6           2048         530         520         6.623         6           2048         530         520         6.623         5           2048         101,994         20.309         124.293         278.649         49.484         27           301         103,994         20.309         124.293         276.648         6         576           303         103,994         20.309         124.293         276         6.623         576			520	520	6,623	0	011
2044 200 2045 520 520 6.623 7 2047 520 520 6.623 6 2047 520 520 6.623 6 2047 520 520 6.623 6 2048 520 520 6.623 5 2048 520 520 6.623 5 2048 520 520 6.623 5 2048 520 520 6.623 5 2048 520 520 520 5 2048 520 520 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5			520	\$20	6.623		8
2045 2045 520 520 6,623 6 2046 520 520 6,623 6 2047 520 520 6,623 5 2048 520 520 6,623 5 2048 520 520 6,623 5 304 101,1934 20.309 1,24,293 2,35,693 5 51RR: 4,8% 6 51RR: 4,8%			023	520	6.623	7	
2046 520 520 6.623 6 2047 520 520 6.623 5 2048 520 520 6.623 5 2048 2049 124,293 5 84,653 49,464 27 518,84 20,309 124,293 258,698 49,464 27 518,84 4,8%			520	520	6.623	9	
2047 520 520 6.423 5 2048 730 520 6.423 5 2048 103. <u>984 20.309 124.293 258.698 49.484 27</u> 51R.R. 4.8% EVC: 0.56		-	520	520	6.623	¢	
2048 2048 520 5201 6.6.2.3 51 20 814 103.084 20.309 1.24.293 2.58.6481 2.7 61RR: 4.8% BVC: 0.56			520	520	6.623	5	
103.934 20.309 1,24.293 258.6981 49.484 27 51RR: 4.8% 54C: 0.56			520	5201	6.623	5	
4,8% 0.56	l'otal	103,984	20.309	124.2931	258,648]	10,4%3	<b>I</b>
	Total	107,954	20.309	1642,451	258,69%] EIRR:	Ĩ	49,4%4
					ERR. BC:		

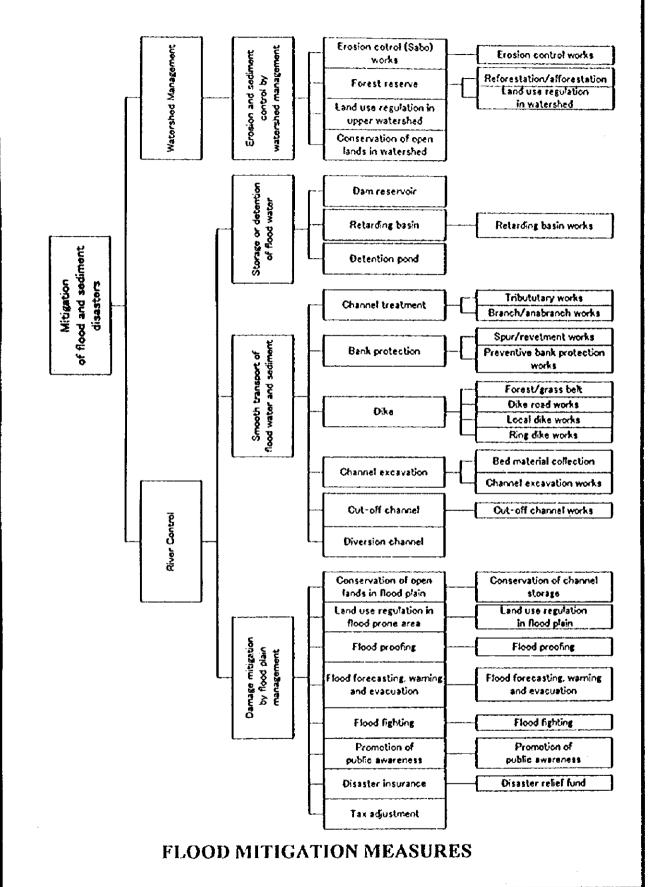
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Total         Demetit         (C)           0         1,343         0         2,323           1,4400         0         1,151         2,005           7,902         2,57         5,395           7,902         2,57         5,395           7,902         2,57         5,395           7,902         2,57         5,395           7,902         2,57         5,395           7,902         2,57         5,395           7,902         2,57         5,395           7,903         1,1725         2,813           6,022         1,1725         2,813           6,021         1,1725         2,813           6,124         1,1725         2,813           6,124         1,1725         2,813           6,124         1,1725         2,813           6,124         1,775         2,814           6,124         1,775         2,814           6,124         1,775         2,813           6,124         2,735         1,905           6,217         2,820         3,184           6,220         3,184         2,7           6,220         3,184         2,7	Project         Remetine         Cost				cost/hanetit		()+counter	wnied (10°6)
(1486)         (1486)<	(1486)         (1486)<	Year	Project		l'otat rinsi	Benefit	<u> S</u>	(B) Renefi
COORD         1.446         O         1.446         O         1.446         O         1.446         O           2001         7.840         0         7.840         0         7.840         0           2001         7.840         0         7.840         0         7.840         0           2001         7.840         1.7         5         5         5         7         0           2001         7.840         1.7         5         5         5         0         1.13           2001         7.840         1.7         5         5         0         1.13         1.13           2001         5.842         1.13         5         5         0         1.13           2011         5.842         1.13         6         1.13         1.13           2013         5.842         1.13         6         1.13         1.13           2013         5.842         1.11         2.148         1.13           2014         5.842         1.13         6         1.13           2013         5.842         1.13         6         1.14           2014         5.844         1.13         1.18     <	2000         1.446         0         1.446         0         1.446         0         2.001           2001         7.460         4         7         9         2.011         2.013           2001         7.460         4         7         9         2.013         2.013           2001         7.460         4         7         9         2.013         2.013           2001         7.460         4         7         7.962         2.57         4.913           2001         7.460         1         7         7.962         2.73         2.913           2001         5.442         2.19         0         1.135         2.19         0.034           2011         5.442         2.19         0.000         1.134         2.731         1.134           2011         5.442         2.19         0.001         1.135         2.134         1.1754           2011         5.442         2.19         0.001         1.134         2.711         1.075           2011         5.442         2.134         0.135         1.144         7.71         1.144           2011         5.442         2.134         1.1234         1.144	1111			1	3	941-1	
2001         1.5.41         0         1.5.43         0         7.860         84         7.860         84         7.964         770           2001         7.860         42         7.860         44         7.944         514           2001         7.860         44         7.944         7.944         514           2001         5.842         126         5.968         84         7.944           2001         5.842         210         6.001         1.135           2001         5.842         210         6.002         1.135           2001         5.842         210         6.001         1.135           2001         5.842         210         6.001         1.135           2001         5.842         210         6.001         1.135           2001         5.842         210         6.001         1.135           2001         5.842         210         6.014         1.135           2011         5.842         210         6.011         1.135           2011         5.842         210         6.011         1.135           2011         5.842         210         5.001         5.1184	2001         3,440         0         3,441         0         3,903           2000         7,860         42         7,860         0         5,903           2000         7,860         42         7,860         0         5,903           2000         3,842         113         7,964         710         1,060           2000         3,842         113         5,994         904         1,033           2001         3,842         113         5,994         904         1,034           2001         3,842         113         5,994         904         1,034           2001         3,842         113         5,994         1,034         2,994           2001         3,842         113         5,994         1,175         2,914           2011         3,842         113         6,1134         2,196         1,103           2011         3,842         1,134         2,196         1,103         2,114           2011         3,842         1,134         2,196         1,103         2,146           2011         3,842         1,134         2,196         1,103         2,146           2011         3,842	2 2000	1,486	ō	1.486	0	155.1	
2002         7,860         0         7,860         0         7,860         0           2004         7,860         4,2         7,964         7,14         7,14           2005         5,842         157         7,964         7,14         7,14           2006         5,842         157         7,964         7,14         7,14           2007         5,842         157         7,964         7,14         7,14           2008         5,842         157         7,962         5,74         7,14           2009         5,842         157         7,962         1,175         1,175           2001         5,842         210         6,002         1,175         1,175           2003         5,842         210         6,002         1,113         1,175           2011         5,842         210         6,013         1,113         1,175           2013         5,842         2,114         2,106         2,114         2,106           2014         5,842         2,114         2,114         2,114         2,114           2013         5,842         5,124         5,124         2,114         2,114           2013	2002         7,000         0         7,000         0         5,000 <td>3 2001</td> <td>3.543</td> <td>3</td> <td>1,543</td> <td>0</td> <td>2,928</td> <td></td>	3 2001	3.543	3	1,543	0	2,928	
2001         7,860         42         7,962         2.57           2006         5,842         12.0         5,004         794         714           2006         5,842         12.0         5,004         794         714           2006         5,842         12.0         5,004         714         774           2006         5,842         12.0         5,004         1,123         714           2001         5,842         210         6,001         1,134         714           2011         5,842         210         6,001         1,135         1,135           2011         5,842         210         6,116         2,106         2,106           2011         5,842         210         6,116         2,106         2,106           2013         5,842         210         6,114         2,106         2,106           2014         5,842         210         6,114         2,106         2,106           2015         5,842         2,125         2,067         2,118         2,067           2013         5,842         2,105         5,211         2,216         2,016           2013         5,212         5,220 <td>2000         7.860         4.2         7.902         2.37         5.99           2000         7.860         4.2         7.942         2.91         4.913           2000         5.842         129         901         2.91         2.913           2000         5.842         129         5.944         901         2.913           2001         5.842         129         5.944         901         2.914           2011         5.842         210         1.152         2.914         2.913           2011         5.842         310         6.113         1.173         2.914           2011         5.842         310         6.113         2.916         1.973           2011         5.842         310         6.113         1.173         2.916           2011         5.842         314         7.77         2.916         7.77           2011         5.842         314         2.77         2.946         7.77           2011         5.842         314         2.77         2.946         7.77           2011         5.842         314         2.77         2.946         7.77           2011         5.842</td> <td>1001 1</td> <td>7,860</td> <td>0</td> <td>7,860</td> <td>0</td> <td>5,905</td> <td></td>	2000         7.860         4.2         7.902         2.37         5.99           2000         7.860         4.2         7.942         2.91         4.913           2000         5.842         129         901         2.91         2.913           2000         5.842         129         5.944         901         2.913           2001         5.842         129         5.944         901         2.914           2011         5.842         210         1.152         2.914         2.913           2011         5.842         310         6.113         1.173         2.914           2011         5.842         310         6.113         2.916         1.973           2011         5.842         310         6.113         1.173         2.916           2011         5.842         314         7.77         2.916         7.77           2011         5.842         314         2.77         2.946         7.77           2011         5.842         314         2.77         2.946         7.77           2011         5.842         314         2.77         2.946         7.77           2011         5.842	1001 1	7,860	0	7,860	0	5,905	
2004         7,860         84         7,944         514           2006         5,842         120         5,964         770           2007         5,842         120         5,964         770           2006         5,842         120         5,061         1,142           2001         5,842         210         6,001         1,1725           2003         5,842         210         6,001         1,1725           2014         5,842         313         6,124         1,7725           2015         5,842         313         6,124         1,7725           2016         5,842         313         6,124         1,7725           2011         5,842         313         6,124         1,7725           2013         5,842         313         6,124         1,7725           2014         5,842         313         6,114         2,773           2015         5,844         1,773         5,446         1,725           2016         5,842         3,146         7,725         5,470           2015         5,542         2,106         5,116         5,164           2016         5,164         5,173 </td <td>2004         7,860         84         7,944         514         4,931           2007         5,842         150         5,994         911         4,931           2007         5,842         150         5,994         901         2,034           2009         5,842         150         5,094         901         2,034           2011         5,842         210         6,001         1,152         2,994           2011         5,842         210         1,134         7,713         2,994           2011         5,842         210         1,1754         2,194         1,037           2011         5,842         210         6,113         1,773         2,194         1,037           2011         5,842         211         6,113         1,773         2,194         1,037           2011         5,842         1,13         1,173         2,194         1,173         2,194           2011         5,842         1,13         1,173         2,194         1,173         2,194           2011         5,842         1,13         2,114         1,173         2,194         1,173           2011         5,842         2,114         &lt;</td> <td>5 2003</td> <td>7,860</td> <td>4</td> <td>7,902</td> <td>52</td> <td>5,397</td> <td>175</td>	2004         7,860         84         7,944         514         4,931           2007         5,842         150         5,994         911         4,931           2007         5,842         150         5,994         901         2,034           2009         5,842         150         5,094         901         2,034           2011         5,842         210         6,001         1,152         2,994           2011         5,842         210         1,134         7,713         2,994           2011         5,842         210         1,1754         2,194         1,037           2011         5,842         210         6,113         1,773         2,194         1,037           2011         5,842         211         6,113         1,773         2,194         1,037           2011         5,842         1,13         1,173         2,194         1,173         2,194           2011         5,842         1,13         1,173         2,194         1,173         2,194           2011         5,842         1,13         2,114         1,173         2,194         1,173           2011         5,842         2,114         <	5 2003	7,860	4	7,902	52	5,397	175
2005         5,842         126         5,908         770           2007         5,442         219         5,004         001           2007         5,442         219         5,004         001           2007         5,442         219         6,001         1,132           2008         5,442         219         6,001         1,132           2001         5,442         219         6,001         1,132           2011         5,442         313         6,124         1,723           2013         5,442         313         6,124         1,723           2014         5,442         313         6,124         1,723           2015         5,442         313         6,124         1,723           2016         5,442         313         6,124         1,733           2017         5,442         313         6,114         3,000           2018         5,442         313         6,114         3,000           2019         5,442         320         5,114         3,000           2011         1,172         5,201         5,201         5,114           2021         5,201         5,201	2000         5.442         120         5.964         770         3.306           2000         5.442         121         5.094         0.01         1.132         2.511           2000         5.442         137         5.094         0.01         1.132         2.511           2001         5.442         137         0.01         1.132         2.511         2.511           2011         5.442         137         0.01         1.132         2.511         2.511           2011         5.442         137         0.01         1.132         2.511         2.511           2011         5.442         137         0.134         1.132         2.511         2.511           2011         5.542         1.134         5.111         2.511         2.511         2.511           2011         5.542         1.134         5.111         2.511         2.511         2.511           2011         5.542         5.6137         2.547         2.547         2.541         5.514           2011         5.542         5.546         5.277         2.547         2.541         5.514           2011         5.542         5.546         5.526         5.144<	6 2004	7,860	7	1.94	514	1,013	319
2000         5,442         157         5,000         1,152           2001         5,442         159         5,000         1,152           2003         5,442         219         6,000         1,152           2004         5,442         219         6,000         1,152           2015         5,442         210         6,000         1,153           2016         5,442         210         6,000         1,153           2013         5,442         210         6,000         1,153           2014         5,442         210         6,000         1,153           2015         5,442         210         6,000         1,153           2016         5,442         210         6,000         1,153           2017         5,442         210         6,211         2,000           2018         5,444         2,000         5,000         2,000           2018         5,444         2,000         5,114         2,000           2011         1,725         5,200         5,000         5,114           2003         5,000         5,000         5,114         2,000           2004         5,000         5,000	2000         5.842         157         5,000         0.11         2.01           2001         5.842         191         5,000         1132         2.911           2001         5.842         219         6,000         1132         2.911           2011         5.842         219         6,000         1133         2.911           2011         5.842         310         6,124         1.723         2.911           2012         5.842         310         6,124         1.733         2.911           2013         5.842         310         6,124         1.733         2.911           2014         5.842         310         6,124         2.060         1.973         1.973           2014         5.842         310         6,124         2.166         1.973         1.976           2015         5.842         310         6,137         2.979         1.973         1.976           2016         5.842         310         6,137         2.979         3.060         1.976         1.976           2017         5.842         5.946         6,131         2.060         1.184         7.7           2017         5.947         <	7 2005	CHR'S	901	X,96.X	170	3,369	\$04
2007         5,442         184         6.000         1.153           2008         5,442         230         6,001         1.154           2001         5,842         230         6,001         1.154           2001         5,842         230         6,001         1.154           2011         5,842         240         6,014         1.154           2013         5,842         240         6,174         1.254           2014         5,842         240         6,114         2.400           2015         5,842         240         6,114         2.400           2016         5,842         240         6,114         2.400           2017         5,842         240         6,114         2.400           2018         5,842         4,15         2.400         2.400           2017         5,842         4,15         2.400         2.400           2018         5,842         4,15         2.400         2.400           2019         5,842         4,15         2.407         2.407           2011         5,842         4,15         2.407         2.407           2011         5,114         2.205 <td>2001         5,442         188         6.030         1.152         2.813           2003         5,442         219         6,001         1.153         2.146           2011         5,442         213         1.135         1.131         2.146           2011         5,442         213         6,113         1.723         2.146           2011         5,442         213         6,113         1.723         2.146           2011         5,442         213         6,113         1.723         2.146           2011         5,442         213         6,113         2.148         7.72           2011         5,442         213         6,113         2.148         7.72           2011         5,442         2.13         6,113         2.148         7.72           2011         5,442         2.13         6,114         2.77         2.488         1.172           2011         5,444         6,217         2.248         1.172         2.146           2012         5,544         4,11         2.148         7.7         2.488         1.107           2013         5,544         5,20         5,114         2.714         2.146</td> <td>X 2005</td> <td>5.842</td> <td>157</td> <td>200</td> <td>196</td> <td>3,078</td> <td>167</td>	2001         5,442         188         6.030         1.152         2.813           2003         5,442         219         6,001         1.153         2.146           2011         5,442         213         1.135         1.131         2.146           2011         5,442         213         6,113         1.723         2.146           2011         5,442         213         6,113         1.723         2.146           2011         5,442         213         6,113         1.723         2.146           2011         5,442         213         6,113         2.148         7.72           2011         5,442         213         6,113         2.148         7.72           2011         5,442         2.13         6,113         2.148         7.72           2011         5,442         2.13         6,114         2.77         2.488         1.172           2011         5,444         6,217         2.248         1.172         2.146           2012         5,544         4,11         2.148         7.7         2.488         1.107           2013         5,544         5,20         5,114         2.714         2.146	X 2005	5.842	157	200	196	3,078	167
2008         5,842         219         6,001         1,134           2010         5,842         230         6,02         1,725           2011         5,442         230         6,02         1,725           2011         5,442         230         6,02         1,725           2013         5,442         217         6,217         2,065           2014         5,442         217         6,217         2,066           2015         5,442         217         6,217         2,066           2014         5,442         217         6,217         2,066           2015         5,442         217         6,217         2,076           2016         5,442         217         6,217         2,076           2015         5,442         217         2,075         2,076           2016         5,442         217         2,497         2,497           2015         5,442         2,106         2,106         2,106           2016         5,442         2,126         2,118         2,118           2021         2,118         2,200         2,118         2,118           2021         2,018         2,006	2001         5.842         219         6.001         1.344         2.571           2011         5.842         219         6.134         1.734         2.446           2011         5.842         313         6.134         1.734         2.446           2011         5.842         313         6.134         1.734         2.446           2011         5.842         313         6.134         1.734         2.446           2011         5.842         313         6.134         1.734         2.467           2011         5.842         313         6.134         2.467         1.497           2011         5.842         313         6.134         2.467         1.734           2011         5.842         313         6.134         2.467         1.734           2011         5.842         313         6.134         2.467         1.734           2011         5.842         313         6.134         2.484         1.773           2011         5.842         313         6.134         2.484         1.773           2012         5.842         314         6.134         2.484         1.734           2013 <td< td=""><td>9 2007</td><td>5.842</td><td>18H</td><td>0.030</td><td>1,152</td><td>2.813</td><td>537</td></td<>	9 2007	5.842	18H	0.030	1,152	2.813	537
2000         5,442         250         6,052         1,534           2011         5,442         313         6,114         1,723           2013         5,442         313         6,114         1,723           2014         5,442         313         6,114         1,723           2015         5,442         313         6,114         1,723           2014         5,442         313         6,114         2,090           2015         5,442         313         6,114         2,091           2016         5,442         314         6,114         2,090           2017         5,442         310         6,114         2,090           2018         5,442         310         6,114         2,090           2019         5,442         310         6,114         2,079           2010         5,442         310         6,114         2,079           2011         5,442         5,200         5,000         3,144           2021         5,200         5,200         5,144         2,079           2022         5,200         5,200         5,104         3,144           2023         5,200         5,200 </td <td>2009         5,442         250         6,052         1,354         2,346           2011         5,842         3,14         6,173         1,373         2,146           2013         5,842         3,13         6,173         1,373         1,346           2014         5,842         3,13         6,173         1,946         77           2014         5,842         4,116         2,106         1,773         1,466           2014         5,842         4,71         2,797         1,946         77           2014         5,842         4,71         2,797         1,946         77           2015         5,842         4,71         2,797         1,947         77           2016         5,842         4,71         2,797         1,947         77           2015         5,842         4,71         2,797         1,184         77           2016         5,842         4,71         2,797         1,184         77           2017         5,842         5,70         3,184         77         77           2018         5,90         5,20         5,184         77         77           2013         5,00         <t< td=""><td></td><td>5.842</td><td>219</td><td>6,061</td><td>נירי</td><td>2.571</td><td>569</td></t<></td>	2009         5,442         250         6,052         1,354         2,346           2011         5,842         3,14         6,173         1,373         2,146           2013         5,842         3,13         6,173         1,373         1,346           2014         5,842         3,13         6,173         1,946         77           2014         5,842         4,116         2,106         1,773         1,466           2014         5,842         4,71         2,797         1,946         77           2014         5,842         4,71         2,797         1,946         77           2015         5,842         4,71         2,797         1,947         77           2016         5,842         4,71         2,797         1,947         77           2015         5,842         4,71         2,797         1,184         77           2016         5,842         4,71         2,797         1,184         77           2017         5,842         5,70         3,184         77         77           2018         5,90         5,20         5,184         77         77           2013         5,00 <t< td=""><td></td><td>5.842</td><td>219</td><td>6,061</td><td>נירי</td><td>2.571</td><td>569</td></t<>		5.842	219	6,061	נירי	2.571	569
2010         5,842         202         6,124         1,723           2011         5,842         3,14         2,195         1,915           2013         5,842         3,14         2,195         2,679           2014         5,842         3,14         2,195         2,679           2015         5,842         3,14         2,096         2,184           2016         5,842         3,10         5,237         2,679           2017         5,842         3,10         5,247         2,679           2018         5,842         3,10         2,195         2,679           2019         5,842         3,00         4,231         1,123           2019         5,842         3,00         4,231         1,124           2010         5,842         5,00         5,184         2,079           2011         5,842         5,00         5,184         2,118           2003         5,00         5,200         5,184         2,118           2004         5,20         5,20         5,184         2,118           2005         5,00         5,20         5,20         5,184           2005         5,00         5,2	2010         5,842         370         6,124         1,723         2,146           2011         5,842         313         6,135         1,915         1,915         1,915           2011         5,842         313         6,135         1,915         1,915         1,915           2013         5,842         313         6,137         2,916         1,915         1,915           2014         5,842         313         6,2317         2,918         1,915         1,995           2015         5,842         446         6,2311         2,488         1,097         1,995           2016         5,842         446         6,2311         2,488         1,097         1,995           2017         5,842         446         6,211         2,488         1,097         1,997           2018         5,900         5,200         5,118         1,178         5,1         2,184         7,7           2021         5,118         5,200         5,118         1,17         2,184         2,1           2022         5,000         5,200         5,118         1,17         2,184         1,1           2023         5,000         5,200         5,118 <td></td> <td>5.8.2</td> <td>250</td> <td>6.092</td> <td>1.534</td> <td>2,349</td> <td>165</td>		5.8.2	250	6.092	1.534	2,349	165
2011         5.842         313         6,153         1,913           2013         5,842         313         6,116         2,106           2014         5,842         313         6,114         2,106           2015         5,842         313         6,114         2,106           2016         5,842         406         6,217         2,497           2017         5,842         406         6,217         2,497           2018         5,842         406         6,217         2,497           2016         5,842         406         6,2111         2,497           2017         5,842         406         6,2111         2,497           2018         5,900         4,356         4,194         2,106           2019         5,201         5,200         5,200         1,184           2022         5,203         5,200         5,200         1,184           2023         5,203         5,200         5,200         1,184           2024         5,203         5,200         5,200         1,184           2025         5,203         5,200         5,200         1,184           2026         5,200 <td< td=""><td>2011         5,442         113         6,118         2,005         1,941         1,941           2011         5,442         113         6,118         2,206         1,941         1,945           2013         5,442         1,01         1,111         2,2481         1,146         1,146           2014         5,442         4,111         2,2481         2,106         1,137         1,246           2015         5,442         4,06         6,111         2,2481         1,496         1,137           2016         5,542         4,05         5,249         2,2679         1,134         77           2016         5,542         4,05         5,200         5,200         1,184         77           2017         5,200         5,200         5,200         1,184         77           2018         5,200         5,200         1,184         77           2013         5,200         5,200         1,184         77           2014         5,200         5,200         5,1184         77           2015         5,200         5,200         5,1184         77           2015         5,200         5,200         5,1184         17     &lt;</td><td>0100</td><td>5 X42</td><td></td><td>6.124</td><td>1.725</td><td>2.146</td><td><u></u></td></td<>	2011         5,442         113         6,118         2,005         1,941         1,941           2011         5,442         113         6,118         2,206         1,941         1,945           2013         5,442         1,01         1,111         2,2481         1,146         1,146           2014         5,442         4,111         2,2481         2,106         1,137         1,246           2015         5,442         4,06         6,111         2,2481         1,496         1,137           2016         5,542         4,05         5,249         2,2679         1,134         77           2016         5,542         4,05         5,200         5,200         1,184         77           2017         5,200         5,200         5,200         1,184         77           2018         5,200         5,200         1,184         77           2013         5,200         5,200         1,184         77           2014         5,200         5,200         5,1184         77           2015         5,200         5,200         5,1184         77           2015         5,200         5,200         5,1184         17     <	0100	5 X42		6.124	1.725	2.146	<u></u>
2011         5,442         3.44         6,217         2,106           2013         5,442         2,47         6,217         2,493           2014         5,442         2,47         6,217         2,493           2015         5,442         2,47         6,279         2,693           2016         5,442         2,47         6,279         2,693           2019         5,442         2,00         4,283         2,000           2010         5,442         2,00         4,283         2,000           2011         1,785         520         520         3,184         2,000           2012         5,203         520         520         5,184         2,000           2013         520         520         520         5,184         2,000           2014         5,203         520         520         3,184         2,000           2015         520         520         520         3,184         2,000           2014         5,203         520         520         3,184         2,000           2014         5,203         520         520         3,184         2,000      2014         2,004         520 <td>2013         5,442         3,44         2,106         1,792           2014         5,442         4,11         2,494         1,406           2014         5,442         4,91         2,494         1,406           2014         5,442         4,91         2,494         1,406           2014         5,442         4,91         2,494         1,406           2014         5,442         4,91         2,694         1,406           2015         5,442         4,91         2,694         1,106           2016         5,442         5,00         4,236         3,184         77           2017         5,500         5,200         5,200         3,184         77           2018         5,000         5,200         5,184         70         77           2019         5,200         5,200         5,184         70         77           2015         5,200         5,200         5,184         70         77           2015         5,200         5,200         5,184         71         77           2015         5,200         5,200         5,184         77         77           2015         5,200         <td< td=""><td></td><td>077.4</td><td></td><td></td><td>1 915</td><td>1 10</td><td>610</td></td<></td>	2013         5,442         3,44         2,106         1,792           2014         5,442         4,11         2,494         1,406           2014         5,442         4,91         2,494         1,406           2014         5,442         4,91         2,494         1,406           2014         5,442         4,91         2,494         1,406           2014         5,442         4,91         2,694         1,406           2015         5,442         4,91         2,694         1,106           2016         5,442         5,00         4,236         3,184         77           2017         5,500         5,200         5,200         3,184         77           2018         5,000         5,200         5,184         70         77           2019         5,200         5,200         5,184         70         77           2015         5,200         5,200         5,184         70         77           2015         5,200         5,200         5,184         71         77           2015         5,200         5,200         5,184         77         77           2015         5,200 <td< td=""><td></td><td>077.4</td><td></td><td></td><td>1 915</td><td>1 10</td><td>610</td></td<>		077.4			1 915	1 10	610
2011         5.442         JT3         6.217         2.487           2014         5.442         4.0         6.217         2.487           2015         5.442         4.0         6.277         2.487           2016         5.442         4.0         6.277         2.487           2017         1.7785         500         4.283         3.000           2019         5.344         500         4.284         3.000           2010         5.344         500         4.284         3.000           2011         1.7785         520         5184         2.677           2010         5.344         500         4.284         3.000           2011         1.7785         520         5184         2.677           2013         520         520         520         3.184           2014         520         520         520         3.184           2015         520         520         520         3.184           2015         520         520         520         3.184           2015         520         520         520         3.184           2014         520         520         520	2011         5,442         773         6,217         2,348         773         6,017         2,448         1,007           2014         5,442         449         6,214         2,448         1,007         711           2015         5,442         449         6,214         2,448         1,007         711           2015         5,442         449         6,211         2,409         1,114         77           2016         5,442         200         5,200         5,200         5,200         771         77           2001         5,442         200         5,200         5,200         5,200         1,144         77           2002         2001         5,200         5,200         5,200         1,144         77           2003         500         5,200         5,200         5,200         1,144         77           2004         5,200         5,200         5,200         1,144         77         77           2005         5,200         5,200         5,1144         78         77         77           2004         5,200         5,200         5,200         1,144         17         77           2005 <t< td=""><td></td><td>1 1 1 1</td><td></td><td>121</td><td>901</td><td>202.1</td><td>610</td></t<>		1 1 1 1		121	901	202.1	610
2010         5.842         4.05         6.243         2.453         2	2011         3.842         4.00         5.241         2.471         1.400           2014         5.842         4.00         6.211         2.679         1.101           2015         5.842         4.00         6.211         2.679         1.107           2016         5.842         4.00         6.211         2.679         1.107           2017         3.842         4.00         6.211         2.679         1.207           2018         5.842         4.00         5.200         5.200         1.184         77           2010         5.842         5.00         5.200         5.200         1.184         77           2011         2.000         5.200         5.200         5.200         1.184         77           2012         5.200         5.200         5.200         5.200         1.184         77           2013         5.200         5.200         5.200         5.200         1.184         77           2014         5.200         5.200         5.200         5.200         1.184         77           2014         5.200         5.200         5.200         5.200         1.184         17           2014						1 617	204
2014         5.442         4.06         6739         2746           2013         5.842         4.06         6719         2746           2014         5.842         4.06         6719         2746           2015         5.842         4.06         6711         2079           2016         5.842         4.06         6711         2079           2017         5.202         5.203         5.00         4.283           2021         5.203         520         5.203         5.1184           2023         5.003         520         5.1184         2079           2024         5.203         520         520         5.1184           2025         5203         520         5.1184         5090           2024         520         520         5.1184         5090           2025         5203         5203         5184         5184           2024         5203         5200         5184         5184           2025         5203         5203         5184         5184           2024         5204         5203         5184         5184           2023	2014         XM2         400         X234         400         771           2017         3,842         400         4,233         3,000         771           2018         5,842         400         4,233         3,000         771           2019         5,842         400         4,233         3,000         771           2010         5,842         400         4,233         3,000         771           2010         5,842         400         4,233         3,000         771           2010         5,842         400         4,233         3,000         771           2011         1,784         77         3,000         7,184         77           2011         2,700         5,20         5,184         7,1         77           2012         5,20         5,20         3,184         7,1         77           2013         5,20         5,20         3,184         7,1         77           2011         2,70         5,184         7,1         7,1         7,1           2011         2,20         5,20         3,184         7,1         7,1           2013         2,01         2,00         3		2442°C	2	11-0			
2015         5.644         4.07         6.279         2.679           2017         5.342         4.09         4.231         2.679           2018         5.342         4.09         4.231         2.690           2019         5.342         4.09         4.231         2.690           2010         5.342         500         4.231         2.690           2011         5.342         500         520         3.184           2021         5.342         500         520         3.184           2021         5.200         520         520         3.184           2021         520         520         520         3.184           2023         520         520         520         3.184           2024         520         520         520         3.184           2025         520         520         520         3.184           2025         520         520         520         3.184           2030         520         520         520         3.184           2031         520         520         520         3.184           2031         520         520         5.184         5	2015         5.842         4.77         6.279         2.679         1.267           2017         1.778         500         5.20         5.20         77           2017         1.778         500         5.20         5.20         77           2017         1.778         500         5.20         5.20         77           2017         5.842         40         5.20         5.20         77           2018         5.90         520         520         3.184         77           2019         520         520         3.184         77         77           2010         520         520         3.184         77         77           2011         5.842         3.00         520         3.184         77           2011         5.842         520         5.184         77         77           2015         520         520         3.184         77         77           2015         520         520         3.184         77         77           2015         520         520         3.184         17         77           2013         520         520         3.184         17		CAN'S		9779	10 + 11 ·		
2016         5.842         4.66         6.111         2.870           2017         3.784         4.66         6.111         2.870           2018         3.785         520         4.283         3.066           2021         520         520         520         3.184           2022         520         520         520         3.184           2023         520         520         520         3.184           2024         520         520         520         3.184           2025         520         520         520         3.184           2025         520         520         520         3.184           2025         520         520         520         3.184           2025         520         520         520         3.184           2025         520         520         520         3.184           2026         520         520         520         3.184           2021         520         520         520         3.184           2022         520         520         520         3.184           2031         520         520         520         3.184 <td>2016         5,842         469         6,311         2,870         1,240           2017         3,783         300         4,283         3,184         771           2017         3,783         300         4,283         3,184         771           2017         3,783         320         520         3,184         771           2010         520         520         3,184         771           2011         2011         2,283         3,184         771           2012         520         520         3,184         771           2013         520         520         3,184         771           2014         520         520         3,184         171           2015         520         520         3,184         171           2014         520         520         3,184         171           2014         520         520         3,184         171           2014         520         520         3,184         171           2014         520         520         3,184         171           2014         520         520         3,184         171           2014</td> <td></td> <td>5,842</td> <td>107</td> <td>6,279</td> <td>2.679</td> <td>1,367</td> <td>n</td>	2016         5,842         469         6,311         2,870         1,240           2017         3,783         300         4,283         3,184         771           2017         3,783         300         4,283         3,184         771           2017         3,783         320         520         3,184         771           2010         520         520         3,184         771           2011         2011         2,283         3,184         771           2012         520         520         3,184         771           2013         520         520         3,184         771           2014         520         520         3,184         171           2015         520         520         3,184         171           2014         520         520         3,184         171           2014         520         520         3,184         171           2014         520         520         3,184         171           2014         520         520         3,184         171           2014         520         520         3,184         171           2014		5,842	107	6,279	2.679	1,367	n
2017         3.785         500         4.285         3.000           2019         2010         520         4.285         3.184           2001         520         520         520         3.184           2002         520         520         520         3.184           2003         520         520         520         3.184           2003         520         520         520         3.184           2003         520         520         520         3.184           2003         520         520         520         3.184           2003         520         520         520         3.184           2003         520         520         520         3.184           2004         520         520         520         3.184           2003         520         520         520         3.184           2004         520         520         520         3.184           2003         520         520         520         3.184           2004         520         520         5.184         520           2014         520         520         3.184         520      <	2011         3,785         500         4,285         3,000         771           2001         2001         200         520         3,184         77           2002         2001         200         520         3,184         77           2003         2001         200         520         3,184         77           2003         2001         520         520         3,184         77           2003         2001         520         520         3,184         77           2003         520         520         3,184         77         77           2004         520         520         3,184         77         77           2005         520         520         3,184         77         77           2004         520         520         3,184         78         77           2005         5200         5,184         71         77         77           2005         5200         5,184         71         77         77           2004         520         520         3,184         71         77           2005         520         520         3,184         17         77	18 2016	5.842	691	0,110,0	2,870	6rc'1	268
2018         520         520         520         3,184           2010         520         520         5,184           2021         520         520         5184           2021         520         520         5184           2021         520         520         5184           2021         520         520         5184           2021         520         520         5184           2021         520         520         520           2022         520         520         5184           2023         520         520         5184           2025         520         520         5184           2025         520         520         5184           2025         520         520         5184           2025         520         520         5184           2035         520         520         5184           2035         520         520         5184           2036         520         520         5184           2035         520         520         5184           2034         520         520         5184           2034 </td <td>2018         520         520         3,184         85           2019         200         520         3,184         77           2011         200         520         3,184         77           2021         200         520         3,184         77           2021         200         520         3,184         77           2021         200         520         3,184         77           2021         200         520         3,184         77           2021         520         520         3,184         77           2022         520         520         3,184         77           2023         520         520         3,184         77           2024         520         520         3,184         77           2025         520         520         3,184         77           2026         520         3,184         77         57           2021         520         520         3,184         17           2023         520         520         3,184         17           2034         520         520         3,184         17           2034<td></td><td>1.785</td><td>200</td><td>4,285</td><td>3,060</td><td>ā</td><td>•</td></td>	2018         520         520         3,184         85           2019         200         520         3,184         77           2011         200         520         3,184         77           2021         200         520         3,184         77           2021         200         520         3,184         77           2021         200         520         3,184         77           2021         200         520         3,184         77           2021         520         520         3,184         77           2022         520         520         3,184         77           2023         520         520         3,184         77           2024         520         520         3,184         77           2025         520         520         3,184         77           2026         520         3,184         77         57           2021         520         520         3,184         17           2023         520         520         3,184         17           2034         520         520         3,184         17           2034 <td></td> <td>1.785</td> <td>200</td> <td>4,285</td> <td>3,060</td> <td>ā</td> <td>•</td>		1.785	200	4,285	3,060	ā	•
2000         520         520         520         5184           20020         520         520         5184           20021         520         520         5184           20023         520         520         5184           20024         520         520         5184           20025         520         520         5184           20025         520         520         5184           20025         520         520         5184           20025         520         520         5184           20026         520         520         5184           20025         520         520         5184           20031         520         520         5184           20032         520         520         5184           20033         520         520         5184           20034         520         520         5184           20035         520         520         5184           20035         520         520         5184           20035         520         520         5184           2036         520         520         5184	2000         520         520         3144         77           2001         200         520         520         3144         77           2002         520         520         520         3144         77           2003         520         520         520         3144         76           2003         520         520         520         3144         70           2003         520         520         520         3144         70           2003         520         520         520         3144         70           2003         520         520         3144         70         70           2004         520         520         3144         70         70           2003         520         520         3144         71         70           2004         520         520         3144         71         70           2004         520         520         3144         71         70           2004         520         520         3144         71         70           2004         520         520         3144         71         70           2004 <td></td> <td></td> <td></td> <td>00</td> <td>3.1%4</td> <td>83,</td> <td>•7</td>				00	3.1%4	83,	•7
2000         500         500         500         510           2001         2001         500         510         1,184           2002         520         520         510         1,184           2003         520         520         5118         1,184           2003         520         520         5118         1,184           2003         520         520         520         1,184           2003         520         520         520         1,184           2003         520         520         520         1,184           2003         520         520         520         1,184           2003         520         520         5104         520         1,184           2004         520         520         520         1,184         1,184           2003         520         520         520         1,184         1,184           2004         520         520         520         1,184         1,184           2004         520         520         520         1,184         1,184           2004         520         520         520         1,184         1,184	2000         200 <td></td> <td></td> <td></td> <td></td> <td>1.2</td> <td>ł</td> <td></td>					1.2	ł	
2020         520         520         520         510           2021         520         520         51184           2023         520         520         51184           2023         520         520         51184           2024         520         520         51184           2025         520         520         51184           2025         520         520         51184           2025         520         520         51184           2025         520         520         51184           2020         520         520         51184           2021         520         520         51184           2023         520         520         51184           2033         520         520         51184           2034         520         520         51184           2035         520         520         51184           2035         520         520         51184           2035         520         520         51184           2035         520         520         51184           2036         520         520         51184	2020         520         520         520         510         520         510         520         510         520         510         520         510         520         510         520         510         520         510         520         510         520         510         520         510         520         510         520         510         520         510         520         511         64 <th64< th=""> <th64< th=""> <th64< th=""></th64<></th64<></th64<>			2				, -
2021         220         220         220         21464           2023         2024         520         520         3.1464           2025         520         520         520         3.1464           2025         520         520         51.164           2025         520         520         51.164           2025         520         520         51.164           2025         520         520         51.164           2025         520         520         51.164           2025         520         520         51.164           2025         520         520         51.164           2025         520         520         51.164           2035         520         520         51.164           2035         520         520         51.164           2035         520         520         51.164           2035         520         520         51.164           2035         520         520         51.164           2035         520         520         51.164           2035         520         520         51.164           2035         520	2001         200         520         520         5184         56           2003         2004         520         520         5184         56           2003         520         520         520         5184         56           2003         520         520         5184         56         57           2003         520         520         5184         56         57           2003         520         520         5184         50         57           2003         520         520         5184         50         57           2003         520         520         5184         50         57           2004         520         5184         11         57         27           2003         520         520         5184         17           2004         520         520         5184         17           2005         5184         13         13         17           2004         520         520         5184         17           2004         520         5184         17         17           2004         520         5184         17         17			22		J, 184	5.3	
20022         520         520         520         5184           20024         520         520         520         5184           20025         520         520         520         5184           20025         520         520         520         5184           20025         520         520         520         5184           20025         520         520         520         5184           2002         520         520         520         5184           2003         520         520         520         5184           2003         520         520         520         5184           2003         520         520         5184         520           2004         520         520         5184         520           2014         520         520         5184         520           2014         520         520         5184         520           2014         520         520         5184         520           2014         520         520         5184         520           2014         520         520         5184         520           2	2022         520         520         520         520         5184         55           2023         2024         520         520         520         5184         55           2025         520         520         520         520         5184         55           2025         520         520         520         520         1184         44           2025         520         520         520         1184         50         52           2025         520         520         520         520         1184         50           2025         520         520         520         1184         10         50           2026         5200         520         1184         11         50         52         1184         11           2031         520         520         5184         11         52         50         52         50         52         50         52         50         52         50         52         50         52         50         52         50         52         50         50         50         50         50         50         50         50         50         50         5			20	520	121.1	ł	•
2023         520         520         520         5184           2025         520         520         5184           2025         520         520         5184           2025         520         520         5184           2025         520         520         5184           2025         520         520         5184           2025         520         520         5184           2031         520         520         5184           2032         520         520         5184           2033         520         520         5184           2034         520         520         5184           2035         520         530         5184           2035         520         530         5184           2035         520         530         5184           2035         520         530         5184           2036         520         530         5184           2035         520         530         5184           2036         520         530         5184           2036         520         5304         5184           2040 </td <td>2023         520         520         520         3184         53           2024         202         520         520         3184         54           2025         520         520         3184         54         50           2025         520         520         3184         50         520         3184         56           2025         520         520         520         3184         30         3184         30           2035         520         520         520         3184         30         3184         30           2035         520         520         3184         30         3184         31         31           2035         520         520         3184         11         32         32           2035         520         520         3184         11         31         31           2035         520         520         3184         11         31         31         31           2035         520         520         3184         11         31         31         31         31         31         31         31         31         31         31         31</td> <td></td> <td></td> <td>520</td> <td>520</td> <td>3.184</td> <td>58</td> <td>.,</td>	2023         520         520         520         3184         53           2024         202         520         520         3184         54           2025         520         520         3184         54         50           2025         520         520         3184         50         520         3184         56           2025         520         520         520         3184         30         3184         30           2035         520         520         520         3184         30         3184         30           2035         520         520         3184         30         3184         31         31           2035         520         520         3184         11         32         32           2035         520         520         3184         11         31         31           2035         520         520         3184         11         31         31         31           2035         520         520         3184         11         31         31         31         31         31         31         31         31         31         31         31			520	520	3.184	58	.,
2024         520         520         520         31.84           2025         520         520         31.84           2025         520         520         31.84           2025         520         520         31.84           2025         520         520         31.84           2025         520         520         31.84           2025         520         520         31.84           2025         520         520         31.84           2031         520         520         31.84           2032         520         520         31.84           2033         520         520         31.84           2034         520         520         31.84           2035         520         520         31.84           2035         520         520         31.84           2035         520         520         31.84           2034         520         520         31.84           2035         520         520         31.84           2035         520         520         31.84           2035         520         520         31.84      2	2024         520         520         520         320         3184         44           2025         520         520         520         3184         46           2025         520         520         520         3184         46           2025         520         520         5184         46           2025         520         520         3184         30           2026         520         520         3184         30           2031         520         520         3184         30           2031         520         520         3184         30           2031         520         520         3184         11           2031         520         520         3.184         17           2031         520         520         3.184         17           2033         520         520         3.184         17           2034         520         520         3.184         17           2035         520         520         3.184         17           2034         520         520         3.184         17           2034         520         520	25 2023		520	520	3,184	3	••
2025         520         520         520         518           2027         520         520         520         3184           2028         520         520         520         3184           2029         520         520         518         520         3184           2031         520         520         520         3184         520         3184           2031         520         520         520         5184         520         3184           2033         520         520         520         5184         520         3184           2033         520         520         520         3184         520         3184           2034         520         520         520         5184         520         3184           2035         520         520         520         5184         520         3184           2035         520         520         520         5184         520         3184           2034         520         520         520         5184         520         3184           2034         520         520         520         5184         520         5184	2025         520         1,184         44           2027         2028         520         3,184         40           2028         520         520         3,184         30           2029         520         520         3,184         30           2020         520         520         3,184         30           2031         520         520         3,184         30           2033         520         520         3,184         17           2034         520         520         3,184         17           2035         520         520         3,184         17           2034         520         520         3,184         17           2035         520         520         3,184         17           2034         520         520         3,184         17           2035         520         520         3,184         17           2036         5304         520         3,184         17           2035         530         530         3,184         17           2036         5304         520         3,184         17           20315         53			520	520	3,184	4	••
2020         520         520         520         5184           2023         520         520         5184           2023         520         520         5184           2023         520         520         5184           2023         520         520         5184           2033         520         520         5184           2033         520         520         5184           2033         520         520         5184           2034         520         520         5184           2035         520         5184         520         5184           2035         520         520         5184         520         5184           2035         520         520         5184         520         5184           2035         520         520         5184         520         5184           2035         520         520         5184         520         5184           2043         520         520         5184         520         5184           2045         520         520         5184         520         5184           2045         520 <td< td=""><td>2027         202         203         21144         203&lt;</td><td></td><td></td><td>15</td><td>U¢\$</td><td>121</td><td>4</td><td>267</td></td<>	2027         202         203         21144         203<			15	U¢\$	121	4	267
CODE         S20         S20         S20         S10           2025         520         520         510         51144           2030         520         520         510         51144           2031         520         520         5104         520         51144           2031         520         520         520         51144           2031         520         520         51144         520         51144           2031         520         520         520         51144         520         51144           2031         520         520         520         51144         520         51144           2031         520         520         520         51144         520         51144           2031         520         520         520         51144         520         51144           2031         520         520         520         51144         520         51144           2045         520         520         51144         520         51144           2045         520         520         51144         520         51144           2045         520         520 <td< td=""><td>2020         521         521<td></td><td></td><td></td><td></td><td>1.1</td><td>UT.</td><td></td></td></td<>	2020         521         521 <td></td> <td></td> <td></td> <td></td> <td>1.1</td> <td>UT.</td> <td></td>					1.1	UT.	
COL         Stor         Stor <ths< td=""><td>CONSTRUCT         STOR         STOR</td><td></td><td></td><td></td><td></td><td>Nal C</td><td>2</td><td></td></ths<>	CONSTRUCT         STOR					Nal C	2	
2025         520         520         520         540           2031         520         520         5184           2032         520         520         5184           2033         520         520         5184           2033         520         520         5184           2033         520         520         5184           2034         520         520         5184           2035         520         520         5184           2034         520         520         5184           2035         520         520         5184           2034         520         520         5184           2035         520         520         5184           2035         520         520         5184           2036         520         520         5184           2040         520         520         5184           2041         520         520         5184           2043         520         520         5184           2044         520         520         5184           2045         520         520         5184           2045 <td>2003         520<td></td><td></td><td>A.C.</td><td></td><td></td><td>3 7</td><td>iá</td></td>	2003         520 <td></td> <td></td> <td>A.C.</td> <td></td> <td></td> <td>3 7</td> <td>iá</td>			A.C.			3 7	iá
2020         520         520         520         5.104           2010         520         520         5.104           2011         520         520         3.104           2013         520         520         3.104           2014         520         520         3.104           2015         520         520         3.114           2015         520         520         3.114           2015         520         520         3.114           2015         520         520         3.114           2015         520         520         3.114           2015         520         520         3.114           2016         520         520         3.114           2015         520         520         3.114           2016         520         520         3.114           2015         520         520         3.114           2015         520         520         3.114           2015         520         520         3.114           2014         520         520         3.114           2014         520         520         3.144      2	2020         2020         520         520         5184         27           2001         200         520         520         3.184         27           2001         200         520         520         3.184         27           2001         200         520         3.184         27           2001         200         520         3.184         27           2001         200         520         3.184         17           2003         520         520         3.184         17           2004         520         520         3.184         17           2005         520         520         3.184         17           2004         520         5.184         17         20           2004         520         5.184         17         20           2004         520         5.184         11         20           2004         520         5.184         11         20           2004         520         5.184         11         20           2004         520         5.184         11         20           2004         520         5.184         1			076	10.0	1	3	•
2000         520         520         520         5184           2001         520         520         5184           2003         520         520         3.184           2003         520         520         3.184           2003         520         520         3.184           2004         520         5184         520         3.184           2005         520         520         3.184         520         3.184           2005         520         520         5.184         520         3.184           2004         520         520         5.184         520         3.184           2004         520         520         3.184         520         3.184           2004         520         520         3.184         520         3.184           2004         520         520         3.184         520         3.184           2004         520         520         3.184         520         3.184           2004         520         520         3.184         520         3.184           2004         520         520         3.184         520         3.184	2000         520         520         1184         27           2001         200         520         3.184         27           2003         200         520         3.184         27           2003         200         520         3.184         27           2003         200         520         3.184         17           2004         200         520         3.184         17           2005         200         520         3.184         17           2004         520         520         3.184         17           2003         520         520         3.184         17           2004         520         5.184         17         20           2004         520         5.184         16         17           2004         520         5.184         16         17           2004         520         5.184         16         17           2004         520         5.184         16         17           2004         520         5.184         17         20           2004         520         5.184         16         17           2004			025	0.20		2	701
2001         520         520         510           2012         202         520         3.184           2013         520         520         3.184           2014         520         520         3.184           2015         520         520         3.184           2016         520         520         3.184           2015         520         520         3.184           2016         520         520         3.184           2017         520         520         3.184           2018         520         520         3.184           2010         520         520         3.184           2011         520         520         3.184           2012         520         520         3.184           2013         520         520         3.184           2013         520         520         3.184           2013         520         520         3.184           2045         520         520         3.184           2045         520         520         3.184           2045         520         520         3.184           2045	2001         520         520         1144         22           2003         200         520         3.144         20           2004         200         520         3.144         17           2005         520         520         3.144         17           2005         520         520         3.144         17           2005         520         520         3.144         17           2004         520         520         3.144         17           2004         520         520         3.144         17           2004         520         520         3.144         17           2004         520         5.144         17         17           2004         520         5.144         17         17           2004         520         5.144         17         17           2004         520         5.144         17         17           2004         520         5.144         17         17           2004         520         5.144         17         17           2004         520         5.144         17         17           2004		-	520	320	7,184		8
2002         520         520         520         3.144           2003         520         520         3.144           2014         520         520         3.144           2015         520         520         3.144           2015         520         520         3.144           2015         520         520         3.144           2015         520         520         3.144           2016         520         520         3.144           2017         520         520         3.144           2018         520         520         3.144           2011         520         520         3.144           2013         520         520         3.144           2043         520         520         3.144           2043         520         520         3.144           2045         520         520         3.144           2045         520         520         3.144           2045         520         520         3.144           2045         520         520         3.144           2045         520         520         3.144      2	2002         2002         2003         200         5164         22           2003         2004         220         520         5184         13           2003         2004         520         5184         13           2004         520         520         5184         13           2005         520         520         5184         13           2004         520         520         5184         13           2005         520         520         5184         13           2004         520         5184         13         13           2004         520         5184         13         14           2004         520         5184         14         13           2004         520         5184         14         14           2004         520         5184         14         16           2004         520         5184         16         17           2004         520         5184         16         17           2004         520         5184         6         18           2004         520         5184         6         18      2			520	220	3.184	21	
2033         520         520         5184           2034         520         5184         5184           2035         520         5184         520         3184           2035         520         520         3184         520         3184           2035         520         520         5184         520         3184           2035         520         520         520         3184           2030         520         520         5184         520         3184           2031         520         520         5184         520         3184           2041         520         520         5184         520         3184           2041         520         520         5184         520         3184           2045         520         520         3184         520         3184           2045         520         520         3184         520         3184           2045         520         520         3184         520         3184           2045         520         520         3184         520         3184           2045         520         520         3184	2033         520         520         3.184         20           2034         220         520         3.184         17           2035         520         520         3.184         17           2035         520         520         3.184         17           2035         520         520         3.184         17           2036         520         5.184         16         17           2039         520         520         3.184         17           2039         520         520         3.184         16           2040         520         5.184         11         17           2041         520         5.184         16         17           2041         520         5.184         16         17           2041         520         5.184         16         17           2042         520         5.184         16         17           2045         520         5.184         6         5           2045         520         5.184         6         5           2045         520         5.184         6         5           2045			520	22	7,184	<u>ਸ</u> ਼	
2014         520         520         5184           2005         520         520         5184           2005         520         520         5,184           2005         520         520         5,184           2005         520         520         5,184           2005         520         520         5,184           2005         520         520         5,184           2005         520         520         5,184           2004         520         520         5,184           2004         520         520         5,184           2004         520         520         5,184           2004         520         520         5,184           2004         520         520         5,184           2004         520         520         5,184           2004         520         520         3,184           2004         520         520         3,184           2004         520         520         3,184           2004         520         520         3,184           2004         520         5,184           2044         520	2014         520         520         3,184         19           2005         520         520         3,184         17           2005         520         520         3,184         17           2005         520         520         3,184         17           2005         520         520         3,184         17           2005         520         520         3,184         16           2004         520         520         3,184         13           2004         520         520         3,184         13           2004         520         520         3,184         14           2004         520         5,184         7         9           2004         520         5,184         7         7           2004         520         5,184         7         7           2004         520         5,184         6         6           2004         520         5,184         6         5           2004         520         5,184         6         5           2014         520         5,184         6         5           2014         520 <td></td> <td></td> <td>520</td> <td>520</td> <td>3,184</td> <td>ខ្ល</td> <td></td>			520	520	3,184	ខ្ល	
2035         520         520         5184           2036         520         520         5184           2038         520         520         5184           2038         520         520         5184           2038         520         520         5184           2040         520         520         5184           2041         520         520         5184           2043         520         520         5184           2041         520         520         5184           2043         520         520         5184           2044         520         520         5184           2045         520         5184         520           2045         520         5184           2045         520         5184           2045         520         5184           2045         520         5184           2045         520         5184           2045         520         5184           2046         520         5184           2045         520         5184           2045         520         5184           2045 <td>2035         520         520         3,184         17           2036         520         520         3,184         13           2038         520         520         3,184         13           2038         520         520         3,184         13           2039         520         520         3,184         13           2030         520         520         3,184         13           2030         520         520         3,184         13           2040         520         5,184         13         14           2041         520         5,184         14         12           2042         520         5,184         14         14           2043         520         5,184         14         14           2044         520         5,184         16         1           2045         520         5,203         3,184         6         1           2044         500         520         5,184         6         1         1           2045         520         520         3,184         6         1         1         1         1         1         1</td> <td></td> <td></td> <td>0.5</td> <td>520</td> <td>3,184</td> <td>61</td> <td>-</td>	2035         520         520         3,184         17           2036         520         520         3,184         13           2038         520         520         3,184         13           2038         520         520         3,184         13           2039         520         520         3,184         13           2030         520         520         3,184         13           2030         520         520         3,184         13           2040         520         5,184         13         14           2041         520         5,184         14         12           2042         520         5,184         14         14           2043         520         5,184         14         14           2044         520         5,184         16         1           2045         520         5,203         3,184         6         1           2044         500         520         5,184         6         1         1           2045         520         520         3,184         6         1         1         1         1         1         1			0.5	520	3,184	61	-
2000         520         510         510           2007         2007         520         510           2008         520         520         5184           2009         520         520         5184           2009         520         520         5184           2009         520         520         5184           2004         520         520         5184           2041         520         520         5184           2042         520         520         5184           2044         520         520         5184           2045         520         520         5184           2045         520         5184         50           2045         520         5184         50           2045         520         5184         50           2045         520         5184         50           2045         520         5184         50           2045         520         5184         50           2045         520         5184         50           2045         520         5184         50           2047         520	2000         2000         2100         2000         21184         15           2007         2009         200         520         520         3,184         13           2009         520         520         520         3,184         13           2009         520         520         3,184         13           2001         520         520         3,184         13           2001         520         520         3,184         13           2001         520         520         3,184         10           2001         520         520         3,184         10           2001         520         520         3,184         10           2001         520         520         3,184         10           2004         520         520         3,184         6           2004         520         520         3,184         6           2004         520         520         3,184         6           2045         520         520         3,184         6           2045         520         520         3,184         6           2045         520         520 <td>•••</td> <td></td> <td>ŝ</td> <td></td> <td>1 184</td> <td>1</td> <td></td>	•••		ŝ		1 184	1	
2006         520         530         54           2015         520         530         54           2016         520         530         54           2018         520         520         54           2019         520         520         54           2019         520         520         54           2011         520         520         54           2013         520         520         54           2013         520         520         54           2013         520         520         54           2013         520         520         54           2014         520         520         54           2045         520         520         54           2045         520         520         54           2045         520         520         54           2045         520         520         54           2045         520         52         54           2045         520         53         54           2045         504         53         54           2043         103,94         50         54<	2020         220         220         220         210         210         210         210           2039         2039         200         520         520         3.184         13           2039         204         520         520         3.184         13           2039         520         520         3.184         13           2041         520         520         3.184         13           2042         520         520         3.184         14           2043         520         520         3.184         9           2045         520         520         3.184         6           2045         520         5.184         7         7           2045         520         5.184         6         6           2045         520         5.184         6         6           2045         520         5.184         6         6           2045         520         5.184         6         6           2045         520         5.184         6         6           103, 94         7,184         6         6         6           103, 94         103,					5		
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Table 4.6(8/8)

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

SEGMENT-2.2 India (Alluvial Plain) <i>Flood runoff</i> <u>Channel capacity</u>	Severe flooding (Qchan << Oflood) Nepal-India border	Transport (Sseg2.2)	Flood runoff Channel capacity	Severe flooding (Ochan << Oflood) Nepal-India border	Sedimentation (Sseg2.2 >> S2.2low) V IN TERAI
SEGMENT-2.2 (Alluvial Plain)	Severe flooding (Ochan << Oflood)	Sedimentation (Sseg2.1 >> Sseg2.2) IKE)		No flooding (Qchan > Oflood)	Sedimentation       Transport       Sedimentation         (SsepM >> Ssep1)       (Ssep1 = Ssep2.1)       (Ssep2.1 = Ssep2.2)       (Ssep2.2 >> S2         CHANNEL WITH CONTINUOUS DIKES IN NEPAL TERAL         AL FLOOD WATER AND SEDIMENT FLOW IN TERAL
SEGMENT-2.1 (Alluvial Plain)	Slight flooding (Qchan < Oflood)	Transport (Sseg1 = Sseg2.1) (S EXISTING CHANNEL (NO DIKE)		No flooding (Qchan > Oflood)	Transport       Transport       Transport         M >> Ssep1)       (Ssep1 = Ssep2.1)       (Ssep2.1 = Ssep2.1)         CHANNEL WITH CONTINUOUS DIKES IN NEPAL TERAL       EPAL TERAL         FLOOD WATER AND SEDIMENT F
SEGMENT-1 (Alluvial Fan)	No flooding (Qchan > Oflood)	Sedimentation (SsegM >> Sseg1) EXI:		No flooding (Ochan > Oflood)	Sedimentation (SsegM >> Sseg1) CHANNEL WITH UAL FLOOD W
SEGMENT-M (Mountain) <u>Channel capacity</u> Flood runoff	No flooding (Qchan >> Qflood) Sediment transport	Transport (Sse <u>r</u> M)	Channel capacity Flood runoff	No flooding (Qchan >> Oflood) <i>Sediment</i> <i>transport</i>	Transport (SsegM) CONCEPTU.
Water flow	Sediment	· · · ·	Water flow	Sediment	
		- - :	TI FO	epartment of Irrigation, IE STUDY ON FLO R SELECTED RIVE IN THE KING	overnment of Nepal Ministry of Water Resources OD MITIGATION PLAN RS IN THE TERAI PLAIN DOM OF NEPAL L COOPERATION AGENCY

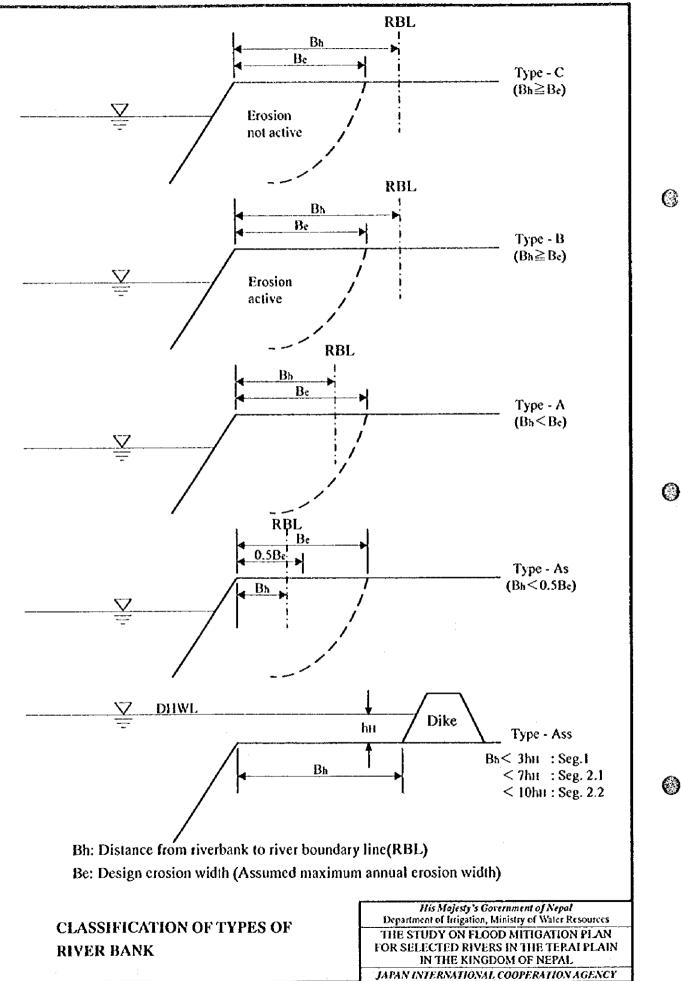
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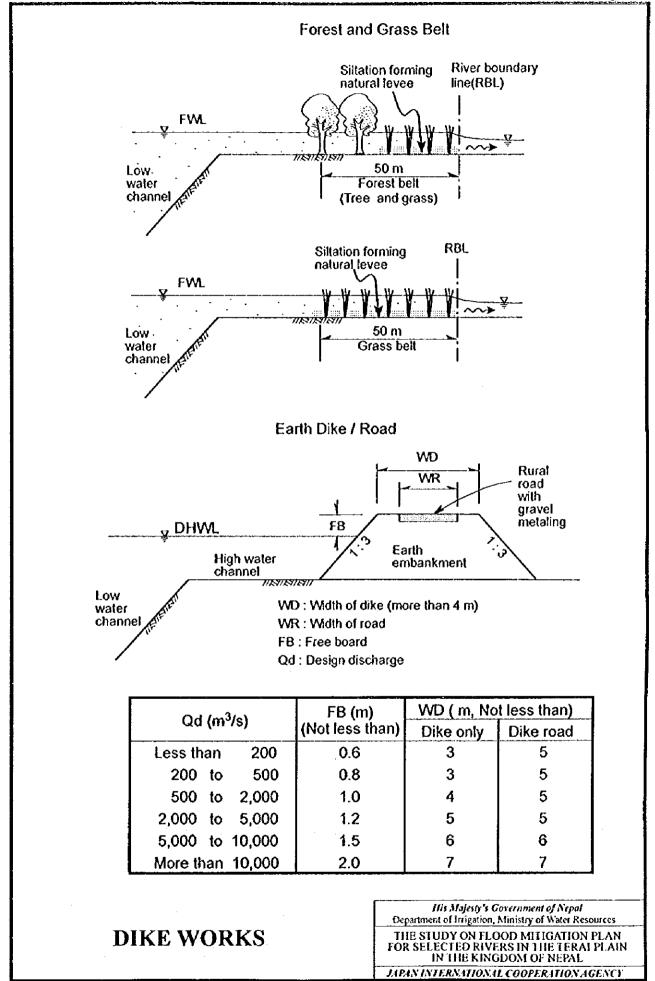
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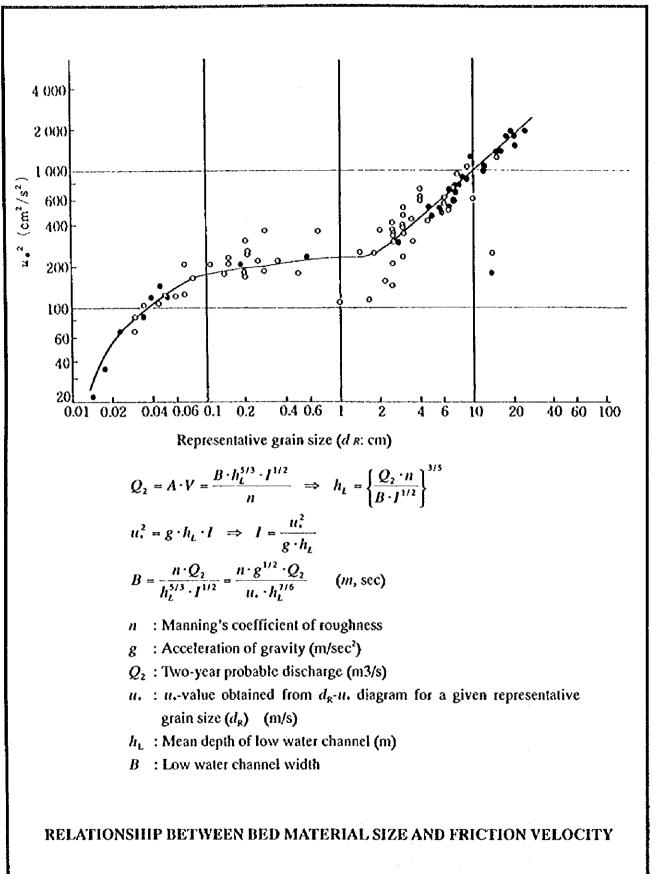
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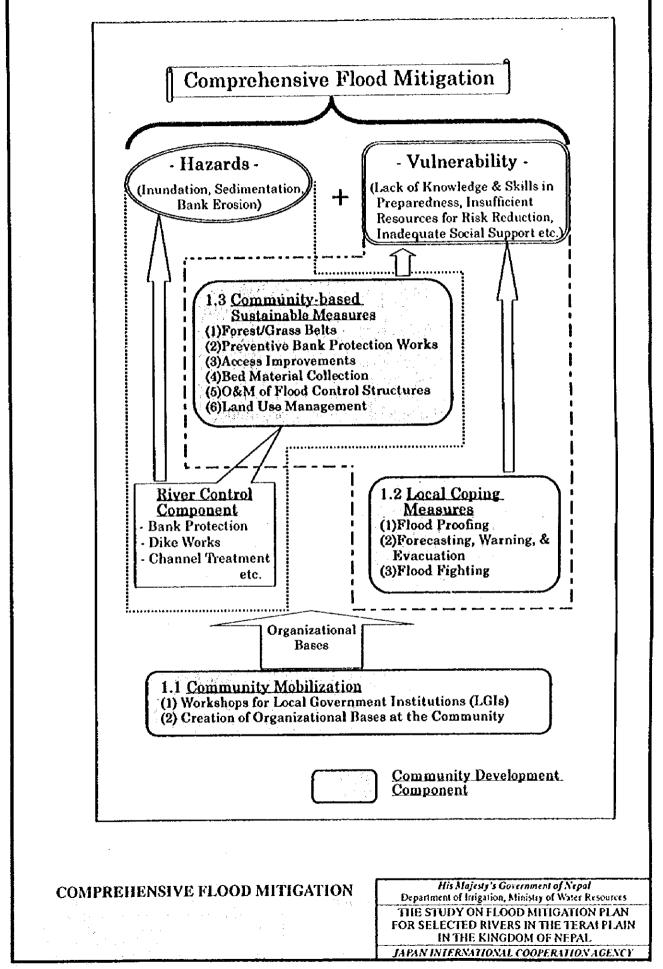


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His Majesty's Government of Nepal Department of Irrigation, Ministry of Water Resources THE STUDY ON FLOOD MITIGATION PLAN FOR SELECTED RIVERS IN THE TERAI PLAIN IN THE KINGDOM OF NEPAL JAPAN INTERNATIONAL COOPERATION AGENCY

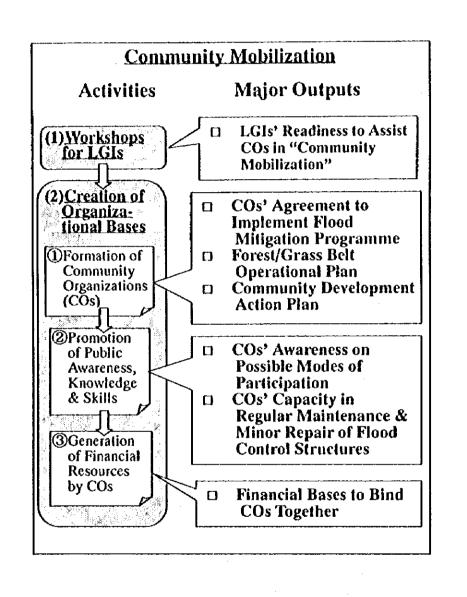


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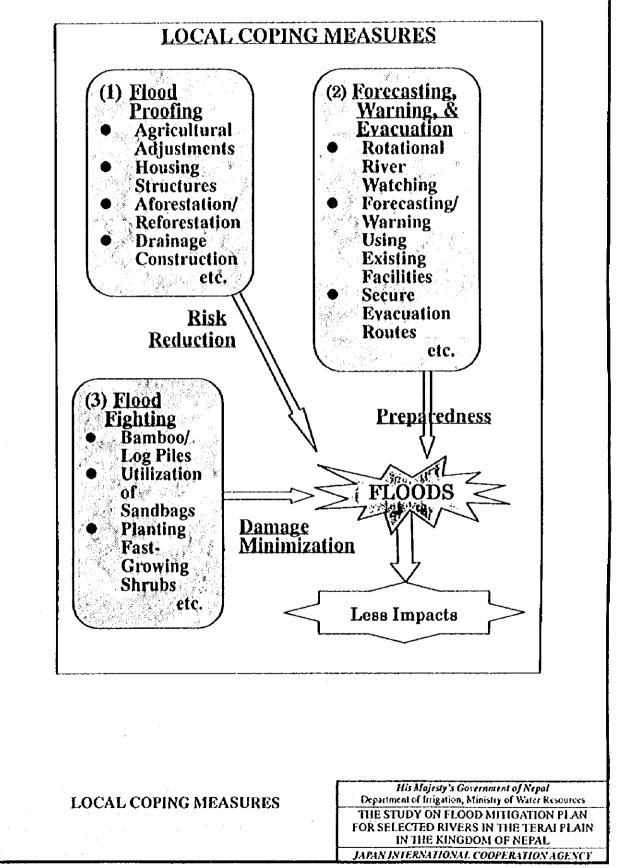
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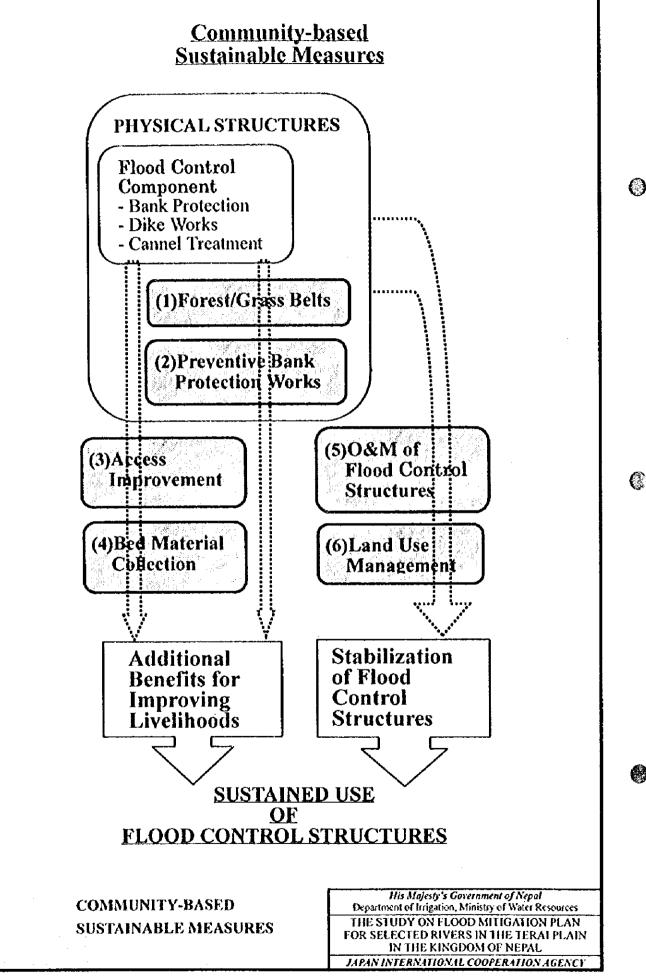


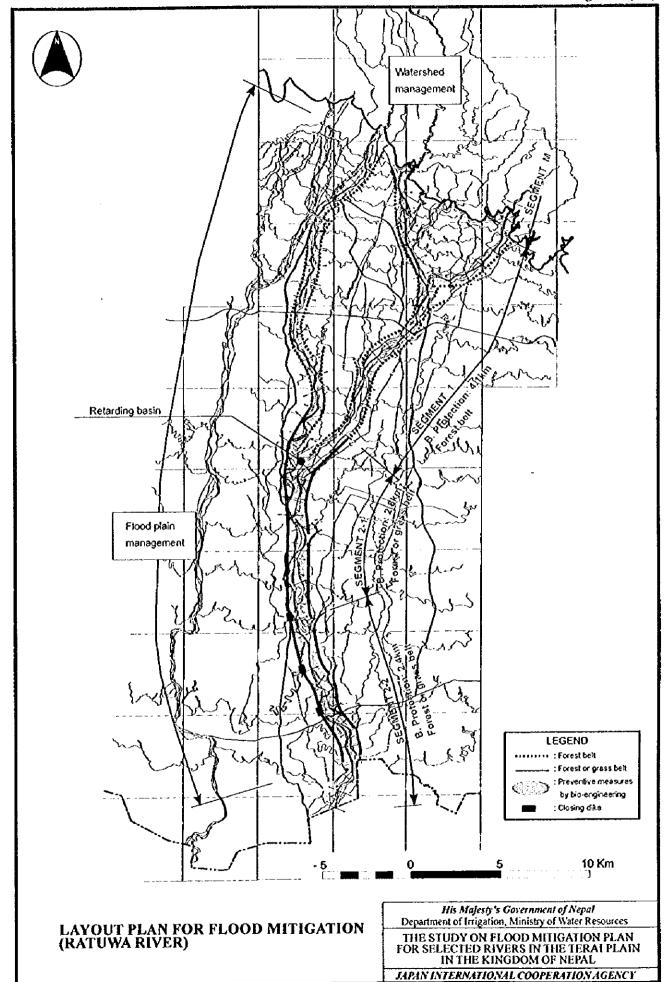
His Majesty's Government of Nepal Department of Irrigation, Ministry of Water Resources THE STUDY ON FLOOD MITIGATION PLAN FOR SELECTED RIVERS IN THE TERAI PLAIN IN THE KINGDOM OF NEPAL JAPAN INTERNATIONAL COOPERATION AGENCY

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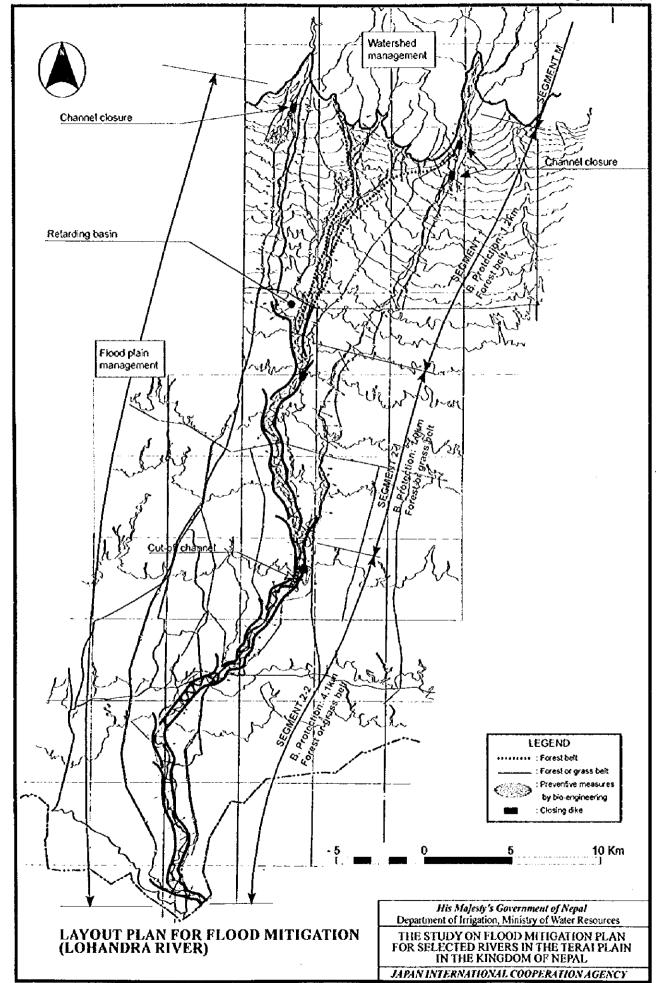
**COMMUNITY MOBILIZATION** 





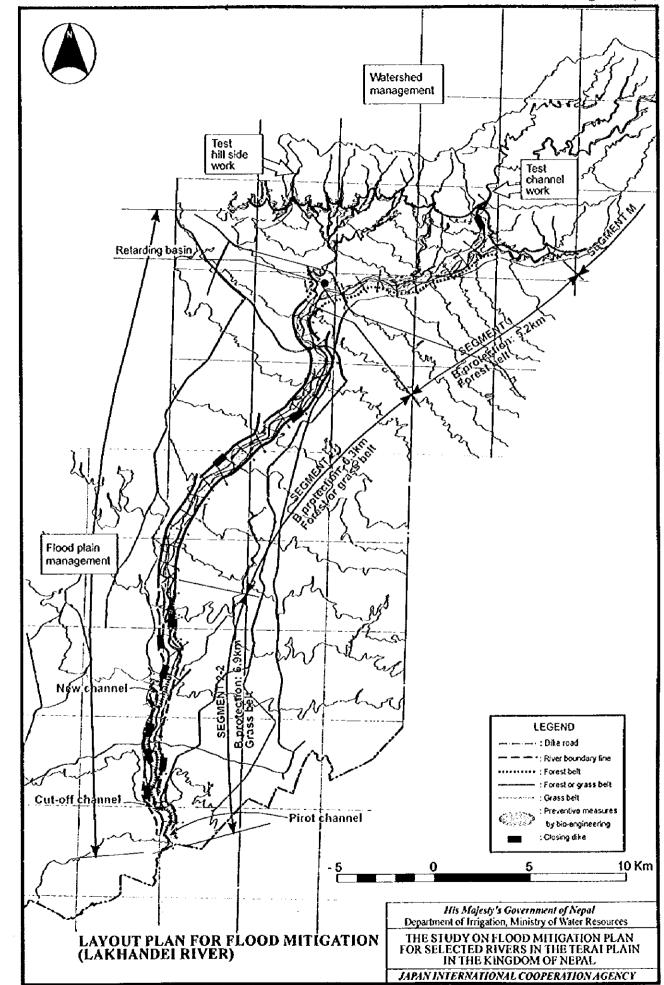


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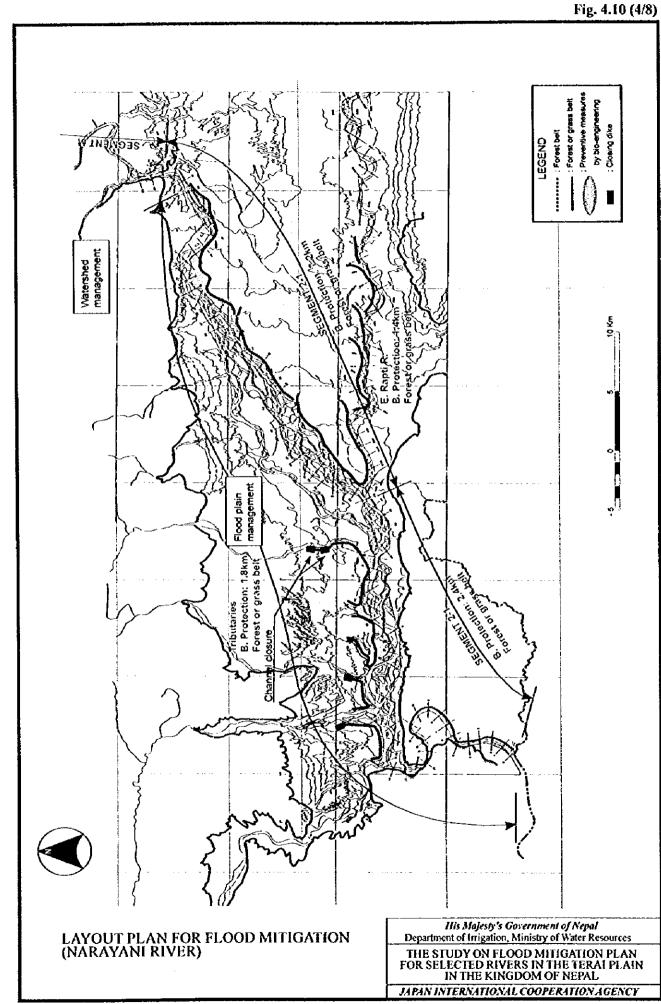
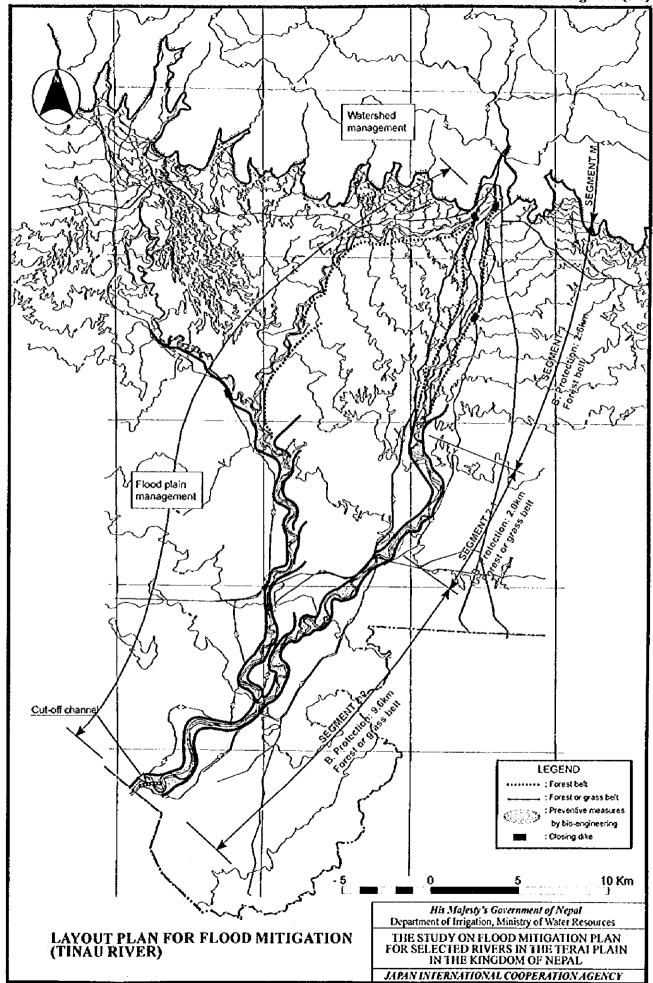
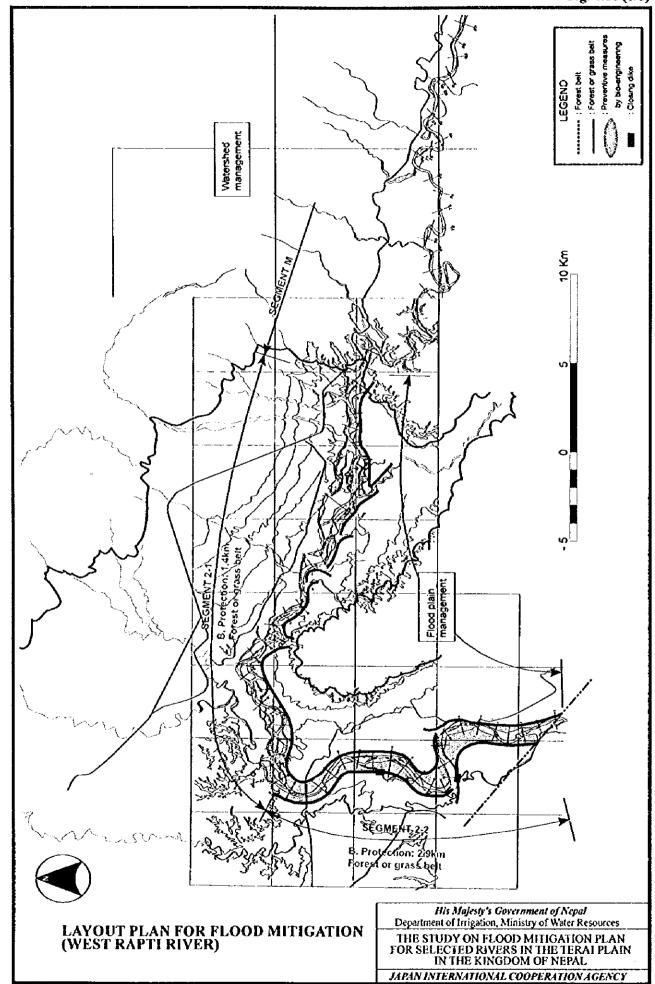


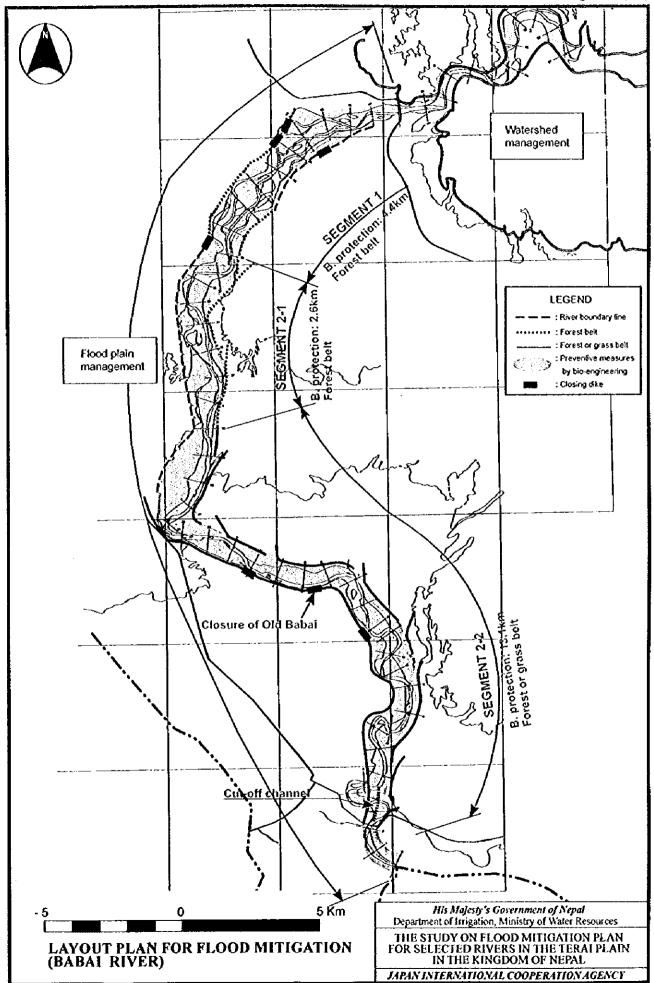
Fig. 4.10 (5/8)



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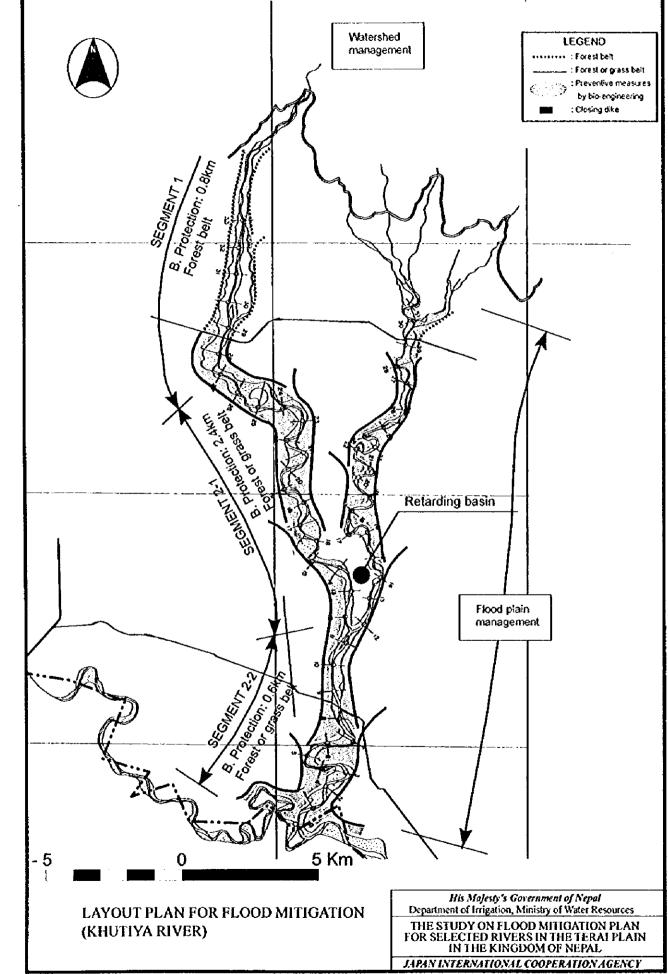


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### ACTION PROGRAM TOWARD TARGET YEAR

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Activities		Phas	sing	
Master Plan	1st.	2nd.	31	rd
National Plan	9th	10th	11th	12th
(year)	(1997-2002)	(2002-2007)	(2007-2012)	(2012-2017)
1) Preparatory Works				
1) Feasibility study:				
River survey				
Restudy of master plan				
·Feasibility study	<u> الشجر بي</u>			
•Environmental study				
2) Fund arrangement				
3) Definite plan/ detail design				
4) Preservation of lands				
5) Rsearch/ investigation	· · · · · · · · · · · · · · · · · · ·			
(A) (C) Align the March March March				•- <del>-</del>
(2) Coordination for Flood Mitigation				
1) Community development				
2) Watershed management				
3) Flood Plain Management				
(3) River Works in Segment-1				
Channel treatment works:				
Tributary works				
Branch/ anabranch works				· · · · · · · · · · · · · · · · · ·
Bank protection works:				
• Spur/ rvetment				
Preventive bank protection measurs				
(by bio-engineering)		·····	<i>.</i>	
Dike works:			,,,,,,,,,	
Forest belt				
Ring dike				
Channel excavation works:				
Bed material collection				
Retarding basin				
(3) River Works in Segment-2				
Channel treatment works:				
Tributary works				
Branch/ anabranch works				
Bank protection works:				
Spur/ revelment				
Preventive bank protection measurs				
(by bio-engineering)				
Dike works:				
• Grass belt				
<ul> <li>Local dike/ dike road</li> </ul>				
Ring dike			·	
Channel excavation works:				
<ul> <li>Bed material collection</li> </ul>				
Channel normalization			· · · · · · · · · · · · · · · · · · ·	
Cut-off channel works				
Relarding basin				

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### CHAPTER 5 SELECTION OF PRIORITY PROJECT

### 5.1 General

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Since a river channel conveys water and sediment continuously from upstream to downstream reaches, flood mitigation measures introduced in the upper reaches affect, to a certain extent, the incidence of flooding in the lower reaches. Therefore, it is common approach to discuss flood mitigation measures from basin-wide viewpoint. Feasibility Study for the flood mitigation is also conducted, in general, from a basinwide viewpoint, not for individual component structures or facilities. The total costs invested in a plan and the total benefits accruing from the investment shall be compared for evaluation, not by component.

Any of the eight river basins studied in the formulation of the Master Plan could be selected for the Feasibility Study, since these rivers have been selected out of the numerous river basins in the Terai plain as model basins. After studying the model river basins, the choice of rivers for the Feasibility Study are narrowed down further based on the following criteria.

- Selection from different rives classes and development regions: The river basin shall be selected from different river classes of I, II and III and from different development regions of the country, since the results of studies would be a technical guideline for planning flood mitigation of other similar river basins in the Terai plain.
- Selection based on priority of implementation: The river basin shall be selected based on the priority of implementation. The priority is evaluated from the following aspects.
  - High economic viability
  - Urgency of flood mitigation
  - More favorable social impacts
  - Less adverse social and environmental impacts
  - Sustainability flood mitigation activities
  - Availability of basic data

### 5.2 **River Class and Development Region**

Rivers in the Terai plain are generally classified into three as follows:

- 1) Class-I rivers which originate in the High Mountains and have large catchment areas,
- Class-II rivers which originate in the Middle Mountains and have medium size catchment areas, and
- 3) Class-III rivers which originate in the Siwalik hills and have small catchment areas.

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On the other hand, the country of Nepal is administratively divided into five development regions, i.e., Eastern, Central, Western, Mid-Western and Far-Western development regions from east to west.

The eight (8) river basins for the Master Plan study fall under the following river class and development region (D.R.):

	(River)	(River class)	(Development region)
1)	Ratuwa R.	Class-III	Eastern D. R.
2)	Lohandra R.	Class-III	Eastern D. R.
3)	Lakhandei R.	Class-III	Central D. R.
4)	Narayani R.	Class-I	Central D. R./Western D. R.
5)	Tinau R.	Class-II	Western D. R.
6)	West Rapti R.	Class-II	Mid-Western D. R.
7)	Babai R.	Class-II	Mid-Western D. R.
8)	Khutiya R.	Class-III	Far-Western D. R.

### 5.3 Priority of Implementation

### (1) Criteria for Priority Classification

Priority classification of eight river basins is given according to the evaluations of the following criteria:

### 1) Higher Economic Viability:

(1-1) Present basin development: Land use and settlements in flood-prone areas

(1-2) Existing public facilities: Road network, irrigation canal systems, etc.

### 2) Urgency of Flood Mitigation:

(2-1) Recent severe flood damage

(2-2) Progress of flood mitigation works

- 3) More Favorable Social Impacts:
  - (3-1) Extent of protected areas, population and its trend
  - (3-2) Existence of municipalities of economic and political importance

### 4) Less Adverse Social and Environment Impacts:

(4-1) Relocation of houses

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(4-2) National park and wetlands

### 5) Sustainability of Flood Mitigation Activities:

- (5-1) Desire of local government and DIO
- (5-2) Availability of local materials for works
- 6) Availability of Basic Data:
  - (6-1) Availability of topographic maps
  - (6-2) Availability of hydrological data

### (2) Method of Evaluation and Result

Based on the study results made so far, the eight river basins included in the Master Plan study were evaluated using the above criteria.

The evaluation was made giving marks of three levels, i.e., 1, 2 and 3 where the priority level 1 indicates highest priority. Therefore, the river basin with the lowest total points has the highest priority.

The evaluation for the respective rivers and items is shown in Table 5.1. According to the evaluation, the five top priority rivers are as follows:

(Rank)	(River)	(River class)	(Development region)
lst.	Babai river	11	Mid Western
2nd.	Lakhandei river	III	Central
3rd.	Tinau river	11	Western
4th	Ratuwa river	111	Eastern
4th	Narayani river	I	Central/Western
	1	I	

### 5.4 Selection of River Basins

### (1) River Basins for Further Study

According to the result of evaluation shown in Table 5.1, the following two river basins with ranking as 1st and 2nd are selected for further study. They also represent different river class and development regions:

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- 1) Babai river basin : Class-II river in Mid-Western Development Region
- 2) Lakhandei river basin : Class-III river in Central Development Region

Discussions were made whether the Narayani river should be included for further study or not. The Narayani river is 4th ranked in priority and class-I river located in both Central and Western Development Regions. Finally the Narayani river was not selected for the following reasons:

- The Narayani river flows in Inner Terai and has a narrow channel section in its the lower reaches near Indian boundary. The Narayani river has different nature from other Class-I rivers such as the Kosi and Karnali rivers which flow in Terai plain without narrow sections in the lower reaches. Therefore, the Narayani river is not a representative basin of the Class-I river type.
- 2) The Narayani river is a large river joined by many tributaries of a similar scale to the other river basins in the master plan study. A feasibility study for such a large river has many study items, which form a whole project in itself. It should form a separate study, divorced from the present study. Otherwise an in-depth study for the selected two river would be difficult.
- 3) On the other hand, the further study result obtained from the chosen class-II and class-III rivers could be applicable to the flood and sediment problems for the tributaries of the Narayani river.

### (2) River Basin for Comprehensive Flood Mitigation Plan

Out of two river basins selected for further study, one river is to be selected for the study on comprehensive flood mitigation plan including watershed. The Lakhandei river was specified for the study which includes the sabo (erosion control) and soil conservation measures in the mountainous regions or watershed area as well. The Lakhandei river originates in the Siwalik hills. These hills yield much sediment, some of which could be controlled through watershed management techniques.

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# SELECTION OF RIVERS FOR PRIORITY PROJECT

. 7. Babai R. 8. Khutiya R.	k. Evaluation Mk. Evaluation Mk.
S.W.Rapti R.	Evaluation M
yani N.   S.Tinau R.	Evaluation Mk.
4. Nara	n Mk.] Evaluation Mk.
3.Lakhandei R.	Evaluation Mk.
1.Ratuwa R. 2.Lohandra R. 3.	Evaluation Mk. Evaluation Mk.
ltems for Evaluation	

### (A) Classification of River Basin

Class of nver			Ħ		n	#	3	Ħ
Development region	Eastern	Eastern	Central	Central/Western	Western	Mid-Western	Mid-Western	Far-Western
Ceveroprisent region		HIDIOPT	- Cumu	Countary 71 Concern	111111111111			

## (B) Priority of Immediate Implementation

(1) Higher Economic Viability		4		¢)	m		4		4		5		n		\$
(1-1) Present basin development	Medium	2	ta H		Medium 2	Medium	() ()	Medium	2	Medium	5	Medium	3	Nol	ω
((1-2) Existing public facilities	Medium	c1	f3 H	-	Ftigh 1	Medium	1 2	Medium	()	Low	3	High	• •	Low	3
(2) Urgency of Flood Mitigation		5		S	5		9		Ş		c)		3		61
(2-1) Recent severe floods	88. 95. 96		87. 38. 96	'n	3 87. 88. 96 3 97. 93. 95 1	88, 93, 5	5 3	1 88, 93, 95 3 96, 95, 93 2 97, 96, 93 1	3	97, 96, 93		1 95. 87. 96 2 97. 86. 83	2	97, 86, 83	ы
(2-2) Progress of flood mitigation works Medium	Medium	<b>c</b> 3	Medium	(1)	Medium 2	Higher	<u></u>	Higher	ŝ	Lower	ч	Lower	ы	Lower	•-1
(3) Favorable Social Impacts		3		S			5		61		S		61		ч
(3-1) Protected area and population	Medium	1	Medium	<b>6</b> .3	Medium 2	More		More	-1	Medium	4	More	-4	Tress	ŝ
(3-2) Existence of municipalities	Damak		•	e	•	Narayangat	at 1	Butwal	1	•	3	Gulariya	Ч	Dhangadhi	÷,

(3-1) Protected area and population	Medium	3	Medium	c,	Medium	ก	More	<b></b> 1	More	-1	Medium	c,	More	Ţ	Less	ŝ
(3-2) Existence of municipalities	Damak	1	•	Э	,	<u>е</u>	Narayangat	-1	Butwal		•	ŝ	Gulariya	l	Dhangadhi	<b></b> 1
(4) Adverse Social/Environment Impacts		ŝ		ы		ŝ		4		4		4		3		9
(4-1) Relocation of houses	Few	-	Some	e1	Some	1	Few		Some	4	Few		Few		Few	
(4-2) National park and wet lands	Small	<b>(1</b> )	None	ŗ	None	+-4	Large	ы	Small	2	Large	ы	Small	(1	Small	3
										l						

(5) Sustainability of Flood Mitigation		(1) (1)		<i></i> с		1		3		3		c1		6		£
(5-1) Desire of local government/DIO (5-2) Availability of local materials	Very active Available		Active Available	∽i ⊷	Very active Available		Active Available	ч н	Active Available	21	Very active Available		Very active Available		Active Available	H H
(6) Availability of Basic Data		4		4		3		2		2		4		3		Ś
(6-1) Topographic maps	Available		Available	~~	Available		Available	1	Available	~1	Available	-1	Available		Not avail.	n
(6-2) Hydrological data	Not avail.	<u>е</u> ч	Not avail. 3	ო	WL avail. 2		Available	•	Available		Not avail. 3	_	WL avail. 2 Not avail.	1	Not avail.	ą

Total point	21	22	19	21	20	22	16	24
(C) Overall Evaluation Priority order	4	\$	2	4	e	\$	1	S

	pmentRepon III/ Eastern III/ Eastern III/ Central IV Central-West. IV Western IV MidWestern II/ MidWestern II/ FarWestern	(Selected) (Selected)
Priority order	RiverClass/DevelopmentRegion	

Table 5.1