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

FLOOD ACTION PLAN

NORTHEAST REGIONAL WATER MANAGEMENT PROJECT (FAP 6)

KALNI-KUSHIYARA RIVER MANAGEMENT PROJECT FEASIBILITY STUDY

ANNEX G NAVIGATION

Final Report
March 1998

SNC ♦ Lavalin International
Northwest Hydraulic Consultants

in association with

Engineering and Planning Consultants Ltd.
Bangladesh Engineering and Technological Services

Canadian International Development Agency

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

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ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
BBS	Bangladesh Bureau of Statistics
BIWTA	Bangladesh Inland Water Transport Authority
BIWTMAS	Bangladesh Inland Water Transport Master Plan
BTSS	Bangladesh Transport Sector Study
CDN	Canadian
CEA	Canadian Executing Agency
CIDA	Canadian International Development Agency
cm	centimetre
d	draught
D	Depth
EIA	Environmental Impact Assessment
FAK	Freight All Kinds
FPCO	Flood Plan Coordination Organization
FW	Future With Project
FWO	Future Without Project
GNP	Gross National Product
GoB	Government of Bangladesh
ha	hectare
HYV	High Yielding Variety
kg	kilogram
km	kilometre
KKRMP	Kalni-Kushiyara River Management Plan
LAD	Least Available Draught
LB	Left Bank
LBS	Left Bank Side
LLW	Low Level Water
LOA	Length Over All
m	metre
MB	Mechanized Boat
MITW	Mechanized Inland Water Transport
mm	millimetre
Mm^3	Million cubic meters
MOS	Ministry of Shipping
MOWR	Ministry of Water Resources
MP	Murate of Potash
mt	metric tonne
NERP	Northeast Regional Water Management Project
NHS	Northeast Hill States (of India)
NMB	Non-Mechanized Boat
NSA	Navigation Survey Area
O&M	Operation and Maintenance
PD	Person-Day
POL	Petroleum, Oil, Lubricants

RB	Right Bank
RBS	Right Bank Side
R/S	Riverside
SCF	Standard Conversion Factor
Tk	Taka (Bangladesh currency. $1 CDN = approx. Tk 30)
TSP	triple super phosphate
WARPO	Water Resources Planning Organization

GLOSSARY

aman	monsoon rice crop
aus	pre-monsoon rice or rice grown in *kharif* I season.
b. aman	broadcast or deepwater *aman* rice grown in *Kharif* I and II seasons
bazar	market
beel	floodplain lake that may hold water perennially or dry up during the winter season
boro	rice grown during the winter season
class I channel	3.6 meter depth; 50 meter width perennial
class II channel	2.4 meter depth; 50 meter width perennial
class III channel	1.8 meter depth; 37 meter width perennial
class IV channel	1.5 meter depth; 37 meter width seasonal
country boat	wood hull boat of traditional design; capacity usually not more than 500 *maunds* (19 tonnes)
dhala	breaches across river banks
dry season	5 months: December-April inclusive
gur	mollasses
haat	big market
haor	depression on floodplain located between two or more rivers
IWT craft	steel-hull boat 350-500-tonne capacity; single screw
kancha road	dirt road
khal	channel
maund	indigenous unit of weight, equivalent to 37.3 kg
pucca road	paved road
taka (Tk)	unit of currency, 1 US $ = 40 taka (approx.)
tempoo	mechanized boat carrying merchandize
thana	geo-administrative unit under a district comprising several unions
union	geo-administrative unit under a *thana* comprising several villages
wet season	7 months: May-November inclusive

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1. INTRODUCTION

1.1 General Information

The Kalni-Kushiyara River Management Project (KKRMP) has a gross area of 336,500 ha and a total population of 1.89 million (1995). It lies within the vast Sylhet Depression which covers most of the northeastern part of Bangladesh. This extensive low-lying land, with its innumerable *haor*s, *beel*s, *khal*s and rivers, is a great reservoir of natural wealth. Its fertile land and natural waterway resources could potentially provide tremendous agricultural and fisheries output. The waterways could also become a cheap means of transportation. The agricultural crops are now seriously damaged due to flash floods in the pre-monsoon season. Flash floods are caused by inadequate drainage capacity of the rivers and their distributaries. Their beds have silted-up very badly. This is because of deposition of a tremendous volume of eroded earth. The sediment comes from the deforested hills and upper areas, as well as from many natural and man-made activities in the area. The area's only means of transportation and communication, waterways, remain undeveloped due to silting-up of the rivers and the more or less complete absence of river maintenance and conservancy works. The waterways in the area have become navigable only during the monsoon season. During the dry season, the draughts in the main channel and all the feeder channels are insufficient. The regional economy of this vast tract of land, with its large rural population (90% rural and 10% urban), is stagnating. Difficulties of transportation increase the cost of the daily necessities of life and are adversely affecting the socioeconomic welfare of the people by restricting movement of goods and passengers in the area.

1.2 Scope and Objectives

The intent of this annex is, firstly, to define the potential economic benefits that would accrue to the region as a result of the river improvements. The improvements focus on mitigating pre-monsoon flood impacts and improving post-monsoon drainage. Secondly, this annex reviews those further improvements that may be needed to establish a navigation channel that could also achieve greater economic benefits. Thirdly, this annex identifies other activities, covering water transportation infrastructures, that could be considered as adding value to the project.

The impact of improved navigation is considered under a number of scenarios, from present condition, to project without river improvement, to project with creation of a Class II navigation channel along the Kalni-Kushiyara River between Fenchuganj and Astagram.

1.3 Methodology

Field surveys were conducted in 1995 to gather data on the water transport fleet, its traffic and volume of employment. These data were collected through structured questionnaires at various market places and river stations on both *haat* (market) and non-*haat* days. The surveys were collected in both the dry and monsoon seasons to account for fluctuations in navigation activities. Traffic projections for future river water transport were formulated for various scenarios to estimate the project impacts and benefits.

The improvement of navigation in the Kalni-Kushiyara River system concentrates on trade generation and benefits a 168 km reach between Fenchuganj and Astagram. This is called the "full river reach" in this report. A detailed traffic study was undertaken in 1995 along a 110 km reach between Madna and Sherpur - this is the navigation survey area (NSA).

The navigation analysis concentrates on a 10 km wide band (5 km on either side of the full river reach, (Figure G.1). This strip of land and its population are considered to have the most influence on the Kalni-Kushiyara traffic.

The estimated population served by the river (full river reach) within the 10 km band of the project area is 745,000 persons (1995). Within this river band, there are 15 major market or urban centres having a total associated union population of 372,000 persons (1995). The population of the major urban centres within the NSA is about 70,000 persons. Details on population are provided in Appendix G.1.

Note that the full river reach includes a section of the south bank of the Kalni-Kushiyara River system that is outside the project area. Thus, the navigation analysis utilizes crop areas, population and forecasts that are slightly different from those confined by the boundary of the project area.

1.4 Data

There is virtually no consistent, reliable published data on navigation within the Kalni-Kushiyara River region (nor for Bangladesh as a whole). Baseline data has been acquired from market surveys, merchant and ship-owner interviews and interpretation of agricultural and non-agricultural product demand. The most consistent sources of data have been NERP reports at the pre-feasibility level and the Bangladesh Inland Waterways Transportation Master Plan (BIWTMAS) report and appendices. Some published statistical data, from the Bangladesh Bureau of Statistics (BBS), on prices and related matters have been utilized.

2. HISTORICAL PERSPECTIVE OF THE KALNI-KUSHIYARA RIVER AS NAVIGATION CHANNEL

2.1 Glimpses of the Glorious Past

The historical records of the Kushiyara, the Kalni and the Surma Rivers as inter-regional links of transportation and communication during the British period are quite glorious. These rivers had >3.0 m draught year-round. Over half a dozen large water transport companies used to carry on prosperous long-distance (average trip length was 1,000 - 1,200 km) trading activities connecting the northeastern Indian province of Assam with such big business centres as Calcutta and Patna. Some of these companies continued their operation until the early 1960s, when they were converted into local rupee companies. Moreover, many Indian large-capacity deep-draught vessels stepped into the carrying business. They were in transit between Calcutta and Assam or Cachhar.

Domestic traffic within Bangladesh was also significant. There were large (capacity 40-50 tonnes) non-mechanized sail boats engaged in carrying quarry products (stones and sands) and bulk cargoes of paddy rice from the Sylhet region.

Many varieties and sizes of wooden hull non-mechanized country boats were used by the people in the vast low-lying lands of the great Sylhet Depression for transportation and communication. Road were (and still are) non-existent in this extensive *haor* area. The Kalni River, the Kushiyara River, the Surma River and their tributaries were deep and navigable along their entire length year-round. The air, water and environment were pollution-free. Life was slow and tranquil. The population was small, and paddy rice and fish production were in surplus. They were exported out of the area to the nearby urban centres of Mohanpur, Kuliarchar and Bhairab/Ashuganj through boats and launches. From there, they went to the far-off capital city of Dhaka and other cities by trains, buses and trucks. All their economic activities, such as agriculture, fisheries, trading and commercial business, and even their domestic and social activities such as health, education and recreation, depended entirely on the non-mechanized boats and the few private commercial launches. The area evolved a boat sub-culture. Almost all households had (and still have) at least one boat; the medium and large land holders generally had more than one boat.

2.2 Decline

Since the 1970s, cargo and passenger launches started replacing the many non-mechanized traditional country boats. In the early 1980s, engine boats began being introduced. The endless rows of big sailing/cargo carrying boats with high and picturesque sails had been common, serene and delightful sights on the Padma, the Jamuna, the Meghna and the Kalni-Kushiyara Rivers. They have now disappeared and become pleasant reminiscences.

Decline in the volume of Indian transit traffic is due to the sharply deteriorating draught conditions along the Kalni and Kushiyara Rivers. With cessation of the Indian in-transit traffic along the Kalni-Kushiyara River since 1965, the navigational importance of this river route was greatly reduced. The siltation of the river channel bed gained momentum year after year due to

man-made and natural processes. Rates of river channel bed siltation was hastened by the channel avulsion just downstream of Sherpur and construction of some closures on the Kalni-Kushiyara River and its tributaries. The Old Kalni River near Markuli was closed in 1978 by the local population in order to prevent pre-monsoon backflow through the Old Kalni River. Due to this avulsion, heavy siltation took place in the Kalni River, especially in the downstream reach of Ajmiriganj. As a result, this class I navigation route (3.0 m LAD) gradually lost its status. It fell to class II (2.4 m LAD) in the early 1970s, then to class III (1.8 m LAD) in early 1980s. It has presently reached a seasonal status of class IV (LAD $\leq$ 1.5 m), since about 1985-86.

The bulk cargo-carrying vessels (stones, gravels, singles and sands) had to switch to a longer (90 km) route via the Surma-Baulai River system. This increased both the time and cost of water transportation in this corridor. Simultaneously, with this handicap for water transport through the Kalni-Kushiyara River, the Dhaka-Sylhet road link was developed. Considerable volume of cargo traffic was diverted to costly, but more speedy, road transport.

3. CURRENT CONDITIONS AND ACTIVITIES

3.1 Brief Overview of the Existing Water Transport System in the Project Area

The Kalni-Kushiyara River project area population is 90% rural, and remains isolated from the powerful driving forces (Asian and international) which propel the national economy of Bangladesh. Other regions of Bangladesh are far more integrated with the mega-urban complex of the capital city of Dhaka through several modern transport corridors (for example Dhaka-Chittagong and Dhaka-Khulna). The project area is thus a socio-economically backward and isolated sub-region within the extensive Sylhet Depression. The main rivers changed their courses over the years, creating many loop channels and distributaries. They are also joined by many tributaries, thus forming a dense network of waterways in the whole of the Kalni-Kushiyara River project area. The existing river network can be seen in Figure G.2. The Kalni-Kushiyara River meets the Upper Meghna River at Kahuagaon, and thus the isolated project area is linked to the arterial waterway network of the whole country.

3.2 Population and Market Centres

The total population of the Northeast Region is estimated at 7.5 million, of which 1.9 million (1995) are in the project area. However, the population that can be considered as directly river-served is estimated at 745,000 (Appendix G.1). Much of the balance is north of the Kalni-Kushiyara River system, and is road and/or rail served although seasonally accessible by water. There is also a substantial population between the Kalni-Kushiyara River system and the Surma-Baulai River system that cannot be considered river-served at present, and most of this population do not have good communication alternatives.

Major market centres are given in Table G.1. The population that has access to the river is concentrated in these towns and unions. The estimated population density is in the range of 2,500-3,000 persons/km^2, which is a significantly higher density than for the region as a whole. The feasibility report estimated population density at 526/km^2 in the project area, while the concentration within a 1.5 km band on either side of the river is in the order of 1,000/km^2.

It should be noted that there are other major centres adjacent to the 10 km wide band of the river that could be considered at least partially river-dependent. These are:

- Beanibazar — upstream of Fenchuganj, left bank
- Sullah — right bank of the Kalni River upstream of Ajmiriganj
- Lakhai — left bank of the Dhaleswari River, below Madna

Effective navigation on the Kalni-Kushiyara River system may well increase river trade to and from those centres.

Table G.1: Major Market and Urban Centres on the Kalni-Kushiyara River System (Boxed section relates to the NSA)

Name	Description	Km	Population		Road	Rail
			Town	Union		
Fenchuganj	Major urban centre; fertilizer plant; tea and rubber	95	15,000	31,650	P	Yes
Balaganj	Regional market	115	13,000	18,450	P	No
Sherpur	Regional market; bridge over	135	10,000	38,950(1)	P	No
Enayetganj	Regional market	150	-nd-	20,000	S	No
Raniganj	Regional market	155	7,000	27,000	S	No
Markuli	Regional market	180	5,000	65,000(2)	No	No
Paharpur	Regional market; duck rearing/eggs	189	5,000	14,500	S	No
Ajmiriganj	Regional market	205	10,000	20,400	S	No
Kakailseo	Regional market; fertilizer	211	6,000	21,350	S	No
Katkhal	Regional market	219	5,000	17,550	No	No
Kadamchal	Local market	223	2,000	-(3)	No	No
Abdullahpur	Regional market	233	5,000	28,750	No	No
Adampur	Regional market	242	6,000	19,500	S	No
Madna	Local market	245	5,000	18,500	S	No
Astagram	Major urban centre	260	-nd-	30,500	P	No
	TOTAL		**94,000**	**372,100**		

Note 1: Sherpur is in two unions: Aushkandi and Khalipur
Note 2: Markuli is at the junction of three unions
Note 3: Kadamchal is in Abdullahpur union

Km: Distance downstream of Amalshid
Town Population: Estimated by survey team 1995/96
Union Population: At 1991 census
Road: P = Perennial; S = Seasonal

3.3 Modal Access

Table G.1, summarizes the modal access to these communities. Only Fenchuganj has both perennial road and rail access. Downstream of Sherpur, the only effective year-round access would be via the river. Figure G.3 provides summary information on road and rail access to different riverine communities.

In general, poor transportation and communication, in terms of reliability and/or cost, will be major inhibiting factors in economic development. Within the Northeast Region, particularly the *haor* areas, roads are expensive to build and maintain through successive floods. As a consequence, rivers are more likely to be the most cost-effective mode. They play a multiple role in transportation, irrigation water supply and post-monsoon drainage.

An example of the potential benefits which can be gained is available from the modal rate comparison between water, road and rail transportation (Table G.2).

Table G.2: Modal Cost Rates Comparison

Commodity	Origin	Destination	Rate (Tk/tonne)		
			Water	Road	Rail
Rice and Grocery	Bhairab Bazar	Fenchuganj	369	683	-nd-
Cement	Chhatak	Dhaka	200-250	533	-nd-
Coal	Sylhet	Dhaka	165	650	800
Stone	Chhatak	Dhaka	193	688	-nd-
Brick	Dhaka	Sylhet	100	687	800
Fertilizer	Fenchuganj	Dhaka	200-250	325	-nd-

Source: NERP Navigation Survey, 1996

The importance of effective year-round navigation can also be seen from comparing wet/dry season rates for typical commodities moved on the Kalni-Kushiyara River system (Table G.3).

Table G.3: Wet/Dry Season Transportation Cost Rates

Commodity	Origin	Destination	Rate (Tk/tonne)		
			Wet	Dry	W/D (%)
Fertilizer	Fenchuganj	Markuli	178.75	261.25	68
Fertilizer	Kakailseo	Katkhal	3.5/bag	5.5/bag	64
Rice/Grocery	Bhairab Bazar	Paharpur	170.0	250.5	68
Paddy	Raniganj	Bhairab Bazar	206.0	288.5	71

Source: NERP Navigation Survey, 1996

Thus, the creation of an effective year-round navigation channel would result in a cost saving of 25%-30%, at the very least, on those goods which are shipped during the dry season. Merchants fix some commodity transport costs at a year-round rate. This rate will tend toward the dry season cost, with additional profit being made on wet season transportation. For these commodities, some reduction can be expected through competition between suppliers. However, reductions may not be more than 15% in these circumstances.

3.4 Navigation Conditions

3.4.1 Kalni-Kushiyara River

An examination of the most recent navigation charts produced by the Bangladesh Inland Waterways Transportation Authority (BIWTA) shows that there is very limited access to river communities above Ikardia. The communities of Shibpur, Nurpur, Madna and Adampur on the eastern loop of the Dhaleswari River are virtually inaccessible during the dry season due to river siltation. Indicative LADs are about 1 m until Madna, and then 0.6 m to Adampur. As a result, through-traffic now takes the western loop of the Dhaleswari River (locally called Baida Nadi), which offers better depths, or is diverted via the Baulai River and Dhakey Khal (locally called the Cherapur Khal) to the river above Kanchanpur. The reach above Issapur is reasonably accessible, although there is a shallow area below Abdullahpur which reduces draughts to 1 to 1.3 m.

There are many shallow stretches along the river between Kanchanpur and Ajmiriganj which would inhibit navigation during the dry season in anything other than a small country boat. Table G.4 provides a comparison of river channel changes between 1988 and 1993 upstream of Ajmiriganj. It shows, in general, good improvements in navigability. However, the river is effectively blocked by major shoals below Manumukh at Km 159, at Km 141 below Amalshid, as well as other areas at Omarpur and below Fenchuganj. Thus, the river is not currently navigable to through-traffic during the dry season, and given the extent of the shoal below Manumukh, the river may not be freely navigable during a certain period into the wet season.

Table G.4: Observed Channel Changes between 1988 and 1993 Charts Upstream of Ajmiriganj (Minimum Depths at LLW)

Km	Location	1988	1993
106	Duralpur	Two shoal areas about 1 km total length	No shoal areas, minor mid-steam shoal
108	Pirispur	Minimum depth 1 m	min depth LBS 4.5 m,, RBS 7.3 m
112	Kalagopi	Shoal area with channel constriction	No shoal area
113		Minimum depth 0.3 m	min depth LBS 2.8 m
120	Protappur	Major shoal about 1 km length Minimum depth 0.15 m	Minor shoal area - less than 30 m Minimum depth LBS 1.8 m
159	Jalalpur Digalbagh	Minor shoal about 0.3 km length Minimum depth 0.3 m	Drying shoal across the river 0.5 km length Height plus 1.5 m
177	Manumukh	Major shoal about 2.5 km length	Minor shoal about 0.6 km length
179		Minimum depth 0.3 m	Minimum depth 1 m
198	Omarpur	Major shoal about 1 km length	Shoal area 0.6 km length
199		Minimum depth 0.15 m	Minimum depth 0.15 m[(1)]
211	Fenchuganj	About 3 km of shoal	Two shoal areas each about 0.3 km
214		Minimum depth 0.3 m	Minimum depth 0.6 m[(2)]

Notes: 1 The interpretation of the bathymetry on the chart may not be correct. An alternative would be a mid-stream shoal with minimum channel depth 1 m LBS and 0.6 m RBS.

2 An alternative would be 2 mid-stream shoals. The upstream shoal would show 1.2 m LBS, 1.8 m RBS minimum depth. The downstream shoal would show a minimum depth of 1.8 m LBS.

3.4.2 Feeder River Routes

The Kalni-Kushiyara River, apart from various *khal*s connecting the *haor*s with the main river, has many tributaries and distributaries. In earlier days, these rivers and *khal*s were navigable year-round. The Kalni-Kushiyara River, along with its network of feeder routes, served as an excellent waterway for the whole area, where no road transport alternative exists. However, siltation to these smaller rivers, *khal*s and *haor*s has disrupted dry season navigation.

The present condition of some of the important river feeder routes within the project area is described below (Figure G.4).

Ajmiriganj-Habiganj Route
This feeder route is actually an old branch of the Kushiyara River joined by the Jingry Khat and Ratna River. This river route has become an unclassified seasonal route due to total offtake siltation near Ajmiriganj, but it becomes navigable during the monsoon from May to November. In the monsoon season, boats to and from Ajmiriganj ply over the submerged flood plain to reduce the length of the route.

Normally, about a dozen engine boats move between Ajmiriganj and Habiganj during the monsoon season. They maintain scheduled trips on *haat* days. These boats are mainly passenger boats, but they also carry cargo. Table G.5 shows the sizes and capacities of the boats.

Table G.5: Dimensions and Capacity of Boats Plying the Ajmiriganj-Habiganj Route

Sizes	Length (m)	Width (m)	Draught (m)	Capacity (*maunds*)
Large	19	3.5	1.00	250-300
Medium	16	3.0	0.75	150-200
Small	7	1.5	0.25	20-30

Source: Traffic Counting Survey by Navigation Component of NERP in Kalni-Kushiyara River Area in 1995 Monsoon Season.

Dhanpur-Beramohona (Gudi) River Route
The Beramohona River originates from the Beramohona Haor and flows to the Surma-Baulai River at Dhanpur. It is locally known as Dhanpur Khal. The Beramohona River also flows to the Kalni-Kushiyara River at Shirail village, north of Ajmiriganj. The Dhanpur-Beramohona River route was a navigable link between the Kalni-Kushiyara and the Surma-Baulai Rivers. Also, it provided a very short link between the following local routes:

- Itna-Ajmiriganj;
- Dhanpur-Ajmiriganj;
- Lipshia-Ajmiriganj;
- Khaliajuri-Ajmiriganj;
- Sachna-Ajmiriganj via Gazaria;
- Somarchar-Ajmiriganj;
- Derai-Ajmiriganj.

Due to large scale channel bed siltation below Ajmiriganj, pre-monsoon flows start spilling through the Beramohona River and damage *boro* crop before the harvest. As a result, local people closed the Beramohona River in 1993.

In the dry season, all boats passing through Beramohona have to stop at the closure; passengers have to walk and take the ferry to reach Ajmiriganj, and cargoes have to be trans-shipped by ox-carts that cost Tk 3 per *maund* (Tk 80/tonne). In the monsoon, the boats can reach Ajmiriganj directly over the floodplain. The farmers are happy with the closure as it prevents flooding of crop lands; but the non-agriculture business people and others would prefer a navigation lock instead of a closure. The cargo transported through this navigation link include firewood, jute, paddy, fruit, fertilizer, salt, POL and bamboo.

Table G.6 shows the sizes of boats passing through the Beramohona River.

Table G.6: Dimensions and Capacity of Boats Plying the Dhanpur-Beramohona Route

Size of Boats	Length (m)	Width (m)	Draught (m)	Capacity (*maunds*)
Large	20	4.25	1.75	350
Medium	16	3.00	1.25	200
Smaller	6	1.50	0.25	15-20

Source: NERP Navigation Survey 1995

Kanchanpur-Dhakey Khal

The Kanchanpur-Dhakey Khal (locally called the Cherapur Khal) is an east-west navigation link between the Surma-Baulai River and the Kalni-Kushiyara River. Due to the Kalni River avulsion below Katkhal in 1994, the Cherapur Khal has become a perennial water course. The *khal* has widened and scoured its bed more than 2 m. Currently it carries above 20% of the Kalni flow during the dry season. The length of the *khal* is about 13.5 km, and the average width is about 35 m.

In the driest period (March), the LAD drops to one meter. At this time, boats larger than 500 *maund* capacity can pass with lighterage, for which the average cost is Tk 2/*maund*. In the dry season, four engine boats make regular trips to Abdullahpur, Kumri-Kadamchal, Katkhal, Kakailseo and Ajmiriganj; and on every Tuesday 10-15 boats from the market attend Mitamain *haat*-day, travelling through Kanchanpur-Dhakey Khal.

During the monsoon period, 15-20 engine boats make regular trips to Chamraghat and Mitamain from Ajmiriganj, Kakailseo, Katkhal, Abdullahpur, Kumri-Kadamchal and Adampur. In the peak monsoon, boats ply over the flood plains, but when monsoon waters recede and the banks of the *khal* become visible, the boats ply along the *khal*. The main cargo carried on this route is bamboo mats, paddy, wood, bananas, bricks, sand and vegetables.

Dimensions and capacity of boats passing through this *khal* are shown in Table G.7.

Table G.7: Dimensions and Capacity of Boats Plying the Kanchanpur-Dhakey Khal

Length (m)	Width (m)	Draught (m)	Capacity (*maunds*)
15-20	3.00- 4.25	0.75-1.75	200-250

Source: NERP Navigation Survey 1995

Chamraghat-Joykolos Route via Samar Char

This feeder river route is about 82 km long. It runs across the Surma-Baulai River system along the Narasunda River, Kalukhal, the Beramohona River and the Old Surma River. Engine boats require about 8 hours for the whole trip. The important markets/river stations served by this route are Chamraghat, Itna, Dhanpur, Samarchar, Derai and Goniganj. During the monsoon season, the boats go up to Joykolos, which connects to Kishoreganj, Sunamganj and Sylhet districts. Four to five boats make regular trips along this route, except during a brief period of two to three months in the dry season.

Chamraghat-Habiganj Route

The Chamraghat-Habiganj route is an important feeder route connecting Kishoreganj and Habiganj districts. The length of the route is about 50 km across the Surma-Baulai River system, using the Narasunda River, Dhakey-Kanchanpur Khal, the Shinai and the Ratna Rivers. This feeder route serves Chamraghat, Ghagra, Dhakey, Kadamchal, Kumri, Bitagol, Habiganj and other places along its way. Engine boats take 4 hours from Chamraghat to Habiganj in the monsoon season, and three hours from Chamraghat to Kadamchal in the dry season.

Many boats coming from Chamraghat also go to Ajmiriganj via Kathkal and Kakailseo. This route from Chamraghat to Ajmiriganj is navigable year-round, but the boats face draught problems at Dhakey, Phulpur, Kanchanpur in Dhakey-Kanchanpur Khal and at Katkhal and Kakailseo in the Kalni-Kushiyara River during dry season (February to March).

3.5 Freight and Passenger Traffic

3.5.1 Navigation Survey Area (NSA)

The NSA is a 110 km reach along the river system between Madna and Sherpur. Freight traffic within this area has been estimated based on the results of a comprehensive survey of 12 market towns or river stations. Three of these stations (Sherpur, Raniganj, Enayetganj) were not accessible by river during the dry season in 1995. Adjustments to the data were made later by incorporating information obtained from interviewing traders.

Tabulations by commodity and by origin/destination are presented in Appendix G.1, which provides wet and dry season estimates as well as annualized data. Table G.8 shows the summary of the annual estimates of freight traffic within the NSA.

Table G.8: Annual Estimates of Freight Traffic within the NSA (tonnes)

	Annual Freight Traffic ('000s tonnes)		
	All Cargo	Out of NSA	Within NSA
In	263	215	48
Out	149	98	51
TOTAL	**412**	**313**	**99**

The trade external to the NSA was 313,000 tonnes, and trade within the NSA was about 99,000 tonnes. Total trade was estimated at 412,000 tonnes, involving a probable population of 450,000. There were significant variations between wet and dry season trade.

This traffic includes some 50,000 tonnes of fertilizer trade that is destined to/from Kakailseo because of the presence of a major dealer in that town. Thus a conservative assessment of the total river traffic generated by local communities would be 0.9 tonnes per person per year.

Number and Type of Water Transport Fleet in 1995

The number and type of water transport fleet in 1995 in the dry and monsoon seasons can be seen in Appendix G.1. It is to be noted that the number of boats estimated on the basis of survey data are actually the number of boat movements (trips). The total annual number of boat and launch movement (trips) at the 12 river stations of the Kalni-Kushiyara River came to about 823,500 of which the engine boats accounted for 39%, non-mechanized boats accounted for 55% and the launches for 6%.

The water transport fleet which has been in use in the Kalni-Kushiyara River over the past years (from the partition date of 1947) has undergone significant changes. There have been changes in traffic, navigability conditions of the rivers and significant technological advances. The large tug-barge operation, which was seen along the Kalni-Kushiyara River in the old days (British and Pakistan periods), is gone. Similarly, the long-distance transit of the large, slow-moving, non-mechanized, colourful country sailboats from Sylhet to Bhairab, Ashuganj, Narayanganj and Dhaka has ceased to exist. They have been replaced by a large number of cargo and passenger launches and engine boats. The existing water transport fleet is very different from the former fleet.

Volume of Employment in Water Transport in the Kalni-Kushiyara River Project Area

The NSA Boat and Traffic counting survey of 1995 carried out by NERP produced data on the number of boats (mechanized (MB), non-mechanized (NMB) and launches) in the current fleet. The survey found that about 823,500 boat trips were made in 1995. The total number of person-days of employment in the water transport fleet at 12 important river stations came to 2.5 million person-days (PDs) in 1995 in the NSA. Factoring in the full river reach area, the total volume of employment came to 4.2 million PDs. The break up of the annual boat crew employment is presented in Table G.9.

Table G.9: Annual Volume of Employment of Boat Crews in the Water Transport Fleet Enumerated at 12 Important River Stations of the Kalni-Kushiyara River in 1995

Season	NSA ('000 PDs)				Full River Reach ('000 PDs)			
	MB	NMB	Launch	Total	MB	NMB	Launch	Total
Dry	396	63	120	579	656	104	199	959
Wet	889	850	196	1,935	1,473	1,408	324	3,205
Annual	**1,285**	**913**	**316**	**2,514**	**2,129**	**1,512**	**523**	**4,164**

Notes: Number of crew/boat as below:
MB=4, NMB=2, Launch=7.
Source: NERP Navigation Survey, 1995

Volume of Water Transport Traffic at 12 River Stations of the Kalni-Kushiyara River

Over 90% of the cargo and passenger traffic in the Kalni-Kushiyara River Management Project Area flows through its waterway network. The waterways and the waterways' physical infrastructure (landing jetties, handling and storage space, navigational aids) in the area, fall grossly short of adequately meeting the traffic demand. The speed, ease, and convenience of moving the traffic through waterways is presently low, and the cost is relatively high. This is mainly due to the under-investment in creating water transport infrastructure in the project area (compared to road and railway in Bangladesh).

The field survey and enumeration of the country boats and IWT vessels by the NERP Navigation Team, at the 12 important river stations on the Kalni-Kushiyara River in the dry and monsoon seasons of 1995, produced data on the volume of traffic. The data are presented for the two seasons separately and for the whole year of 1995 in Appendix G.1. Break-up of the incoming and outgoing traffic figures has also been given. A total of 441,000 tonnes of cargo traffic was handled through the Kalni-Kushiyara River in 1995 at the 12 stations. The total annual passenger traffic handled at these stations came to 9.7 million. Factoring up on basis of population, the annual volume of traffic for the full river reach came to 682,000 tonnes.

3.5.2 Kalni-Kushiyara River System

Assuming that the findings of the NSA can be applied to the complete river system from Madna to Zakiganj, then the probable total traffic would be in the order of 750,000 tonnes. This is likely to be at the upper end of estimated quantities, as Fenchuganj has good road and rail links, but poor downstream river linkages. Trade links between Zakiganj and Sylhet as well as India appear to be by road. Thus total current domestic trade within the river system can be estimated at 500,000 to 750,000 tonnes.

3.5.3 Indian Transit Traffic

Table G.10 gives available data on Indian transit traffic over the past 35 years. Transit traffic via the Jamuna and Kalni-Kushiyara River system was suspended in 1965, when a war broke out between Pakistan and India. It remained suspended during the period 1965-73, until Bangladesh revived the inter-country transportation agreement. Transit traffic has never recovered.

During the 8 years of suspended activities, India was forced to make alternative arrangements to serve its Eastern States. This included creating rain linkages between Calcutta and Assam as well as improving road access. Appendix G.1 provides a more detailed appraisal of India's Northeast Hill States.

It is apparent from the traffic data that although the Jamuna/Brahmaputra river link to Assam may be the most cost-effective, India prefers to handle trade via alternate all-India routes. Consequently, we cannot expect, even if an economic case could be made for greater river traffic via the Kalni-Kushiyara River system, that there will be any significant increase with improved LADs.

We must presume that India will maintain its transit traffic pattern. They will pay conservancy dues based on a need to maintain the rights to an alternate system to serve the Eastern States and as a means of maintaining a strategic capability for deployment of materials and equipment in the event of an emergency.

Table G.10: Indian In-transit Traffic on the Jamuna and Kalni-Kushiyara Rivers

Year	Total Traffic ('000 tonnes)	Jamuna River Share ('000 tonnes)	K-K River system Share ('000 tonnes)
1960-61	891	790	101
1961-62	1,000	887	113[1]
1962-63	844	765	79
1963-65	-na-	-na-	-na-
1965-73	Indian in-transit traffic remains suspended.		
1973-75	-na-	-na-	-na-
1975-76	-na-	-na-	-na-
1976-77	4	4	-
1977-81	-na-	-na-	-na-
1981-82	50	33	17[2]
1982-83	65	43	22
1983-84	60	40	20
1984-85	78	52	26
1985-86	97	66	32
1986-87	98	65	33
1987-88	100	67	33
1988-89	95	63	32
1989-90	55	37	18
1990-91	65	43	22
1991-92	50	33	17
1992-93	43	22	21
1993-94	55	29	26
1994-95	-na-	-na-	23[3]

Notes:

1 Total of 1,000,000 tonnes in traffic is split in ratio of 7.85:1 as found for the year 1960-61 to obtain traffic share via Jamuna and Kalni-Kushiyara River systems.

2 Traffic figures for Jamuna and Kalni-Kushiyara River systems for the years 1981-82 through 1990-91 were derived as per advice of BIWTA at ratio 2:1 from the total in-transit traffic figures shown in BIWTA Annual Traffic Report, 1991-92 year.

3 The in-transit Indian traffic 23,000 tonnes for 1994-95 via the Kalni-Kushiyara River system was obtained from custom officer Zakiganj.

3.6 Passenger Traffic

3.6.1 Navigation Survey Area

Passenger traffic has been estimated in the same manner as freight operation: from a survey of 12 markets/stations between Madna and Sherpur. Estimated passenger trips were about 3.33 million during the dry season and 6.36 million during the wet season, with an annual movement of 9.7 million (Appendix G.1).

Travel activity is somewhat influenced by the season. There is an average of 7.7 trips per person per month during the dry season and 10.5 trips per person per month during the monsoon season.

Travel activities on the river are undoubtedly depressed because of the lack of linkages to centres where people wish to travel (Community Profiles in Appendix G.1). In general, communities other than Fenchuganj have business contacts primarily with Bhairab Bazar. This is where most rice, grocery items and consumer goods are shipped from, as well as to where most paddy is forwarded for processing. Official travel to major centres appears to be Sylhet in the upper river reaches, and Habiganj in the lower reaches. Examples of times and costs for personal travel are given in Table G.11.

From the travel times given it is obvious that launch travel is very slow, averaging only 9 km/hour on the main Kalni-Kushiyara River system channel. This may be partly due to extremely shallow draughts in many areas, and also to the relative inefficiency of the present launch design and propulsion.

3.6.2 Full River Reach

By extending the findings of the NSA to the full river reach, the total current travel is in the order of 16 million person-trips per year, excluding crew members. Given a reasonable year-round channel, it could be expected that numbers would increase significantly in the dry season. They could not be expected to reach monsoon season levels because of the reduced opportunity for dry season travel. However, for those communities where dry season travel is difficult and/or expensive, an improvement in both access time and reduction in cost could result in a much higher travel activity than is apparent. Also, crew members should not be overlooked. They may be carrying products to the market to undertake trading there, or bringing produce back to their villages.

Travel, above the basic necessities of visits to markets and travel to administrative centres, is essentially an economic function. Thus, the more disposable income available to the local population and the greater the access to travel opportunities, the higher the travel propensity.

Table G.11: Kalni-Kushiyara Personal Travel Linkages

From	To	Season	Time (hrs.)	Cost (Tk)	Mode
Markuli	Bhairab Bazar	Wet Dry	2.5 6.0	20 75	direct launch via Sherpur
Paharpur	Habiganj	Wet Dry	2.5 3.5	26 46	launch jeep
Paharpur	Bhairab Bazar	Wet Dry	10.0 14.0	60 60	launch launch
Ajmiriganj	Habiganj	Wet Dry	2.5 3.5	26 46	country boats jeep, on foot
Ajmiriganj	Bhairab Bazar	Wet Dry	10.0 12.0	60 60	launch launch
Kakailseo	Habiganj	Wet Dry	2.5 4.0	26 49	country boats country boats & on foot
Kakailseo	Bhairab Bazar	Wet Dry	9.0 11.0	57 57	launch launch
Abdullahpur	Habiganj	Wet Dry	2.0 5.0	25 0	engine boats foot
Abdullahpur	Bhairab Bazar	Wet Dry	7.0 7.0	48 48	launch launch

4. FUTURE WITHOUT PROJECT (FWO) CONDITION

4.1 Introduction

This section presents the impact on navigation for the future without project (FWO) scenario.

Given the history of channel instability over the last 30 years, it is difficult to accurately predict the future morphologic characteristics of the Kalni-Kushiyara River system. Avulsions and channel shifts are highly complex processes that may be triggered by chance events. Therefore, any forecast will be somewhat speculative. Nevertheless, it was felt that a realistic scenario could be developed on the basis of the river's recent geomorphic evolution. The following comments summarize the main features of this assessment. Additional details of the analysis are contained in Annex A - Sedimentation.

Spills, river bank breaching and bank erosion will continue to occur between Sherpur and Ajmiriganj. However, the rate of bank erosion in this reach is expected to decline in comparison to the last 30 years. This is because most of the recent channel instability in this reach was related to channel adjustments following the Suriya avulsion and Markuli closure. It is expected that the channel has reached its equilibrium width and further channel widening will be minor. However, the meander pattern is still adjusting by eliminating short radius bends through natural loop cuts. This will cause some short-term bank erosion problems between Sherpur and Markuli but should eventually lead to a more stable pattern.

Since 1993, the main instability on the river has occurred downstream of Ajmiriganj and it is expected that this situation will continue in the future. Cherapur Khal is enlarging rapidly and appears to be diverting a substantial amount of flow into the Baulai River system. A complete avulsion would result in the abandonment of the lower Kalni-Dhaleswari River and major erosion and sedimentation problems along the lower Baulai River. The magnitude of these impacts would be at least as large as the impacts resulting from the earlier Suriya avulsion. However, based on a comparison of channel lengths and slopes along the Baulai and Kalni Rivers, it appears unlikely that the Baulai route will capture all of the flow in the immediate future. It appears more likely that Cherapur Khal will enlarge until it forms a major distributary channel, carrying slightly less than half of the incoming flows on the Kalni River. Empirical Regime equations suggest the top width of Cherapur Khal could reach up to 200 m (similar to the branch of the Kalni River that developed opposite Katkhal village in the early 1990's). This development will produce significant channel adjustments on both the lower Baulai River and lower Kalni River systems.

Increased flows through Cherapur Khal will induce bank erosion and increase channel shifting along the 13.5 km length of the *khal*. Channel widening alone should produce bank erosion of approximately 280 ha and will add an additional sediment load of approximately 15 million tonnes to the Baulai River. Downstream of the diversion, Kalni River flows will be decreased substantially, particularly in the dry season and the pre-monsoon season (effectively the channel-forming flows on this river). The reduced discharges will result in partial infilling of the channel and a reduction of the channel cross-section. Empirical Regime equations can be used as a guide for estimating the change in the channel geometry that will occur. However, more direct guidance can be provided from the observed channel changes that presently occur on the Kalni River immediately downstream of the Baida River bifurcation. At this point about 60% of the flow is

carried by the Baida channel and about 40% continues down the Kalni branch. Surveys along this reach show the cross-sectional area at bankfull stage decreases by around 450 m^2 (about 50%) below the bifurcation. On this basis it was estimated that the cross-section of the Kalni River will be reduced by 400 m^2, downstream of Cherapur Khal. This corresponds to an increase in the average bed level of between 1.5 - 1.0 m. This would effectively cause the Dhaleswari branch between Issapur and Kalma to be abandoned in the dry season.

4.2 Impacts on Navigation

The hydromorphological changes are expected to impact water transport sector in the following way:

- Water transportation will face setbacks during the post-monsoon season for a longer period, maybe starting from November. Length of critical dry period for navigation (February - March) may also increase to January - April.

Table G.12: Present Dry Season Traffic-Lower Reach

Station	Total Traffic	
	Cargo ('000 tonnes)	Passenger ('000 passengers)
Madna	0.8	70
Kadamchal	0.7	75
Adampur	7.3	326
Abdullahpur	5.2	220
Katkhal	2.4	268
Kakailseo	57.2	157
Ajmiriganj	39.9	1,655
Total	**113.5**	**2,771**

Source: NERP, 1995 Navigation Survey

- Currently, LAD is about 0.25 m at Issapur and falls below 0.75 m at many places (Khajir Khola, Adampur, Madna, Shambazar, Manumukh) during the dry period. Further deterioration indicates BIWTA service (launch) between Ajmiriganj and Bhairab Bazar will be totally disrupted during the dry season. Moreover, medium and small size engine boats and non-mechanized country boats, may also be inactive from the Kalni-Kushiyara River for a longer period (January-April) particularly downstream of Cherapur Khal.

- The cost of cargo and passenger transportation will considerably increase due to slow movement of cargo and passenger fleets including frequent stoping and several transhipments due to inadequate draught. Moreover, in many places the basic essential cargo items will have to take costlier, under-graded seasonal roads. About 295,000 persons in river communities between Cherapur Khal and Abdullahpur will be seriously affected based on NERP 1995 navigation survey (Table G.12 the sum of Abdullapur and Kadamchal). Cost of POL, fertilizer, seeds will also be increased which in turn may have adverse impact on *boro* production.

- Cherapur Khal (Dhakey-Kanchanpur route) will be perennial due to an increase in depth during the dry season. But the navigation distances will be increased by 12 km to Bhairab Bazar for the residents living upstream of Cherapur Khal which in turn will increase the cost of transportation. Based on NERP 1995 navigation survey, this will adversely impact 2.8 million passengers in the river reach between Katkhal and Ajmiriganj (Table G.12).

- The bed level of the Baulai will increase due to the deposition of 15 million tonnes of eroded materials. This might disrupt the Baulai navigation system during the dry season.

- Feeder rivers will also suffer loss of navigability as siltation will increase at their confluences with the main river;

4.3 Analysis of FWO Condition

4.3.1 Forecasts on Freight Traffic

Table G.13 shows that freight traffic in the project area will double in Year 2026 from its present level during the dry season.

Freight traffic has been analyzed based on the following assumptions:

- The demand for building materials (boulders, stones, sands, rods, cement etc.) in the project area is mostly urban. The available survey data implies a per capita consumption of building materials of 0.97 tonnes. It is assumed that the per capita consumption in the dry season is 0.60 tonnes (62%) and 0.37 tonnes (38%) in the wet season.

- The urbanization is rather low (10%) compared to a 19% national average and the pace of urbanization is not expected to increase spectacularly. But a considerable number of foreign wage earners from this area send large remittances to their families. A significant percentage of the remittance is used for civil construction. The total annual demand for building materials will continue to increase. It is assumed to increase by 3% over Years 2-10, 4% over Years 11-30;

- Petroleum, Oil and Lubricant (POL) is a strategic and essential agricultural input for paddy cultivation in the extensive agricultural lands. The demand for POL will increase as HYV *boro* cultivation become more favourable in the project area. But with the continuing deterioration of the river draughts under FWO condition, movements of POL will increase at lower rates than the national average of 4 to 5%. It is assumed that the annual rate of growth of POL traffic will be 3% over Year 2-10 and 2% over Years 11-30 both for urban and rural populations.

Table G.13: Projected Dry Season Freight Traffic - FWO Scenario

Item	Present 1995 ('000 tonnes)	FWO 2026 ('000 tonnes)
Fertilizer Demand	22	48
Fertilizer Rehandled	2	5
Fertilizer Transit	28	28
Rice	30	46
Building Materials	73	208
POL-Urban	3	7
POL-Rural	7	17
Other Food Items	20	30
Consumer Goods	31	47
Internal Rehandle	13	26
Total	**229**	**426**

Source: NERP, 1995 Navigation Survey

- The growth pattern of consumer goods is determined by the population growth rate and level of personal income. The annual population growth rate is 1.8% compared to a national average of 2.1%. The sub-regional GNP is also found to be lower (2.1%) than the national average of 4%-5%. Based on these considerations, it is assumed that the annual growth rate of consumer goods will be 2% during Years 3-10, 1.5% during Years 11-20 and 1% during Years 21-30.

From the navigation FWO scenario, it could be inferred that the cost of living will increase significantly and all other activities will slow down to a minimum, a situation neither desirable nor acceptable. Moreover, people of the project area are already confined within their homesteads for three to five months in a year during the monsoon season. Disruption of navigation will also confine them during the dry season.

5. FUTURE WITH PROJECT (FW) CONDITION

5.1 Introduction

Under the future with project (FW) scenario, navigation along the Kalni-Kushiyara River will improve significantly. The channel improvements between Madna and Ajmiriganj including removal of shoals at 5 locations upstream of Ajmiriganj will facilitate year round navigation for large mechanized IWT vessels (Figure G.5 and G.6). Given assured operation during the dry season, the In-Transit and Inter-Country cargo movement between Bangladesh and India should improve. Inflow and outflow of major commodities should increase substantially and it is expected that the Ajmiriganj port will regain its former importance. Movement of passenger traffic will also increase because of direct links with Dhaka and as a shortened distance of about 22 km. The navigation impacts are summarized into the following major headings:

- Freight Traffic;
- Passenger Traffic; and
- International Traffic

5.2 Freight Traffic

The potential navigation benefits for cargo movements were estimated based on cost savings and projected cargo volumes.

The expected cost savings are mostly based on estimates of the differences between wet and dry season freight rates (Table G.14). This is calculated as the differences between BIWTA type craft rates operating at 2.4 m LAD (Class II) versus dry season rates for country boats. Possible cost savings also include the increase in the dry-season traffic movement on the river diverted from other channels and roads.

Table G.14: Cargo Cost Savings - FW Scenario

Commodity	Savings (Tk/tonne)
Fertilizer:	
Project area use	67.5
Rehandled	12.5
Trans-shipment	122.5
Through-traffic	36.0
All Other Commodities	64.5

Cargo Profiles and Forecasts

Table G.15 shows that freight traffic will be increased by about 200,000 tonnes under FW condition. This will produce an additional employment opportunities of about 0.63 million person-days in the project area based on current employment ratio of 0.317 mt to a person-day.

For the purposes of projecting cargo traffic movements, commodities have been grouped into six main headings: fertilizer, building materials, POL, other food items, rice/paddy and consumer goods/miscellaneous.

Fertilizer is the main industrial traffic on the river. It consists of an internal demand component, internal rehandle, trans-shipment, and through-shipments.

The *internal demand* for fertilizer is mainly determined by paddy fertilizer requirements. This has been estimated based on FW cropping pattern and fertilizer application rates along the 5 km band of the main river.

Table G.15: Projected Dry Season Freight Traffic - FW Scenario

Item	FWO (2026) ('000 tonnes)	FW (2026) ('000 tonnes)
Fertilizer Demand	47.5	51.3
Fertilizer Rehandled	4.8	5.1
Fertilizer Transit	28.0	36.0
Fertilizer Through-Shipment.	0.0	160.0
Rice	46.0	46.0
Building Materials	207.8	228.7
POL-Urban	7.4	9.8
POL-Rural	17.2	18.9
Other Food Items	30.0	30.1
Consumer Goods	47.2	47.3
Internal Rehandle	25.5	38.1
Total	**461.4**	**671.3**

Since commodity movements tend to move from the wholesale market to the local market and then to the village, there is also an *internal rehandled* component. The NSA traffic survey shows about 7.5% of net in bound cargo during the dry season and over 20% in the monsoon season. A 10% rehandling factor has been assumed for the analysis.

There are also fertilizer *trans-shipments* because of the presence of major fertilizer wholesalers (at Kakailseo and Ajmiriganj) within the project area. These wholesalers buy large quantities of urea from the Fenchuganj plant and then retail it to farmers in the project area. At present the merchants in Kakailseo and Ajmiriganj ship some 28,000 tonnes in excess of local needs and they have indicated that with a more effective dry season navigation channel they could increase their business about 30%. Based on this, it is estimated that fertilizer trans-shipments during the dry season should amount to about 36,000 tonnes.

Fertilizer *through-shipments* through the project area is also considered. It is expected that this will involve 10,000 tonnes from the existing fertilizer plant at Fenchuganj and 150,000 tonnes from the Shah Jalal plant. The production capacity of Shah Jalal plant is 310,000 tonnes and is expected to start operation in Year 2000.

Details of cargo profiles and forecasts are presented in Chapter 7.

5.3 Passenger Traffic

Although passengers should realize some savings, most of these are likely to be time-related rather than actual reduced travel costs. For example, a passenger might reduce his travel time from 5 hours to 4 hours and this time-saving could have an opportunity cost (or implied benefit) similar to his/her hourly wage rate. Additionally, improved access to more remote areas during the *rabi* season will inevitably generate additional commercial activity which would then translate into more direct and indirect (i.e. spin-off) employment opportunities. This includes additional employment for boat crews.

For example, if dry season passenger traffic was equal to even 75% of monsoon season passenger traffic, this would suggest that passenger traffic could climb by 800,000 people. Thus, even if each passenger saved or generated just 20 additional Taka from this economic activity (which is about 50% of a farm labourers daily wage), it could amount to some Taka 16 million/year. However, this benefit is not included in the economic assessment, because the available data does not distinguish between launch passengers on purely local routes and those on longer runs where savings may be achievable.

5.4 International Traffic

With the proposed project, it will be physically possible to accommodate additional transit traffic through the Kalni-Kushiyara River reach particularly for the Northeast Hill States (NHS) of India.

5.4.1 Population in NHS

The total population in the seven Northeast Hill States of India in 1991 was 31.55 million, up from about 20 million in 1971 (Table 12, Appendix G.1). Most of this increase has taken place in Assam. The population growth in this region has been faster than in India as a whole, effectively doubling since 1961.

5.4.2 Needs for Transit Traffic in NHS

Given the population growth and increasing expectations, the cargo demand between India and the Northeast Hill States through Bangladesh is at least two million tonnes, double the transit traffic of 1961-62 (Table G.10). Available information also show that the rapid growth in population has led to modern mechanized agricultural methods and as a result, the demand for fertilizer has increased. This would suggest transportation needs closer to 3 million tonnes.

5.4.3 Expected Transit Traffic through KKRMP

Transit traffic through the Kalni-Kushiyara was upto 113,000 tonnes/year in the early 1960s (Table G.10). However, since the resumption of the trade agreement entitled "Protocol on Inland Water Transport and Trade" between Bangladesh and India in 1973, cargo volumes have only reached about 25% of previous transit volumes. (Table G.10).

The distance by river from Calcutta to Karimganj is about 820 km. The estimated freight cost of a Bangladesh IWT type vessel on the Calcutta to Karimganj route is Tk 450/tonne. Handling costs for cargo might add Tk 100/tonne. Thus, the landed cost at Karimganj would be less than Tk 1,000/tonne.

The distance between Calcutta and Karimganj by road is slightly longer than the distance by river. This suggests that the Calcutta - Karimganj water transport route should offer significant cost savings and higher potential for Indian transit traffic, since the cost of road transport is at least two times higher than the water transportation cost in Bangladesh. The above cost savings also do not take into account the impact of possible back haul business such as logs or other bulk cargo.

The KKRMP will provide a Class II navigation channel round the year. As a result, the Indian transit traffic could increase to over 250,000 tonnes/year based on the ratio of population and

traffic volume of 1961 (Table G.10). However, improvement of the Kalni-Kushiyara River would not automatically result in increased cargo unless there is a parallel political agreement to take advantage of the improved waterway. This may require a modification to the agreement between Bangladesh and India on transit cargo to increase marine transit quantities.

5.4.4 Expected Benefits from Indian Transit Traffic

Future transit traffic volume in the Kalni-Kushiyara may vary from a present figure of 24,000 tonnes/year to 250,000 tonnes/year. The corresponding benefit could then vary from Tk 2.4 to 25.0 million, assuming a GOB levee of Tk 100/tonne, a reasonable assumption. However, these benefits have not been included in the project's economic assessment since they are dependent on future political decisions.

5.5 Impact During Execution

The first adverse impact during the execution of the project is the possible interference in the plying of the vessels/country boats at the places of dredging works. There may be complete/partial blockage of the navigation channel created by the dredgers or the pipe-lines while the pipes are discharging the spoil on the far side of the river. This would be a problem particularly during the dry season, when the effective channels become rather narrow. A contingency plan has been developed to take care of these problems and issues. Details of mitigation measures are provided in the Environmental Management Plan of the KKRMP feasibility study main report.

6. ANCILLARY DEVELOPMENTS WITH ADDED VALUE

6.1 Stop Locks

Because of the community service nature of the river, there are many towns and villages, as well as major centres, that are accessed via the Kalni-Kushiyara River during the flood season. Damage to embankments is evidence of the determination of local boatmen to take the shortest possible route to their destination.

There are two places where river closures have been erected to control flooding, but which have had serious impacts on the movement of people and goods. These are at Markuli (1978) and Beramohona (1994), and both prevent ready access into the hinterland. In both places, the barrage acts as a barrier to navigation for perhaps 10 months of the year. The flood control benefit is important, but only acts for a short period for pre-monsoon floods.

Consideration of a simple Guillotine stoplock structure integrated with the embankments would permit flood control to be maintained, but also enable vessel movements when water levels were equal on both sides. There may also be benefits with regard to post-monsoon drainage.

Because of the long establishment of the Markuli closure, the reach of the Old Kalni River located behind the closure has all but disappeared over some 2 km and would require re-excavation as a navigation channel. Also, there is about a 1 m water level difference between the Kalni and the old Surma as a result of silting over the past 20 years. This could be recovered by the flood control works proposed. An alternative would be to select a different right bank channel to convert to navigation purposes. Such structures could be considered for any spillway closure that was required to achieve flood benefits, but was also valuable for irrigation water access, flood drainage and navigation.

Initial cost estimates for a 10 m wide opening, including concrete abutments and a simple chain hoist gate mechanism, indicate a price of Tk 5 million.

6.2 Other Channel Works

6.2.1 Landing Stages

Access to river craft is difficult because most of the Kalni-Kushiyara lacks landing stages that would enable easy transfer of goods and passengers between ship and shore. This is partially a problem of river characteristics and the difference between dry season and wet season flows. However, it is also a function of the type of river craft used - vee hulls which cannot easily be put ashore for transfer. If both Inland Waterways Transportation (IWT) vessels and country boats are redesigned along the lines of the type of craft envisaged in Section 6.4 of this annex, then the problem is much reduced, although it does not go away all together.

6.2.2 Channel Markers

An essential component of improved navigation for dry season operation will be channel markers to indicate shoal areas and the direction of the channel if it goes across a shoal rather than through it or takes one side of the river or another. Such markers will be needed for safe navigation even if only daylight operations are considered.

6.3 Barak River (Lower Khowai)

Re-excavation of the Barak River, as well as providing flood control and post monsoon drainage, could have useful navigation benefits as well. Habiganj is a major destination for many persons from the lower Kalni area, partly for official purposes, but also as a road/rail head for travel to Bhairab Bazar and Dhaka. As access requirements are more for personal travel than large scale commodity movements, a 1.8 m LAD channel would meet requirements for navigation purposes.

6.4 Shallow Draft Craft

6.4.1 IWT Craft

IWT boats are poorly adapted to shallow draft operations. Typical characteristics are shown in Table G.16 and Figure G.7.

Table G.16: Characteristics of IWT Boats

Cargo	LOA	LWL	B	D	d	Δ_L	C_b	Engine	Speed
350	39.0	37.5	7.39	2.90	2.5	500	.7	1x300	10–12 kph
450	42.0	41.5	9.15	3.05	2.5	645	.7	1x350	10–12 kph
550	45.0	43.0	9.68	3.35	2.8	780	.7	1x500	10–12 kph
650	44.8	42.9	9.15	3.20	2.9	816	.8	-nd-	-nd-

Source: BIWTMAS, p. 6-17.
Notes: 1. Speeds may be lower if in shallow water and when loaded.
2. Symbols are defined in Figure G.7.

Vessels could be adapted to a shallow water environment by increasing block coefficient (C_b) moving from a conventional "ocean" bow to a spoon type bow, and from a cruiser to a transom stern. Additionally, a move from single to twin screw propulsion would enable propeller diameters to be reduced and a tunnel hull arrangement incorporated. This is much more efficient in shallow draft environments, and the spoon type bow is quite efficient at speeds normally employed in the river system.

Figure G.7 presents a sketch of a standard shallow draft IWT vessel that would enable significant production cost reductions to be achieved by prefabrication of bow, stern, and mid-body section, as well as a standard stern house and bridge assembly. Larger and smaller capacities could be achieved by adding/subtracting mid-body sections. A shallow draft vessel like this has other advantages in that it can get closer to the bank for load and discharge, simplifying loading stages.

The proposed redesigned IWT vessels could achieve the economy of a Class I Channel with existing vessels; but on a Class III channel, this would significantly reduce dredging requirements.

The vessel outlined could readily be adapted to container movement by ensuring that the hatch opening matches international container sizes with appropriate clearance. Operating with containers, the boats could carry 36–45 TEU, depending on container gross weight and river draft.

Although inland operations could be more effectively conducted with tug/barge operation, the generally narrow deep water channels, extreme course changes needed in meanders and loops, and the need to maintain two-way traffic may preclude the use of such equipment.

6.4.2 The Modern Country Boat

The country boats, as the traditional means of water travel within Bangladesh, have a long and honourable history. Until recently, they were sail or oar powered, but most now operate with some kind of engine. Seasonally employed boats typically use tube well pump engines to provide motive power.

While such craft have shown an ability to respond to changing circumstances and continue to play a critical role in the transportation sector, they are hydrodynamically inefficient and consume large quantities of wood. This latter situation puts continued pressure on a dwindling resource and justifies the consideration of alternatives.

Given the relative availability of labour and the number of hours needed to build a glass fibre hull, it may be appropriate, particularly for passenger launches, to develop a series of standard plugs that could be used to produce basic hulls that would then be outfitted locally. This would require a significant change in approach to country boat construction; but by starting with launches, the concept could be demonstrated and commercial development of other hulls could then be more readily considered.

Glass fibre has many advantages, and it is probably preferable in the Bangladesh environment to ferro-concrete hulls. Major benefits for launches would be:

- more stable hull;
- shallow draft;
- higher speed for given horsepower;
- low wash;
- long-life hull;
- easy repair;
- built in buoyancy.

An example of the type of craft, which could be licensed, is provided in Figure G.7. This includes 2 examples of the standard range of vessel from RTK Marine in the UK.

A small pilot project to demonstrate the practical operational feasibility in the selected short and medium haul (25-60 km ranges) river routes, especially connecting Bhairab Bazar with *haor* destinations (e.g. Astagram, Ajmiriganj, etc.) can be carried out with lot of prospects for speedy, modern water transport in the area.

7. ECONOMIC ANALYSIS

7.1 Introduction

Since the early 1960's, the Kalni-Kushiyara River navigation channel between Fenchuganj and Astagram has deteriorated from a Class I perennial navigation river to a Class IV seasonal river route. Silting and shoaling is now so extensive it is creating serious draft problems for navigation during the dry season (December-April). This is equally true of the various tributaries, especially the Manu River, Khowai River, and the Kalni-Baulai connecting channel.

The proposed project would provide for a Class II navigation channel (defined as 2.4 m LAD and 50 m width) throughout the *rabi* (dry) season between Fenchuganj and Astagram.

7.2 Baseline Data

A detailed traffic survey was undertaken within the 110 km reach between Madna and Sherpur. It concentrated on a 5 km band on each side of the river. The full river reach includes a section of the south bank of the Kalni-Kushiyara that is outside the project area.

A general profile of existing water transport in the region (12 stations navigation survey - NERP, 1995) is indicated in Table G.17.

Table G.17: Kalni-Kushiyara River Transport Profile, 1995[1]

Item	Dry Season	Monsoon Season	Annual
No. of Boat Trips	147,680	675,203	822,883
Total Cargo (,000t)	179	292	441
Passengers (,000)	3,333	6,355	9,688

Note: 1 About 60% of this linear distance is in the study area.

Of the total cargo, the important traffic items are: paddy & milled rice (21.4%), fertilizer (19.0%), building materials (rock, sand, cement, rod, etc. - 9.0%), fruits and vegetables (10.3%), and consumer goods (3.8%).

7.3 Cargo Benefit Calculations

The potential navigation benefits for cargo movements are based on estimated **cost savings** and **projected cargo volumes**. The summation of the cost savings generated from different types of cargo movement is considered the total navigational impact of the project.

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7.3.1 Cargo Cost Savings Used for Project Economic Analysis

The cargo transportation cost savings, presented in this section, are based on the difference between IWT type craft operating at 2.4 m LAD and dry season rates for country boats. The achievable transportation cost savings are defined as 50% of the estimated transportation cost savings calculated based on the NERP, 1995 Navigation Survey. Typical examples are provided in Table G.18.

Table G.18: Example of Cargo Transportation Cost Savings Calculation

Cargo	Route	Km	Wet IWT (Tk/tonne)	Dry C/B (Tk/tonne)	Estimated Cost Savings (Tk/tonne)	Achievable Cost Savings (Tk/tonne)
Fertilizer	Fenchuganj–Kakailseo (in bound)	116	115	250	135	67.5
Fertilizer	Kakailseo–Bhairab Bazar (out bound)	89	115	225	110	55.0
Fertilizer	Kakailseo-Katkhal	8	44	69	25	12.5
Rice	Bhairab Bazar–Markuli	120	141	270	129	64.5
Flour	Bhairab Bazar–Adampur Bazar	60	75	152	77	38.5

For Bhairab Bazar - Markuli, achievable savings for inbound goods will be assumed at Tk 64.5/tonne or 50% of the estimated saving of Tk 129/tonne. Internal rehandled cargo savings will be taken at Tk 12.5/tonne based on an assumption that 8 km (Kakailseo-Katkhal) is fairly typical of local movements, and 50% of the indicated wet/dry difference could be achieved.

For fertilizer trans-shipped through Kakailseo, inbound savings will be assumed at Tk 67.50/tonne and outbound at Tk 55/tonne for a total of Tk 122.5/tonne (half of the estimated cost savings).

Through-shipped fertilizer, assuming movement from Fenchuganj to Dhaka, will be compared between an IWT rate operating at 2.9 m draft, and the truck rate. The estimated IWT rate at 2.4 m draft is Tk 253/tonne compared with a truck rate of Tk 325/tonne. This shows cost savings of Tk 72/tonne and 50% of this (or Tk 36/tonne) will be assumed as achievable. The achievable transportation cost saving for all other commodity also Tk 68.5/tonne.

7.3.2 Cargo Profiles and Forecasts

For the purposes of projecting cargo traffic movements, commodities have been grouped into six main headings: rice/paddy, fertilizer, building materials, petroleum/oil/lubricants (POL), other food items, and consumer goods/miscellaneous. Each is briefly profiled following.

Fertilizer: Fertilizer is the main industrial traffic on the river. It consists of an internal demand component, internal rehandling, trans-shipment, and through-shipments.

Much of the project area is dedicated to rice/paddy production. Thus, the *internal* (i.e. project area) *demand* for fertilizer is largely determined by paddy fertilizer requirements. The initial fertilizer demand under the FW project situation is estimated from cropping pattern projections, the total cultivated area within 5 km band on each side of the river, and estimated fertilizer application rates (Table G.19).

Table G.19: Fertilizer Application Rates and Cultivated Area

Fertilizer	HYV *Boro* (kg/ha)	Local *Boro* (kg/ha)	B *Aus* (kg/ha)	Origin
Urea	134.7	42.4	7.0	Fenchuganj
TSP	73.3	19.1	0	Bhairab Bazaar
MP	26.3	2.1	0	Bhairab Bazaar
Net Cultivated Area within the 5 km band each side of the River:				**138,900 hectares**

Fertilizer is assumed to be transported during the dry season to meet the planting schedules of these winter-sown crops. The resulting estimate of 21,760 tonnes is then expected to increase at the same rate as national fertilizer consumption growth rates during the last five years which corresponds to about 3%/year during the life time of the project.

Since commodities tend to move from the wholesale market to the local market and then to the village, there is also an *internal rehandled* component. The NSA traffic survey estimated that this was presently about 7.5% of net inbound cargo during the dry season; over 20% in the monsoon season. Therefore, a 10% rehandling factor was assumed. The resulting estimate of 2,176 tonnes is also expected to increase at a rate of 3%/year during the life time of the project.

Additionally, there are fertilizer *trans-shipments* because of the presence of major fertilizer wholesalers (at Kakailseo and Ajmiriganj) within the project area. These wholesalers buy large quantities of urea from the Fenchuganj plant and then retail it to farmers in the project area. At present the merchants in Kakailseo and Ajmiriganj ship some 28,000 tonnes in excess of local needs and they have indicated that with a more effective dry season navigation channel they could increase their business about 30%. Based on this, it is assumed that fertilizer trans-shipments during the dry season should amount to about 36,000 tonnes and it is assumed it will remain constant at that level during the life time of the project..

Finally, fertilizer *through-shipments* through the project area must also be considered. It is expected that this will involve 10,000 tonnes from the existing fertilizer plant at Fenchuganj and 150,000 tonnes from the Shah Jajal plant when it commences operations in about the Year 2000. Therefore, the resulting estimate of 160,000 tonnes is assumed to remain constant during the life-time of the project.

Rice/Paddy: Most smaller farmers in the project area typically consume, or sell most of their *boro* (dry-season) paddy during the monsoon season and subsequently buy milled rice in the local market during the dry season. This rice comes from either larger local farmers who retain part of their boro production through the wet season or imports from Bhairab Bazaar through the Kalni-Kushiyara River channel.

The NERP navigation survey shows that for the existing population, within the 5 km band on each side of the river, the dry season (5 months) demand for rice exceeds the rice production by 30,000 tonnes.

Therefore, this KKRMP area presently imports about 30,000 tonnes of rice equivalent to 44,000 tonnes of paddy, during each dry season of which 24,000 tonnes comes from Bhairab Bazar and 6,000 tonnes from Habiganj. Thus, by further assuming that the ratio of imported rice to the total rice demand in the area remains the same for the entire life of the project, future rice import estimates are tied to population growth projections.

Building Materials: This commodity group covers materials such as cement, reinforcing rod, sand, stone, shingles and brick, and is largely an urban demand. Virtually all building takes place in the dry season. Survey data indicates that the urban per capita consumption of building materials is about 0.97 tonnes, implying a present use-level of about 72,690 tonnes. About 62% of the building materials are estimated to presently move in the wet season while the remaining 38% move in the dry season. As a result, the price of building materials moved in the wet season is inflated by storage costs while the price of building materials moved during the dry season is inflated by higher transport costs.

In the future it is expected that the total demand for building materials will increase by 3%/year during Years 2-10, 4%/year during Years 11-20, and 5%/year during Years 21-30.

Petroleum, Oil & Lubricants (POL): The demand for petroleum, oil, and lubricants largely depends on irrigation and urbanization in the area. Shipments to the region during the dry season are much greater than during the monsoon season because fuel is required for *boro* rice/paddy irrigation pumps. The traffic survey conducted indicated that the current movement was about 7,300 tonnes for rural use and 3,100 tonnes for urban use, giving a total movement of about 10,400 tonnes in the full river reach.

In the future, it is expected that the demand for POL by the urban population in the area will increase (like building materials) by 3%/year during Years 2-10; 4%/year during Years 11-20; and 5%/year during Years 21-30. Traffic movements of POL to meet the demand for the rural population are expected to increase at a slightly slower rate: 3%/year during Years 2-10 but only 3.5/year during Years 11-30.

Other Food Items: This includes fruits and vegetables, wheat and flour, salt, molasses/*gur*, and spices. The current dry season movements are shown in Table G.20.

Table G.20: Other Food Items - Current Dry Season Freight Traffic

Other Food Items	Traffic ('000 tonnes)
Vegetables & Fruit	8.9
Wheat & Flour	7.1
Salt	1.6
Molasses/Gur	1.6
Spices	0.4
TOTAL	**19.6**

Assuming per capita consumption of these items remains the same in the future, future cargo movements during the dry season are similarly tied to population trends.

Other Consumer Goods/Miscellaneous: This category includes consumer goods and other unidentified items such as timber, clothing, shoes, etc.. The traffic survey indicates that the net in-bound cargo movements of these items during the dry season presently amounts to about 30,800 tonnes on the full river reach. It is expected that per capita consumption of these items will also remain the same over the life time of the project.

Rehandling Factor: The NSA traffic survey for the dry season indicates a rehandling percentage of 7.5% of net inbound cargo. It is expected that the rehandle percentage will increase to 10% after the project is implemented.

7.4 Phasing

It is expected that the navigation benefits from the proposed initiative (project) would be gradually phased in from 0% during Years 1-4; 20% during Year 5; 40% during Year 6; and 100% during Year 7-30.

7.5 Summary

A summary of the base data employed to project future cargo navigation benefits, for the proposed intervention, is provided in Table G.21. The economic unit navigation cost savings are calculated by applying the Standard Conversion Factor (SCF=0.9, Annex E) to the Financial unit cost saving.

Table G.21: Navigation Benefits Parameters for Project Economic Analysis

ITEM	Unit Cost Saving (Tk/tonne)		Dry Season Baseline Quantity (tonnes) Year 1	Annual Growth of Cargo Movement Years 2-30 (FW) (%)		
	Financial	Economic		2-10	11-20	21-30
Fertilizer Demand	67.5	60.8	21,760	3%		
Fertilizer (Rehandled)	12.5	11.3	2,176			
Fertilizer (Trans-Ship.)	122.5	110.3	36,000	constant		
Fertilizer (Through-Ship)	36.0	32.4	160,000			
Rice	64.5	58.1	30,000	function of population		
Bldg. Materials	64.5	58.1	72,690	3%	4%	5%
POL Items	64.5	58.1				
Urban			3,123	3%	4%	5%
Rural			7,287	3%	3.5%	3.5%
TOTAL			**10,410**			
Other Food Items	64.5	58.1	19,600	function of population		
Consumer Goods & Miscellaneous	64.5	58.1	30,820			
Rehandling Factor	64.5	58.1	10% non-fertilizer			

The detailed economic simulations are provided in Appendix G.1 and indicate the following cargo navigation benefits should arise (Table G.22).

Table G.22: Projected Economic Cargo Navigation Benefits

Year	Navigation Benefits (million/Tk)	Year	Navigation Benefits (million/Tk)
1-4	0.0	17	25.9
5	(20%) 4.3	18	26.4
6	(40%) 8.6	19	26.9
7	(100%) 21.9	20	27.4
8	22.2	21	28.1
9	22.6	22	28.7
10	22.9	23	29.4
11	23.3	24	30.1
12	23.7	25	30.8
13	24.1	26	31.5
14	0.0	27	32.3
15	25.0	28	33.1
16	25.5	29	34.0
		30	34.9

8. CONCLUSION AND RECOMMENDATIONS

Despite the fact that it is becoming increasingly difficult to maintain the waterway system, due to continuous siltation of rivers, its maintenance is generally much less capital intensive than the construction and maintenance of roads based on Bangladesh Transport Sector Study (BTSS, 1994). In addition, land transportation also can have significant adverse impacts. These include:

- initial acquisition of large amount of cultivable lands;
- displacement of homesteads, and
- subsequent construction of bypass roads to reduce traffic congestion once growth centres have been established along the main roads.

Conversely, the impacts of maintenance dredging are positive, as the spoils are used to create new, or extend existing village platforms (Annex I - EIA).

From the above, it may be inferred that, in order to insure sustainable development of its transport sector, Bangladesh needs a strong national policy and coordination at the highest level, among the relevant ministries and agencies, to determine the optimal share of the various transport modes both for national and international traffic and plan accordingly.

Coordination is also required within transport modes. For example, as a part of Bangladesh Transport Sector Action Plans, a dredging targets of about 1.1 million m^3 as been set for the lower reach of the Kalni River from Ikardia to Ajmiriganj. The KKRMP feasibility study shows that maintenance dredging at strategic locations along the Kalni-Kushiyara River without the full development of the KKRMP is not sustainable. This suggests that strong coordination is required between Ministry of Water Resources (MOWR) and Ministry of Shipping (MOS) which will minimize O&M costs and maximize the benefits to the nation.

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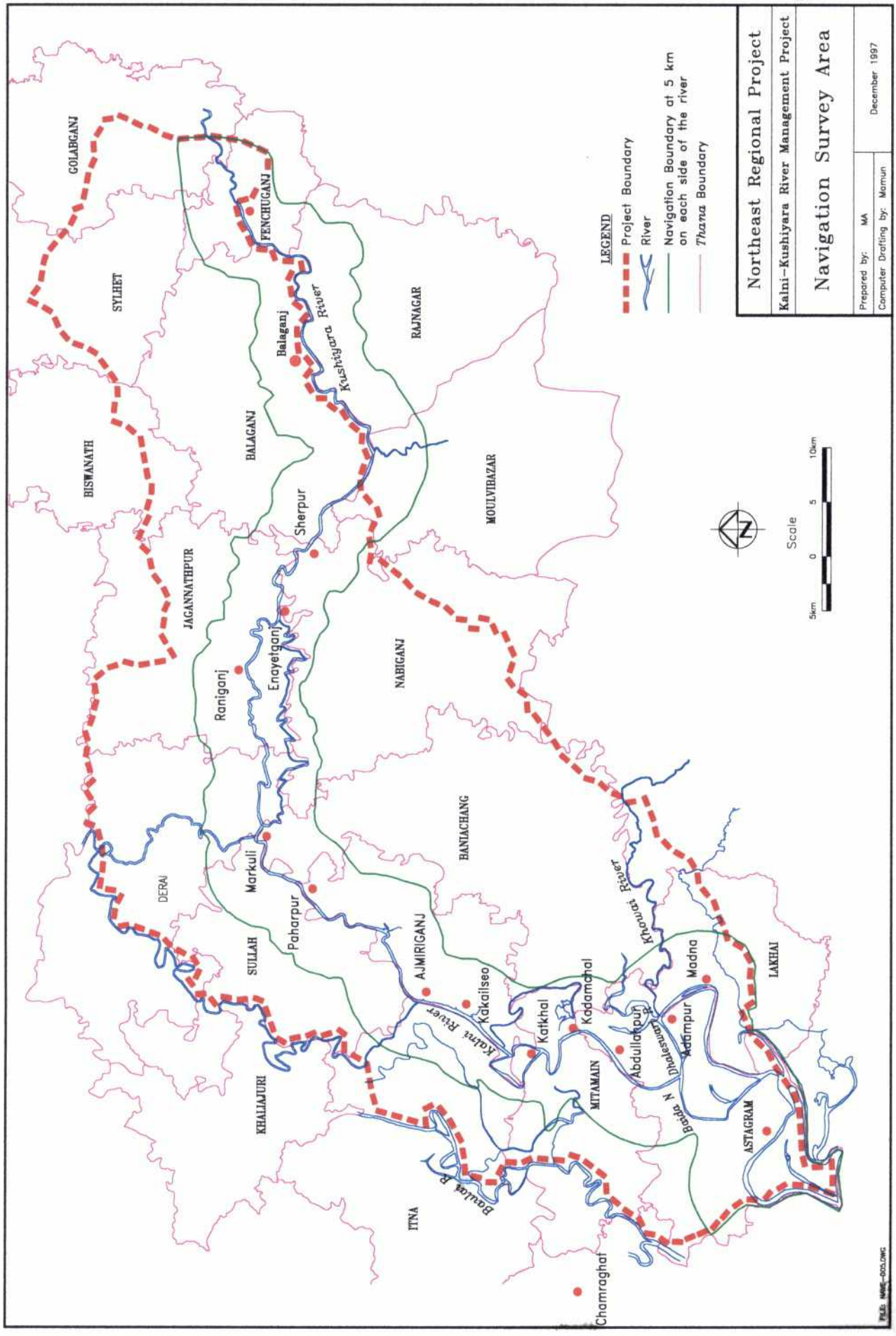
FIGURES

Figure G.1


Northeast Regional Project
Kalni-Kushiyara River Management Project
Navigation Survey Area
Prepared by: MA
Computer Drafting by: Mamun
December 1997
LEGEND
Project Boundary
River
Navigation Boundary at 5 km on each side of the river
Thana Boundary
Scale
0
5
10km
5km
N
GOLABGANJ
FENCHUGANJ
SYLHET
BISWANATH
BALAGANJ
Balaganj
Kushiyara River
RAJNAGAR
JAGANNATHPUR
Sherpur
MOULVIBAZAR
Raniganj
Enayetganj
NABIGANJ
DERAI
Markuli
BANIACHANG
SULLAH
Paharpur
AJMIRIGANJ
Khowai River
Kakailseo
Katkhal
Kadamtal
Madna
LAKHAI
Kalni River
Abdullahpur
Dholeswari R
Adampur
MITAMAIN
KHAJAJURI
Baulai R
Bata N
ASTAGRAM
ITNA
Chamraghat
FILE: NAME-005.DWG

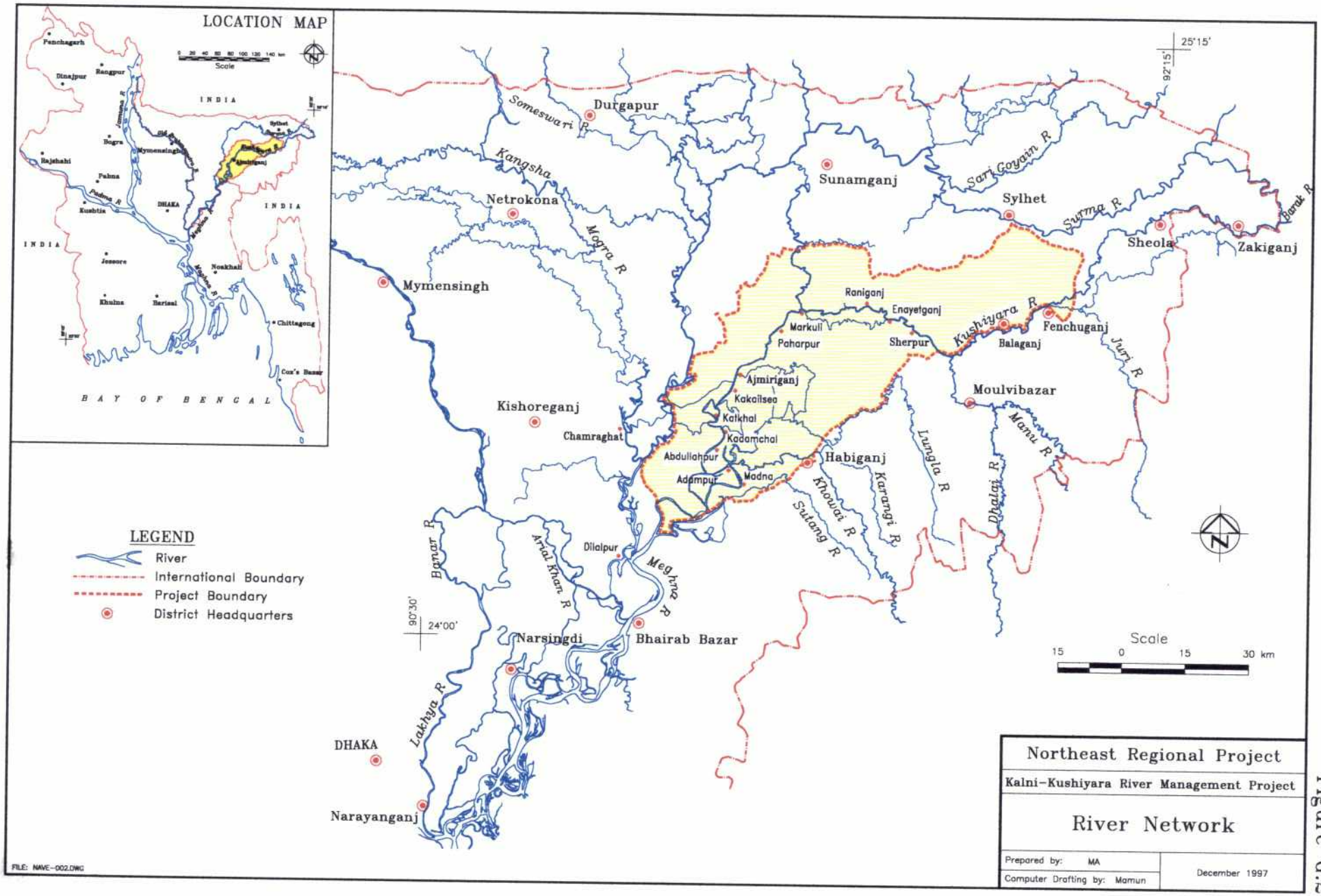

LOCATION MAP
Panchagarh
Dinajpur
Rangpur
Bogra
Rajshahi
Pabna
Kushtia
DHAKA
Jamuna R
Mymensingh
Sylhet
Sunamganj
Ajmiriganj
Jessore
Noakhali
Khulna
Barisal
Chittagong
Cox's Bazar
INDIA
BAY OF BENGAL
Scale
LEGEND
River
International Boundary
Project Boundary
District Headquarters
Someswari R
Durgapur
Kangsha
Netrokona
Mogra R
Mymensingh
Kishoreganj
Chamraghat
Dilalpur
Banar R
Arial Khan R
Meghna R
Narsingdi
Bhairab Bazar
Lakhya R
DHAKA
Narayanganj
Sari Goyain R
Surma R
Jiarul R
Sheola
Zakiganj
Raniganj
Enayetganj
Markuli
Paharpur
Sherpur
Kushiyara R
Fenchuganj
Balaganj
Juri R
Moulvibazar
Manu R
Ajmiriganj
Kakailsea
Katkhal
Kadamchal
Abdullahpur
Adampur
Madna
Habiganj
Lungla R
Dhalai R
Khowai R
Karangi R
Sutang R
92°15'
25°15'
90°30'
24°00'
Scale
15 0 15 30 km
Northeast Regional Project
Kalni-Kushiyara River Management Project
River Network
Prepared by: MA
Computer Drafting by: Mamun
December 1997
FILE: NAVE-002.DWG

Figure G.2

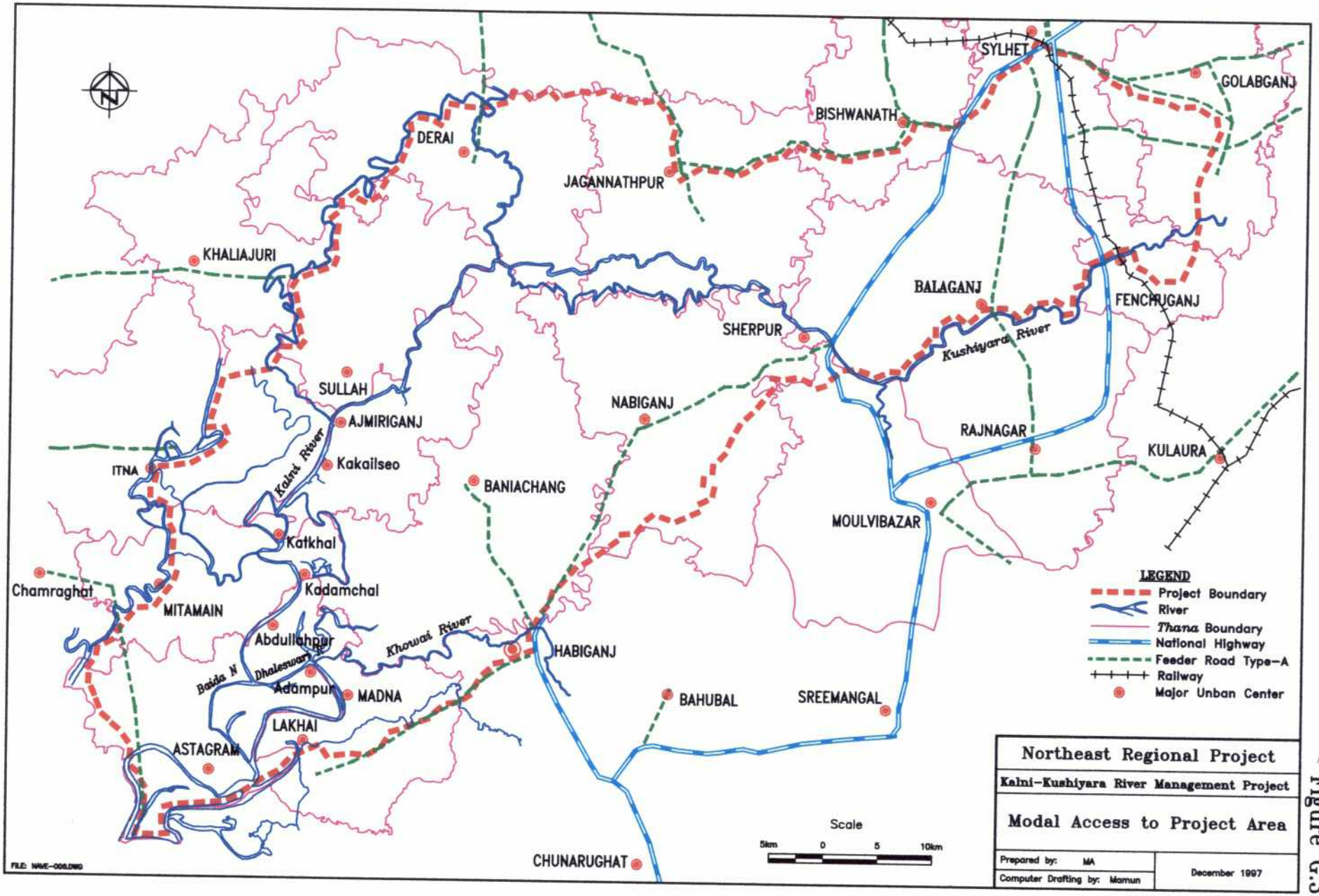

SYLHET
GOLABGANJ
BISHWANATH
DERAI
JAGANNATHPUR
KHALIAJURI
BALAGANJ
FENCHUGANJ
SHERPUR
Kushiyara River
SULLAH
AJMIRIGANJ
NABIGANJ
RAJNAGAR
KULAURA
ITNA
Kakailseo
Kalni River
BANIACHANG
MOULVIBAZAR
Katkhal
Kadamchal
Chamraghat
MITAMAIN
Abdullahpur
Khowai River
HABIGANJ
Baida N
Dhaleswari R
Adampur
MADNA
BAHUBAL
SREEMANGAL
LAKHAI
ASTAGRAM
CHUNARUGHAT
N
LEGEND
Project Boundary
River
Thana Boundary
National Highway
Feeder Road Type–A
Railway
Major Unban Center
Scale
5km 0 5 10km
Northeast Regional Project
Kalni–Kushiyara River Management Project
Modal Access to Project Area
Prepared by: MA
Computer Drafting by: Mamun
December 1997

Figure G.3

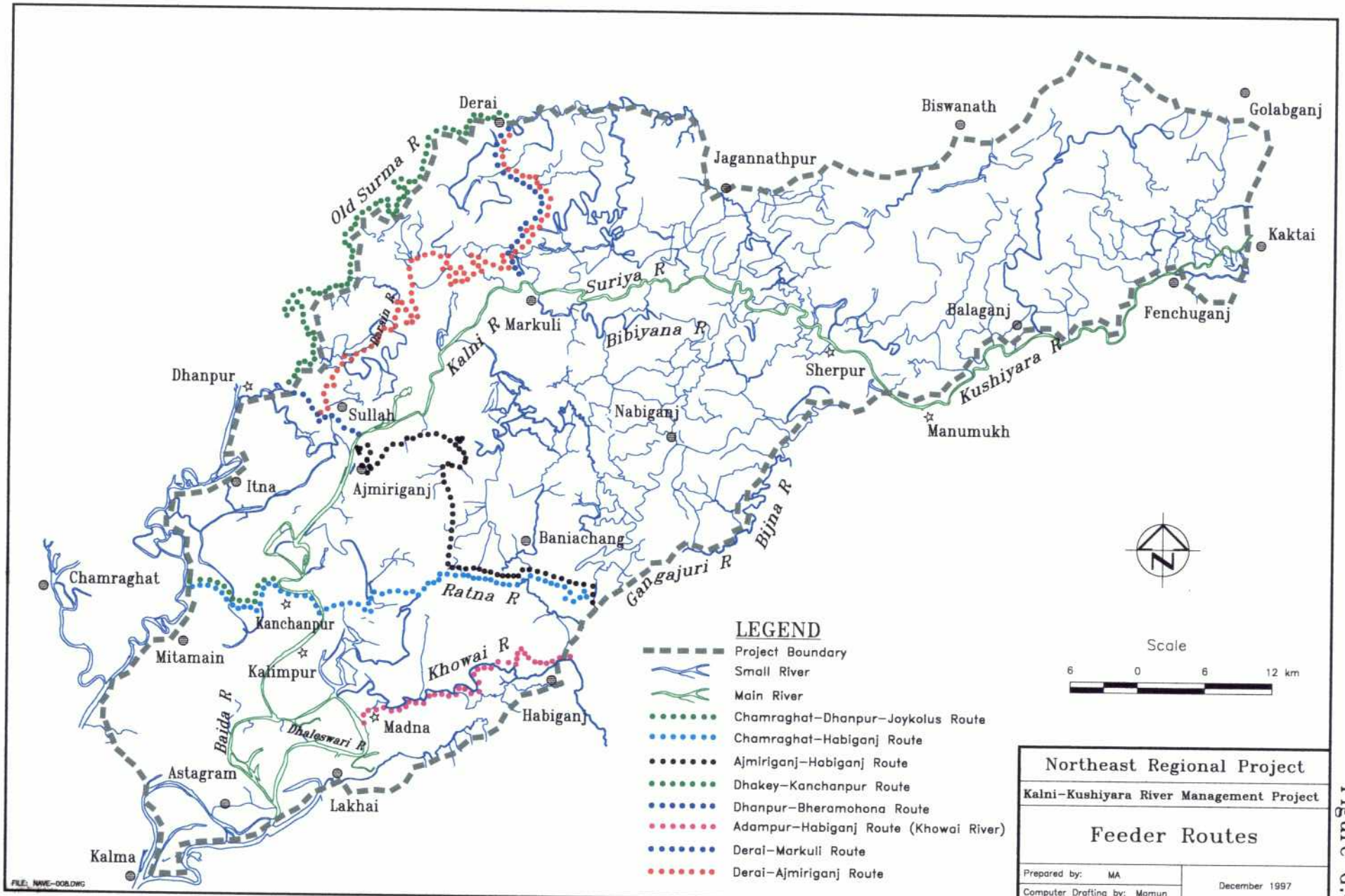

Derai
Biswanath
Golabganj
Jagannathpur
Kaktai
Old Surma R
Suriya R
Kalni R
Markuli
Bibiyana R
Dhanu R
Balaganj
Fenchuganj
Sherpur
Kushiyara R
Dhanpur
Sullah
Nabiganj
Manumukh
Itna
Ajmiriganj
Bijna R
Baniachang
Gangajuri R
Chamraghat
Ratna R
Kanchanpur
Mitamain
Khowai R
Kalimpur
Baida R
Dhaleswari R
Madna
Habiganj
Astagram
Lakhai
Kalma
N
Scale
6 0 6 12 km
LEGEND
Project Boundary
Small River
Main River
Chamraghat–Dhanpur–Joykolus Route
Chamraghat–Habiganj Route
Ajmiriganj–Habiganj Route
Dhakey–Kanchanpur Route
Dhanpur–Bheramohona Route
Adampur–Habiganj Route (Khowai River)
Derai–Markuli Route
Derai–Ajmiriganj Route
FILE: NAME-008.DWG
Northeast Regional Project
Kalni–Kushiyara River Management Project
Feeder Routes
Prepared by: MA
Computer Drafting by: Mamun
December 1997

Figure G.4

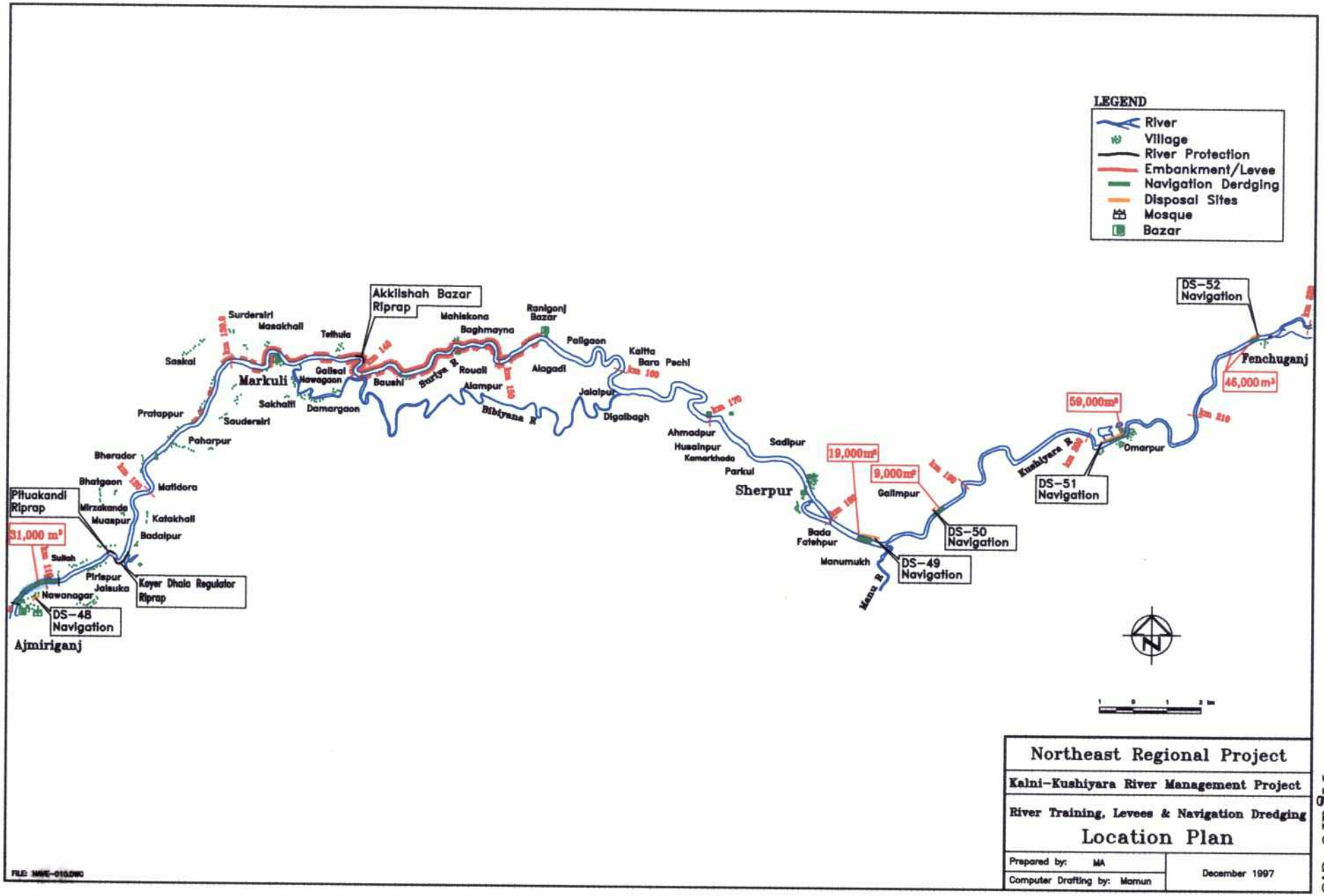
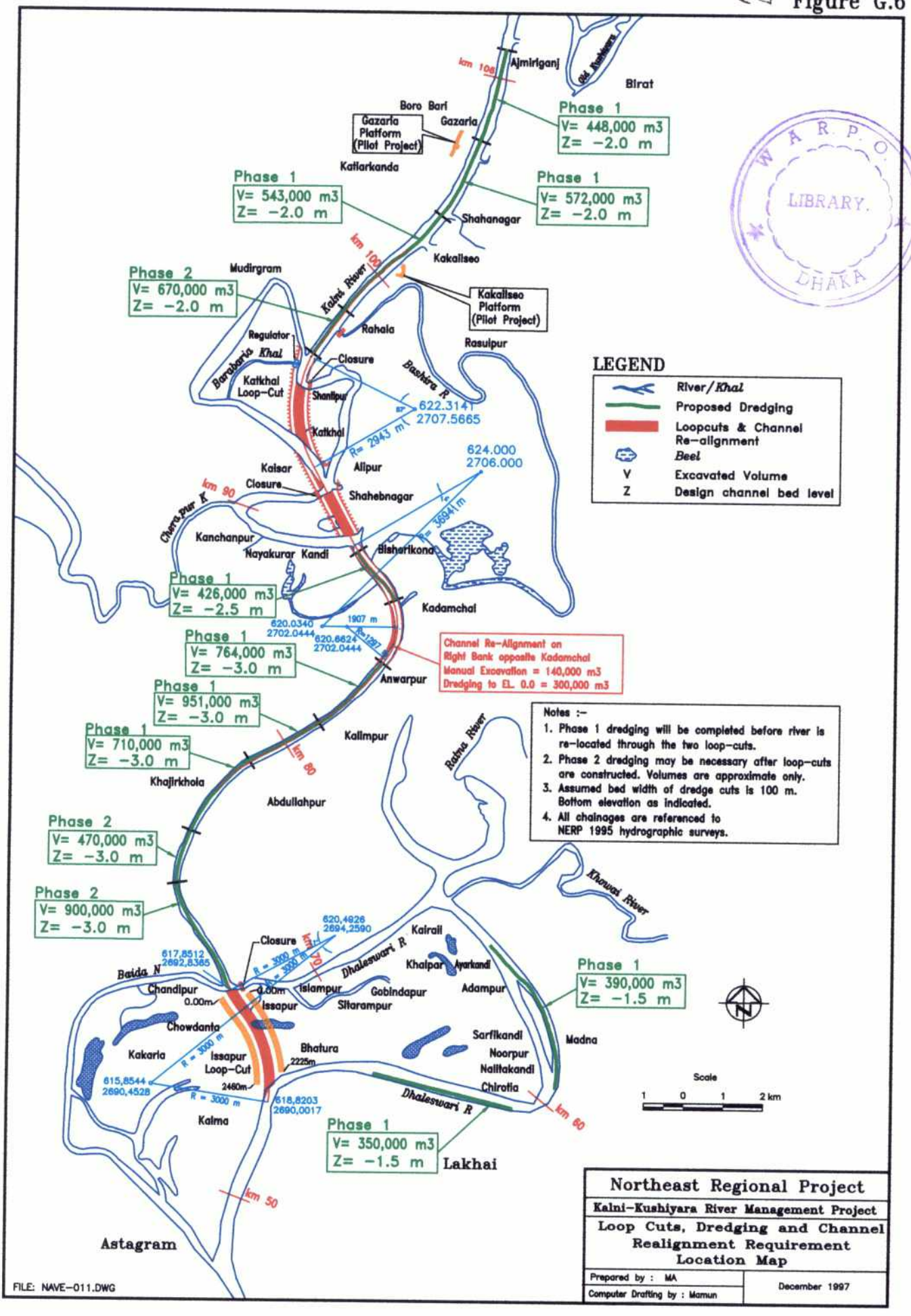
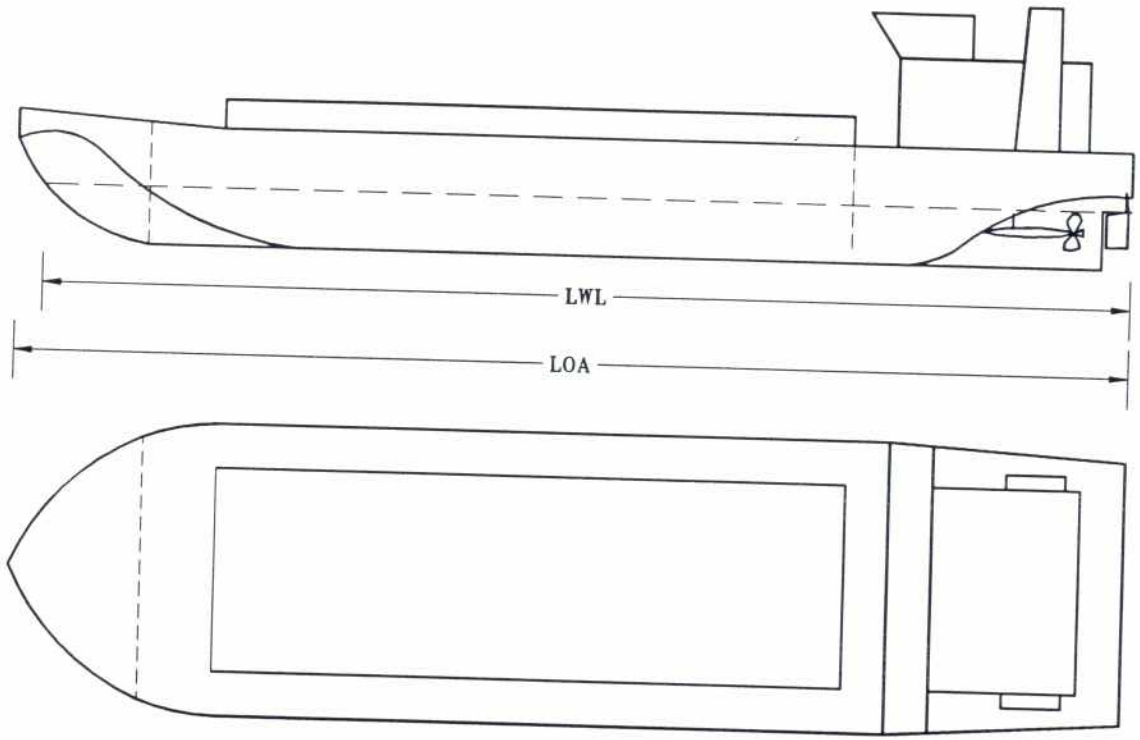
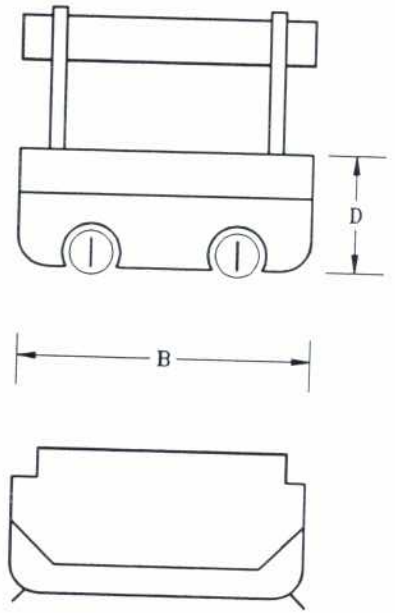

LEGEND
River
Village
River Protection
Embankment/Levee
Navigation Derdging
Disposal Sites
Mosque
Bazar
Akkilshah Bazar Riprap
Ranigonj Bazar
Surdersiri
Masakhali
Telhula
Mahiskona
Baghmayna
Paligaon
Kaltta
Bara Pechi
Saskai
Markuli
Galisal
Nawagaon
Baushi
Sarlya R.
Rouali
Alagadi
Alampur
Bibiyana R.
Jalalpur
Digalbagh
Sakhalti
Damargaon
Pratappur
Saudersiri
Paharpur
Bherador
Bhatgaon
Mirzakanda
Muaspur
Mattidora
Katakhali
Badalpur
Pituakandi Riprap
31,000 m³
Sultak
Pirizpur
Jalsuka
Nawanagar
Koyer Dhala Regulator Riprap
DS-48 Navigation
Ajmiriganj
Ahmadpur
Husainpur
Kemarkhola
Parkul
Sadipur
Sherpur
19,000m²
9,000m²
Gallmpur
Bada Fatehpur
Manumukh
Manu R.
DS-50 Navigation
DS-49 Navigation
Kushiyara R.
59,000m²
DS-51 Navigation
Omarpur
DS-52 Navigation
Fenchuganj
46,000 m³
N
Northeast Regional Project
Kalni-Kushiyara River Management Project
River Training, Levees & Navigation Dredging
Location Plan
Prepared by: MA
Computer Drafting by: Mamun
December 1997

Figure G.5

Figure G.6







LOA	50 m	L/B	4.5 m
B	10 m	L/D	12.5 m
D	4 m		
Cb	.8 m		
Hold Cube		1,000 m³	

2 x 130 bhp
ΔL 200 t
Tunnel Stern

@ 1.5 m draft 400T
@ 2.0 m draft 600T

LOA	60 m	L/B	6.0 m
B	10 m	L/D	15.0 m
D	4 m		
Cb	.81 m		
Hold Cube		1,200 m³	

2 x 130 bhp
ΔL 250 t
Tunnel Stern

@ 1.5 m draft 480T
@ 2.0 m draft 720T

NOTES:

1. Boat could be easily standarized in terms of bow, stern, accommodations.
2. Longer/shorter by adding/subtracting mid-body section
3. Standard engines/screws/propellers/rudders.
4. Speed benefit of better L/B.
5. Engines could be designed to run on compressed Natural Gas, reducting fuel costs.

FILE: NAVE-01.DWG

Northeast Regional Project

Kalni-Kushiyara River Management Project

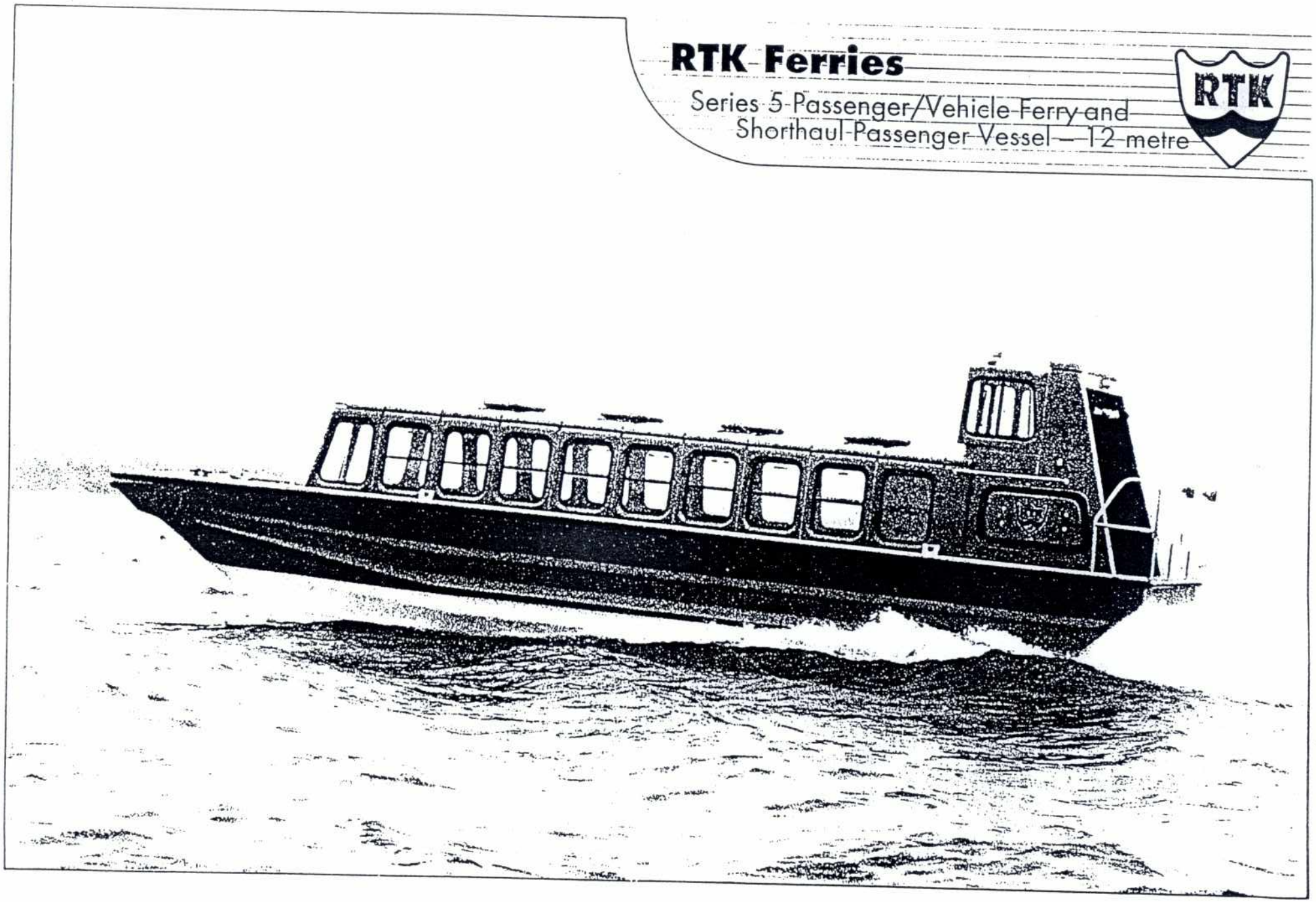
Estimated Capacity
Shallow Draft IWT Boat

Prepared by: MA	December 1997
Computer Drafting by: Jalal	

Figure G.7

RTK Ferries

Series 5 Passenger/Vehicle Ferry and
Shorthaul Passenger Vessel — 12 metre



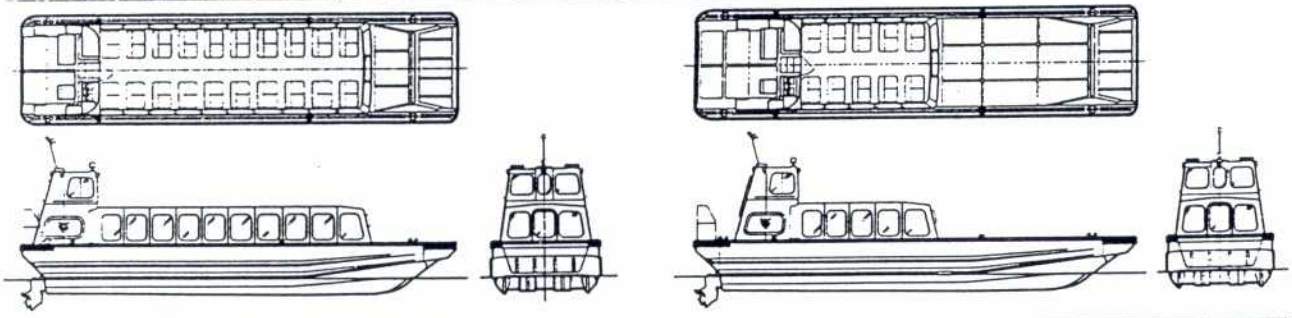
RTK Ferries

SERIES 5
12 METRE SHORTHAUL PASSENGER VESSEL – SPV 512

Length O/A		12.65m
Beam		3.20m
Overall Height:	Hull	1.49m
	Bridge	3.59m
Draft laden:	Drive up	0.45m
	Drive down	0.97m
Width of ramp at base		1.85m
Weight Unladen		6600kg
Max payload (approx)		3400kg
Speed light		24 knots

SERIES 5
12 METRE PASSENGER/VEHICLE FERRY – PVF 512

Length O/A		12.65m
Beam		3.20m
Overall Height:	Hull	1.49m
	Bridge	3.59m
Draft laden:	Drive up	0.45m
	Drive down	0.97m
Width of ramp at base		1.85m
Weight Unladen		6100kg
Max payload (approx)		3900kg
Speed light		25 knots



HIGH SPEED SHALLOW DRAFT OPERATION

WAVE RIDING HULL □ LARGE CLEAR SELF DRAINING DECK

BOW RAMP FOR EASY LOADING/OFFLOADING □ BUILT-IN BUOYANCY

EXCELLENT STABILITY □ HEAVY DUTY CONSTRUCTION

MODULAR FIT-OUT □ LOW MAINTENANCE

Technical Specification

HULL
The hull is constructed of a matrix of glass fibre woven roving and chopped strand mat in a high performance integrally coloured polyester resin. A rigid polyurethane foam "chassis" structure is overlaminated onto the outer skin forming an immensely strong and torsionally stiff structure. The deck is coated with a non-slip grit surface and fixing points are provided. Scuppers are located in the sides for removal of water from the deck area. The hull is antifouled to the waterline.

INTEGRAL BUOYANCY
Between the hull structure members the buoyancy compartments are filled with a closed cell polyurethane foam giving an excess reserve of buoyancy at the craft maximum displacement.

BOW RAMP
Glass fibre reinforced plastic loading ramp with non-slip surfacing. Manually operated winch.

FENDERING/GUNWALES
Full peripheral 'D' section fendering at gunwale. Solid nylon rubbing strake at waterline. The gunwale is stainless steel rolled section fitted with lifting points and bollards.

BEACHING SKEGS
2 full length stainless steel skegs with additional beaching skegs at bow.

FUEL TANKS
Zinc coated mild steel, welded, pressure tested pannier fuel tanks mounted on internal bulwarks. 2 x 180 litre.

OPERATIONS BRIDGE
All weather GRP cabin mounted aft above gunwale level with canvas dropscreen giving access to stern. Door and access steps to welldeck. Fitted with a helmsmans seat, observer bench seat, 2 fire extinguishers, manual and electric bilge pumps.

CABIN ACCOMMODATION
All-weather GRP accommodation cabin on deck forward of operations bridge with access doors to bridge and welldeck.
PVF 512 – Ferry seating for 20 passengers.
SPV 512 – Ferry seating for 40 passengers.

ENGINE OPTIONS
Twin engine installation either in the form of diesel sterndrives (110 – 200 hp per engine) or waterjet (200 – 300 hp per engine). For special applications outboard motor's or petrol sterndrive units can be fitted (up to 330 hp per engine).

ELECTRICAL
Navigation lights, internal light, searchlight, klaxon and windscreen wipers are operable from the helmsman's position.

OPTIONAL EQUIPMENT

Air Conditioning	Helmsmans compass
Boat trailer	Kedge anchor and winch
Bridge hardback	Lashing kit
Cabin heating	Lifesaving equipment
Deck awning	Opening windows
Deck gear	Radar
DTp Approval	Safety kit
Echo sounder	SSB radio
Emergency exits	VHF radio
Fire retardency	Washroom/toilet
Galley	Welldeck seating
Heat Shield	

Other items can be incorporated into the boat to meet customers applications. Please contact our Engineering Department to discuss specifications.

RTK MARINE
446 Blandford Road
Hamworthy
Poole
Dorset BH16 5BL
England
Tel: (0202) 685581
Fax: (0202) 683347

RTK Sea Trucks

Series 5 Sea Truck Workboat
and Goods Vehicle Ferry — 12 metre

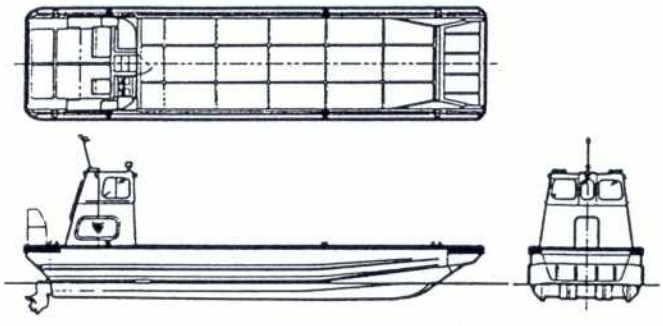
RTK Sea Trucks

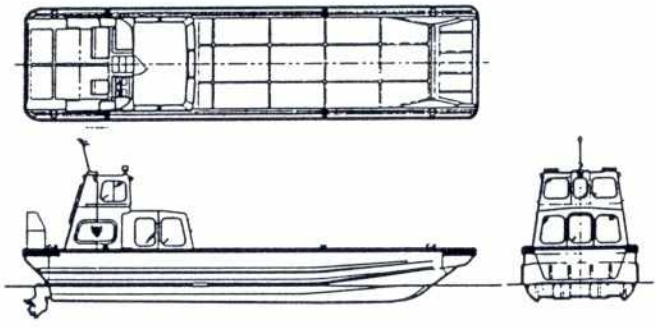
SERIES 5
12 METRE GOODS VEHICLE FERRY – GVF 512

Length O/A		12.65m
Beam		3.20m
Overall Height:	Hull	1.49m
	Bridge	3.59m
Draft laden:	Drive up	0.45m
	Drive down	0.97m
Width of ramp at base		1.85m
Weight Unladen		5500kg
Max payload (approx)		4500kg
Speed light		26 knots

SERIES 5
12 METRE WORKBOAT – STW 512

Length O/A		12.65m
Beam		3.20m
Overall Height:	Hull	1.49m
	Bridge	3.59m
Draft laden:	Drive up	0.45m
	Drive down	0.97m
Width of ramp at base		1.85m
Weight Unladen		5750kg
Max payload (approx)		4250kg
Speed light		26 knots





WAVE PIERCING HULL – LARGE CLEAR SELF DRAINING DECK

HIGH SPEED SHALLOW DRAFT OPERATION

BOW RAMP FOR EASY LOADING/OFFLOADING

BUILT-IN BUOYANCY – EXCELLENT STABILITY – HEAVY DUTY CONSTRUCTION

MODULAR FIT-OUT – LOW MAINTENANCE

Technical Specification

HULL
The hull is constructed of a matrix of woven roving and chopped strand mat in a high performance integrally coloured polyester resin. A rigid polyurethane foam "chassis" structure is overlaminated onto the outer skin forming an immensely strong and torsionally stiff structure. The deck is coated with a non-slip grit surface and fixing points are fitted. Scuppers are located in the sides for removal of water from the deck area. The hull is antifouled to the waterline.

INTEGRAL BUOYANCY
Between the hull structure members the buoyancy compartments are filled with a closed cell polyurethane foam giving an excess reserve of buoyancy at the craft maximum displacement.

BOW RAMP
Glass reinforced plastic loading ramp with non-slip surfacing. Manually winch operated.

FENDERING/GUNWALES
Full peripheral 'D' section fendering at gunwale. Solid nylon rubbing strake at waterline. The gunwale is stainless steel rolled section fitted with lifting points and bollards.

BEACHING SKEGS
2 full length stainless steel skegs with additional beaching skegs at bow.

FUEL TANKS
Welded mild steel, pressure tested pannier fuel tanks mounted on internal bulwarks. 2 x 180 litre.

OPERATIONS BRIDGE
All weather GRP cabin mounted at above gunwale level with canvas dropscreen giving access to stern. Door and access steps to welldeck. Fitted with a helmsmans seat, observer bench seat, 2 fire extinguishers, manual and electric bilge pumps.

CABIN ACCOMMODATION
No cabin is fitted to the Goods Vehicle Ferry.
The Sea Truck Workboat is fitted with two modular cabin sections to make a general purpose cabin (1.75m x 2.5m) on deck, forward of the operations bridge, with access doors to bridge and welldeck.

ELECTRICAL
Navigation lights, internal light searchlight, klaxon and windscreen wipers are operable from the helmsman's position.

ENGINE OPTIONS
Twin engine installation either in the form of diesel sterndrives (110 – 200 hp per engine) or waterjet (200 – 300 hp per engine). For special applications outboard motors or petrol sterndrive units can be fitted (up to 330 hp per engine).

OPTIONAL EQUIPMENT

VHF Radio	Safety kit
Radar	Deck Gear
SSB radio	Lashing kit
Helmsmans compass	Boat trailer
Echo sounder	Kedge anchor & winch
Opening windows	Crane – 250kg
Deck awning	Cabin hardback
Air conditioning	Echo sounder
Passenger seating	Heat shield

Other items can be incorporated into the boat to meet customers applications. Please contact our Engineering Department to discuss specifications.

RTK MARINE

(Reg. Office)
Lake Avenue
Hamworthy
Poole
Dorset BH15 4NY
England
Tel: (0202) 685581
Fax: (0202) 683347

KALNI-KUSHIYARA RIVER MANAGEMENT PROJECT

ANNEX G
NAVIGATION
APPENDIX G.1

SUPPORTING INFORMATION

March 1998

TABLE OF CONTENTS

LIST OF TABLES

1. DATA QUALITY

For inland waterway operations there is little, if any, valid data available that is both comprehensive and current. As a result, information had to be developed from secondary and sometimes tertiary sources, and consequently, this information can only be interpreted as indicative.

Some points to keep in mind with regard to the data are:

- cargo may enter the transportation chain multiple times. Most cargo for the Kalni-Kushiyara River will originate in Bhairab Bazar, be shipped to market centres and then carried, again by boat, to the final destination;

- traffic estimates within the NSA are predicated on the basis of four data points only: *haat* and non-*haat* days monsoon season and *haat* and non-*haat* days during the dry season;

- base population data, derived from the 1991 census, is assumed reliable. Estimations for the NSA and full and partial river reaches are based on NERP population projections for the complete project area. Population density is assumed to be fairly uniform per kilometre of river;

- gross agricultural production figures are assumed reliable. They are derived from official statistics, and modified and extrapolated as necessary by NERP specialists;

- non-agricultural data has had to be interpolated from a variety of official and commercial sources; and

- land area data for cropping and flood types within the 5-km band on either side of the river have been provided by NERP. Some interpretation of this data has been undertaken for the portion of the river that is outside the project area but inside the navigation analysis.

2. FREIGHT COST ESTIMATES

The estimated operating costs for a standard 350 tonnes Inland Waterways Transportation (IWT) type boat have been developed from two primary sources, advice from SHAMS Shipping and estimates by The Mariport Group Ltd. Other sources of data include NERP reports on payments to boatmen. Primary data has not, however, been provided. The cost structures, although reasonable relative to known freight costs, must be considered as estimates.

The largest single cost element in the analyses is fuel, which has been priced at Tk 12.7/litre per navigation group (equivalent to about US $340/tonne). This is some US $100/tonne higher than international marine diesel prices. Based on a typical engine installation, the boat will consume about 36 litres/hour. This is somewhat higher than values from SHAMS Shipping. The operating cost is Tk 457/hour. Vessels are assumed to moor at night, and only operate 12 hours per day. Daily costs are estimated as follows: Tk 1,000/day for crew (Captain, Engineer, 2 leading hands, 6 boatmen), Tk 600/day for maintenance, Tk 800/day for overhead, for a total of Tk 2,400/day.

The average Dhaka/Sylhet round-trip is estimated to take about 11 days, of which 7 days are sailing. The estimated voyage costs are: Tk 38,388/trip for fuel, Tk 28,400/trip for other expenses, for a total of Tk 64,788/trip.

The total cost for 32 trips per year is Tk 2,073,216. This is comparable with advice, from SHAMS Shipping, that annual revenue is Tk 2 million per boat, with an average of 3 trips per month. With 5 dry and 7 wet months, this suggests 12 dry season trips at 150 tonnes cargo and 20 wet season trips at 350 tonnes cargo, for a total of 8,800 tonnes. The average cost is thus Tk 235/tonne. This agrees with reported freight rates for cement of Tk 200-250/tonne from Sylhet to Dhaka.

On a seasonal basis, the difference in freight costs is significant: Tk 391/tonne dry season and Tk 188/tonne wet season. The annual value of the freight savings by maintaining an effective dry season channel is thus about Tk 1 billion, assuming 10 million tonnes of cargo.

Applying the above cost estimates to operating in the Kalni-Kushiyara River system results in the following estimated transit costs for fertilizer from Fenchuganj to Dhaka, as well other cargoes and routes. Also, Indian Transit costs for goods from Calcutta to Karimganj have been estimated. These latter costs are based on Bangladesh IWT type boats, and not on Indian vessel costs.

Note that in all the calculations, no back haul cargo has been assumed. On both the Dhaka/Sylhet corridor and on the Kalni-Kushiyara River, there are significant back haul opportunities that will contribute to owners' profits, as well as potentially reduce costs.

Tables 1 to 10 show the calculation basis for the trip cost rates, in Tk/tonne, for both daylight sailing only and 24 hours operations for each of the following routes:

- Fenchuganj - Dhaka
- Calcutta - Karimganj
- Fenchugang - Kakailseo
- Bhairab Bazar - Ajmiriganj
- Bhairab Bazar - Adampur Bazar
- Bhairab Bazar - Markuli
- Dhaka - Sylhet

(i) ***Fenchuganj - Dhaka:*** *325 km, 10 km/hour, daylight sailing*

Table 1: Trip Cost Rate - Daylight Sailing Only
Fenchuganj - Dhaka: 325 km, 10 km/hour

Channel Depth		**Class III 1.8 (LAD m)**	**Class II 2.4 (LAD m)**	**Class I 3.6 (LAD m)**
Cargo (tonnes)		**150**	**200**	**350**
Loading Time (days)		0.75	1.0	1.75
Unloading Time (days)		1.50	2.0	3.50
Sailing Time (days)		5.50	5.5	5.50
TOTAL TRIP TIME (days)		**7.75**	**8.5**	**10.75**
Trip Cost (Tk)	Fuel	30,162	30,162	30,162
	Other	18,600	20,400	25,800
TOTAL TRIP COST (Tk)		**48,762**	**50,562**	**55,962**
TRIP COST RATE (Tk/tonne)		**325**	**253**	**160**

If 24-hour sailing were possible, the total sailing time would be 2.75 days, then the total trip cost rate would be as shown in Table 2.

Table 2: Trip Cost Rate - 24 Hours Sailing
Fenchuganj - Dhaka: 325 km, 10 km/hour

Channel Depth		Class III 1.8 (LAD m)	Class II 2.4 (LAD m)	Class I 3.6 (LAD m)
Cargo (tonnes)		**150**	**200**	**350**
Loading Time (days)		0.75	1.00	1.75
Unloading Time (days)		1.50	2.00	3.50
Sailing Time (days)		2.75	2.75	2.75
TOTAL TRIP TIME (days)		**5.00**	**5.75**	**8.00**
Trip Cost (Tk)	Fuel	30,162	30,162	30,162
	Other	12,000	13,800	19,200
TOTAL TRIP COST (Tk)		**42,162**	**43,962**	**49,362**
TRIP COST RATE (Tk/tonne)		**281**	**220**	**141**
COST SAVINGS: Daylight - 24 hours (Tk/tonne)		**44**	**33**	**19**

(ii) Calcutta - Karimganj: 819 km, 10 km/hour, daylight sailing only

Table 3: Trip Cost Rate - Daylight Sailing Only
Calcutta - Karimganj: 819 km, 10 km/hour

Channel Depth		Class III 1.8 (LAD m)	Class II 2.4 (LAD m)	Class I 3.6 (LAD m)
Cargo (tonnes)		**150**	**200**	**350**
Loading Time (days)		0.75	1.0	1.75
Unloading Time (days)		1.50	2.0	3.50
Sailing Time (days)		14.00	14.0	14.00
TOTAL TRIP TIME (days)		**16.25**	**17.0**	**19.25**
Trip Cost (Tk)	Fuel	76,776	76,776	76,776
	Other	39,000	40,800	46,200
TOTAL TRIP COST (Tk)		**115,776**	**117,576**	**122,976**
TRIP COST RATE (Tk/tonne)		772	**588**	**351**

If 24-hour sailing were possible, then the total sailing time would be 7.0 days, then the total trip cost rate would be as shown in Table 4.

Table 4: Trip Cost Rate - 24 Hours Sailing
Calcutta - Karimganj: 819 km, 10 km/hour

Channel Depth		Class III 1.8 (LAD m)	Class II 2.4 (LAD m)	Class I 3.6 (LAD m)
Cargo (tonnes)		**150**	**200**	**350**
Loading Time (days)		0.75	1.0	1.75
Unloading Time (days)		1.50	2.0	3.50
Sailing Time (days)		7.00	7.0	7.00
TOTAL TRIP TIME (days)		**9.25**	**10.0**	**12.25**
Trip Cost (Tk)	Fuel	76,776	76,776	76,776
	Other	22,200	24,000	29,400
TOTAL TRIP COST (Tk)		**98,976**	**100,776**	**106,176**
TRIP COST RATE (Tk/tonne)		**660**	**504**	**303**
COST SAVINGS: Daylight - 24 hours (Tk/tonne)		**112**	**84**	**48**

The year-round average trip cost rate, assuming equal numbers of trips in the dry season and monsoon season, based on daylight sailing only, would be Tk 450/tonne for a class II channel and Tk 526/tonne for a class III channel.

(iii) ***Fenchuganj - Kakailseo:*** *116 km, 10 km/hour, daylight sailing only*

Table 5: Trip Cost Rate - Daylight Sailing Only
Fenchuganj - Kakailseo: 116 km, 10 km/hour

Channel Depth		Class III 1.8 (LAD m)	Class II 2.4 (LAD m)	Class I 3.6 (LAD m)
Cargo (tonnes)		**150**	**200**	**350**
Loading Time (days)		0.75	1.0	1.75
Unloading Time (days)		1.50	2.0	3.50
Sailing Time (days)		2.00	2.0	2.00
TOTAL TRIP TIME (days)		**4.25**	**5.0**	**7.75**
Trip Cost (Tk)	Fuel	10,968	10,968	10,968
	Other	10,200	12,000	17,400
TOTAL TRIP COST (Tk)		**21,168**	**22,968**	**28,368**
TRIP COST RATE (Tk/tonne)		**141**	**115**	**81**

If 24-hour sailing were possible, then sailing time would be 1.0 days, then the total trip cost rate would be as shown in Table 6.

Table 6: Trip Cost Rate - 24 Hours Sailing
Fenchuganj - Kakailseo: 116 km, 10 km/hour

Channel Depth		Class III 1.8 (LAD m)	Class II 2.4 (LAD m)	Class I 3.6 (LAD m)
Cargo (tonnes)		**150**	**200**	**350**
Loading Time (days)		0.75	1.0	1.75
Unloading Time (days)		1.50	2.0	3.50
Sailing Time (days)		1.00	1.0	1.00
TOTAL TRIP TIME (days)		**3.25**	**4.0**	**6.25**
Trip Cost (Tk)	Fuel	10,968	10,968	10,968
	Other	7,800	9,600	15,000
TOTAL TRIP COST (Tk)		**18,768**	**20,568**	**25,968**
TRIP COST RATE (Tk/tonne)		**125**	**103**	**74**
COST SAVINGS: Daylight - 24 hours (Tk/tonne)		**16**	**12**	**7**

(iv) ***Bhairab Bazar - Ajmiriganj:*** *95 km, 10 km/hour, daylight sailing only*

Table 7: Trip Cost Rate - Daylight Sailing Only
Bhairab Bazar - Ajmiriganj: 95 km, 10 km/hour

Channel Depth		Class III 1.8 (LAD m)	Class II 2.4 (LAD m)	Class I 3.6 (LAD m)
Cargo (tonnes)		**150**	**200**	**350**
Loading Time (days)		0.75	1.0	1.75
Unloading Time (days)		1.50	2.0	3.50
Sailing Time (days)		2.00	2.0	2.00
TOTAL TRIP TIME (days)		**4.25**	**5.0**	**7.25**
Trip Cost (Tk)	Fuel	10,968	10,968	10,968
	Other	10,200	12,000	17,400
TOTAL TRIP COST (Tk)		**21,168**	**22,968**	**28,368**
TRIP COST RATE (Tk/tonne)		**141**	**115**	**81**

(v) ***Bhairab Bazar - Adampur Bazar:*** *60 km, 10 km/hour, daylight sailing only*

Table 8: Trip Cost Rate - Daylight Sailing Only
Bhairab Bazar - Adampur Bazar: 60 km, 10 km/hour

Channel Depth		Class III 1.8 (LAD m)	Class II 2.4 (LAD m)	Class I 3.6 (LAD m)
Cargo (tonnes)		**150**	**200**	**350**
Loading Time (days)		0.75	1.0	1.75
Unloading Time (days)		1.50	2.0	3.50
Sailing Time (days)		1.00	1.0	1.00
TOTAL TRIP TIME (days)		**3.25**	**4.0**	**6.25**
Trip Cost (Tk)	Fuel	5,484	5,484	5,484
	Other	7,800	9,600	15,000
TOTAL TRIP COST (Tk)		**13,284**	**15,084**	**20,484**
TRIP COST RATE (Tk/tonne)		**89**	**75**	**59**

(vi) ***Bhairab Bazar - Markuli:*** *120 km, 10 km/hour, daylight sailing only*

Table 9: Trip Cost Rate - Daylight Sailing Only
Bhairab Bazar - Markuli: 120 km, 10 km/hour

Channel Depth		Class III 1.8 (LAD m)	Class II 2.4 (LAD m)	Class I 3.6 (LAD m)
Cargo (tonnes)		**150**	**200**	**350**
Loading Time (days)		0.75	1.0	1.75
Unloading Time (days)		1.50	2.0	3.50
Sailing Time (days)		2.00	2.0	2.00
TOTAL TRIP TIME (days)		**7.75**	**5.0**	**7.25**
Trip Cost (Tk)	Fuel	10,968	10,968	10,968
	Other	10,200	12,000	17,400
TOTAL TRIP COST (Tk)		**21,168**	**22,968**	**28,368**
TRIP COST RATE (Tk/tonne)		**141**	**115**	**81**

(vii) ***Dhaka - Sylhet:*** *405 km, 10 km/hour, daylight sailing only*

Table 10: Trip Cost Rate - Daylight Sailing Only
Dhaka - Sylhet: 405 km, 10 km/hour

Channel Depth		Class III 1.8 (LAD m)	Class II 2.4 (LAD m)	Class I 3.6 (LAD m)
Cargo (tonnes)		**150**	**200**	**350**
Loading Time (days)		0.75	1.00	1.75
Unloading Time (days)		1.50	2.00	3.50
Sailing Time (days)		6.75	6.75	6.75
TOTAL TRIP TIME (days)		**9.00**	**9.75**	**12.00**
Trip Cost (Tk)	Fuel	37,017	37,017	37,017
	Other	21,600	23,400	28,800
TOTAL TRIP COST (Tk)		**58,617**	**60,407**	**65,817**
TRIP COST RATE (Tk/tonne)		**391**	**302**	**188**

3. POPULATION AND LAND AREAS

3.1 Population

The population of the project area is estimated at 1,893,890 persons. Of these, 10.2% are urban, 51.5% are farming and 38.3% are rural-landless.

By the year 2025, the population is estimated to be 2,881,819 persons. Of these, 18.4% are urban, 21.5% are farming and 60.1% are rural-landless. This is a FWO projection, and takes into account the growing impoverishment of the region and concentration of land in relatively few hands. The FW scenario may not impact overall population in the region or its urbanisation. The probable impact will be on the relative disposition of farming (i.e., still owning land) and rural-landless populations.

For navigation impact analysis, three discrete population estimates have been made. They are based on the overall project areas, and each assume similar growth rates and urban population ratios.

Project Within the 5 km Band on Each Side of the River
Note that this excludes the south bank population between the Manu River and Fenchuganj. This is outside the project area.

Full River Reach Within the 5 km Band on Each Side of the River
This population includes an estimate of additional persons within Moulvibazar, Rajanagar and Fenchuganj *thanas*. These people have a direct dependency on the river over the complete project reach.

NSA Within the 5 km Band on Each Side of the River
The NSA was determined prior to the full project reach being agreed upon. As a result, it covered a limited section of the river between Madna and Sherpur. A separate estimate of population was undertaken to permit scaling to the full river reach.

Population estimates for each of the above cases is provided in Table 11. *Thanas* have been arranged in their approximate west to east order.

Table 11: Population Estimates-1991 Census With Projections-1995

	Project Within[1] 5 km Each Side of River		Full River Reach[2] Within 5 km Each Side of River		NSA Within[2] 5 km Each Side of River	
	Proportion	Population	Proportion	Population	Proportion	Population
Astagram	0.75	98,719			0.10	13,163
Lakhai	0.37	40,422				
Mitamain	0.44	47,597				
Baniachang	0.11	26,931				
Ajmiriganj	0.61	52,621				
Itna	0.14	18,453				
Sullah	0.44	39,447				
Derai	0.15	27,203				
Jagannathpur	0.39	72,859				
Nabiganj	0.19	46,061				
Balaganj	0.43	100,380			0.15	35,016
Moulvibazar	0.03	7,737	0.05	12,895		
Rajanagar			0.20	34,856		
Fenchuganj	0.18	14,405	0.80	65,284		
Sylhet	-neg-	-neg-				
Golapganj[2]	0.05	11,454				
TOTAL		**604,289**		**695,182**		**419,773**
1995 Projection		**647,858**		**745,304**		**450,039**
Urban @ 10.2%		**66,082**		**76,021**		**45,904**

Notes: 1. NERP estimate
2. Estimate by Navigation Group of NERP

3.2 Land Areas

The estimated land area within the project and within the 5 km each side of the river is 128,347 ha. The additional land area within the full river reach was estimated at 34,510 ha. The total is 162,857 ha of which 138,900 ha is not cultivable. A land area estimate by the navigation group for the NSA is 94,328 ha. This uses the same system of proportioning as the population estimates.

4. INDIA'S NORTHEAST HILL STATES

4.1 General

The seven Northeast Hill States are virtually cut off from continental India. The only land access is via the 20-km wide Siliguri Neck in West Bengal. The region is ethnically diverse and has been a politically sensitive area since Indian independence. Travel restrictions for foreigners were only lifted in May 1995, but special permits are still required. Table 12 provides a summary of the data for the Northeast Hill States of India.

Table 12: Summary Data of the Northeast Hill States

		Assam	Meghalaya	Arunchal Pradesh	Nagaland	Manipur	Mizoram	Tripura
Population (m)		22.41	1.77	0.87	1.21	1.84	0.69	2.76
Area (sq km)		78,438	22,500	84,000	16,579	22,327	21,000	10,500
Rural (%)		89	81	87	83	74	54	89
Scheduled Castes & Tribes (% population)		n/a	81	64	84	28	94	44
Literacy - % male		62	53	51	68	72	86	71
% female		43	45	29	55	48	79	50
Religion	% H	72	18	29	14	60	4	89
	M	26	3	1	2	7	1	7
	C	n/a	53	4	80	30	94	1
	T&A	n/a	26	52	4	n/a	n/a	n/a
	B	n/a	0	14	0	n/a	n/a	n/a
	O	2	0	0	0	3	1	3
Housing	% R	67	56	75	52	40	59	44
Shortage	U	29	13	38	26	42	13	29

Abbreviations:

Literacy: M = Male; F = Female
Religion: H = Hindu; M = Muslim; C = Christian
T&A = Tribal & Animalist; B = Buddhist; O = Other

Housing: R = Rural; U = Urban

Source: 1991 Indian Census, 1996 India Handbook, Passport Books © September 1995, South China Morning Post. 17 July, 1996.

The total population in 1991 was 31.55 million, up from about 20 million in 1971. Most of this increase has taken place in Assam. The population growth in this region has been faster than in India as a whole. Population has effectively doubled since 1961.

The article in the South China Morning Post referenced in Table 12 quotes problems associated with housing shortages in the region as being due to:

- geographical isolation;
- difficult terrain;
- bad roads;
- poor communications, and
- lack of infrastructure.

This will lead to high transportation costs, and it should be attractive to transit goods through Bangladesh.

4.2 Transportation

Until the late 1960s, India did not have rail connection to the Northeast Hill States, and road linkages were poor. The primary mode of transportation was by water, both via the Jamuna/Brahmaputra River to Dhubri (head of navigation) and via the Kalni-Kushiyara River to Karimganj.

India was forced to build rail links in the late 1960s when navigation was suspended in 1965. This was done because of increasing unrest caused by the autonomy movement in East Pakistan. The movement culminated in hostilities between the Pakistan army and what is now Bangladesh between 26 March and 16 December 1971. Transit navigation then recommenced in 1973 after an interim of eight years.

However, from a peak of nearly one million tonnes of transit cargo in the early 1960s, cargo volumes only reached 100,000 tonnes in 1987/88, and are roughly half that quantity at present. The split in the 1960s was roughly 90% Jamuna, 10% Kalni; today it is almost 50/50. Given population growth and increasing expectations, it is likely that the cargo demand between India and the Northeast Hill States is at least two million tonnes.

However, rapid growth in population has led to over-cropping. It has been suggested that traditional agricultural methods are leading to land degradation. Also, with the amount of agricultural land dedicated to tea production (an export crop), it is likely that the region is less self-sufficient than in the past. There will also, presumably, be increased demand for fertilizer movement to improve crop yields. This would suggest transportation needs closer to 3 million tonnes.

4.3 Surface Transportation

Road links, at least from current mapping, are generally secondary and lesser-grade roads. Rail links are somewhat limited, with lines along both north and south sides of the Brahmaputra River in Assam. There are few rail lines into the hill-country east of Bangladesh.

Average speeds calculated from express bus and train transit times support assertions of difficult terrain and/or poor road or rail conditions. In general, average speeds do not exceed 30 km/hour. Mainline services to Calcutta are somewhat better, but Guwahati (capital of Assam and effectively the gateway to the region) is 1,151 km from Calcutta. Typical internal distances, as provided by the NERP navigation team, are given in Table 13.

Table 13: Indian Inter-cities Distances

Distance From Guwahati to:	State	Town	Road (km)	Rail
	Assam	Dhubri	260	Yes
	Meghalaya	Shillong	103	no
	Nagaland	Kohima	0	no
	Mizoram	Aizawl	0	no
	Tripura	Agartala	599	no
	Manipur	Imphal	579	no
	Arunchal Pradesh	Itanagar	401	no

Note: Different sources sometimes disagree with regard to distance, road grade and routes

Waterborne distances from Calcutta are about 820 km to Karimganj and 825 km to Dhubri. Rail links are present at Karimganj (on the Kalni River) and at Dhubri (on the Brahmaputra River). However, as will be seen, river/road transportation between Calcutta and Guwahati (at 1,085 km) does not offer any real savings over the all-rail route. On the other hand, the Kalni-Kushiyara River route could be quite attractive to certain areas.

4.4 Transportation Costs

Transportation costs are reportedly high, but with little substantiation other than the cost of a 50 kg bag of cement at 130 rupees in Calcutta and 235 rupees in Imphal. The Imphal cost will include transportation costs, handling between rail and road and probably local retailer and/or wholesaler mark-up.

The difference between these two is equivalent to 2,100 rupees, or about US $60/tonne. Assuming transfer and local distribution costs are worth the equivalent of US $10/tonne gives a tonne km rate of 2.9¢. North American rates for bulk carload lots of 90-100 tonnes rather than unit trains are about 1.5¢/tonne km. However Freight All Kinds, FAK, box car rates at about 45 tonnes are significantly higher at 2.5¢/tonne km. Thus the implied Indian rail rates, although high, are not outrageously so.

Water transportation should be able to better this rate, but this will depend on route distance, cargo size, and transfer costs. For example, shipment by water to Dhubri may be relatively inexpensive, but transfer and then trucking to the final destination may be more costly than, say, rail to Silchar, then truck to Imphal. There should, logically, be a catchment area around Karimganj and Dhubri that could be served—particularly as there is a rail connection.

Distances by water to Karimganj (at 820 km) should offer significant savings. For example, Silchar is about 50 km by road from Karimganj, but 325 km from Guwahati. Thus total transit distance from Calcutta by rail is 1,476 km, compared with a water/road route via Bangladesh of 870 km. However, there is a lack of basic information to undertake an analysis of the least-cost routings to major destinations.

The estimated freight cost by a Bangladesh IWT type vessel on the Calcutta to Karimganj route, depending on whether a class II or class III channel is created, is Tk 450 and Tk 525 per tonne respectively. Handling costs for cargo might add Tk 100/tonne. Thus landed cost at Karimganj would be less than Tk 1,000/tonne, compared with a transportation cost of Tk 2,500/tonne Calcutta to Imphal.

There would appear, therefore, to be potential benefits. The above costs also do not take into account the impact of possible back haul business such as logs or other bulk cargo.

4.5 Marine Opportunity

Although marine transit traffic via Bangladesh undoubtedly suffered as a result of the eight year hiatus due to political uncertainty, it would seem that waterways generally have a low priority in India (see attached article). We must presume, therefore, that India maintains its rights to navigation through Bangladesh as a strategic alternative to domestic routes in the event of possible disruption. This can be argued from the fact that both transit routes now carry about the same quantity of cargo, despite the historic preference for the Jamuna/Brahmaputra, the known poor condition of the Kalni-Kushiyara River system, the intermodal opportunities through Dhubri, and the above noted benefits of routing cargo via the Kalni-Kushiyara River system and Karimganj to the Northeast Hill States.

Also, the conservancy fee of Tk 15.1 million (US $360,000) is worth about US $7.50/tonne on current cargo quantities. Consequently, the tonnage moved and the conservancy dues paid may not depend on economics or the relative merits of the routes. Thus, activities by Bangladesh to materially upgrade the Kalni-Kushiyara River would not automatically result in increased cargo unless there were a parallel political agreement to take advantage of the improved waterway. This may require a more general agreement between Bangladesh and India on transit cargo to increase marine transit quantities. However, it may not increase conservancy dues. These are already exceptionally high on a transit-tonne basis.

5. FREIGHT TRAFFIC SURVEY

5.1 Methodology of the Field Survey and Data Collection

The field survey and data collection on water transportation in the Kalni-Kushiyara River project area was carried out in a pragmatic way. The primary data collection instruments were two specifically designed questionnaires: schedule-1 and schedule-2. Schedule-1 is a succinct one page data sheet covering basic information regarding the country boats and IWT vessels present on the day of enumeration. Schedule-2 is a detailed questionnaire which was filled-up for 10% of all the boats recorded into Schedule-1.

The survey and data collection were carried out during the monsoon and the dry seasons of 1995. There is a variation in the traffic between *haat*-days and non-*haat* days. To account for this, the survey and data collection were carried out on a *haat*-day and a non-*haat* day at each of the 12 selected river stations/*ghats* of the Kalni-Kushiyara River; this was done during both the dry and monsoon seasons. The survey and enumeration works were carried out from dawn to dusk at each station/*ghat*. The enumerators were briefed about the purpose of the survey and the methodology to be followed in the actual enumeration and data collection. Supervision of the field survey and data collection works was maintained through the two field officials of the Navigation Component study. The NERP Senior Navigation Specialist also carried out field inspections during the survey period.

Tables 14 to 19 summarize the data on the number of boats or launches transportation fleet and traffic volume for 12 river stations. Data has been broken-up into dry and monsoon seasons, by incoming and outgoing, by station-to-station movements and by item.

Table 14: Total Number of Boats/launches (Boat Movements or trips) at 12 River Stations on the Kalni-Kushiyara River in the Dry Season of 1995

River Stations	Incoming Boats/Launches (trips)			Outgoing Boats/Launches (trips)			Total (trips)		
	MB	NMB	Launches	MB	NMB	Launches	MB	NMB	Launches
Madna	1,804	952	408	1,804	952	408	3,608	1,904	816
Paharpur	2,076	136	544	1,940	136	544	4,016	272	1,088
Kadamchal	2,368	236	408	2,368	100	408	4,736	336	816
Adampur	5,424	1,832	408	8,696	200	408	14,120	2,032	816
Abdullahpur	3,192	1,824	408	3,608	1,824	408	6,800	3,648	816
Katkhal	4,320	1,288	408	1,652	880	408	5,972	2,168	816
Kakailseo	8,320	1,624	408	8,872	444	408	17,192	2,068	816
Ajmiriganj	15,504	5,536	816	12,372	12,668	816	27,876	18,204	1,632
Markuli	4,536	472	1,224	4,264	272	1,224	8,800	744	2,448
Raniganj	1,404	36	1,088	1,404	36	1,088	2,808	72	2,176
Enayetganj	788	0	1,088	788	0	1,088	1,576	0	2,176
Sherpur	760	36	1,360	760	36	1,360	1,520	72	2,720
Total:	**50,496**	**13,972**	**8,568**	**48,528**	**17,548**	**8,568**	**99,024**	**31,520**	**17,136**

Notes: 1. Summation of Boats/Launchers (i.e. boat movements/trips) handled at nine river stations/*ghats* on the Kalni-Kushiyara river in the Dry Season of 1995

2. MB = Mechanized Boats; NMB = Non-mechanized boats.

Source: Traffic Counting Survey by the Navigation Component of NERP in the Monsoon of 1995.

Table 15: Total Number of Boats/launches (Boat Movements or trips) at 12 River Stations On the Kalni-Kushiyara River in the Monsoon Season of 1995

River Stations	Incoming Boats/Launches (trips)			Outgoing Boats/Launches (trips)			Total (trips)		
	MB	NMB	Launches	MB	NMB	Launches	MB	NMB	Launches
Madna	7,328	10,763	687	8,019	5,038	687	15,347	15,801	1,374
Paharpur	3,206	21,297	916	3,206	20,381	919	6,412	41,678	1,835
Kadamchal	3,086	11,490	687	3,135	9,183	687	6,221	20,673	1,374
Adampur	9,385	15,566	687	8,033	6,696	687	17,418	22,262	1,374
Abdullahpur	3,697	17,819	687	3,855	17,884	687	7,552	35,703	1,374
Katkhal	6,134	27,824	687	6,374	19,831	687	12,508	47,655	1,374
Kakailseo	9,368	45,143	687	11,287	31,146	687	20,655	76,289	1,374
Ajmiriganj	43,628	42,727	1,374	38,121	35,927	1,374	81,749	78,654	2,748
Markuli	6,178	14,085	2,061	6,227	10,378	2,061	12,405	24,463	4,122
Raniganj	4,156	15,723	1,832	7,345	13,945	1,832	11,501	29,668	3,664
Enayetganj	5,796	10,300	1,832	4,362	9,629	1,832	10,158	19,929	3,664
Sherpur	9,694	7,486	1,832	10,681	4,700	1,832	20,375	12,186	3,664
Total:	**111,656**	**240,223**	**13,969**	**110,645**	**184,738**	**13,972**	**222,301**	**424,961**	**27,941**

Note: The traffic counting data of *haat*-days and non-*haat* days have been multiplied by the no. of *haat* days and non-hat days of the monsoon season of 1995.

Source: Traffic Counting Survey by the Navigation Component of NERP in the Monsoon of 1995.

Table 16: Total Number of Boats/launches (Boat Movements or trips) Handled at 12 River Stations/*ghat*s on the Kalni-Kushiyara River in 1995

River Stations	Incoming Boats/Launches (trips)			Outgoing Boats/Launches (trips)			Total (trips)		
	MB	NMB	Launches	MB	NMB	Launches	MB	NMB	Launches
Madna	9,132	11,715	1,095	9,823	5,990	1,095	18,955	17,705	2,190
Paharpur	5,282	21,433	1,460	5,146	20,517	1,463	10,428	41,950	2,923
Kadamchal	5,454	11,726	1,095	5,503	9,283	1,095	10,957	21,009	2,190
Adampur	14,809	17,398	1,095	16,729	6,896	1,095	31,538	24,294	2,190
Abdullahpur	6,889	19,643	1,095	7,463	19,708	1,095	14,352	39,351	2,190
Katkhal	10,454	29,112	1,095	8,026	20,711	1,095	18,480	49,823	2,190
Kakailseo	17,688	46,767	1,095	20,159	31,590	1,095	37,847	78,357	2,190
Ajmiriganj	59,132	48,263	2,190	50,493	48,595	2,190	109,625	96,858	4,380
Markuli	10,714	14,557	3,285	10,491	10,650	3,285	21,205	25,207	6,570
Raniganj	5,560	15,759	2,920	8,749	13,981	2,920	14,309	29,740	5,840
Enayetganj	6,584	10,300	2,920	5,150	9,629	2,920	11,734	20,001	6,384
Sherpur	10,454	7,522	3,192	11,441	4,736	3,192	21,895	12,258	6,384
Total:	**162,152**	**254,195**	**22,537**	**159,173**	**202,286**	**22,540**	**321,325**	**456,553**	**45,621**

Source: Traffic Counting Survey by the Navigation Component of NERP in the Dry and Monsoon of 1995.

Table 17: Volume of Traffic With Break-up of Inflow and Outflow Handled at 12 River Stations/ *Ghats* in the Kalni-Kushiyara River in the Dry Season of 1995

River Stations	Incoming Traffic		Outgoing Traffic		Total	
	Cargo (tonnes)	Passenger (Nos)	Cargo (tonnes)	Passenger (Nos)	Cargo (tonnes)	Passenger (Nos)
Madna	663.45	37,672	150.00	31,824	813.45	69,496
Paharpur	3,812.12	90,848	465.00	62,424	4,277.12	153,272
Kadamchal	583.00	39,892	105.00	34,792	688.00	74,684
Adampur	6,128.64	146,856	1,116.40	178,728	7,245.04	325,584
Abdullahpur	2,926.36	119,332	2,254.40	100,984	5,180.76	220,316
Katkhal	1,821.68	157,072	582.60	110,884	2,404.28	267,956
Kakailseo	32,202.88	81,856	24,960.40	75,596	57,163.28	157,452
Ajmiriganj	30,277.44	883,600	9,627.20	771,762	39,904.64	1,655,362
Markuli	1,757.52	154,676	500.80	101,920	2,258.32	256,596
Raniganj	22,824.00	24,428	7.00	23,752	22,831.00	48,180
Enayetganj	4,427.00	17,356	0.00	13,592	4,427.00	30,948
Sherpur	2,095.65	37,196	46.00	36,012	2,141.65	73,208
Total	**109,519.74**	**1,790,784**	**39,814.80**	**1,542,270**	**149,334.54[1]**	**3,333,054**

Note : 1. Raniganj, Enayetganj and Sherpur were not included in the dry season survey as their approaches were not navigable by even the smallest country boats. But data collected from the traders in these three stations showed a total cargo traffic of 29,399 tonnes for the dry period. This has been accounted for in this table.

Source: Traffic Counting Survey by the Navigation Component of the NERP in the year 1995.

Table 18: Volume of Traffic (Cargo in Tonnes and Passengers in Nos.) With Break-up of Inflow and Outflow Handled at 12 River Stations/*ghats* on the Kalni-Kushiyara River area in the Monsoon of 1995

River Stations	Incoming Traffic		Outgoing Traffic		Total	
	Cargo (tonnes)	Passenger (Nos)	Cargo (tonnes)	Passenger (Nos)	Cargo (tonnes)	Passenger (Nos)
Madna	12,188.39	144,728	9,153.11	161,674	21,341.50	306,402
Paharpur	6,958.12	135,339	7,666.92	136,942	14,625.04	272,281
Kadamchal	1,063.26	109,868	5,967.54	91,758	7,030.80	201,626
Adampur	8,275.42	223,879	8,019.60	209,863	16,295.02	433,742
Abdullahpur	7,258.97	183,612	10,050.76	173,663	17,309.73	357,275
Katkhal	3,393.16	136,258	1,691.86	115,711	5,085.02	251,969
Kakailseo	4,917.69	294,151	3,953.60	275,425	8,871.29	569,576
Ajmiriganj	77,413.76	1,257,617	30,051.79	1,217,039	107,465.55	2,474,656
Markuli	6,681.77	208,487	9,832.12	246,913	16,513.89	455,400
Raniganj	14,477.58	173,979	8,072.52	183,245	22,550.10	357,224
Enayetganj	32,803.80	68,504	957.84	70,859	33,761.64	139,363
Sherpur	7,348.63	259,273	13,810.54	276,806	21,159.17	536,079
Total:	**182,780.55**	**3,195,695**	**109,228.20**	**3,159,898**	**292,008.75**	**6,355,593**

Note: The traffic counting data of *haat*-days and non-*haat* days have been multiplied by the no. of *haat* days and non-*haat* days of the monsoon season of 1995.

Source: Traffic Counting Survey by the Navigation Component of the NERP in the year 1995.

Table 19: Total Annual Volume of Traffic With Break-up of Inflow and Outflow Handled at 12 River Stations On the Kalni-Kushiyara River in the Year 1995

River Stations	Incoming Traffic		Outgoing Traffic		Total	
	Cargo (tonnes)	Passenger (Nos)	Cargo (tonnes)	Passenger (Nos)	Cargo (tonnes)	Passenger (Nos)
Madna	12,851.84	182,400	9,303.11	193,498	22,154.95	375,898
Paharpur	10,770.24	226,187	8,131.92	199,366	18,902.16	425,553
Kadamchal	1,646.26	149,760	6,072.54	126,550	7,718.80	276,310
Adampur	14,404.06	370,735	9,136.00	388,591	23,540.06	759,326
Abdullahpur	10,185.33	302,944	12,305.16	274,647	22,490.49	577,591
Katkhal	5,214.84	293,330	2,274.46	226,595	7,489.30	519,925
Kakailseo	37,120.57	376,007	28,914.00	351,021	66,034.57	727,028
Ajmiriganj	107,691.20	2,141,217	39,678.99	1,988,801	147,370.19	4,130,018
Markuli	8,439.29	363,163	10,332.92	348,833	18,772.21	711,996
Raniganj	37,301.58	198,407	8,079.52	206,997	45,381.10	405,404
Enayetganj	37,230.80	85,860	957.84	84,451	38,188.64	170,311
Sherpur	9,444.28	296,469	13,856.54	312,818	23,300.82	609,287
Total:	**292,300.29**	**4,986,479**	**149,043.00**	**4,702,168.00**	**441,343.29[1]**	**9,688,647.00**

Note : 1. Raniganj, Enayetganj and Sherpur were not included in the dry season survey as their approaches were not navigable by even the smallest country boats. But data collected from the traders in these three stations showed a total cargo traffic of 29,399 tonnes for the dry period. This has been accounted for in this table.

Source: Traffic Counting Survey by the Navigation Component of the NERP in the year 1995.

6. COMMUNITY PROFILES

This chapter presents the profile of the following communities:

- Zakiganj Bazar
- Fenchuganj
- Balaganj
- Sherpur
- Raniganj
- Markuli
- Paharpur
- Ajmiriganj
- Kakailseo
- Abdullahpur
- Katkhal
- Adampur
- Madna

6.1 Zakiganj Bazar

Union:	Zakiganj
Thana:	Zakiganj
Pop. 1991:	15,000 (estimated)
Union pop. 1991:	20,326

Zakiganj is mainly on a higher plain. The land level is about 9 m above the low water level in the Kushiyara River. It is located to the north of the Kushiyara River, opposite the Indian border in the upper reach of the river system. It is 20 km from Amalshid. Zakiganj Bazar is in the *thana* headquarters. The high hills can easily be seen from the Zakiganj area. The main economic activity is border trading. On the opposite side of Zakiganj is the northeastern Indian state of Assam. Rice, chillies and ginger are regularly imported across the border. Indian in-transit cargo vessel are loaded here. All daily necessities of life are available, but they are mainly Indian commodities. The related union and Indian territory across the border are market hinterlands. People mainly travel to Sylhet.

Market

Haat days:	Sunday, Thursday
Size:	300 permanent vendors, and a total of 1,200 on a *haat* day

It is generally local people who visit the market-place.

Communications

Rail:	No rail
Pucca Road:	Yes, well communicated
Gravel Rd:	No
Seasonal Track:	Not needed
River:	Yes, well connected

The major commodities shipped to/from the town are paddy, betel nut, rod, cement, clothes and stationery. The paddy, betel nut, bananas and firewood is shipped to Sylhet by road. Whilst rod, cement, clothes and stationary items are brought from Sylhet by road. The cost of shipping from Sylhet to Zakiganj by road during the wet and dry seasons is Tk 4.27 tonne km (Tk 12/ *maund*). Cargo is not transported by river.

Passenger cost: The launch fare from Zakiganj to Fenchuganj is between Tk 40/person and Tk 60/person.

Personal communication

Destinations:	Mainly Sylhet
Method of transportation:	Mainly by bus, during both the wet and dry seasons
Duration of trip:	Three hours during both the wet and dry seasons
Fare:	Tk 32 by bus.
Frequency of travel:	People travel between the main centres weekly or fortnightly

6.2 Fenchuganj

Union:	Fenchuganj
Thana:	Sylhet
Pop. 1991:	15,000
Union pop. 1991:	31,630

Though Fenchuganj is in a hilly area, the market place lies on the plain. Tea and rubber gardens are found in the area. The first fertilizer factory was established at Fenchuganj in 1962. It not far from the river station. The site for the proposed Shahjalal fertilizer factory is beside the existing fertilizer factory. The land level is about 4.5 m above the low water level in the Kushiyara River. The distance from Fenchuganj to Amalshid is 95 km. The rail infrastructure at Fenchuganj is very good, and rail is the main transportation system. The education rate is higher than other places. The migrating population is high due to the fertilizer factory. Remittance is the main source of income in the area. Modern facilities are available in Fenchuganj. There are many problems due to flash flooding in the area. The low-lying land is rapidly being silted up due to overbank spills and sediment deposition from the Kushiyara River.

Market

Haat days:	There is a bazar held every day. There are two *haat* days in the week
Size:	500 permanent vendors on both the river banks
Products sold:	Fish, grocery items, vegetables, medicine, clothes, rice etc

The number of local people who visit the market is about the same as the number of people visiting from outside the area.

Communications

Rail:	Yes
Pucca Road:	Yes, well communicated
Gravel Road:	No
Seasonal Track:	No
River:	Yes

Major Commodities

There are 5 principal commodities shipped to/from the town and immediate vicinity (Table 20).

Table 20: Major Commodities of Fenchuganj

Commodity	Shipped to	Shipped from	Mode	Cost of Transport Wet Season	Cost Transport Dry Season
Fish		Down stream	Boat	Tk 10/box	Tk 10/box
Fertilizer	Kakailseo, downstream etc		Boat	Tk 2.66/tonne km	Tk 4/tonne km
Rice & grocery items		Bhairab, Sylhet	Boat	Tk 4.27/tonne km (Road), Tk 1.80 tonne km (waterways)	Tk 4.27/tonne km (Road), Tk 1.80 tonne km (waterways)
Paddy	Bhairab		Boat	Tk 1.35/tonne km	Tk 1.35/tonne km

Note: Fertilizer transportation cost is Tk 2.66/tonne km. There is normally no variation in the dry and wet season transportation cost. The freight rate is a year-round weighted average.

6.3 Balaganj

Union: Balaganj
Thana: Balaganj
Pop. 1991: 1,3000 (estimated)
Union pop.: 18,419

Balaganj is in a comparatively low-lying area. There are important *haor* areas in the *thana*. Balaganj Thana headquarters is on the north bank of the Kushiyara River. The *thana* headquarters is about 115 km from Amalshid. The land level is about 4.5 m above the low water level of the river. It is linked with Sylhet by road. All the things necessary for daily life are bought and sold in the market place. It is a rich area. A large proportion of the population has lived abroad as wage-earners, and they have noticeably changed the infrastructure.

Market: N/A
Haat days: N/A
Size: 500 permanent sellers on both banks of the river
Products sold: Fish, grocery items, vegetables, medicine, clothes, rice etc.

The market area is sometimes submerged during the monsoon period. The proportion of people visiting the market to local residents is about 9:1.

Communications

Rail: No
Pucca Road: Yes, well communicated
Gravel Road: No
Seasonal Track: No
River: Yes

Major Commodities

There are 5 principal commodities shipped to and from the town and the immediate vicinity (Table 21).

Table 21: Major Commodities of Balaganj

Commodity	Shipped to	Shipped from	Mode	Cost of Transport Wet Season	Cost Transport Dry Season
Fish	---	Down stream	Boat	Tk 10/box	Tk 10/box
Fertilizer		Fenchuganj	Boat	Tk 2.66/tonne km	Tk 4/tonne km
Rice & grocery items	---	Bhairab	Boat	Tk 178.7/tonne	Tk 261.2/tonne
Paddy	Bhairab	---	Boat	Tk 1.35/tonne km	Tk 1.35/tonne km

Note: Fertilizer transport cost is Tk 2.66/tonne km. There is normally no variation in the dry and wet season transportation cost. The freight rate is a year-round weighted average.

Personal Communication (Tables 22 and 23)

Table 22: Personal Communication from Balaganj

Travel to	Mode Wet Season	Mode Dry Season	Time Required Wet Season (hours)	Time Required Dry Season (hours)
Markuli	Boat, launch	Boat, launch	7	7
Ajmiriganj	Boat, launch	Boat, launch	9	9
Bhairab	Bus	Bus	6	6
Dhaka	Bus	Bus	8	8
Sylhet	Bus	Bus	1.5	1.5
Moulvibazar	Bus	Bus	1.5	1.5
Srimangal	Bus	Bus	2.5	2.5
Fenchuganj	Boat, launches	Boat, launch	1.5	1.5

Table 23: Cost and Frequency of Personal Communication from Balaganj

Places	Cost Wet Season (Tk)	Cost Dry Season (Tk)	Frequency of Travel Main Centres	Frequency of Travel Locally
Bhairab	70	70	Weekly	Daily
Srimangal	20 (Road)	20 (Road)		Weekly
Moulvibazar	15 (Road)	15 (Road)		Daily
Fenchuganj	15 (Waterways)	15 (Waterways)		Fortnightly
Dhaka	90 (Waterways, Road)	90 (Road	Monthly	Daily
Sylhet	15	15	Weekly	Daily

Note: calculation on the basis of Tk 0.69/passenger km for waterways in the Dhaka Sylhet transport corridor. Tk 0.27/passenger km in the road sector in the same route.

6.4 Sherpur

Union: Sadipur of Balaganj and Moulvibazar
Thana: Balaganj and Moulvibazar
Pop. 1991: 10,000 (estimated; within 1 km radius of the market centre)

Sherpur is mainly on the highlands, and located along the Dhaka-Sylhet highway. This community lies on both sides of the Kushiyara River, connected by the Sherpur Bridge. The place is an important bus station. The land level is about 4.5 m above the low water level. It is a rapidly growing urban centre. When the town was founded, before construction of the Sherpur bridge, it was connected by a ferry service. The distance from Amalshid to Sherpur is 135 km. All the daily necessities of rural life are sold here. People from Raniganj of Jagannthpur Thana, Kashba of Nabiganj Thana, Sadipur of Balaganj Thana and Moulvibazar Sadar Thana are the navigation hinterlands. It is well connected to Dhaka, Sylhet, Bhairab and Moulvibazar.

Market:
Haat days: N/A
Size: 500 permanent sellers on both river banks
Products sold: Fish, grocery items, vegetables, medicine, clothes, rice etc.

The proportion of people visiting the market to local residents is about 10:1.

Communications
Rail: No
Pucca Road: Well communicated
Gravel Road: No
Seasonal Track: No
River: Yes

The clearance of Sherpur bridge is about 4.5 m during high water and 10.5 m during low water.

Major Commodities (Table 24)

Table 24: Major Commodities of Sherpur

Commodity	Shipped to	Shipped from	Mode	Cost of Transport Wet Season	Cost of Transport Dry Season
Fish	--	Down stream	Boat	Tk 15/boat	Tk 15/boat
Fertilizer		Fenchuganj	Boat	Tk 2.66/tonne km	Tk 4/tonne km
Rice & grocery items	--	Bhairab	Boat	Tk 1.70/tonne km	Tk 1.70/tonne km
Paddy	Bhairab	--	Boat	Tk 1.35/tonne km (waterways)	Tk 1.35/tonne km (waterways)

Note: Fertilizer transport cost is Tk 2.66/tonne km. There is normally no variation in the dry and wet season transportation cost. The freight rate is a year-round weighted average.

Personal Communication (Tables 25 and 26)

Table 25: Personal Communication from Sherpur

Travel to	Mode Wet Season	Mode Dry Season	Time Required Wet Season (hours)	Time Required Dry Season (hours)
Markuli	Boat, launch	Boat, launch	7.0	7.0
Ajmiriganj	Boat, launch	Boat, launch	8.0	8.0
Bhairab	Bus	Bus	5.0	5.0
Dhaka	Bus	Bus	7.0	7.0
Sylhet	Bus	Bus	1.5	1.5
Moulvibazar	Bus	Bus	1.0	1.0
Srimangal	Bus	Bus	2.0	2.0
Fenchuganj	Bus	Bus	2.0	2.0

Table 26: Cost and Frequency of Personal Communication from Sherpur

Places	Cost Wet Season (Tk)	Cost Dry Season (Tk)	Frequency of Travel Main Centres	Frequency of Travel Locally
Bhairab	65	65	Weekly	Daily
Srimangal	10 (Road)	10 (Road)		Weekly
Moulvibazar	5 (Road)	5 (Road)		Daily
Fenchuganj	15 (Waterways)	15 (Waterways)		Fortnightly
Dhaka	80 (Road)	80 (Road)	Monthly	Daily
Sylhet	10 (Road)	10 (Road)	Weekly	Daily

Note: Calculation on the basis of Tk 0.69/passenger km for waterways in the Dhaka/Sylhet transport corridor. Tk 0.27/passenger km in the road sector in the same route.

6.5 Raniganj

Name: Raniganj
Union: Raniganj
Thana: Jagannathpur
District: Sunamganj
Pop. 1991 7,000 (estimated)
Union pop. 1991: 27,000

Raniganj is in a low-lying area, located about 20 km downstream of Sherpur and 155 km from Amalshid. The adjacent areas are submerged under 2 m to 4.5 m of water in the monsoon period. Though the market place does not generally submerge, the water level can reach the highland of the market. There is no communication system from Raniganj except waterway.

In the dry season, the land level is about 3.5 m above the low water level. It was a growing market, but recently it has been stagnating. This is due to development of a road system in the command area. The hinterlands of this community are Raniganj and Asharkandi union, Jagannathpur Thana and Dhigahalbagh of Nabiganj Thana. The major commodities sold are dry fish, fish, rice, molasses, vegetables, poultry and bamboo items. The source of grocery items and vegetables from Comilla and other highland areas is Bhairab.

Market

Haat day:	Monday and Thursday
Size:	250 permanent shops and another 200 temporary shops
Products sold:	Paddy, rice, flour, POL, fertilizer, vegetables and numerous other types of consumers items

The proportion of people visiting the market to local residents is about 9:1.

Communication

Rail:	No
Pucca Road:	No
Gravel Road:	No
Seasonal Track:	There is a regional track used only in the dry season
River:	River is the only means of transportation

Major Commodities

The five major commodities are paddy, rice, construction materials, POL and Fertilizer. Paddy is shipped to Sherpur by engine boat. Some construction material comes from Chittagong by road or water until Bhairab, and then from Bhairab by engine boats. POL and rice are shipped to the market from Bhairab. Fertilizer comes from Fenchuganj by engine boats (Table 27).

Table 27: Major Commodities of Raniganj

Item	From	To	Dry Season Cost (Tk/tonne)	Wet Season Cost (Tk/tonne)
Paddy	Raniganj	Bhairab	288.5	206
Rice	Bhairab	Raniganj	288.5	206
Construction materials	Bhairab	Raniganj	288.5	206
Construction materials	Chittagong	Raniganj	441.0	441
POL	Bhairab	Raniganj	288.5	206
Fertilizer	Fenchuganj	Raniganj	220.0	0

Personal Communication

People mainly travel to Jagannathpur and Sunamganj for official correspondence, and to Bhairab and Chittagong for business transactions. People reach Jagannathpur on foot during the dry season and by boat in the monsoon season. They reach Sunamganj, Bhairab and Chittagong using a launch or bus. People generally travel to main centres fortnightly, and to the local centre every day (Table 28).

Table 28: Cost of Personal Communication from Raniganj

From	To	Cost (Tk)		Time needed (hours)	
		Dry Season	Wet Season	Dry Season	Wet Season
Raniganj	Jannathpur	0 (by foot)	7	1.5	1.0
Raniganj	Sunamganj	65	20	6.0	2.5
Raniganj	Bhairab	102	102	8.5	8.5

6.6 Markuli

Union: Daulotpur
Thana: Baniachang
Pop. 1991: 5,000 (estimated)
Union pop. 1991: Daulotpur union 20,282; Habibpur union 21,469; Kolonj union 23,222

Markuli stands on the left bank of the Kushiyara River in Doulatpur Union under Baniachang Thana in Habiganj district. It lies on the political junction of 3 *thanas*. It is 180 km from Amalshid. During peak water levels the market is not submerged, but the adjacent areas in the *haor* basin remain underwater about 5 to 6 months. The daily necessities of life are available in the market. Police come to the market place. There is also a wireless station. The main economic interaction is with Sherpur, Ajmiriganj and Bhairab. There are official interactions with Baniachang and social interactions with the three related thanas. The market area is subjected to river erosion. River training and loop cutting is needed.

Market

Haat day: Friday and Monday
Size: About 20 big and 80 small vendors. Besides these, some temporary shops sit in the open air

The people marketing at Markuli are 95% local and 5% visitors.

Communication

The only connection to the market is by waterway. So far no rail, *pucca*, semi-*pucca* or *kancha* roads have been developed. Paddy is transported to Bhairab by engine boats in both the dry and monsoon seasons. Rice, flour, construction materials, POL and consumer goods are brought to Markuli from Bhairab/Ashuganj. Fertilizer is transported from Fenchuganj.

Personal Communication

People from Markuli go to Baniachang and Habiganj for official purposes and to Bhairab for business. In the dry season, people reach Markuli using launches and buses from Sherpur. In the monsoon season, they come directly by boat.

Major Commodities

Food grain, construction materials, fertilizer, POL and consumer goods are the major items. Transport costs are Tk 261.25/tonne during the dry season and Tk 178.75/tonne during the wet season.

6.7 Paharpur

Union:	Badalpur
Thana:	Ajmiriganj
Pop. 1991:	5,000 (estimated)
Union Pop.:	14,481

This market stands on the left bank of the Kalni-Kushiyara River in Habiganj district. In the peak flood season water remains 0.6 m lower than the land level of the market, but the surrounding areas are inundated for three to six months a year. It is 189 km from Amalshid. It is an important market place. The community is fully Hindu. About 200 duck rearing farms have been introduced under local initiatives. Eggs are regularly exported to Bhairab and Ashuganj. The hinterlands are Badalpur union of the same *thana* and Pratappur of Sullah Thana of Sunamgaj district. A new type of transportation device has been innovated in the area to transport paddy during the dry season, which consists of a power tiller to pull a loaded bullock cart.

Market

Haat day:	There are no *haat* days, only daily bazars
Size:	About 100 permanent shops

Communication

Rail:	No
Pucca road:	No
Gravel road:	No
Seasonal Track:	A seasonal track runs from the market to Baniachang

Major Commodities

The 5 major commodities are paddy, rice, fish, POL and fertilizer. All the five commodities are shipped by engine boats. Paddy is shipped to Ashuganj and Bhairab. Rice and POL are brought to Paharpur from Bhairab and Ashuganj. Fertilizer is shipped to Paharpur from Fenchuganj (Table 29).

Table 29: Major Commodities of Paharpur

Item	From	To	Cost (Tk/tonne)	
			Dry Season	Wet Season
Paddy	Paharpur	Ashuganj	250.0	170
Fish	Paharpur	Bhairab	828.0	828
Rice	Bhairab	Paharpur	250.5	170
POL	Bhairab	Paharpur	250.5	170
Fertilizer	Fenchuganj	Paharpur	143.0	143

Personal communication

People mainly travel to Bania Chamy Habiganj for official purposes and to Bhairab for business purposes. In the dry season they move by Jeep from Salsuka, and in the wet season they reach Habiganj by boat. People travel to Bhairab by launch and trawler throughout the year. A few people travel to Bhairab via Habiganj (Table 30).

Table 30: Cost of Personal Communication from Paharpur

From	To	Cost (Tk)		Time Needed (hours)	
		Dry Season	Wet Season	Dry Season	Wet Season
Paharpur	Habiganj	46	26	3.5	2.5
Paharpur	Bhairab	60	60	14.0	10.0

People generally travel to the local centre every day and to a main centre weekly.

6.8 Ajmiriganj

Union: Ajmiriganj
Thana: Ajmiriganj
District: Habiganj
Pop. 1991: 10,000 (estimated)
Union pop.: 20,401

This market stands on the left bank of the Kalni-Kushiyara River in Habiganj district. The distance from Ajmiriganj to Amalsid is 205 km. Another market was established on the opposite bank of the river in 1995.

Market:
Haat day: Sunday and Thursday
Size: About 250 permanent and 300 temporary shops

Communications
Rail: No
Pucca road: No
Gravel road: No
Seasonal Track: A seasonal track runs from the market to Baniachang

Major Commodities
The 5 major commodities are paddy, rice, fish, POL and fertilizer. All five commodities are shipped by engine boats. Paddy and fish are shipped to Ashuganj and Bhairab. Rice and POL are brought to Ajmiriganj from Bhairab and Ashuganj. Fertilizer is brought to Ajmiriganj from Fenchuganj (Table 31).

Table 31: Major Commodities of Ajmiriganj

Item	From	To	Cost (Tk/tonne)	
			Dry Season	Wet Season
Paddy	Ajmiriganj	Ashuganj	247.5	165
Fish	Ajmiriganj	Bhairab	825.0	825
Rice	Bhairab	Ajmiriganj	247.5	165
POL	Bhairab	Ajmiriganj	247.5	165
Fertilizer	Fenchuganj	Ajmiriganj	140.0	140

Personal communication
People mainly travel to Habiganj for official purposes and to Bhairab for business purposes. In the dry season people travel from Ajmiriganj by Jeep. In the wet season they reach Habiganj by boat. People travel to Bhairab by launch and trawler through the year. A few people travel to Bhairab via Habiganj (Table 32).

Table 32: Personal Communication from Ajmiriganj

From	To	Cost (Tk)		Time Needed (hours)	
		Dry Season	Wet Season	Dry Season	Wet Season
Ajmiriganj	Habiganj	46.0	26.0	3.5	2.5
Ajmiriganj	Bhairab	60.0	60.0	12.0	10.0

People generally travel to the main centres once a week and to the local centre every day.

6.9 Kakailseo

Union:	Kakailseo
Thana:	Ajmiriganj
District:	Habiganj
Pop. 1991:	6,000 (estimated)
Union pop. 1991:	21,334 nos

Kakailseo is located 211 km from Amalshid. The market is normally flood-free. It is about 1.5 m above the normal land level of the adjacent river bank areas. In the 1988 flood, the Kakailseo market was flooded by 0.6 m of water. The 1974 flood inundated the market by 0.3 m. During low water, the land level is 1.5 m above water level. During the peak flood level, the land on the opposite side of the river is deeply flooded. The related unions are Mirka and Joyshiddi of Kishorganj district. The market is an important centre for fertilizer business. A local businessmen controls about 50% of the total fertilizer of the Fenchuganj factory. It is a disposal point even up to Nandail of Mymensingh district. He has launches which regularly shuttle between Bhairab and Ajmiriganj. Potatoes, sweet potatoes, fish and paddy are the main local commodities.

Market

Haat days:	Friday and Monday
Size:	About 125 permanent shops and 100 temporary shops

Communications

Rail:	No
Pucca road:	No
Gravel road:	No
Seasonal Track:	There is a seasonal track used during the dry season
River:	River the one and only means of communication

Major Commodities

The major 5 commodities are paddy, fish, rice, POL and fertilizer. All of these 5 commodities are shipped by engine boats. Paddy and fish are shipped to Bhairab and Ashuganj. Rice and POL are brought to Kakailseo from Bhairab and Ashuganj. Fertilizer is brought to Kakailseo from Fenchuganj (Table 33).

Table 33: Major Commodities of Kakailseo

Item	From	To	Cost (Tk/tonne)	
			Dry Season	Wet Season
Paddy	Kakailseo	Ashuganj	247.5	165
Fish	Kakailseo	Bhairab	825.0	825
Rice	Bhairab	Kakaileo	247.5	165
POL	Ashuganj	Kakailseo	247.5	165
Fertilizer	Fenchuganj	Kakailseo	140.0	140

Personal Communication

People mainly travel to Ajmiriganj and Habiganj for official purposes and to Bhairab and Ajmiriganj for business purpose. They reach Ajmiriganj and Bhairab by launch and trawler throughout the year. Some people travel to Ajmiriganj on foot during the dry season. They reach Habiganj by jeep via Ajmiriganj. Poor people reach Baniachang on foot, and then avail buses or other motorized vehicles to get to Habiganj (Table 34).

Table 34: Personal Communication from Kakailseo

From	To	Cost (Tk)		Time Needed (hours)	
		Dry Season	Wet Season	Dry Season	Wet Season
Paharpur	Habiganj	46	26	3.5	2.5
Paharpur	Bhairab	60	60	14.0	10.0

People generally travel to the main centres once a week and to the local centre daily.

6.10 Abdullahpur

Union: Abdullahpur
Thana: Astagram
Pop. 1991: 5,000 (estimated)

Abdullahpur is 233 km from Amalshid. A fair number of people from the community live in Europe, the middle east and Malaysia. The earned remittance is mainly used for civil suits concerning the ownership of *haor* land. The area is low-lying. The river is wider here and the area is a trouble spot. The river bank is 0.6 m to 1.0 m above the water level during low water. On the other hand, the market is about 3 m above the land level. There are boat-making activities in the community. Since the area is mostly low-lying, it is very difficult to raise homesteads. There is a solar electricity programme and a telephone network in the market-place.

Market

Haat days:
Size: 125 vendors
Products sold: Fish, grocery items, vegetables, medicine, clothes, rice etc.

The proportion of visitors to the market to local residents is 10:1.

Communications

Rail: No
Pucca Road: No
Gravel Road: No
River: Yes

Major Commodities (Table 35).

Table 35: Major Commodities of Abdullahpur

Commodity	Shipped to	Shipped from	Mode	Cost of Transport Wet Season	Cost of Transport Dry Season
Fish	Kuliarchar	---	Boat	Tk 20/box	Tk 20/box
Fertilizer	---	Kakailseo	Boat	Tk 2.50/bag Tk 48/tonne Tk 3.2/tonne km	Tk 4.50/bag
Rice & grocery items	----	Bhairab	Boat	Tk 115.5/tonne	Tk 115.5/tonne
Paddy	Bhairab	----	Boat	Tk 115.5/ tonne	Tk 115.5/tonne

Personal Communication (Tables 36 and 37).

Table 36: Personal Communication from Abdullahpur

Travel to	Mode Wet Season	Mode Dry Season	Time Required Wet Season (hours)	Time Required Dry Season (hours)
Bhairab	Boat, Launch	Boat, Launch	7	7
Habiganj	Boat	On foot, boat	2	5
Astagram	Boat	On foot, boat	2	3

Table 37: Cost and Frequency of Personal Communication from Abdullahpur

Places	Cost Wet Season	Cost Dry Season	Frequency of Travel Main Centres	Frequency of Travel Locally
Bhairab	Tk 48.30	Tk 48.30	Weekly	Daily
Habiganj	Tk 25.00	Tk 50.00	Weekly	Daily
Astagram	Tk 10.00	Tk 15.00	Weekly	Daily

Note: Calculation on the basis of Tk 0.69/passenger km

6.11 Katkhal

Union: Abdullahpur
Thana: Mithamain
Pop 1991: 5,000 (estimated)

The community is very low-lying. During low water, the land is 1 m above the river water. The market is almost 4.5 m above the land level. It is located is 219 km from Amalshid. All the things necessary for day-to-day living are available here. Special duck farming has been started in the adjacent market places, and eggs are regularly being exported to Bhairab.

Market
Haat days:
Size: 150 vendors
Products sold: Fish, grocery items, vegetables, medicine, clothes, rice, POL etc.

The proportion of visitors to the market to local residents is about 10:1.

Communications
Rail: No
Pucca road: No
Gravel road: No
River: Yes

Major Commodities (Table 38)

Table 38: Major Commodities of Katkhal

Commodity	Shipped to	Shipped from	Mode	Cost of Transport Wet Season	Cost Transport Dry Season
Fish	Kuliarchar	-	Boat	Tk 20/box	Tk 20/box
Fertilizer		Kakailseo	Boat	Tk 3.50/bag Tk 48/tonne Tk 3.2/tonne km	Tk 5.50/bag
Rice & grocery items		Bhairab	Boat	Tk 115.5/tonne	Tk 115.5/tonne
Egg	Bhairab				
Paddy	Bhairab	-	Boat	Tk 115.5/tonne	Tk 115.5/tonne

Note: Calculating the cost on the basis of Tk 1.8/tonne km for cargo movement. The cost per *maund* of transport from Bhairab to Ajmiriganj is Tk 6/maunds.

Personal Communication (Tables 39 and 40).

Table 39: Personal Communication from Katkhal

Travel to	Mode Wet Season	Mode Dry Season	Time Required Wet Season (hours)	Time Required Dry Season (hours)
Bhairab	Boat, launch	Boat, launch	7	7
Habiganj	Boat	Boat, by foot	2	5
Mithamain	Boat	Boat, by foot	2	3

Table 40: Cost of Personal Communication from Katkhal

Places	Cost Wet Season (Tk)	Cost Dry Season (Tk)	Frequency of Travel Main Centres	Frequency of Travel Locally
Bhairab	45	45	Weekly	Daily
Habiganj	25	50	Weekly	Daily
Mithamain	10	20	Weekly	Daily

Note: Calculation on the basis of Tk 0.69/passenger km

6.12 Adampur

Union: Abdullahpur
Thana: Astagram
Pop. 1991: 6,000 (estimated)

Adampur is an important market located on the southwest bank of the Kushiyara River. It is in low-lying land. During the monsoon period the whole area is submerged, and the market and villages look like an island in the sea. The water level in the monsoon period is 10 to 12 feet in the *haor* areas. During low water, the river bank is at least 5 feet above the water level. The land level of the market is normally 8 feet above the river bank level. The distance from Amalshid to Adampur is about 240 kilometres. All the things necessary for day-to-day living are available here. There is a high school and a family welfare centre (family planning centre) in the market. Fish is a main export item in the area. There is a small-scale ice making plant in the market, and commercial supply is available from a private source. The main communication is with Bhairab and Kakailseo for grocery items and fertilizer.

Market
Haat days: Sunday and Thursday
Size: 200 permanent sellers

The proportion of people visiting the market to local residents is 9:1.

Communications

Rail: No
Pucca Road: No
Gravel Road: No
Seasonal Track: To Astagram, 3.5 hours needed.

Major Commodities (Table 41)

Table 41: Major Commodities of Adampur

Commodity	Supplied to	Items	Shipped from	Mode of Transport
Fish	Bhairab, Kuliarchar	Fertilizer	Kakailseo	Boat
Chillies	Bhairab	Grocery items	Bhairab	Boat
Potatoes	Bhairab	Rice	Bhairab	Boat
-	-	Vegetables	Bhairab, Habiganj	Boat

Note: There is normally no variation in the dry and wet season transportation cost. The freight rate is a year-round weighted average. The cost of shipping cargo from Bhairab is Tk 115.5/tonne (Tk 1.95/tonne km).

Personal Communication

People mainly travel to Bhairab and Habiganj, during both the wet and dry seasons. During the dry season, people can reach Habiganj on foot. This takes about 5 hours. People can also communicate by boat year-round. The trip to Habiganj takes about 2 hours. The trip to Bhairab takes about 6.5 hours, and costs Tk 33/person (Tk 0.59/passenger km). The price is the same in the wet and dry seasons. People generally travel to the main centres weekly and to the local centre every day.

6.13 Madna

Union: Balla
Thana: Lakhai
Pop. 1991: 5,000 (estimated)

Madna is 245 km from Amalshid. During the monsoon season, the depth of water in the areas adjacent to the market is 1.8 m to 2.1 m. In the dry period, launches divert their route through Ekordia, and only one launch comes to Madna. During the dry period, importing fertilizer is costly. An almost 15 km detour has to be taken due to shallow draughts.

Market

Haat Days: No *haat* days but there is a daily bazar
Size: 100 vendors
Products Sold: Fertilizer, rice, grocery items, vegetables, fish etc.

The proportion of people visiting the market to local residents is 9:1.

Communications

Rail: No
Pucca Road: No
Gravel Road: No
Seasonal Track: Up to Habiganj, 12 km
River: To Bhairab, Kuliarchar, Ajmiriganj and upstream.

Major Commodities (Table 42).

Table 42: Major Commodities of Madna

Commodity	Shipped to	Commodity	Shipped from	Mode of Transport
Fish	Bhairab, Kuliarchar	Fertilizer	Kakailseo	Boat
Chillies	Bhairab	Grocery items	Bhairab	Boat
Potatoes	Bhairab	Rice	Bhairab	Boat
-	-	Vegetables	Bhairab, Habiganj	Boat

Note: There is normally no variation in the dry and wet season transportation cost. The freight rate is a year-round weighted average. The cost is Tk 115.5/ tonne from Bhairab (Tk 1.95/tonne km).

Personal Communication

People mainly travel to Bhairab and Habiganj. They can travel on foot to Habiganj during the dry season, and boats are available throughout the year. The trip on foot to Habiganj takes about four hours. By boat, it takes about 1.5 hours. The boat to Bhairab takes about 5.5 hours. The cost of the trip is Tk 30 (Tk 0.59/passenger km) during both the wet and dry seasons. People generally travel to the main centres weekly and to the local centre daily.

6.14 General

Livestock Movement

There is not much livestock in the study area. It is brought from Dhaka through Chamraghat of Kishoreganj district by boat and from Nabiganj by foot.

Revenue or Import Tariff through Zakiganj Transit Point

On 18 April 1996, the Zakiganj customs office was visited by the field staff of the NERP navigation component. Data was collected regarding the revenue earnings from the customs officials.

In the 1995/96 fiscal year, the revenue collected through Zakiganj transit point within the last 9 months was Tk 20.5 million. But in 1994-96 (12 months), it was Tk 894,700. Due to longer draught problems, the income was low.

Large quantities of garlic, rice, fruit and chillies are imported through this route. About 20 trucks transport the items.

Customs and Duty Taxes
It is reported that 30% of the total imported value of goods is received as customs. Income tax is collected at a rate of 2.5%. If the imported items value is greater than Tk 100,000, then an additional 2.5% is collected.

Potential Improvements in Cargo Movement
Interviews were done at various places to determine how much a river dredging programme could improve cargo movement. Improvements are of 2 types

- dredging without loop cuts, and
- dredging with loop cuts and other activities.

Zakiganj customs officials, estimated was that cargo movement could double since in-transit vessels are plying through the channel half the year.

On the other hand, some people believe that traffic movement, both cargo and passenger, will not increase. This is due to the consumption inelasticity, which is fixed by the demand for necessary items. But natural or induced growth may occur. Population growth, market demand, education facilities, health necessities and opportunities are not always fixed.

Table 43 shows the distances of various river routes.

Table 43: Riverine Distances

Route	Distance (km)	Route	Distance (km)
Zakiganj-Fenchuganj	75	Madna-Bhairab Bazar	55
Fenchuganj-Sherpur	40	Bhairab Bazar -Dhaka	120
Sherpur-Markuli	45	Kakailseo-Madna(old)	30
Markuli-Ajmiriganj	70	Kakailseo-Madna(new)	45
Ajmiriganj-Madna	40		