No. 02

THE PEOPLE'S REPUBLIC OF BANGLADESH

MODEL RURAL DEVELOPMENT PROJECT PLAN

FOR

HOMNA AND DAUDKANDI UPAZILA

COMILLA DISTRICT

FINAL REPORT

(ANNEXES)

NOVEMBER, 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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ANNEXES

CONTENTS

ABBREVIATIONS

AMC	Agricultural Modernization Center
ATI	Agricultural Training Institute
BADC	Bangladesh Agricultural Development Corporation
BARI	The Bangladesh Agricultural Research Institute
BB	Bangladesh Bank
BBS	Bangladesh Bureau of Statistics
BBS	Bhumiheen-Bityaheen Samabaya Samity (Landless/Assetless Cooperative Society)
BJC	Bangladesh Jute Corsponds
BJMC	Bangladesh Jute Mills Corsponds
BJRI	Bangladesh Jute Research Institute
BKB	Bangladesh Krishi Bank
BRDB	Bangladesh Rural Development Board
BRRI	Bangladesh Rice Research Institute
BS	Block Supervisor
BWDB	Bangladesh Water Development Board
B.Aman	Broadcasted Aman
CCA	Central Coperative Association
CP	Comilla Proshika
DAE	Department of Agriculture Extension
DC	Deputy Commissioner
DTW	Deep Tube-well
EC	Eligible Couples
FAO	Food and Agricultural Organization of the United Nations
FFW	Food-For-Work
FFYP	First Five Year Plan
FY	Fiscal Year
GB	Grameen Bank
GDP	Government of Bangladesh
GNP	Gross National Product
GOB	Government of Bangladesh
HA	Hectare
HQ	Head Quarters
HYV	High-Yielding Variety
IFAD	International Fund for Agricultural Development
ILO	International Labour Organization
IMP	Irrigation Management Program
IRDP	Integrated Rural Development Program
IRWP	Integrated Rural Works Program
JICA	Japan International Cooperation Agency
KSS	Krishak Samabaya Samity (Farmer's Cooperative Society)
LGEB	Local Government Engineering Bureau
LGRD	Local Government and Rural Development
LLP	Low-Lift Pump
LV	Local Variety
MBSS	Mahila Bittohin Samabay Samity
MLGRDC	Ministry of Local Government Rural Development and Cooperatives
MOA	Ministry of Agriculture
MRDPP	Model Rural Development Project Plan
MSS	Mahila Samabaya Samity (Women's Cooperative Society)
NCB	Nationalized Commercial Bank
NGOs	Non-governmental Organizations
OECF	Overseas Economic Corporation Fund
PEC	Private Expart Company
PER	Post-Flood Emergency Programme
PWD	Public Works Department
RHD	Roads and Highways Department
RWP	Rural Work Program
SMO	Subject Matter Officer
STW	Shallow Tube-well
S/W	Scope of Work
TCCA	Thana Central Co-operative Association
TFYP	Third Five Year Plan
TK	Taka
T.Aman	Transplanted Aman
UAO	Upazila Agricultural Officer
UCCA	Upazila Central Cooperative Association
UNDP	The United Nations Development Program
WFP	World Food Programme

ABBREVIATIONS OF MEASUREMENTS

Length

mm	=	millimeter		
cm	=	centimeter		
	=	0.39 in.		
m	=	meter	=	1.09 yd.
	=	3.28 ft.		
km	=	kilometer	=	0.62 ml.
in.	=	inch	=	2.54 cm
ft.	=	foot	=	30.48 cm
yd.	=	yard	=	91.44 cm
ml.	=	mile	=	1.61 km

Area

cm^2	=	square centimetre		
m^2	=	square meter		
km^2	=	square kilometre		
	=	100 ha		
ha	=	hectare	=	0.01 km^2
	=	2.5 ac		
ac	=	acre	=	0.41 ha
	=	4,050 m^2		
ft^2	=	square feet		
	=	0.03 m^2		
$mile^2$	=	square mile	=	2.59 km^2

Electrical Measures

kW	=	kilowatt	=	1,000 watt
MW	=	megawatt	=	1,000 KW
GW	=	gigawatt	=	1,000 MW
kV	=	kilovolt	=	1,000 volt

Other Measures

%	=	percent
°	=	degree
'	=	minute
"	=	second
°C	=	degree in centigrade
crore	=	10 million
lakh	=	0.1 million

Volume

lit.	=	liter		
cm^3	=	cubic centimeter		
m^3	=	cubic meter		
	=	1,000 lit.		
MCM	=	million m^3		
	=	$1x10^3$ m^3		
ft^3	=	cubic feet	=	0.028 m^3
	=	28.32 lit.		
ac-in.	=	acre inch	=	88.05 m^3
ac-ft.	=	acre feet	=	1,234 m^3

Weight

g	=	gram		
kg	=	kilogram		
t	=	metric ton	=	1,000 kg
lb	=	pound	=	375 g

Time

sec	=	second		
min	=	minute	=	60 seconds
hr	=	hour	=	60 minuits
	=	3,600 seconds		
day	=	24 hrs	=	1,440 minutes
	=	86,400 seconds		
yr	=	year		

Derived Measures

m^3/sec	=	cubic meter per second (Cumec)
ft^3/sec	=	cubic foot per second (Cusec)

Monetary

US$	=	US dollar
¥	=	Japanese yen
TK	=	Taka

US$1=TK 31.9=¥ 127.6

ANNEX A
PRESENT CONDITION

ANNEX A

PRESENT CONDITION

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FIGURES

1. Natural Condition

1.1 Location and Topography

(1) Location

The Study Area consists of two Upazilas, Daudkandi and Homna. It is at the west end of Comilla District which is one of the districts in Chittagong Division. The District headquarter, Comilla, is at a distance of 166 km by railways and 88 km by road from Dhaka.

Daudkandi Upazila is at a distance of about 45 km from Dhaka. It lies between 23°25' and 23°39' north latitudes and between 90°39' and 90°53' east longitudes. The Upazila is surrounded by Homna Upazila in the north, Muradnagar and Chandina Upazilas in the east, Kachua and Matlab Upazilas of Chandpur District in the south, and Gazaria Upazila of Munshiganj District and Bandar Upazila of Narayanganj District in the west. It is also bordered by Batakandi Nadi in the north and Meghna and Dhanagoda rivers in the west.

There are twenty-two (22) Unions in the Upazila, and Barkanda and Gobindapur Unions are isolated from other Unions by Kalatia Nadi. The total area of Upazila is about 375 km^2 including an area of 49 km^2 of rivers which is more than 13 percent of the total area.

Homna Upazila lies between 23°37'N and 23°45'N in latitudes and 90°38'E and 90°53'E in longitudes. The Upazila is surrounded by Bancharampur Upazila of Brahmanbaria District in the north, Muradnagar Upazila in the east, Daudkandi Upazila in the south, and Araihazar Upazila of Narayanganj District in the west. It is also bordered by Titas Nadi in the north and Meghna river in the west.

The total area is about 179 km^2 out of which an area of 16 km^2 is under rivers. Though there are ten (10) Unions in total, Chandanpur and Radhanagar Unions are completely isolated from other eight Unions because of its poor transportation condition.
The area of each Upazila is shown in Table 1.1.1.

(2) Topography

The significant feature of Bangladesh is its very flat land. The greater part of the landscape of the country is dominated by alluvial plains which was developed by three major rivers namely the Bramaputra (Jamuna), the Ganges (Padma) and the Meghna, and numerous unstable

tributaries. So the country is predominantly flat and low-lying except for the Tertiary Hills of Chittagong and some pleistocene Terraces.

Comilla District including the Study Area is in the shape of slope down gradually from the foot of Tippera Hills (India) towards the west. The slope is so gradual that it does not create any radical change on the continuous flat surface of the land. The major portion of the Study Area is flat plain intersected by many rivers and creeks.

Relationship between acreage and ground elevation in the Study Area is shown below:

(Unit: sq.km)

Ground (m in PWD)	Daudkandi		Homna		Total	
	Area	Accumulation	Area	Accumulation	Area	Accumulation
above 5.0	6 (1.6)	6 (1.6)	5 (2.8)	5 (2.8)	11 (2.0)	11 (2.0)
5.0 - 4.0	61 (16.3)	67 (17.9)	43 (24.0)	48 (26.8)	104 (18.8)	115 (20.8)
4.0 - 3.0	164 (43.7)	231 (61.6)	71 (39.7)	119 (66.5)	235 (42.4)	350 (63.2)
3.0 - 2.0	95 (25.3)	326 (86.9)	44 (24.6)	163 (91.1)	139 (25.1)	489 (88.3)
below 2.0	49 (13.1)	375 (100.0)	16 (8.9)	179 (100.0)	65 (11.7)	554 (100.0)

Note : Parenthesized figures indicate the percentage.
Source : Computed from the Counter Map (S = 1/15,840)

This table indicates that 98 percent of the total area is below 5 m (in PWD) and about 80 percent area is below 4 m (in PWD). Figure 1.1.1 and 1.1.2. show the topographic feature of the Study Area.

1.2 Meteorology

1.2.1 General

Bangladesh has a tropical monsoon climate with a hot and humid summer and a dry cool winter season. The average annual temperature ranges from 18.9°C to 29.0°C. Annual rainfall ranges from 1,600 mm to 2,000 mm in the west, 2,000 mm to 4,000 mm in the southeast and 2,500 mm to 4,000 mm in the northwest.

The country has mainly four seasons, the winter (Dec-Feb.), summer or pre-monsoon (Mar-May), monsoon (Jun-Sept) and autumn (Oct-Nov). The summer is the transition period from

dry to wet season, sometimes lasting for several months. The monsoon season has the number of rainy days on average exceeds the number of dry days, and autumn is the transition period from wet to dry season. The winter is the most pleasant season when the temperature and humidity are low.

1.2.2 Meteorological features of the Study Area

The meteorological conditions of Comilla district including the Study Area is almost similar to the conditions of country.

Meteorological data on temperature, humidity, prevailing wind speed and pan evaporation are collected at Comilla meteorological station and Dhaka meteorological station (Refer to Tables 1.2.1, 1.2.2 & Figure 1.2.1).
The mean temperature ranges from 19.0°C in January to 28.6°C in May. The average diurnal range increases from a minimum of 5.4°C in July to a maximum of over 13°C.

One of the most severe meteorological features in Bangladesh but also in the Study Area is cyclone. 33 of cyclones had severely affected Bangladesh between 1960 and 1985, and some of them had assailed the Study Area. The cyclones sometimes cause large disaster which kills mankind and causes damages to agricultural products and properties. Periods of peak activity of the cyclones are May and September-November (Refer to Table 1.2.3).

1.2.3 Rainfall

(1) Availability of data

Rainfall data are collected at Comilla meteorological station, Dhaka meteorological station and Daudkandi station (Refer to Tables 1.2.4,1.2.5 & 1.2.6).

Available Daily Rainfall Records of Selected Station

Name of Station	Available Years of Records	Years with Incomplete Records
Comilla	1961 - 1980	1963, 67, 68, 70, 71, 72, 78
Dhaka	1961 - 1980	1966, 71, 74
Daudkandi	1965 - 1982	1965, 71, 72, 82

The mean annual rainfall in the Study Area is about 2,900 mm at Daudkandi station.

(2) Seasonal rainfall distribution

The mean annual rainfalls are presented as follows:

(Unit: mm)

Name of Station	Season				Annual	Period of Record
	Dec-Feb	Mar-May	Jun-Aug	Sep-Nov		
Comilla	30	417	1,281	463	2,191	1961-1980
Dhaka	33	460	1,103	454	2,050	1961-1980
Daudkandi	68	687	1,569	581	2,905	1965-1982

About 65 percent of the total annual rainfall occurs during the monsoon season in the Study Area.

1.3 Surface Water

1.3.1 River system in the Study Area

Bangladesh occupies a large part of the delta through which most of the rainfall and melted snow of the Himalayan mountains drains into the Bay of Bengal by Ganges-Brahmaputra-Meghna river system. The Meghna river lies on the western border of the Study Area and drains the Indian states of Meghalaya and Tripura, which rank among the highest rainfall areas on earth. This river is formed by the confluence of the Surma and Kushiyara rivers 140 km northeast of Dhaka and the drainage basin upstream of Bhairab Bazaar is 60,700 km^2.

The second river in the Study Area is the Gumti river which rises in India and enters Bangladesh at Katak Bazaar, a few kilometers east of Comilla town. This river across Daudkandi Upazila from east to west and flows into the Meghna river just north of Daudkandi. The catchment area up to the border between Bangladesh and India is approximately 2,150 km^2. The drainage area remains virtually unchanged between the border and Muradnagar, about 13 km upstream from eastern border of the Study Area, as the river is embanked at both sides. In the Study Area the river is tidal, with maximum variations at Daudkandi of about 0.6 m in the dry season. The average river bed slope in the lower reach (the Study Area) of the river is about 12 cm per km.(see Figure 1.3.1)

There are so many small rivers and tributaries in the Study Area which are finally flow into the Meghna river.

1.3.2 Available data

The Meghna river has a lot of gauging stations on both sides. Water level data at two gauging stations, Badyar Bazaar and Meghna Ferry Ghat, near the Study Area are collected. The Gumti river has also some gauging station. There is one gauging station in the Study Area at Daudkandi where is the river mouth of the Gumti river and another one is at Jibanpur, upstream of the Study Area. Water level data at Daudkandi and Jibanpur, and Discharge data are available (Refer to Tables 1.3.1 to 1.3.3).

The water level at Daudkandi correspond to the water level in the Meghna river as Daudkandi gauging station locates at junction of Meghna and Gumti rivers.

Available Surface water data of Selected Station

Name of Station	Data	Available Years of Records	Years with Incomplete Records
Meghna river			
Badyar Bazaar	WL	1968-1987	1968
Meghna Ferry Ghat	WL	1968-1987	1968, 71
Gumti river			
Daudkandi	WL	1960-1988	1960, 63, 65-73, 79-81, 88
Jibanpur	WL	1977-1988	1979-81, 88
	DM	1965-1988	1965, 71, 72, 82-84, 86

Note: WL: Water Level Data, DM: Discharge Measurement Data

1.3.3 Flood analysis

The most severe natural condition in Bangladesh is flood which affects large parts of lands every year. Floods are normally associated with yearly monsoon rains that pour into the entire Ganges-Brahmaputra-Meghna river system which drains the most of rainfall and melted snow of the Himalayan mountains.

Normally monsoon flood inundates the large parts of the Study Area between June and October. The three main hydrological factors which cause inundation are:

(a) Water level of Meghna river
(b) Floods of the Gumti river (along the Gumti river)

(c) Rainfall in the Study Area

It is apparent that the actual magnitude of flooding (i.e. depth and duration) is dependent on the joint occurrence and complex interaction of the above flood causing factors. In the Study Area, the inundation depth is basically affected by the Meghna water-level, and at times temporarily partially increased by heavy rainfall and overflow from Gumti river.

The peak flood water level of 10 daily average between 1960 and 1988 at Daudkandi station is 5.08 m (PWD) which occurs in August. The maximum peak flood water has occurred in September, 1988 which has covered about 84 percent of national territory and the almost part of the Study Area was inundated. The peak flood water level of 10 daily average in 1988 was 6.27 m in PWD (Refer to Figure 1.3.2).

The relationship between water level and inundation area in the Study Area (Average between 1960 and 1988 at Daudkandi) is shown in Figure 1.3.3. The inundation area and duration by inundation depth in the Study Area which were estimated by average water level at Daudkandi (1960-1988) and relation between ground elevation and area in the Study Area are shown below:

Inundation Depth (m)	Area (ha)	Percentage (%)	Duration (days)
0	7,400	1.3	0
0 - 0.5	25,800	4.7	0 - 74
0.5 - 1.0	61,000	11.0	74 - 103
1.0 - 1.5	112,600	20.3	103 - 124
1.5 - 2.0	118,200	21.4	124 - 146
2.0 - 2.5	96,000	17.3	146 - 171
2.5 - 3.0	51,700	9.3	171 - 210
> 3.0	81,300	14.7	> 210
Water Surface	(65,000)	(11.7)	
Total	554,000	100.0	

More than 58 percent of the Study Area is inundated for more than four months in average years.

1.4 Groundwater

1.4.1 General

Groundwater is fundamental water resources for Bangladesh mainly as the drinking water and irrigation water and there is still high potential for the groundwater development. Except for Chittagong Hill Tracts, Rajshahi Hill Barind and the Madhupur Tracts north of Dhaka, groundwater occurs at shallow depths, and groundwater levels are at or near ground level during the period July-October. The lowest groundwater levels fall April-May range from place to place. Groundwater levels fall after mid-October in response to evapotranspiration and rapid drainage of surface water. The natural rate of fall is highest in October-November. During the dry season nearly all minor rivers are sustained by groundwater outflows.

1.4.2 Groundwater levels and trends

The fluctuations of groundwater levels in the observation wells at Daudkandi and Elliotgonji and water level in Meghna River at Daudkandi in 1986 to 1988 are shown in Figure 1.4.1. This hydrograph shows a seasonal response to recharge and discharge. The groundwater levels are lowest in pre-monsoon season and rise in response to recharge and reach their highest level in August, and again decline to the low level in response to evapo-transpiration and rapid drainage of surface water. These hydrographs show that the groundwater levels and surface water level in the river are apparently related to each other, and this relationship is very close in the riverside observation well.

1.4.3 Groundwater quality

Groundwater quality of an area is mainly dependent on condition of deposition of sediments and geologic condition rather than depth of water bearing strata. Even in a same locality and at same depth the quality of water may vary due to localized geologic condition.

According to the results of study which was carried out by BWDB, groundwater quality in the Study Area is summarized as follows.

Iron content in water is one of the major problem of the Study Area. In the most part of the area iron content has exceeded 1 ppm i.e. the maximum range limit of Bangladesh standard (International standard is 0.3 ppm). The main source of iron content in groundwater in the Study Area may be due to iron rich sediments which deposited by the rivers. Though iron in

irrigation water is of no practical significance to plant growth or soil texture but on the contrary high iron content puddle the land which retard the plant growth and production.

Chloride content in the Study Area is higher in comparison to other area of Bangladesh except coastal and off shore islands. Though it is within the maximum range limit of Bangladesh (600 ppm) high chloride content may accelerate corrosion in pipes, fixtures and injured crops.

The total dissolved solid (TDS) concentration in Daudkandi is rather high but that in Homna is acceptable.

1.4.4 Potential groundwater development

Figure 1.4.2 shows the result of study which was carried out by BWDB (BWDB Water Supply Paper No.488). According to the result concluded by BWDB, the Study Area is moderate to poor for further development for deep or shallow tubewell because of water quality and capacity of recharge.

1.5 Geology

Geologically, Bangladesh is a part of basin which is bordered by the outcropping pre-Cambrian basement rocks of the Indian Shield on the west and by the Shillong Plateau to the north and hills in the east. The most part of Bangladesh comprises a gently sloping surface formed by recent delta and alluvial plains of the Ganges, Bramaputra and Meghna rivers. Bangladesh is covered almost completely by Quaternary sediments deposited less than 2.4 million years ago, but early Tertiary sediments occur along the northern border and in the late Tertiary sequence in the eastern folded belt.

The most part of the District including the Study Area except for the east side of the District is alluvial and soil consists of sandy clay and sand along the course of rivers and fine silt forming into clay in the flat part of the plain. The thickness of this type of deposit varies from place to place.

1.6 Soils

(1) General soil types

Soils of Bangladesh are developed under three Physiographic positions such as Floodplain area (80%), Northern and Eastern Hills (12%) and Madhupur and Barind Tracts (8%). The Floodplain area which are the most extensive and important physiographic division of the country are formed by alluvial deposits of recent geological origin.

In the project area that comprises of Daudkandi and Homna upazilas two major physiographic units have been recognized, i.e. Old Brahmaputra Floodplain and Middle Meghna Floodplain. Each unit has its specific geological and hydrological conditions which have influence on soil formation.

Old Brahmaputra Floodplain is spread over to southern and eastern parts of Daudkandi. The landscape consists of low broad ridges, extensive basins of levees and basins formed by erosion and deposition. On the other hand, the Middle Meghna Floodplain comprised of a low-lying area in the northern and western parts of Daudkandi and the whole area of Homna. Features such as meander scrolls, levees, channels and basins are distinct, although differences in elevation between levees and basins are slight. The soils are developed in mixed Old Brahmaputra and Meghna alluvium.

General soil types in the project area were divided into two great group soils, i.e. Grey Floodplain soils and Noncalcareous Dark Grey Floodplain soils.

(2) Soil genesis and classification

Soils in the project area are developed in silty alluvium laid down by the Old Brahmaputra and Meghna rivers, mainly under tidal estuarine conditions. Soil development is very rapid, and soil materials is only very young alluvium, so that such a soils are classified into Entisols according to Soil Taxonomy, USDA.

In materials older than about 10-15 years, a cambic B- horizon has usually developed to a depth of 25cm at least, and the soils are classified into Inceptisols.

All the Floodplain soils have grey matrix colors, mottles or pet coatings indicative of seasonal wetness, and belongs to aguic suborders or subgroups of Inceptisols and Entisols. Such as soils are Aeric Haplaquept. Dark colored soils in Old Brahmaputra Floodplain are classified as

Aeric Mollic Haplaquept. Soils characterized by this gray compact fine sandy loam topsoils in Middle Meghna Floodplain are classified as Typic Psammaquent.

(3) Soil associations

The Department of Soil Survey came into existence under the Ministry of Agriculture and works of the erstwhile Government of Pakistan with assistance from FAO and UNDP in 1962. Under the first phase of work the reconnaissance soil survey of the country was carried out. By the year 1975, this Department completed reconnaissance soil survey of Bangladesh. Typical soil series of the country were found out by reconnaissance soil survey. Soil associations that are groups of two or more soil series regularly occurring together in the landscape, were used to mapping unit. Mapping units in Daudkandi and Homna are shown in Table 1.6.1 and Figure 1.6.1. Farther information of each soil associations such as soil series, Sub soil characteristics, position etc. are shown in Table 1.6.2.

(4) Soil texture

The soils of the project area developed from alluvium. Generally silt loam to silty clay loam soils are predominant in floodplain ridges and silty clay and clay soils are in basins. Some sandy soils occur in the ridges of Meghna floodplain. The ridge soils generally occupy very gentle slope. Their main limitations are seasonal flooding, droughty in dry season and low level of available nutrients, especially nitrogen in the topsoils. The basin soils generally occupy almost level sites. Their main limitations are seasonal deep flooding, heavy consistence, slow permeability and relatively low level of available nutrient in the top soils. Distribution area of various soil texture are shown in Table 1.6.3.

(5) Land potentiality

Land potentiality is similar to land capability developed by the U.S. Soil Conservation Service. Land capability for agricultural land were classified into five categories which are as follows:

Class I	Very good agricultural land
Class II	Good agricultural land
Class III	Moderate agricultural land
Class IV	Poor agricultural land
Class V	Non agricultural land

Land potentiality in the project area is shown in Table 1.6.2 and Figure 1.6.2. Moderate agricultural land of Daudkandi is larger area than that of Homna.

(6) Crop suitability

Crop suitability classification is a method of rating soils in terms of their relative suitability for the production of specific crops. These ratings are called Crop Suitability Classes and are classified into the following four ratings:

Suitability	Class 1, Well suited
Suitability	Class 2, moderately suited
Suitability	Class 3, poorly suited
Suitability	Class 4, not suited

Crop suitability by soil series are expressed by annual wetland crops (paddy crops), annual dryland crops (rabi crops) and perennial crops (fruit). Furthermore, crop suitability with irrigation is shown in order to estimate the irrigation effect. Their crop suitability is shown in Table 1.6.4 and Table 1.6.5.

Irrigation effects are recognized in Boro of wetland crops and dryland crops such as Wheat and Chill. Other crops are no response to irrigation.

2. Social Condition

It would be mentioned that under the present policy of national development, the People's Republic of Bangladesh is now trying to solve her utmost basic problems in the socio-economic aspects in which the agricultural production for sufficient foodgrains and the efficient rural development for up-grading living conditions are listed up among national top priorities.

As noted in the Main Report, present social conditions in the Project Area imply persistent characteristics of Rural Low-Income Class in this country where living conditions such as habitation, employment, health & sanitation, eduction, and especially production are considered as basic urgent needs for proper improvements.

The Study Area consists of 32 unions covering 676 villages, administratively made up in 2 Upazila, Daudkandi and Homna, located at the westernmost part of Comilla District adjacent to Dhaka Metropolitan by streams of the Meghna River.

The governmental organization is shown in from Figure 2.1.1 to 2.1.7 Table 2.1.1 shows institutions in bangladesh concerned with rural development program.

2.1 Population

According to the census in 1981, the total population in the Study Area is 613,963 people (Daudkandi: 414,860, Homna: 199,103) with a high population density of 1,108 people per sq.km (Daudkandi: 1,106, Homna: 1,112). These figures on population, at first glance, remark one of highest population densities in rural Bangladesh combined with a steadily high population growth of average 2.6 percents per annum, effecting low level living conditions in the Study Area.(see Table 2.1.2) Figure 2.1.8 shows population density in the Study Area based on the 1981 : census.

Out of the total population of 613,963, male population is 308,291 (Daudkandi: 207,715, Homna: 100,676) and female population is 305,572 (Daudkandi: 207,715, Homna: (8,427) with a sex ratio of 101, lower than the regional average of 105.

Most of local inhabitants in the Study Area have been living upon household-employment and agriculture, mainly rice cultivation, while a minor part has been engaged in rural industries and business.

Their living conditions, therefore, have been basically faced with gradually limited conditions in agricultural development and frequent natural calamities occurred in this region as well as in the whole country.

This situation of rural population and agricultural population is shown as follows:

Bangladesh Rural and Agriculture

Item	Rural Population per ha (person/ha)	Agricultural Population per ha (person/ha)	Paddy Productivity (t/ha)	Irrigation (%)	Fertilizer (kg/ha)
Bangladesh	10.5	8.7	2.01	19.7	51.2
Burma	3.9	1.9	3.17	10.4	16.7
Indonesia	10.7	6.1	3.78	37.8	75.0
Pakistan	4.6	2.4	2.61	72.4	61.6
Philippines	6.7	2.9	2.39	11.6	28.8
Thailand	2.9	2.1	1.89	17.6	18.3
India	4.3	2.7	1.85	23.9	34.6

Source: Mahabub Hossains et. al, Fertilizer Consumption, Pricing and Foodgrain Production in Bangladesh, IFPRI/BIDS.

Rural Situation and Agriculture in the Study Area

Item	Daudkandi	Homna	Total
Total Population	414,860	199,103	613,963
Cultivated Area (ha)	28,000	15,163	43,163
Rural Population per ha	14.8	13.1	14.2
Agricultural Population	180,892	84,877	265,859
Cultivated Area (ha)	28,000	15,163	43,163
Agricultural Population per ha	6.4	5.6	6.1

Source: Upazila Information, 1988

2.2 Habitation

The low land configuration is the utmost handicap effecting all economic activities including habitation in the Project-site.

During the last flood in 1988 all households in the Project-site were submerged, which more than 8,000 units in Daudkandi and 3,000 units in Homna were damaged. The total households in Daudkandi and Homna are 43,809 and 37,360 units, respectively. This means approximately 6 family-members per household, similar to the situation in the whole country.

Most of these households are simply made of light materials such as wood, bamboo, soil-mortar, palm-leaves, galvanized sheets and built on a land-filled foundation of about 2 meters above the field level.

There are no sewerage and no water-supply to each household. Drinking water is from tube-wells but in remote villages people drink water from rivers. For other purposes, water is provided by nearby ponds and river. From this situation, contamination has been frequently occurred during flood seasons, causing serious health problems.

Regarding electrification only 25% of households in Daudkandi and 5% in Homna are connected with electric power.

From this background, the situation of habitation should be basically improved in order to secure better living conditions and, therefore, economic activities, especially during the 2-3 month period of annual floods.

It would be mentioned that flood damages are not only on housing structures but also on the stability in daily life for approximately half of a year in annual intervals which requires a proper measure for this aspect.

2.3 Employment

The situation of employment as mentioned in the Main Report implies 2 following aspects:

First, as approximately half of the employed population are engaged in household employment, contributing to the persistent aspect of under-employment which has been observed as a serious problem in the Study Area as well as the whole country.

The situation of employment is as follows:

Item	Daudkandi	Homna	Total
Unemployed	57,653 (21.4%)	24,417 (18.8%)	82,070 (20.5%)
Household Employment	109,687	50,119	159,806
Cropping	69,829	30,031	99,860
Other agriculture	1,466	1,727	3,193
Manufacturing	2,116	1,321	3,437
Service	13,181	8,345	21,526
Others	15,489	14,091	29,580
Total	269,421 (100%)	130,071 (100%)	399,492 (100%)

Remarks: Relatively low unemployment rate (regional average: 25%
High rate household employment (underemployment)
Low rate of manufacturing employment

Second, the unemployment figure in the Study Area, which has been cited as 82,070 people in the census of 1981 (Daudkandi: 57,653, Homna: 24,418), insists also proper measures for a solution in this aspect.

These 2 aspects, underemployment and unemployment, which have directly and indirectly effected the low-income living conditions in the Study Area, therefore, has basically inquired a proper employment generation program apart from present programs of rural employment creation such as RWP, FFWP, etc. to be implemented as soon as possible.

2.4 Industries and economy

The major industry in the Study Area is agriculture which structure can be considered as a composition of household-employment works and cropping cultivation. In this aspect, more than 80 percents of the labour force in the Study Area are engaged in agricultural production, a situation of the whole rural Bangladesh.

Other industries such as manufacturing and business are still in a minor position as shown in the present employment partition mentioned above.

Agriculture

Concerning agriculture, the situation of farm-holding is shown as follows:

Item		Daudkandi	Homna	Total
Total Households	(nos.)	69,542	34,702	104,244
Farm Holding Households	(nos.)	55,620	26,281	81,901
Percentage	(%)	80	76	79
Small Farm Households (0.05 - 2.49 acres)	(nos.)	46,988	22,361	69,349
Medium Farm Households (2.5 - 7.49 acres)	(nos.)	8,091	3,683	11,774
Large Farm Households (7.5 acres and above)	(nos.)	541	237	778

Source: BBS, Zila Series; Comilla, 1988

From these above figures, almost 20 percents of households are non-farm holding households which are almost poor landless families. And more than 85 percents of farm holding households are small farm households of less than 2.5 acres per family.

Regarding farm-lands, which are almost low lands submerged by annual floods, are almost subjected to rice cultivation with the land use plan as follows:

Item		Daudkandi	Homna	Total
Land Area	(ha)	32,600	16,300	48,900
Cultivated Area	(ha)	28,000	15,168	43,163
Percentage	(%)	85.9	93.0	88.3
Single Cropped Area	(ha)	2,800	7,278	10,078
Double Cropping Area	(ha)	21,600	6,290	27,890
Triple Cropped Area	(ha)	3,600	1,595	5,195
Crop Intensity	(%)	203	162	189

Source: Upazila Information, 1988

From these figures more than 80 percents of land areas have been used as cultivated areas (farm lands) with a crop intensity of almost 200 percents.

According to Upazila information, at present conditions, the annual production of rice in the Study Area is at average of 35,000 tons, or about 40 percents of the foodgrain requirement for the population of the Study Area (613,963 persons) as per the census of 1981.

Other agricultural products are potatoes, pulses, jute, oil crops and vegetables which cropping areas and production in details are mentioned in the section of Agriculture.

From the present figures of agricultural production, the productivity in rice production is very low, at average of approx. 1.5 ton per ha, while the production in potatoes and vegetables is considered at normal productivities.

In other aspects related to agriculture, livestock and fishery are still in a situation of minor developments.

Livestock

Concerning livestock, main constraints would be considered in the low land configuration in the Study Area in which all limited relatively high lands (approximately 10 percents) are reserved for habitation, the situation of insufficient feeds and the function of Upazila Livestock Office for mainly insemination of cattle only.

The present situation of livestock in the Study Area is as follows:

Item	Daudkandi	Homna	Total/Average
Total Houscholds	69,542 (100%)	34,702 (100%)	104,244 (100%)
Houschold with livestock			
Bovine	33,577 (48%)	17,320 (50%)	50,906 (49%)
Goat/Sheep	25,866 (37%)	13,452 (39%)	39,318 (38%)
Poultry	60,193 (86%)	30,392 (88%)	90,585 (87%)
Number of head			
Bovine	85,539	44,907	130,446
Goat/Sheet	56,862	27,373	84,235
Poultry	501,410	284,364	785,774
Number of head per family			
Bovine			
Small farm	1.1	1.2	1.2
Medium farm	3.4	3.6	3.5
Large farm	5.7	6.4	6.0
Average	2.5	3.0	2.6
Goat/sheep			
Small farm	0.8	0.8	0.8
Medium farm	1.2	1.2	1.2
Large farm	1.8	2.7	2.1
Average	2.2	2.0	2.1
Poultry			
Small farm	7.2	1.2	7.6
Medium farm	11.9	14.2	12.7
Large farm	17.4	21.6	18.7
Average	8.3	9.3	8.7

Source: BBS, Zila Series, Comilla, Feb. 1989

Fishery

Despite of favourable natural conditions the fishery development in the Study Area is considered as stagnant due to following constraints.

a. Unplanned fishing
b. Primitive methods
c. poor organization
d. no planning in areas and seasons
e. unproper natural conditions for high-biology
f. recent polluted sources from agricultural chemicals and factories waster

The present situation of fisheries is as follows:

Item		Daudkandi	Homna	Total	Note
1. Pond Fishery					
1)	(nos.)	3,339	1,794	5,133	
a. Cultured		1,075	409	1,484	
b. Not cultured		1,096	421	1,517	
c. Derelict		1,168	964	2,132	
2) Areages of ponds	(acres)	2,170	736	2,906	
	(ha)	878	294	1,172	
	(ha/pond)	0.26	0.17	-	
2. Open Water Fishery					
1) Registered fisherman	(person)	2,244	822	3,066	
2) Area	(ha)	101	50	151	
3) Villages		100	NA	NA	
4) No. of boat	(no engine)	1,040	520	1,560	
5) No. of net		1,416	601	2,017	
6) Total revenue collection	(Tk/yr)	36,665	64,000	100,665	
7) Dependent persons		10,004	5,000	15,004	
3. Total Production	(ton)	2,550	1,727	4,277	
a. Fish		1,900	1,667	3,567	80% fro river
b. Shrimp		650	60	710	Riverine
4. Total Demand	(ton)	5,700	2,760	8,460	38 g/p/day
5. Shortages	(ton)	3,150	1,033	4,183	
6. Others					
1) Highest catch data per day		4.2	3.8		Nov.
2) Lowest		0.8	0.9		March
3) Daily income,	max. (Nov.)	61.0	62.0		Tk/day
	min. (Mar.)	15.0	16.0		Tk/day
4) Wholesale price	(Tk/kg)	15.0	16.0		
5) Feeding period	(month)	8 to 10	8 to 10		
6) Seed supplying time		Mar. to Apr.	Mar. to May		
7) Target yield	(kg/sq.m)	0.27	0.27		30 man/acre

Source: Upazila Information, March 1989

Forestry

Resources on forestry are considered extremely limited due to no forest areas are noted in the Study Area.

There is a significant lack of coals locally produced for home fuel.

Rural Business and Manufacturing

Next to agriculture, business and manufacturing are considered as important industries, especially for the future production planing. Major business have been carried out in Growth Centers (Daudkandi: 5 places, Homna: 3 places) and Hat Markets occurred 1-2 times per week, and small shops selling goods for daily needs.

In the Growth Centers, there are many retail shops of rice, vegetables, fish, meat, medicaments, oils, agricultural tools, irrigation equipments, ice cream, etc. managed by Upazila Parishad.
Every year at the beginning of new physical year, people or groups shall buy certain spaces by auction as well as Hat Market. (One unit space is approximately 4 m^2 at Tk. 200,000 to Tk. 500,000 per year).

Therefore, only organized people or groups have the privilege for making this business. On the other hand, there are also many shops beside the roads in town, almost of all these shops are belongs to individual owners mainly living in big city. Such shops rent at Tk. 300 to Tk. 500 per month. Goods are supplied by each owner.

In the present situation, there is no chance for landless farmers to join rural business except daily labour due to their lack of fund.

Manufacturing is carried out by various rural industries but in small scale in which Daudkandi has 60 rice mills while Homna has 45 places. Both Upazila have oil mills and rapeseed oil refineries. There are also 2 jute factories in Daudkandi.

Concerning cottage industries, Daudkandi has bamboo, wood, and cloth manufactured in home cottage. Homna has handloom, cloth weaving and wood crafts.

Rural Industries in the Study Area

(Unit: place/house)

Industry	Detail	Comilla	Daudkandi	Homna
Rural Industry				
- Hand loom factory	manufacturing	-	-	1
- Bicycle factory	repair	-	-	2
- Ice cream factory		-	-	2
- Sow mill factory	timber	-	-	3
- Rice mill and flour mill	boiling, husking and milling	-	60	45
- Mustard oil mill	extraction	-	10	3
- Printing press		-	-	3
- Engine industry		-	-	3
- Biscuit factory		-	-	2
- Jute mill		-	2	-
- Rickshaw	repair	-	-	-
- Agricultural machines	repair	-	-	-

Data Source: Upazila Information, Nov. 1988

The situation of business and industries, therefore, is still at the primitive stage which inquires measures for improvement.

2.5 Income and Expenditure

Agricultural income which is largely discussed in the part of Agro-Economy is also considered as a basic problem in social condition to be mentioned as below:
For inhabitants in the Study Area, there are 2 following kinds of expenditure:

1. Basic expenditure
2. Supplemental expenditure

a. Minimum basic expenditure for 1 average family of 6 persons (3 elders and 3 children) would be estimated as follows:

	Month	Year
Food grains	350	4,200
Other foods	350	4,200
Oil, fuel, etc.	200	2,400
Other basic expenses (Medicine, etc.)	100	1,200
Total		12,000 Tk.

b. Minimum supplemental expenditure would be estimated as follows:

	Month	Year
Clothes	150	1,800
Education	150	1,800
Transportation	100	1,200
Other supplemental expenses	100	1,200
Total		6,000 Tk.

Total (a + b) = 18,000 Tk/year

The minimum expenditure per annum per household would be 18,000 Tk at market price of 1988.

Concerning income, almost households are living upon agriculture which the farm holding situation can show a parameter of income. Present conditions are as follows:

Item		Daudkandi	Homna	Total
Total Households	(no.)	69,542	34,702	104,244
Farm Holding Households	(no.)	55,620	26,281	81,901
Percentage	(%)	80	76	79
Small Farm Households (005 - 2.49 acres)	(no.)	46,988	22,361	69,349
Medium Farm Households (2.5 - 7.49 acres)	(no.)	8,091	3,683	11,774
Large Farm Households (7.5 acres and above)	(no.)	541	237	778

From these figures, there are almost 20 percents of non-farm holding households in Daudkandi and 24 percents in Homna.

Due to minor figures in other business, at least 10 percents of all households in Daudkandi and 12 percents in Homna would be considered as distress-families or poor landless households.

From the income survey in random basis to 320 households in the Study Area (10 households per union, Daudkandi: 22 unions and Homna: 10 unions), the average income of a landless household is 10,100 Tk. per annum.

The gap of approx. 8,000 Taka per year between minimum expenditure (18,000 Tk/year) and the average income of a landless household (10,100 Tk/year) implies the basic socio-economic situation in the Study Area.

2.6 Health and Sanitation

1) Objectives of TFYP

Major objectives of the Sector have been formulated on the broad principles of promoting and supporting development and operation of a national health care system so as to attain the global strategy "Health for All by the year 2000."

These objectives are :

i) to improve the quality and to increase coverage of health care delivery system;

ii) to consolidate and strengthen existing PHC programme and its supporting system;

iii) to prevent, control and treat major communicable and non-communicable diseases;

iv) to foster appropriate health manpower development and its optimum utilization;

v) to promote systematic development of Homeopathy, Unani and Ayurvedic systems of medicine on scientific basis;

vi) to mobilize resources to support expanding health care services;

vii) to promote adequate production, supply and distribution of essential drugs, vaccines and other diagnostic and therapeutic agents;

viii) to develop a network of health information system for monitoring and development of an affordable health care delivery; and

ix) to promote and provide facilities for bio-medical and health system research. (quoted from TFYP)

Table 2.6.1 shows Major Indicators and Targets. In order to realize the above objectives, Primary Health Care (P.H.C) services will be provided through three tier system of consultation and reference. The level of services are (a) community level (village level) through community health worker/voluntary health worker (b) Intermediate level (ward level) through health posts with mid-level health manpower, and (c) health Center level (Union level) through Union

Health and Family Welfare Center (UHFWC). The on-going for establishment of UHFWC and raising up of voluntary community health worker/health volunteers will be speeded up.

Increasing piped water supply from 41,040 m^3/day to 49,704 m^3/day in Dhaka, 8,664 m^3/day to 17,784 m^3/day in Chittagong, 11,263 - 18,240 m^3/day in district towns and 451 - 2,280 m^3/day in upazila towns and provision of one tubewell for drinking water per 125 persons in rural area are the important targets of the Third Plan for avoiding water born diseases. The existing water supply project of Dhaka, Chittagong and the various on-going projects for expansion and improvement of water supply in 35 districts will be completed by 1990. During the Plan period 174,000 tubewells will be installed and 50,000 tubewells replaced in rural areas. Further, to improve environment, provision of 13 watersealed sanitation units in each village will be covered during the Third Plan period, and for that 500,000 water sealed sanitation units will be produced and distributed among homesteads.

2) Present situation in Study Area

There are 2 main aspects to be considered in the domain of Health and Sanitation.

First, the present situation of insufficient facilities (infrastructures) and supporting materials concerning these aspect such as drinking water supply, sewerage, clinics, medicaments, etc. has been largely observed.

In the Study Area, the condition of drinking water from hand-tubewell is not sufficient both of quality and quantity as per requirement. In particular, landless farmers get their water from hand-tubewell which belongs to neighboring farmer or river and pond.

As far conditions of sewage system, there are kacha latrines (hole in ground for toilet) under unhygienic conditions. Very few water sealed latrines and sanitary latrines flash toilet are existing in public places such as Upazila HQ, Upazila Health Complex and School.

Second, the aspect of poor nutrition with low calories and insufficient nutrient values has been seriously considered also. Presently, a significant decrease in

calories in foods per capita per day has been observed at average of 1,800 calories in comparison to be minimum requirement of 2,200 calories. This would be resulted from the poor income for supporting foods and the lack of nutrient foods such as fish or meat (animal protein) in daily meals.

The situation would be summarized as follows:

Item	Daudkandi	Homna	Total
Situation	Poor	Very poor	
Upazila Health Office at HQ	1	1	2
Upazila Health Officer	1	1	2
Hospital	3	1	4
Clinic	14	4	18
Equipment & Medicaments	Insufficient	Insufficient	
Health Promotion	Insufficient	Insufficient	
Drinking water	No-treatment	No-treatment	
Hand Pump for Drinking Water	3,630	2,986	6,616
Toilet Sewerage	No sewerage	No sewerage	

Remarks: Insufficient programs on basic health-care promotion
Poor equipment and materials
Effected by poor income, flood and insufficient infrastructures

Source: Upazila Information, 1988

2.7 Education

1) Objectives of TFYP

The objectives of the education sector in the TFYP are as follows: (see Table 2.7.1)

i) to enrol 70% of the primary age-group children by 1990 and ensure their retention for completion of primary school cycle in order that UPE/1 might be achieved by the end of the century;

ii) to reduce the rural-urban gap in educational facilities;

iii) to provide in-service training to primary, secondary and technical education teachers;

iv) to give emphasis on science, technical and vocational education;

v) to reduce illiteracy among the adults;

/1: UPE: Universal Primary Education

vi) to rationalize enrollment among various disciplines at the college and university levels; and

vii) to reduce the set in educational opportunities between sexes;

2) Scholarship/Stipends

Owing to poverty, it is difficult for the poor parents to ensure education for their children and this essentially leads to inequality in educational opportunity. In Bangladesh, Where about 75% of the people live below the poverty line, the inequality in educational opportunity is a major problem in the education system. In such a situation, award of scholarships/stipends should play an important role in ensuring opportunity for study to the students. During the SFYP, a comprehensive programme for award of scholarships and stipends on the basis of merit as well as merit-cum-means was undertaken. Distribution of scholarships on regional and sex basis at the lower level (primary and junior scholarships/stipends on union and thana basis) worked as a good mechanism for wider dispersal of scholarships for nourishing talents throughout the country.

Under the, TFYP, general scholarships and stipends will be awarded to 0.125 million and 0.265 million students respectively, while 0.110 million students will enjoy stipends in the field of technical education.

1. Scholarships will be awarded from Class V in Primary School and Class VIII in High School as well as College and University students. The amount of scholarship range between Tk. 60.00 to Tk. 71.00 per month for school students.

2. Stipends will be awarded to college and University students with an amount of about Tk. 200 per month.

3. Repayment of scholarships is not required.

3) Present situation in Study Area

Despite of the main role of education in economic development, the education situation in the Study Area is considered merely stagnant with a school

attendance of approx. 17 percents (Daudkandi: 19.3, Homna: 15.4) for the age-group of 5-24.

(Unit: %)

Item	Total	Male	Female	Remarks
Daudkandi	19.3	24.6	13.9	in 1981
Homna	15.4	20.4	10.2	in 1981

As a result of facts the literacy rate in the Study area of approx. 17 percents (Daudkandi: 19.8, Homna: 14.7) is observed as average in this country but considerably low in comparison with other Asian LDCs.

School-facilities are not in good conditions but reportedly counted as 292 units (Daudkandi: 201, Homna: 91), and 43 units Secondary schools (Daudkandi: 31, Homna: 12), spreading all over the Study Area.

The low figures in school attendance, Primary School enrollment number of 68,435 (Daudkandi: 50,233, Homna: 18,202), and Secondary School enrollment number of 16,922 (Daudkandi: 12,007, Homna: 3,915), imply 2 following aspects in rural education.

First, there is a lack of significant promotion of education in the rural side in order to make local people understand the importance of education.

Second, the hardness in rural life resulted from a low income has made parents avoid their children from schools for daily earnings.

The situation of education would be summarized as follows: (see Table 2.7.2)

Item		Daudkandi	Homna	Total
Upazila Education Office		1	1	2
Upazila Education Officer		1	1	2
Primary School	(no.)	201	91	292
Enrollment	(person)	50,233	18,202	68,435
Secondary School	(no.)	31	12	43
Enrollment(person)		13,007	3,915	16,922
School Attendance (5 - 24 years)	(%)	19.3	15.4	-
Literacy Rate	(%)	19.8	14.7	

Remarks: Low literacy rate
Education is depended on family incomes
Distress families could not send their children to school

Source: Upazila Information, 1988

2.8 Family planning

1) Objectives of TFYP

The CBR is expected to decline from the present level of 39.0 per 1,000 population to 31.0 by 1990. Presuming that the CDR will also decline during the period from 15.0 to 13.4 because of health measures, the rate of growth will decline from 2.4 percent to 1.8 percent. Demographic change to this extent will require an increase in the rate of contraceptive practice from 25.0 percent in 1985 to 40.0 percent in 1990. In absolute term this means that the number of eligible couples (EC) using contraceptives has to double from 4.2 million in 1985 to 8.2 million in 1990.(see Table 2.8.1 & 2.8.2)

Note: CBR (Crude Birth Rate), CDR (Crude Death Rate)

2) Obstacles and constraints of birth control planning

The rural women of Bangladesh work extremely hard throughout the day. They are the ones who get up earliest in the morning and go to bed the latest. Starting from preparing food out of the meagre stock and serving the same to all the members of the family, she helps manage the cows, the poultry birds, dry, process and preserve paddy and other crops, wash clothes and utensils and keep the house clean under difficult situations. Yet she receives the left over of the meagre food she can manage for the family. In most cases her health is extremely poor, incapable of doing the hard work she needs to do. And even in

such a situation she gives birth to children too frequently. The child mortality is still high.

Because of the social insecurity and the existing power structure in the villages a large family is considered as an asset rather than a liability. In the midst of such a situation the message of family planning has yet to make any significant impact on the society.

Note: quoted from " Strategy for Rural Development Projects" Bangladesh Planning Commission, January, 1984.

3) Present situation in Study Area

From the social structure as mentioned above, the program of family planning adopted in the national scale for population control such as sterilization, oral pills, condoms, etc. have been reportedly promoted but its result has been considered still at low figures.

Many basic socio-economic problems related to this program such as education, religion, employment, propaganda, etc. should be promoted at the same time in this framework in order to obtain a better result.

The present situation would be summarized as follows:

	Daudkandi :	Homna	Total
Upazila Family Planning Office	1	1	2
Family Planning Officer	1	1	2
Contraceptive Practices	Adopted	Adopted	
Contraceptive Promotion	Insufficient	Insufficient	
Contraceptive Application	n.a.	n.a.	

Remarks: Insufficient promotion and application
Lack of program-target
Insufficient women roles in community

Source: Upazila Information, 1988

2.9 Foodgrain self-sufficiency and nutritional condition

Three nutrition surveys conducted so far in Bangladesh in 1962-64, 1975-76 and 1981-82 have revealed an alarming under nutrition situation in the country. The nutrition status has, over the years, declined at a very fast rate and the energy intake has dropped from 2,301 Cal.

in 1962-64 to 2,094 Cal. in 1975-76, and to 1,943 Cal. in 1981-82. The position described in the latest survey report and analyzed in the National Nutrition Policy , is summarized below:

1) Cereals

Production, when calculated as per capita per day availability, was 429 g against recommended daily allowance of 434 g to provide 1,502 Cal. Per capita intake was 488 g (1,688 Cal.). Out of this, 434 g was rice and this provided the whole of the recommended calorie from this source. However, in addition to rice, the per capita intake of wheat was 32 g (107 Cal.) and other cereals 23 g (80 Cal.). That means, cereals provided 187 Cal. (12.5%) more than the recommended daily allowance.

2) Starchy foods

a) Roots and tubers

Production, when calculated as per capita per day availability, was 52 g against recommended daily allowance of 423 g to provide 415 Cal. Per capita intake was 63 g (62 Cal.), and to conform with the recommended allowance the deficit from this source was 360 g (353 Cal.)

b) Sugar and gur

Production, when calculated as per capita per day availability, was 18 g against recommended daily allowance of 29 g to provide 112 Cal. Per capita intake was 9 g (35 Cal.) and the deficit was 20 g (77 Cal.)

3) Pulses and legumes

Production, when calculated as per capita per day availability, was 6 g against recommended daily allowance of 112 g to provide 395 Cal. Per capita intake was 8 g (28 Cal.) and the deficit was 104 g (367 Cal.)

4) Vegetables

Production, when calculated as per capita per day availability, was 24 g against recommended daily allowance of 213 g to provide 81 Cal. Per capita intake was 120 g (46 Cal.) and the deficit was 93 g (35 Cal.)

5) Vegetables

Production, when calculated as per capita per day availability, was 42 g against recommended daily allowance of 56 g to provide 27 Cal. Per capita intake was 17 g (8 Cal.) and the deficit was 39 g (19 Cal.)

6) Oils

Production, when calculated as per capita per day availability, was 2 g against recommended daily allowance of 6 g (54 Cal.). Per capita intake was 3 g (27 Cal.) and the deficit was 3 g (27 Cal.).

7) Foods from animal origin

Production, when calculated as per capita per day availability was 51 g against recommended daily allowance of 98 g of fish, meat, milk, egg and other foods of animal origin to provide 115 Cal. Per capita intake was 44 g (51 Cal.) and the deficit was 54 g (64 Cal.).

While the recommended daily allowances of carbohydrates, proteins and fats are 532 g, 100 g and 19 g to provide respectively, 2,129 Cal. (78.9%), 400 Cal. (14.8%) and 171 Cal. (6.3%), the per capita intakes were 415 g, 48 g and 10 g. Due to calorie shortage, most part of the ingested proteins and fats, including the essential amino acids and fatty acids, were burnt into the body to meet the energy requirement. consequently, nutrient demands to support normal metabolic functions, growth and wear and tear process seriously suffered.

Concomitant with deficient calorie intake there was also an acute shortage in the consumption of a number of micro nutrients. Significant among them were riboflavin (vitamin B_2), vitamin C, vitamin A, iron, lodine and zinc. Vitamin B_2 intake was found to be 0.7 mg against the recommended daily allowance of 1.5 mg. About 97% of the households surveyed had deficient intake of this

nutrient. Vitamin C intake was found to be 13 mg against the recommended daily allowance of 50 mg. About 87% of the households had deficient intake of tis nutrient. Vitamin A intake was found to be 763 I.U. against the recommended daily allowance of 2,500 I.U. About 88% of the households had deficient intake of this vitamin. Iron intake, although found to be 23.4 mg against the recommended daily allowance of 10-18 mg, 70% of the population was anemic due to malabsorption, intestinal disorders and worm infestations. Iodine intake, although not reported against the recommended daily allowance of 140 microgram, more than 10 million people living in areas around the Jamura suffer from goitre and this problem is present all over the country.

Zinc intake was not also reported against the recommended daily allowance of 10 mg but studies with kwashiorker children revealed that even the apparently control subjects did not maintain more than 50% of the normal blood level.

It, therefore, appears that excepting cereals all other items of foods were produced much below the required levels. During 1981-82 the net area sown was 21.2 million acres and with a cropping intensity of 153.8% the total area cropped was 32.6 million acres. With the transitional technology in use and the limited land and funds available for cultivation not enough food was produced to bridge the prevalent nutrient gap. To these constraints have now been added many other problems of gigantic nature. Among them the following need serious consideration while doing a planning exercise.

Every year a sizeable percentage of cultivable land is lost to new homesteads, townships, industry, and roads and highways. This land could have been saved through vertical construction and, in appropriate cases by making subways, tunnels and overbridges. (quoted from FAO, Dhaka, 1989)

3. Agriculture

3.1 Land Use

In Bangladesh, factors such as hydrology, seasonal distribution of rainfall and soil characteristics determine largely the land use including types of crops to be grown and the intensity of land use. The most dominant factor in the Study Area is hydrological conditions which makes up 5 land types defined on the basis of flood depth as follows:

	Land Type		Flood Depth
1.	Hill/Highland	(F0) ;	less than 0.3 m
2.	Medium Highland	(F1) ;	0.3 to 0.9 m
3.	Medium Lowland	(F2) ;	0.9 to 1.8 m
4.	Lowland	(F3) ;	greater than 1.8 m
5.	Flooded land	(F4) ;	greater than 1.8 m

Suitable rice in Medium Highland (F1) is T. Aman which in Medium Lowland (F2) and Lowland (F3), B. Aman is considered suitable.

The land use in Bangladesh which is largely effected by flood conditions during the monsoon, therefore, defines the annual cropping system with following characteristics.

Application of single, double and triple cropping areas has been based on these conditions.

In the Study Area, agricultural lands are mainly consisted of two kinds, single with triple cropped land and main single with some double cropped land. In Homna, the figure of single cropped land is higher than double cropped land, approximately 50%, resulted in a low crop intensity of 157%. In Daudkandi, however, the figure of double cropped land is higher with a crop intensity of 179%.

The land use situation in the Study Area is shown in Table 3.1.1 This table shows figures collected by the census in 1981 and estimated figures for the present situation.

In accordance with the population growth, areas for homestead and infrastructure would be increased to some extent, resulted in a decrease of agriculture land. In 1988, agricultural land covers approximately 78% of the total land area in the Study Area.

3.2 Crop Production

Crop production in Daudkandi and Homna from 1985-86 to 1987-88 are shown in Tables 3.2.1 and 3.2.2, respectively, average of above three years' data are shown in Table 3.2.3 in which non-rice crops are divided into Rabi and Kharief crops and some crops are summed up.

(1) Crop area

Total cropped areas in Daudkandi and Homna are 51,650 ha and 22,700 ha, respectively. Percentage of each crop area to total cropped area is shown below.

(Unit: %)

Crops	Daudkandi	Homna	Crops	Daudkandi	Homna
Aus	7.1	7.8	Wheat	16.3	16.6
T. Aman	1.5	-	Potato	7.7	0.5
B. Aman	35.5	45.5	Oilseed	4.8	4.6
Boro	16.5	12.3	Pulses	1.2	-
Rice Total	60.7	65.6	Jute	3.0	4.4
			Chilli	2.7	3.2
			Vegetables	3.5	4.5

Percentage of total rice area and B. Aman area are higher in Homna than in Daudkandi and that of Boro area lower in Homna. T. Aman is not cultivated in Homna. These may be attributed to higher proportion of area of low-lying land in Homna. As for non-rice crops, differences in percentage of crop areas between two Upazila are small except for that of potato. In Homna, area of potato is small and no pulses is grown. Crop intensity based on average cropped area is 179% in Daudkandi and 157% in Homna.

(2) Crop season

There are three crop seasons in the Study Area as in the other areas of the country. They are Rabi season (October to March), Kharief-I season (April to June) and Kharief-II season (July to September). Crop season may be distinguished primarily by temperature, rainfall and flood conditions. The feature of these physical conditions and crops grown in each crop season are described below:

1) Rabi season

Temperature is low, especially from December to February and rainfall is scarce with much sunshine. As there is no flood in this season, non-rice crops can be grown in areas of various land types. Minimum temperature is scarcely below 10°C, therefore, many kinds of both tropical and temperate crops are grown in this season. These are Boro rice, wheat, potato, oilseed, pulses, winter vegetables, etc.

Most of Rabi crops are grown with residual soil moisture under rainfed condition. Then, their life cycles are short and their productivities are low. However, Boro is usually cultivated with irrigation and produces high yield under favourable conditions. Recently, some of non-rice crop such as chilli, wheat and winter vegetables are also irrigated and attained to higher yield.

2) Kharief-I season

In this season, temperature goes up sharply in April and rainfall become largest during May to June. Hot spell, hailstorms and Cyclones sometimes destroy the crops and flood comes in the latter half of the season. Start of flooding is different owing to elevation of land type. In areas where flood starts later, Kharief-I crops such as Aus rice, jute, oilseed and vegetables are grown, while in low-lying land where flood comes earlier, Kharief-I crops are not cultivated, but B. Aman is sown one month before flooding. Boro is usually harvested in this season (April to May). Chilli, sesame, groundnut, mungbean and some vegetables are grown both in Rabi and Kharief-I season.

3) Kharief-II season

Temperature is still high in this season same as the previous season, but rainfall goes down gradually and flood water level goes up to maximum in this season. T. Aman is not tolerant to deep flood water and usually transplanted in areas where maximum flood level is low (less than 1 m) and flood duration is short. B. Aman which is called deep water rice (DWR) is tolerant to deep flood water and can continue to grow in this season. Non-rice crops are not grown in this season except in homestead areas, as there is no high land in the Study Area.

(3) Cropping pattern

Multiple cropping is prevalent in the Study Area due to small size of landholding and low productivity per area. Cropping patterns in the Study Area are primarily regulated by flood conditions which are different owing to elevation in various land types. Major cropping patterns by land type in both Upazila are shown in the table below:

Land Type	Daudkandi	Homna
Medium High Land (F1)	Wheat - T. Aus - T. Aman Potato - Jute - T. Aman Winter Veg. - Jute	Boro - B. Aus Winter Veg. - Jute Chilli - Jute
Medium Low Land (F2)	Wheat - B. Aman Potato - Jute Mustard/Boro - Fallow Potato/Boro - Fallow Mustard/Wheat - Mixed Aus & Aman Potato/Sesame - B. Aman Chilli - B. Aman	Wheat - B. Aus Sweet Potato - Jute Mustard - B. Aman Boro - B. Aus Potato - B. Aman
Low Land (F3)	Wheat - B. Aman Boro - B. Aman Fallow - B. Aman Fallow - Mixed Aus & Aman	Boro - B. Aman Fallow - B. Aman

In the medium high land (F1) where flood starts later and flood level is less than 1 m with short duration of flood, double cropping of Rabi crops with Kharief-I crops are main cropping patterns. Triple croppings of T. Aman with Rabi and Kharief-I crops have recently been disseminated in Daudkandi but not yet in Homna. Jute and T. Aman are suitable in this flood condition, but B.Aman is usually grown in areas where water depth may be 1 m or more.

In the low land (F3) where flood comes earlier and flood level is deep (more than 1.8 m) with long duration of flood, single cropping of B. Aman or mixed cropping of Aus and Aman are predominant. Double croppings of B. Aman with some Rabi crops are also practised in the land. Boro is grown in areas where flood comes relatively later and short-term Rabi crops in earlier flooding areas.

In the medium lowland (F2) where flood conditions are middle between F1 and F2 land, cropping patterns in F1 and F3 land are mixed. Double croppings of Rabi crops with Kharief-I crops and B. Aman with Rabi crops especially with Boro are the main cropping patterns. As this land covers largest area, number of cropping patterns in the land are largest in the Study Area.

(4) Farming practices

Present seed rate and amount of fertilizer in major crops are shown in Table 3.2.4. Farmers usually apply no or minimum fertilizer to B. Aman, oilseed and pulses, while they apply much fertilizers to Boro, potato and vegetables. The followings are outlines of farming practices in major crops.

1) Aus

Aus (LV) is usually direct-seeded in March to April and matures in 90-110 days. When the crop is harvested in June, it escapes flooding. Delayed seeding due to inadequate rainfall in March and April is risky and produces lower yield. Low yield in B. Aus (LV) may be attributed to drought, storm, flood and less intensive management. Aus (HYV) is transplanted in the limited area of Daudkandi, which yields more than twice of B. Aus (LV). Some varieties developed recently and suitable for direct-seeding are not yet disseminated in the area.

2) B. Aman

B. Aman is usually direct-seeded in March to April and harvested in November to December with long growth duration. B. Aman has the ability of elongating stem under flood water and is called deep water rice (DWR). As younger seedlings have no ability of elongation, B. Aman should be broadcasted at least 30 days before flood begins. When seeding will be delayed due to prolonged harvesting of Boro, seedlings of DWR may be transplanted up to three weeks before flood comes. B. Aman and Aus are often grown as a mixed crop in the Study Area. However, many experiments revealed that the total yield of the mixed crop was in no case higher than the yield of the crops grown separately.

3) T. Aman

T. Aman has no ability of elongation, therefore it is grown in areas where flood level is less than 1 m. T. Aman is seeded in June on seedbed. Thirty days old seedlings are transplanted in July to August and harvested in November to December. constraint of rainfed T. Aman is drought after flood recedes. Supplemental irrigations during panicle formation to flowering stage are

effective for stable and better grain yield. T. Aman (HYV) grown in small area of Daudkandi produces more than twice yields of LV.

4) Wheat

Wheat is the most important cereal crop after rice. Wheat is seeded in November to December and harvested in March to early April. As growing season of wheat is short due to short duration of appropriate cool temperature, high yield same as that in temperate zone can not be expected. Large seed rate (120-130 kg/ha) is necessary to compensate low vegetative growth for higher yield.

5) Potato

Potato is prevalent in Daudkandi. It is planted in late October to November and harvested in February to March. Potato needs large input of seed potato, fertilizer and labour for higher yield. Seed potato of HYV is necessary to be disease-free (especially virus-free) one, then, farmers should purchase every year large quantity of seed potato which is produced and supplied inadequately by BADC and is very expensive. Constraint of potato in the Study Area is incidence of soil diseases which may be attributed to continuous cropping and heavy application of chemical fertilizer.

6) Oilseed

The main oilseed crops in the Study Area are mustard in Rabi season and sesame in Kharief season. Mustard includes three species of genus Brassica which are called rape and mustard. Several HYV have been released. Mustard is planted in October to November and harvested in January to March. Growth duration is 70-80 days in LV and 90-100 days in HYV. Mustard seed usually contains 40-45% oil which is principal edible oil in the country. Yield of oil pressed by expeller is 36-39%.

Sesame can be grown both in Kharief and Rabi season but the former is prevalent. Kharief sesame is planted in February to March and harvested in June. It matures in 85-90 days. The crop is often mixed with B. Aman and Aus. Sesame seed contains 44% oil which is used as hair oil and cooking medium.

7) Pulses

The main pulses in Rabi season (winter pulses) are lentil and chickpeas. Mungbean and blackgram are grown both in Rabi and Kharief season (summer pulses). Winter pulses are sown in October to November and harvested in February to March, maturing in 90-100 days. Summer pulses are grown from March to June and matures in 65-90 days. Pulses are important crops as a protein source of human nutrition and as a rotation crop to enrich soil fertility.

8) Jute

Two species of jute are grown in the Study Area, i.e., Corchorous capsularis (white jute) and C. olitorious (Tossa jute). The former is tolerant to submerging and prevalent in both Upazila. Jute is sown in March to April and harvested in June to July. Grown duration is 100-120 days. Harvesting time is at the beginning of flowering. Stems are cut and retted, then crude fibre is extracted, dried and sold in the market which is processed in the jute mill. Premature flowering is induced by earlier planting and reduces yield and qualities of fibre.

9) Vegetables and others

Winter vegetables include tomato, pumpkin, bottle gourd, radish, carrot, cabbage, spinach, etc. and summer vegetables include cucumber, brinjal, beans, squash, lady's finger, etc. In Table 3.2.3, sweet potato, onion and garlic are included in winter vegetables and watermelon in summer vegetables in this report. Winter vegetables are usually planted from October to December and harvested from December to March. Summer vegetables are planted in February to April and harvested from April to June.

4. Agro Economy

4.1 Land Tenure

Land is the most important factor of agricultural production in Bangladesh.

Based on 1983/84 Census Data, Bangladesh covers approximately 9,038 thousands ha of owned land in which 8,062 thousand ha (89.2%) were cultivated for agricultural crops and 386 thousand ha are used as home stead. Therefore, land utilization for agriculture is very high in this country.

In the Study Area, Daudkandi has 32,600 ha and Homna has 15,000 ha of land holdings. In which, the share of cultivated and home stead land are 88.6% and 3.5% in Daudkandi and 89.8% and 4.1% in Homna respectively.

Therefore, land utilization for agricultural in the Study Area is in the same level as national country.

However, land tenure status and land distribution characterize the socio-economic status in the specified rural zone.

4.1.1 Tenure status

Land tenure status in the Bangladesh have four kinds of type as follows: Owner-cultivator, owner-manager, owner cum tenant, and tenant.

Based on the land occupancy survey of Rural Bangladesh in 1977, the type of owner-manager occupied the largest number and the largest operated land area. The next was the type of owner cum tenant while pure tenant type of land tenure has the smallest number and the smallest operated land area.

Land Tenure Status in Bangladesh in 1977

Tenure Type	No. of Household (thousand)	Percent of Total (%)	Operating Land Area (thousand ha)			Percent of Total (%)
			Owned	Leased	Total	
Owner-cultivator	1,923.8	23.5	797.2	-	797.2	10.5
Owner-manager	3,082.0	37.7	3,309.4	-	3,309.4	43.5
Owner Cum Tenant	2,618.3	32.6	1,763.9	1,406.2	3,170.1	41.6
Tenant	559.5	6.18	-	334.5	334.5	4.4
Total	8,183.6	100.0	5,870.5	1,740.7	7,611.2	100.0

Regarding to operating land area, however, 43.5% of them belonged to owner manager, 41.6% belonged to owner cum tenant farmers. In the other side the operating land area was divided into 77% of owned land and 23% of leased land, therefore, it seems that the most of agricultural land are cultivated by land owners by themselves. However, the operating land by owner-manager that has 43.5% of share in the whole land was cultivated actually by landless farmers and/or agricultural labours. On the other hand, small share of leased land is telling us that most land owner wants to rather manage than rent out own land giving the contract for farming practices to landless and/or agricultural labour household, because agricultural land is a significant factor of production in Bangladesh.

Regarding to land tenure status in the study area, sampling survey conducted in the late of 1988 year, indicates as follows:

Percentages of Farmer's Number of Land Ownership

(Unit: %)

	Owner-cultivator*	Owner Cum Tenant	Pure Tenant	Total
Daudkandi	60	33.9	6.1	100
Homna	76	21.3	2.7	100

Note: * Include owner-manager

60% of the farm number are operating own land and 33.9% of total farmers belong to owner cum tenant in Daudkandi, while in Homna, there are 76% of owner-cultivator, 21.5% of owner-cum tenant and 2.7% of pure tenant.

Above data indicate that tenure status in Daudkandi is kept on the national level, and in the case of Homna, it is incline rather to owner-cultivator type.

The following table show the share of owned and leased land in the Study Area.

Out of whole operating land 83% and over of them belongs to owner land while leased land has only less than 17% of total land in both Upazila of Study area.

From above data it can be recognized that many land owner want to rather choice own land operation than to rent out the land as leased land due to plenty of landless or agricultural labours.

The share of owned and leased land in the Study area.

(Unit: %)

	Owned	Leased	Total
Daudkandi	85.9	14.1	100.0
Homna	83.1	16.9	100.0

(Unit: %)

	Total	Small Scale	Middle Scale	Large Scale
1977	100	50	41	9
1983/84	100	70	25	5

(Unit: %)

	Total	Small Scale	Middle Scale	Large Scale
Comilla District	100.0	84.5	14.5	1.0
Daudkandi	100.0	84.4	14.6	0.9
Homna	100.0	84.5	14.0	1.5

No. of Landless Households Estimated

(Unit: 1,000)

	Non-farm Households		Farm Household		Rural Household		Percentage of Landless to Total Rural Household D/Cx100%
	Total (A)	No Land	Total (B)	Less than 0.2 ha (B)*	Total (A)+(B) = C	Landlessness (A)+(B)* = D	
Comilla Dist.	16.5	36	974	356	1,139	521	45.7
Daudkandi	13.9	6.1	55.6	15.1	69.5	29.0	44.2
Homna	8.4	3.5	62.3	8.2	34.7	16.6	47.8

Source: 1983/84 Agricultural Census

Above data are showing that, Comilla district has 521 thousand of landlessness, it correspond to 45.7$ of total rural household. And comparing with national level (44.8%), it was rather high.

In the other side Daudkandi and Homna had 290 thousand and 166 thousand of landless household. Their ratio to the whole rural households are 44.2% and 47.8% respectively. Thus Homna Upazila seems to have rather more landless household than other area.

After all, following conclusion and recommendation would be expressed in this chapter.

(1) In view of land distribution, the Study Area have rather significant amounts of landless and rural low-income households.

(2) Most of land owners operate their own lands by employing landless or agricultural labour as cultivators.

(3) Therefore, in this new model rural development project, taking actual land tenure status into consideration, the strategies and its targets are envisaged.

(4) In the Project, rural low-income class i.e. small farm household should be distinguished from specially landless, and middle, and large farm households, because they are farmers but have a lots of surplus labours.

4.2 Marketing and Trade System related to Agricultural Products and Inputs to be Set Up

4.2.1 Rural marketing organization

In rural area of Bangladesh, on specified days markets are opened and villagers go there to purchase goods and to sell his farm products. The extremity organization of the rural market

in Bangladesh is called as "Hat". Bazaars are opened in crossed road area, or empty and wide areas, once or twice a month. Its scale is rather bigger than "Hat".

The terminal organization of rural market in Bangladesh is the Growth Center. This market is opened permanently and is playing the role of intermediate trade. It is located always in significant place like nearly port, terminal main road and Upazila office, etc. And it includes only wholesalers, retailers, but also financial organization, postage, storage, and slaughterhouse, etc.

As such a marketing organization is a common system in Bangladesh, Study Area has the same marketing organization. In Daudkandi, now, there are 5 Growth Centers, 27 Hats, while in Homna 3 Growth Centers and 7 Hats. However, data on Bazaars are not available.

4.2.2 Marketing system for farm products

Agriculture in Bangladesh is still staying in the under development and self-sufficiency stage. Most farmers, except large and middle scale of farm households, have not much surplus of farm products. A few surplus of minor crops such as potato, pulses, mustard and vegetables cultivated by small farm household for self-consumption are sent to Hats, Bazaar and/or Growth Centers some time in order to earn money. However, they are still unmarketable. Consequently, the agricultural marketing system in the Study Area is considered stagnant.

On the contrary, large and middle farms could have plenty surplus of production. They would trade own surplus through such a marketing channel as Middleman → Wholesaler → Retailer.

According to Upazila information, in the Study Area minor crops for the purpose of commercialization are potato, jute pulses, chilli, oilseed of Rabi crops, but fruit and vegetables except water melon are not commercialized as yet.

In the Bangladesh, rather completed marketing systems are the channels only for rice and jute. Figure 4.2.1 and 4.2.2 shows the marketing system of vice and jute
Rice marketing channel; it has two different routes → the free marketing route, and the regulated route by governmental control.

In the farmer case, there are three activity stages, that is primary, secondary and terminal. At the primary stage, merchants and brokers or middle men purchase paddy from farmers and at

secondary stage the wholesalers treat the paddy. Rice millers are also concerned in paddy marketing.

In the latter case, the Ministry of Food has promoted the paddy collection in rice bowl area in every harvesting season. There not only paddy growers but also middle men, rice miller can joint in the marketing. The paddy collected by government would be preserved after milling with contract millers. And the rice will provide to consumers through ration shops who have governmental card or license.

Jute seems to be more simple than paddy because of only one line of marketing route. However, a sort of organizations such as BJC, BJMC, PEC, etc., are concerned in the jute trade. They collect jute material, process and export to over seas. A few of jute are consumed in the country.

The marketing channel for minor crops trading in whole country is as follows:

> Producer (grower) → Middle men → Agent or wholesaler → Retailer or process → Consumers.

Other minor crops are trade in at rural market like Bazaars and Growth Centers with growers of through first middle men, as it is mentioned before.

4.2.3 Marketing system for agricultural inputs

In rural area of Bangladesh, the marketing for agricultural inputs is active unexpectedly. Farmers, especially large an middle farmers want to irrigate, supply fertilizer, control weed, pest and disease and they are very concerned with introduction of HYV.

Formerly, agricultural inputs (fertilizer, chemicals, irrigation and drainage equipments, agricultural machinery and crop seeds, etc.) were delivered to the farmers through BADC and its office is Upazila and through farmer's cooperatives.

However, now BRDB organized new marketing system for agricultural inputs on the base of deep tube well. On the other hand every farmer is able to purchase directly modern inputs like chemical fertilizer and pesticides, minor irrigation equipment and improved seeds, etc. from merchant. Therefore on the marketing for agricultural inputs UCCA and farmer's cooperatives could not play their role as the supporting body for farmer's benefits.

4.2.4 Marketing prices, distribution charge and marketing measures

Under the TFYP Government policies regarding market prices for agricultural output and inputs will directly promote efficient use of scarce resources for accelerate crop output.

Regarding the prices at farm gate, Homna has rather higher price than Daudkandi. It is caused, perhaps, from unfavourable agricultural conditions and small surplus. However, the distribution charge is almost homogeneous.(see Table 4.2.1)

Main marketing measures working in the Study Area and their fee of transport are shown in Table 4.2.2. Even though the transportation means and fees in each Upazila differ from each other, they are still poor and traditional. Rickshaw, boat,van car, pulling car, are the main transportation means. Along with the progress of agricultural production, modernization of marketing distribution in the Study Area should be promoted.

As a conclusion, it is pointed out that the marketing and trade system for agricultural products and inputs are still under developed. It is caused, mainly from insufficient surplus of the agricultural products. On the other hand marketing organization, and marketing measures are in an inadequate situation. Because there are rural road constraints and undeveloped transport equipment.

Besides, farmer's cooperatives have not supported and promoted rural marketing activities.

4.3 Farm Income and Agricultural Productivity

Bangladesh is a small and a low income country with per capita income of US$160 only. and income in rural area is more depressing. The rural poverty that is more than 80% of rural residents have taken less than 2,100 calories intake, and more than a half of them can't meet the basic needs of living, comes from densely population, lots of petty farmers and mainly low agricultural income in the cause of low productivity. In addition, they have no employment opportunities outside farm.

4.3.1 *Agricultural income and its productivity*

Added values of agriculture, livestock, forestry and fisheries in whole country and Comilla district during 5 years from 1981 to 1985 are elaborated.(Table 4.3.1)

Total added value per capita was 1,300 and/or 2,100 Taka in whole country while Comilla had 1,200 Taka and/or 1,800 Taka. They were equivalent to 65.6 and 56.3 US$ in 1985/86 years (US$1 = 32 Taka).

According to this information rural residents have to get the same amount of income as the added value of agriculture, livestock, forestry and fisheries, from outside to keep national level of income. However, most of rural households have no employment opportunities outside of farm.
Agricultural income depends on the receipt from agricultural products and productivity.

The yield, production cost and net return of major agricultural crops in whole country during recent three years are shown in Table 4.3.2. And it indicates that Boro and T. Aman and wheat have rather high yield and same net return but Aus and jute are not so profitable crops in Bangladesh.

The most critical factor is that their yields and returns are unstable every year.

The yield, production cost and net returns of main crops in the Study Area are indicated in Table 4.3.3 In the Study Area paddy yield is lower than national level. Accordingly, returns of them are also smaller than the national level. Particularly, the returns of Aus and Aman in Daudkandi were negative and Boro's return in Homna was also negative in 1988.

Wheat in the Study Area has rather good yield and its return also was positive. However, jute in Homna was not profitable. On the other hand vegetables in Study Area seems to have very high level of return, on the country, potato and chilli were not so profitable.

Regard to agricultural productivity, it is indisputable that both Upazilas have still limited productivity in the agricultural field. This is caused, of cause, from such a factor that Project Area is located in low level of altitude and always suffered from flood damage under inadequate natural circumstance.

4.3.2 Receipt and outlay of rural household

Based on the sampling survey carried out in 1988, the income sources or rural households in the Study Area were as follows:

(Unit: %)

	Agri-Culture	Fishery	Rural and Cottage Industry	Business	Daily Labour	Service	Others	Total
Daudkandi	71.4	2.7	2.3	-	17.7	4.1	1.8	100.0
Homna	62.4	5.0	4.9	3.0	18.8	4.0	2.0	100.0
Average	68.5	3.4	3.1	0.9	18.1	4.0	1.9	100.0

The most important income source for households in the Study Area, of course, was agriculture in both Upazilas. However, daily labour is also rather significant income source in the area.

Each Upazila has its own characteristics in regard to income sources. Homna depends on more non-agriculture income sources than Daudkandi. The rural households in Homna have larger share of income sources from fishery, rural, and cottage industry, business and daily labour than Daudkandi.

When making plan of rural development project, existing actual income sources of households in the area should be taken into consideration.

Depend on the income source of household they can be distinguished into three kinds of rural households that is agricultural household, fishery household and daily labour household. Now, their character would be analyzed with their income outlay and labour force, etc.

a. Agricultural Household

The Balance of Income and Outlay

Per Household

	Member of Family	Member of Force	Hold-ings (ha)	Household Income (Taka)	Agricultural Income (Taka)	Household Outlay (Taka)	Agricultural Income per Ha (Taka)	Per Capita Income (Taka)	Per Capita Outlay (Taka)
Daudkandi	7.8	3.5	1.6	50,566	31,187	35,470	19,492	6,482	4,547
Homna	7.3	3.0	1.7	31,184	15,908	29,908	9,358	4,545	4,097

In spite of the scale of family, labour force, and holdings are almost same in both Upazila household income, agriculture income and household outlay differ much each other. Agricultural household in Daudkandi seems to be more efficient than Homna due to high agricultural productivity.

Agricultural income of agricultural household by scale of holding are shown in below table.

(Unit: Taka)

Item	Less than 1 ha	1 - 3 ha	3 - 5 ha	5 ha and over
Daudkandi	16,448 (100)	27,883 (170)	61,238 (372)	161,223 (980)
Homna	12,550 (100)	18,497 (147)	46,331 (369)	-

Along with the holding scale, agricultural income of households became larger and larger, in the Study Area, specially in Daudkandi Upazila.

b. Fishery Household

The income and outlay of the fishery household in the Study area is shown below.

	Family Member (person)	Labour Force (person)	Income of Household (Taka)	Outlay of Household (Taka)	Per Capita Income (Taka)	Per Capita Outlay (Taka)
Daudkandi	9.5	5.0	95,117	63,590	10,012	6,693
Homna	5.8	1.8	41,570	19,764	7,167	3,407

Above data indicate that household income per capita of fishery household in Study area is larger than agricultural household. Therefore fishery in the Study Area will be more profitable than agriculture due to higher productivity.

c. Daily Labour Household

The income and outlay of daily labour household are indicated in following statistics.

	Family Member (person)	Labour Force (person)	Income of Household (Taka)	Outlay of Household (Taka)	Income per Labour Force (Taka)	Per Capita Income (Taka)	Per Capita Outlay (Taka)
Daudkandi	6.1	1.8	9,678	23,352	5,377	1,586	3,828
Homna	5.9	2.2	10,941	19,829	4,973	1,854	3,361

Daily labour households in the Study Area have small number of family and labour force. The household composition also in rather small. Nevertheless, they have a scanty of household income and outlay. Their household income in Daudkandi was less than 10 thousand Taka in a year and it was only 1,586 Taka (50 US$) per head of family equivalent to 38% of average national level. In Homna Upazila it was 1,854 Taka (58 US$) and equivalent to 45% of national level. Even though the household outlay has also the lowest level in whole country, their income could not cover the outlay. Consequently, daily labours are obliged to rely on the aid or debt always. One of the significant problems is how to relief them urgently in this new model of rural development project.

4.3.3 Household income, and outlay of the landlessness

Landless farmer's income survey carried out by other project team in March of 1989, reveals the following information.

Landless farmers in the Study Area are mostly depend on such a income source that:

Daudkandi	:	Agricultural labour Fishery, Boat Operator Rickshaw Cottage industry Business trade
Homna	:	Agricultural labour Fishery Cottage industry Daily labour

The most important income source are agricultural labour and fishery for them.

Their holdings, family scale, household income and outlay and working days in a year are shown below.

		No.of Family Member	Holdings	Household Income	Household Outlay	Working Days
		Person	ha	Taka	Taka	Days
Daudkandi	Alongside of mainroad	6.8	0.04	14,000	20,400	293
	Inland area	6.1	0.03	10,600	12,100	305
	Alongside of mainroad	5.4	0.16	23,000	22,750	274
Homna	Inland area	5.5	0.14	9,322	12,100	29.1

Their household income exceeds the daily labour's one in value in the Study Area. However, the landless resident alongside of main road seems to be rather advantageous in earning than inland area.

In regard to their working days in which include all kinds of the works as for agriculture, fishery, cottage industry, its pattern in any Upazila and in any places was almost same. That is they are engaged in farming practices during dry season (from Dec. to June), while in rainy season they do fishery work or boat operation. During off season of farming they wanted to be engaged in rickshaw and/or cottage industry. Therefore of other permanency is provided to landless farmer, the labour shortage problems, might occur in the farming season in the Study Area.

4.4 Historical Movement of Bangladesh Farmer's Cooperatives

Since colonial. Bangladesh have had farmer's cooperatives as one of farmer's organization. However, in that time as many farmers were changed with heavy interest rate counted at a compound rate after every quarter, they could not pay the interest and loosed their land.

By 1940s cooperative acts enacted by which credit cooperative developed with multipurpose aim. However, the cooperatives was bad effective due to the pressure of big farmer's who took of the credit for fertilizer, seed and other agricultural inputs at the lost of small farmer. Besides cooperatives have had decreased member due to the increment of rural low income class.

On the other hand there were Thana Irrigation program group organized as one of the farmer's organization.

In 1957, Comilla academy was set up to promote rural development in Comilla district. At that time, Comilla type of farmer's cooperatives was organized.

Comilla type of farmer's cooperatives has aimed at multi-purpose activity for not partial farmers but whole farmers. And its final object was to increase agricultural production with diffusion of new technology through farmer's cooperative organization, and to promote rural development program. In 1960, new Comilla type of cooperative set up in Kotobari Upazila area and to 1963 this has spreaded into the whole Comilla district.

4.4.1 Comilla type of farmer's cooperatives

This type of cooperative has two tier system: the primary UCCAs are in the village level and its counterparts or unions are in Upazila level. The tier system cooperative has a net work of farmer's cooperatives under BRDB. And it is one of the farmer's institution utilizing new improved technology, agricultural inputs and credit, etc.

Comilla type of cooperatives have started, initially, to assist whole farmer's interests and to help landless and petty farmers. However, they were discouraged to participate in the cooperatives due to large farmers were only favoured by its activities.

Thus, the primary cooperatives were obliged to reorganize. Now, on the village level there are four kinds of cooperatives: KSS, BSS, MBSS and MSS*.

*	KSS	Farmer's cooperatives
	BSS	Landless cooperatives
	MBSS	Women's landless cooperatives
	MSS	Women's cooperatives

Primary cooperative is operated under managing committee consisting of six member elected by cooperative members.

The enrolled members of the cooperative have to purchase a stock and to pay administration fee (2 Taka) furthermore the member should have thrift deposit every week. The cooperatives on village level can provide the farming loan to enrolled members. And the cooperative has a responsibility for joint purchase of agricultural inputs, joint sale of the farm products. On the

other hand, the cooperative can set up the project for land consolidation and socio-economical development in the rural area and organize group works to achieve them.

The cooperative union, UCCA is located in each Upazila having a cooperative board headed by a president and members. UCCA is operated by the managing committee, including a chairman, vice-chairman and several managers. Each manager has an own task. UCCA is supervised with BRDB. However he can organize, supervise and guide the primary cooperatives. His main tasks are to train and educate the leaders and model farmers of village cooperatives. And he has responsibility for performance of financial transaction such as loan, credit dividend or interest payment and to provide agricultural input as well as to purchase farm products from cooperatives.

4.4.2 Existing organization for farmer's cooperatives and their activity in Study Area

In the Study area, KSS, BSS and BMSS are organized as primary cooperatives, but MSS seems to be not yet organized.

Table 4.4.1 shows numbers of each kinds of cooperative enrolled members, their deposit and credit money in both Upazila, Daudkandi and Homna.

Daudkandi has 470 villages in which KSS registered is 410 i.e. 60 less than number of villages while Homna has 200 villages in which KSS registered in 221 that is 21 over than number of villages. On the other hand BSS number covered 11% of villages in Daudkandi while Homna covers 35.5% of villages. And MBSS numbers covered 4.7% of villages in Daudkandi while in Homna it covers 8% of villages.

With regard to the average enrolled members per unit of cooperative, Daudkandi has 35 persons in KSS, 41 persons in BSS and 41 persons in BMSS while Homna has 56, 44 and 35 persons in each cooperative. In view of above data in the Study Area, Homna has rather promoted organization of farmer's cooperatives than Daudkandi.

The amounts of deposits received depend on cooperative numbers and number of enrolled members of cooperative. As regards to the deposit amount per head of enrolled member, Daudkandi is rather higher than Homna.

The cooperative credit is provided to enrolled members through UCCA. In the Study Area, long-term loan is provided to KSS for purchasing STW, DTW and HTW and short-term loan is for purchasing fertilizer, seeds, chemicals and small irrigation equipments, etc.

Since reorganization, UCCA has the RPP (Rural Poor Program) for BSS and MBSS members for the following matters: 1) beef fattening, 2) rickshaw, 3) rice threshing, 4) small trading, 5) machinery repairing work shop, 6) pond fishing, 7) livestock for milk production, 8) oil mill, 9) hand loam, 10) cans and bamboo works, 11) poultry, goat raising, 12) bee keeping, 13) net mating, 14) carpentry, 15) duck raising, 16) tailoring, 17) vegetable/kitchen guarding.

However, landless farmers do not use the loan to proper purposes which gives farmers returns as well benefits. Loans are used for the basic needs of life at primary stage which returns can not be expected.

4.4.3 Categories rural households

The households in rural area of Bangladesh consist of three categories:

Non-farm Households	:	Households with less than 0.02 ha or no cultivated land are treated as non-farm households.
Farm Households	:	Households with more than 0.02 ha cultivated land are treated as farm households and they are broadly classified a) Small, b) Medium, and c) Large farm household.
Agricultural Labour Households	:	Households whose major income source during the proceeding year was from working as agricultural labour are considered as agricultural labour households. Agricultural labour is defined as labour exchanged for wages or kinds for agricultural activities on operated land by other households.

Non-farm households and farm households are categorized depending on land holding's size, while agricultural labour households is categorized with income resources of the households. Therefore, total number of three kinds of households unindicted whole rural households number.

Landlessness and Rural Low-Income Class in Bangladesh.

In the rural of Bangladesh state, there are the following conceptions. Landless households and Rural poor households. However, both concepts are used usually as a target of strategies in Rural development program. Consequently, their definitions are not so clear that object and strategies of the project differ from case by case.

According to "the Strategy for Rural Development Project" published by BRDB, Farm households with less than one ha have too small farm production with that unable to support their family and they have no employment opportunities to supplement income shortage.

According to the Government of Bangladesh such a farm household is defined as rural poor households.

On the other land BRDB nominated the non-farm households and farm households with less than 0.2 ha of land tenure as landless households. These landless households have a great relationship with rural poor households and both of them are promoting the poor situation in the rural areas.

However, in the actual project, their definition rather differs from above case. For example, on the some rural development project, the farm households with less than 0.4 acre of 6,000 Tk of farm income are nominated as rural poor household.

On the other hand as regards as landless farm, the households with no land tenure but with homestead as nominated are landless households.

5. Rural Infrastructure

5.1 Irrigation and Drainage Condition

5.1.1 Irrigation condition

The expansion of irrigated land is one of the most important factors to sustain the growth in agricultural production especially the increasing use of high yielding varieties (HYVs), and there is a big potential for the irrigation development in Bangladesh. The pattern of modern irrigation development up to the present has proceeded in three main phases:

- the lead factor from the 1950s to the mid 1970s was surface water development by means of rented low lift pumps (LLPs). But most of the best sites with access to adequate water supplies had been developed by around 1975.

- groundwater irrigation using tubewells began with the sinking of deep tubewells (DTWs) in the mid-1960s, and DTWs became an important factor contributing to the growth in irrigated area by the mid-1970s. But the expansion in number of DTWs slowed dramatically in early 1980s because of less amount of groundwater due to planless installation of new tubewells.

- expansion of modern irrigation occurred with development of shallow tubewells (STWs) in the private sector. Between 1978 and 1985 the number of shallow tubewells increased to more than ten times.

The Government of Bangladesh has established the "National Water Plan (NWP)" in 1986 including the further irrigation development. The objectives of the National Water Plan (1985-2005) are the development of water resources to:

- maximize agricultural growth and production and contribute to achieving foodgrain self-sufficiency; and

- ensure adequate water supplies in time and quantity for fisheries, domestic and industrial use, navigation, salinity control and environmental management,

subject to available water and land resources, and financial, human, and institutional limitations.

Irrigation system

In the Study Area irrigation is being carried out by many farmers already using both traditional and modern irrigation methods. Normally, irrigation is practiced in dry season (Dec.- Apr.) in the Study Area. The major constraint to irrigation development is the availability of water in the dry season though there are two water resources of surface water and groundwater. Gravity intake of water in the Study Area is not possible in the dry season because of its topographic features.

The irrigation methods which are being practiced in the Study Area are as follows (Refer to Figure 5.1.1):

(1) Minor irrigation mode (Traditional method)

For centuries farmers have used indigenous techniques for irrigating dry season crops near low lying areas with water from wells, canals, borrow pits, or perennial streams. These traditional modes are strictly manual and have low lifts. Although the Dhoon and Swing basket can only be operated at lifts up to about 1.5 to 2 meters. These modes are low cost and labour intensive; they provide opportunity to use otherwise unemployed family labour; and they do not require imported parts or energy.

a. Dhoon

Dhoon likes a scoop in the shape of a boat made of wooden planks or hollowed trunk of local trees. The design is simple and made by village carpenters. A scoop is attached to a cross beam with a counter weight. This crossbeam rests on a support that acts as a fulcrum. The operator stands on a scaffolding made of bamboo from where he pulls the scoop down into the water. Lifting is assisted by the counterpoise beyond the fulcrum of the cross pole. The water is then discharged into the field as the scoop is raised. Dhoons normally irrigate 1.6 to 2 ha of Boro rice each.

b. Swing basket

The Swing basket is one of the simplest and most mobile irrigation techniques. Two men stand on either side of a water source holding ropes connected to a triangular shaped basket made of woven cane, plain sheet steel, or the flattened tin of a used container. In a rythmic motion the basket is lowered into the water

source, then by simultaneous pulling on the ropes the basket swings upward and at the moment of discharge a sharp tug on the rope connected to the bottom of the basket inverts it and discharges the water. Certain types of swing basket can be operated by one man where the lift does not exceed one meter. One swing basket can irrigate 1.5 ha of Boro rice.

(2) Low lift pumps (LLP)

A small low-lift centrifugal pump of 15 to 30 hp with a nominal discharge capacity of 28 liters/sec (1 cusec) or 57 liters/sec (2 cusec) usually located on the bank of river, canal or water body, and discharging into an earthen channel or directly into field. One LLP can typically irrigates about 16 ha (by 2 cusec).

(3) Shallow tubewell (STW)

A shallow tubewell (STW) uses a centrifugal pump, driven by a 5 hp diesel engine, located at the top of the well at the ground surface to lift groundwater by suction. The limited suction head of about seven meters restricts use of this mode to areas where the groundwater table does not drop below 7 m during the peak demand period. The delivery capacity of these diesel driven units averages about 14 liters/s with a typical command area of about 5 ha.

(4) Deep tubewell (DTW)

A deep tubewell (DTW) is a cased well, with the screen usually set at below surface of more than 25 m and a 15-25 hp turbine pump set which is driven by a diesel engine or electric motor. DTW generally operate with a maximum pumping lift of 20 m, and a nominal discharge capacity is 57 liters/sec (2 cusec) with a typical command area of about 24 ha.

(5) Hand tubewell (HTW)

Hand tubewells have long been in use to lift groundwater for drinking. During recent years use of hand tubewells for irrigating small tracts of land has spread rapidly under the Manually Operated Shallow Tubewell Irrigation (MOSTI) program of the Bangladesh Rural Development Board (BRDB). This is a labour intensive mode using locally made pumps. The wells are shallow, drilled (jetted) by indigenous methods to about 20 m with discharge capacities of 0.5 to 0.75 l/sec and a suction limit of about 7 m. HTW can irrigate 0.2 to 0.25 ha of HYV rice.

Surface irrigation (Low Lift Pump, Traditional Methods, etc.) is carried out using water mainly from rivers and canals. There are so many tributaries in the Study Area which finally flow into the Meghna river in addition to major rivers, such as the Gumti and Titas rivers. The all rivers in the Study Area are tidal, so the water levels fluctuate periodically.

There are uncountable number of irrigation canals in the Study Area of which most of the canals were constructed by farmers. However, some canals are silted up and have less flow capacity due to lack of maintenance after sedimentation by floods. Landless farmers are cultivating on the sedimented area and this conduct is also disturbance for the proper maintenance of canals.

Irrigated area

Present irrigation conditions in the Study Area under the above mentioned irrigation methods are summarized below.

Irrigation Method		Daudkandi	Homna	Total
Low Lift Pump	(No.)	455	76	531
	(ha)	7,154	707	7,861
	(ha/unit)	15.7	9.3	14.8
Deep Tubewell	(No.)	57	-	57
	(ha)	1,025	-	1,025
	(ha/unit)	18.0	-	18.0
Shallow Tubewell	(No.)	114	48162	
	(ha)	414	155	569
	(ha/unit)	3.6	3.2	3.5
Hand Tubewell	(No.)	764	2,750	3,514
	(ha)	195	356	551
	(ha/unit)	0.26	0.13	0.16
Others	(ha)	2,122	312	2,434
Total Area	(ha)	10,910	1,530	12,440

Source: Upazila Information, Feb.1989

The total irrigated area in the Study Area is 12,440 ha and this is 28.7 % of net cultivated area (38.5 % in Daudkandi Upazila and 10.2 % in Homna Upazila). The present irrigation conditions in each unions in Daudkandi and Homna Upazilas are shown in Tables 5.1.1 and 5.1.2 and Figure 5.1.1. Percentages of irrigated area against the total area of each Upazila are 23.4 % in Daudkandi and 6.8 % in Homna. The percentage of Homna is very low comparing with that of Daudkandi, though even that in Daudkandi is not high. The reasons of less development in irrigation practices in Homna Upazila are assumed that the average ground elevation of Homna Upazila is higher than that of Daudkandi Upazila, so higher lift is

required for the irrigation practice, and Homna is more isolated than Daudkandi for the development of industries including agriculture.

5.1.2 Existing drainage condition

There are some existing drainage systems in the Study Area. The topographic features in the Study Area indicate general slope toward the south and the west in the northern area and slope toward the west in the southern area of the Gumti river. Flooding water is drained with this tendency and finally flow into the Meghna river.

Flooding of the Study Area occurs as a result of:

- overbank flow from the rivers
- rainfall in the Study Area which accumulates in the lower areas.

There are many drainage canals in the Study Area which are connected to the rivers. These are constructed by farmers for the acceleration of drainage of flooding into the rivers and prevention of water logging or ponding in the lower areas. Some drainage canals are also used for the purpose of irrigation canals. Generally, the maintenance work for the drainage canals in the Study Area are properly carried out by the farmers except for some canals.

5.1.3 Existing flood control condition

Though nearly all the part of the Study Area are inundated in the peak flood water period, there is no major flood control facility in the Study Area except for the road embankments. Inhabitants in the Study Area are trying to raise the road surface above the flood water level to ensure transportation in the flood season. Generally major roads have higher elevation surface. They also raise the habitation area to prevent the flood damage. However, as the elevation is not high enough the flood water sometimes overbank the road surface and habitation land.

5.1.4 Existing development plan

There are two major projects near the Study Area. One is Gumti Phase I Sub-Project (Gumti-South Project) and the other is Gumti Phase II Sub-Project.

Feasibility study on the Gumti Phase I Sub-Project was completed in January 1984 and Detail design is under progress. Features of the project are as follows:

Project area is bounded by the main trunk road Daudkandi - Comilla in the south and Gumti river at the east, north and west sides, and it covers a gross area of approximately 37,340 ha which includes east end of the Study Area. Tree option plans were studied and the final plan is provision of flood control, drainage and irrigation, and which consists of

- Flood control plan	:	56.5 km of polder embankment including 29 km of high and low embankment	
- Drainage plan	:	Construction and rehabilitation of drainage canals and preparation of necessary facilities.	
- Irrigation Development Plan	:	Western area :	8,400 ha of additional irrigation area with 15 km of feeder canal and one pump station (12.0 m^3/sec)
		Eastern area :	2,300 ha of additional irrigation area by gravity intake

Gumti Phase II Sub-Project is now under feasibility study and the reports will be prepared by the end of 1989. There are two options of future development plan for a gross area of 137,630 ha. One is provision of flood control and drainage (FCD) and the other is provision of flood control, drainage and irrigation (FCDI).

The main element of the FCD proposal is the construction of a polder embankment around the project area from the Indian Border with drainage regulators, embankments in the project area for the isolation of sub-area and some related facilities.

The FCDI proposal includes main components of four major pump stations and six pump stations for the irrigation of 10,8500 ha.

5.2 Feeders and Rural Roads

(1) Road system in Bangladesh

In Bangladesh the road system consists of 5 categories which are National Highways, Regional Highways, District Roads, Feeder Roads and Rural Roads.

In the category of Feeder Roads 2 kinds of Feeders, A and B, are observed. In the category of Rural Roads, however, 3 classes (1, 2 and 3) are existing.

Functions of the road system is as follows:

- National Highways : Communications between Dhaka Metropolitan and 4 Divisions
- District Roads/ Regional Highways : Communications between District Office and District Business Centers, connecting to National Highway(s)
- Feeders A (F.A) : Communications between Upazila Headquarters and National Highway(s)
- Feeders B (F.B) : Communications between Feeder(s) A/Upazila Headquarters and Growth Center(s)/Business Center(s)
- Rural 1 (R1) : Communications between Union Headquarters/Market(s) and Upazila Headquarters/Feeders
- Rural 2 (R2) : Communications between villages/farms with union parishad
- Rural 3 (R3) : other village roads

Structures of these road categories are determined

Concerning the maintenance of roads, Roads and Highways Department (RHD) is responsible for National Highways and Feeders A, while Feeders B and Rural Roads are subjected to LGEB and Upazila Parishad (see Table 5.2.1).

(2) Present situation of the road system

The present situation of roads in the Study Area is as follows: (see Table 5.2.2)

Item	Daudkandi	Homna	Total
Pavement-Roads (km)	24.1	-	24.1
Partly Pavement Roads (km)	9.7	-	9.7
Non-pavement Roads (km)	558.4	310.6	869.5
Total (km)	592.2	310.6	902.8
Non-pavement Ratio (%)	94.3	100.0	96.3
Road Density (km/km^2)	1.8	1.9	1.8

Source: BBS, Comilla District Statistics, 1983

	Daudkandi			Homna			Total		
	No.	Distance (km)	Bridge	No.	Distance (km)	Bridge	No.	Distance (km)	Bridge
National Highways	1	18.5	5	-	-	-	1	18.5	5
Feeders A	1	13.3	14 ferry2	1	5.0	9	1	18.3	23 ferry2
Feeders B	2	19.5	7	2	16.6	10	4	36.1	17
Rural Roads	15	120.5	76	7	64.1	45	22	184.6	121
Total 19	19	171.8	102	10	85.7	64	28	257.5	166

According to statistical figures in 1983 road densities in Comilla District are as follows:

Daudkandi	:	1.8 km/km^2
Homna	:	1.9 km/km^2
Comilla	:	2.1 km/km^2
Bangladesh	:	1.2 km/km^2

The road network in the Study area consists of the National Highway Dhaka-Chittagong passing through Daudkandi. This National Highway is located in the middle part of Daudkandi. At Goripur, this National Highway is connected by 4 Feeder A directing to Homna in the North .(see Figure 5.2.1)

The National Highway and this Feeder A connect 2 Upazila parishads with Dhaka Metropolitan and District Office. Besides, they connect to Chittagong, the industrial district and harbor for foreign trade, implying a very important role in the economic life of Bangladesh.

The main road network in the Study Area centering on this National Highway and this Feeder A, consists of 17 roads (140 km) in Daudkandi and 9 roads (80.7 km) in Homna.

This road network supports not only the rural life for inhabitants but also the distribution aspect of materials for the production, playing an important role in economy.

In the Study Area, due to annual floods, the water level of Meghna Gumuti River increases, inquiring the road surface to be made up 2-3 m higher than ground level.

In Daudkandi, in 29 years of the period 1960-1988, there were 3 times of flood level higher than 6 m, covering almost the Study Area. Especially during he last flood of August 1988,

the water level was 6.34 m (the highest in recent years), largely damaging all roads and bridges in the area.(see Table 5.2.3)

The national highway Dhaka-Chittagong passing through the Meghna Gumti River by 2 ferries at the entrance of Daudkandi, inquires approximately 1 hour for these transferrings. One bridge is under construction. Another will be implemented soon.

The Feeder A connects Homna to the National Highway. Its present condition, however, is very poor with so many damages that only rickshaws can be used. As a matter of facts, the transportation of materials is almost carried out by boat.

Besides, the damaged situation of bridges and roads in the Study Area is so serious that the communication by cars in the Study Area is almost impossible. This is resulted from annual floods, especially the last flood in 1988.

From the poor situation of roads as now, the communications and transportation by surface roads are relied on manpower. And during flood seasons, as the water covering almost portions in the Study Area, the communications by small boats are indispensable.

(3) Constraints in development

In Homna, the Feeder A connecting to Daudkandi and the National Highway is largely damaged at the place of 20 km south from Upazila parishad, resulted in a communication by boats.

At present time, the distribution of produces is occurred from Hat Markets in unions to Growth Centers. From Growth Centers produces are distributed to other places, mainly Dhaka Metropolitan by boats. Materials for production, in versa, are transported by this route from other places to the Study Area. This distribution system however, could not relied on boats only for all transportation. Manpower, especially rickshaws should be used accordingly.

In recent years, socio-economic activities and the communication-system from the Study Area toward outside have been partly improved. But the road network is not completely improved for a proper connection with all important places.

From this situation, the distribution of materials and produces in the Study Area is limited, making constraints to activities of Growth Centers, Hat Markets, and therefore, the development of the Study Area.

5.3 Distribution Facilities

(1) Growth Centers

Growth Centers are considered as main facilities for distribution of materials, produces, goods, etc. in Upazila in the rural side. Especially the sale of local produces and distribution of industrial goods and imported items. The management is carried out by Upazila office which management committee is chaired by the Upazila chairman.

The management profit of Growth Centers will be made up to Upazila budget by its 70%, while 5% for national taxes and 25% for management fees.

In the Study Area, Daudkandi has 5 units of Growth Centers while Homna has 3 units. Their activities are very animated but very inconvenient due to drains and inside passages are in poor conditions. Besides there is a significant lack of shop-shelters. In Homna there is no electricity.(see Table 5.3.1 and Figure 5.2.1)

The business-system in Growth Centers is carried out by shops owned by businessmen and people selling items such as rice, vegetables, cereals, etc. without shops.

The latters are composed of mostly low-income landless people making business by selling foodstuffs along road-sides.

There is a necessity for reservation of business-places for these low-income landless people in the new system of Growth Centers.

(2) Hat Markets

In the Study Area, there are 27 Hat Markets in Daudkandi and 7 Hat Markets in Homna or 34 in total.(see Table 5.3.2)

These Hat Markets play a role of small Growth Centers, supporting the life of inhabitants in the Study Area.

These Hat Markets combined with Growth Centers make a distribution network for supplying consumption goods and materials for production in the Study Area.

The management of these Hat Markets is carried out by Upazila parishad with a management committee chaired by the Upazila chairman.

Shops of fish, meat, vegetables, rice, etc. in these Hat Markets are also in poor conditions, inquiring a proper improvement.

(3) Godown

Main godowns in the Study Area are food godowns, fertilizer godowns, seed storages and cold storages of potatoes and others.

Existing godowns are summarized as follows:

Item	Capacity	Nos.	Location
Daudkandi Upazila			
Fertilizer godown	4,000	1	Daudkandi Growth Center
Food godown	1,000	1	Daudkandi Growth Center
"	500	2	Daudkandi Growth Center
"	250	2	Gouripur, Elliotgonj
"	250	1	Batakandi
Cold storage (potato)	2,500-4,500	4	Daudkandi, Elliotgonj
Seed storage (paddy)	50-100	22	
Note: Cold storages are operated by private organization.			
Homna Upazila			
Food godown	500	2	Homna Growth Center
"	250	1	Dulalpur
"	250	1	Ramkrishnapur
Seed storage (paddy)	50	1	Homna H.Q.

The utilization of godowns has been observed very frequently.

In 2 Upazila in the Study Area, foodgrain godowns have been used for main storage of rice and wheat brought from outside.

These food grains will be distributed to Hat Markets through Growth Centers. Besides, some construction works such as roads, etc. supported by some foreign sources have been paid by wheat to workers.

According to the census of 1988, the population in the Study Area is 769,000 inhabitants (Daudkandi: 520,000, Homna: 249,000). The volume of foodgrains for this population would be 96,000 tons of rice. The present production in the Study Area is 35,000 tons or 36%. The insufficient portion should be supplied from outside. The role of godown will be very important for storage of foodgrains supplied from outside, especially for provision of foodstuffs during annual foods.

Another factor for this necessity is the population growth of 2.6% in the Study Area which inquires the establishment of godowns.

In Daudkandi, the cold storages are for potatoes produced in the Study Area. With this function, potatoes have been exported to other countries, making a good business for the Study Area. From this background, the privatization of these cold storages is supported by the governmental policy.

In Homna, there is no cold storage. From this situation, fresh foodstuffs have been not available at all times during the year. There is a necessity of construction of at least 1 storage. Due to the present situation of poor economic conditions in Homna, the construction of a private cold storage is considered very difficult.

5.4 Others

(1) Electrification

Electric power in the Study Area is supplied by the Comilla Rural Electrification Board-1 which headquarters is located in Chandina Upazila.

The supply system is as follows:

Main line	(3-phase, high voltage)	11,000 V
Secondary line	(Single phase, low voltage)	6,350 V
Tertiary line	(3-phase, low voltage)	400 V
Terminal line	(Single phase, low voltage)	230 V

The main line was established in both Upazila, Daudkandi and Homna, already, secondary line is under construction.

According to the electrification plan of this corporation, until June 1992, except the western part of Cataria, all parts in the Study Area will be connected to electric power.

Concerning tertiary line, the construction is depended on local needs. At present, 75% of areas in Daudkandi have been connected to electric power but in Homna only the area of Upazila headquarters is connected to electric power.

In the future, the electric connection to households will be carried out by this corporation upon inquiries.

The Model Rural Development Plan, therefore, will inquire the development of electrification in the Study Area.

(2) Tele-communications

The situation of tele-communications in the Study Area is based on post offices, telephone-boxes and telegram-boxes which are shown in the following table.

Item	Daudkandi	Homna	Total
Post-Office (place)	37	14	51
Telephone Box (place)	2	1	3
Telegram Box (place)	2	1	3

In the future, the procedure of development would need more facilities to be established for this purpose.

(3) Drinking water system

The drinking water in the Study Area is almost relied on shallow wells with hand pumps but in remote villages hand pumps are insufficient. People in remote villages drink almost water from rivers.

The situation of sewerage in the Study Area is very poor. contamination in drinking water is a very serious problem to local inhabitants.

The supply of drinking water in major facilities by deep wells and in villages by hand pumps from shallow wells is considered necessary.

From this background, the supply of drinking water in Upazila parishads, Growth Centers, Hat Markets, Schools, etc. would be made by deep tube wells and in villages by hand pumps.

(4) High schools and colleges

In the Study Area, there are 31 high schools and 2 colleges in Daudkandi, and 12 high schools and 1 college in Homna.(see Table 5.4 1)

These high schools need improvements of buildings, drinking water supply and teaching materials.

TABLES

Table 1.1.1 Estimated Area of Unions

Unit: ha

No.	Name of Union	Area of Upazila*	Area of Union		
			Statistic**	Measured***	Ajusted
	(Daudkandi Upazila)				
1.	Balarampur North		1,144	1,040	1,084
2.	Balarampur South		1,206	1,103	1,149
3.	Barakanda		1,982	3,335	3,475
4.	Bitikandi		2,239	2,195	2,287
5.	Daudkandi North		1,382	1,480	1,542
6.	Daudkandi South		1,237	1,750	1,824
7.	Elliotgonji North		1,423	1,358	1,415
8.	Elliotgonji South		1,343	1,340	1,396
9.	Goalmari		2,393	1,880	1,959
10.	Gobindapur		2,701	1,390	1,448
11.	Gouripur North		1,181	1,310	1,365
12.	Gouripur South		859	925	964
13.	Jagathpur North		957	1,020	1,063
14.	Jagathpur South		1,414	1,350	1,407
15.	Maruka		2,667	2,880	3,001
16.	Mazdpur		1,463	1,940	2,022
17.	Mohammedpur		2,804	2,650	2,762
18.	Narayenda		1,976	1,960	2,042
19.	Panchgachia East		1,516	1,395	1,454
20.	Panchgachia West		1,197	1,648	1,717
21.	Sundalpur East		1,191	1,620	1,688
22.	Sundalpur West		888	471	491
	Total	37,555	35,163	36,040	37,555
	(Homna Upazila)				
1.	Bhasania		1,932	1,845	1,904
2.	Chandanpur		2,185	3,100	3,198
3.	Chanderchar East		1,330	1,560	1,610
4.	Chanderchar West		1,799	1,145	1,181
5.	Ghagutia East		1,147	1,103	1,138
6.	Ghagutia West		470	1,260	1,300
7.	Homna north		1,190	1,665	1,718
8.	Homna South		1,222	1,128	1,164
9.	Nilakhi		2,225	2,340	2,414
10.	Radha Nagar		1,970	2,175	2,244
	Total	17,871	15,470	17,321	17,871

Source: * District Statistics 1983,Comilla
** Bangladesh Population Census1981, Community Tables of all Thanas of Comilla District,July 1985
*** measured each Union on the 1:50,000 scale map by planimeter

Table 1.2.1(1/5) Meteorolgical Condition at Comilla Station

Maximum Temperature (°C)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	26.6	26.6	32.8	34.4	33.2	31.6	31.5	31.3	31.7	31.7	29.0	25.9
1962	25.7	28.3	33.2	33.8	33.1	31.4	32.4	31.7	32.9	31.0	29.3	27.0
1963	-	-	-	-	-	-	-	-	-	-	-	-
1964	25.0	29.0	33.2	32.6	32.7	31.3	29.8	31.6	32.0	30.9	29.3	27.3
1965	26.0	28.5	31.5	33.8	33.6	31.6	31.0	30.2	31.5	31.6	30.0	26.8
1966	25.9	30.4	33.2	35.3	35.0	30.4	31.4	30.7	31.2	30.6	29.3	25.1
1967	-	29.2	29.8	33.1	32.5	31.8	31.3	31.5	30.6	30.6	28.7	26.9
1968	25.8	28.1	31.7	32.3	32.5	30.2	31.1	31.4	31.8	31.0	29.3	-
1969	25.2	29.6	32.4	33.3	34.2	30.7	30.8	30.0	31.9	31.9	29.2	27.3
1970	25.6	28.9	31.6	33.2	33.4	31.9	30.6	31.5	31.7	31.3	29.2	-
1971	25.6	28.2	32.8	-	-	-	30.3	30.2	32.0	31.5	29.2	-
1972	-	-	32.8	32.7	32.9	31.6	32.1	30.7	32.7	32.6	30.5	27.6
1973	25.5	26.3	29.8	29.4	31.2	31.0	31.7	31.2	30.6	30.8	28.1	24.5
1974	24.6	27.9	31.1	31.3	31.7	30.8	28.9	30.2	30.3	31.5	30.4	25.4
1975	25.4	28.6	32.8	32.4	32.4	31.5	29.6	31.4	30.7	30.7	27.7	25.5
1976	25.5	27.9	31.3	32.7	31.4	29.6	30.1	30.1	31.2	30.5	29.7	26.0
1977	24.9	27.6	31.3	29.2	30.4	29.9	30.5	31.1	31.9	30.5	29.0	26.2
1978	-	-	-	-	-	-	-	-	-	-	-	-
1979	27.0	26.7	21.0	33.5	33.9	33.0	30.9	30.8	31.1	31.1	30.6	25.9
1980	25.1	27.0	30.6	33.2	31.2	31.0	30.8	30.9	31.1	30.5	30.1	27.1
Ave.	25.6	28.2	31.3	32.7	32.7	31.1	30.8	30.9	31.5	31.1	29.4	26.3

Table 1.2.1(2/5) Meteorolgical Condition at Comilla Station

Minimum Temperature (°C)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	13.7	14.1	22.4	23.8	25.1	25.2	25.5	25.5	24.8	23.5	17.1	11.2
1962	10.0	14.7	18.1	24.2	22.2	23.9	24.8	22.8	25.2	23.0	17.2	12.6
1963	-	-	-	-	-	-	-	-	-	-	-	-
1964	12.1	15.6	21.2	23.1	23.7	24.4	24.1	25.1	25.4	24.2	19.4	14.2
1965	12.3	13.7	18.0	22.9	24.9	24.7	24.9	25.0	25.3	23.7	18.7	15.3
1966	13.9	16.2	19.6	23.8	25.1	25.0	25.4	25.6	24.9	22.4	19.6	14.2
1967	-	16.9	19.6	22.5	24.7	25.4	25.3	25.0	25.2	22.7	16.0	13.6
1968	12.0	13.8	19.4	22.0	24.2	25.0	25.8	25.6	25.7	23.2	18.9	-
1969	10.2	13.6	20.3	22.9	24.5	24.8	24.9	24.8	24.8	23.6	20.8	16.5
1970	14.8	16.7	20.2	24.1	25.9	26.9	26.0	26.0	26.3	24.2	20.9	-
1971	12.8	14.2	17.4	-	-	-	25.0	24.5	25.2	24.0	17.8	-
1972	-	-	21.9	23.8	26.3	25.7	26.5	25.3	26.1	24.5	19.5	12.5
1973	11.8	16.0	17.8	23.7	23.9	25.8	25.7	25.0	24.7	23.7	19.6	14.3
1974	12.0	13.4	19.7	23.0	24.1	24.9	25.0	25.5	25.0	24.9	21.8	14.4
1975	12.3	15.7	20.0	23.8	25.0	24.9	24.9	25.5	25.3	24.9	19.4	13.3
1976	11.9	16.0	20.6	23.5	24.4	24.8	25.3	25.1	25.3	23.0	20.0	12.1
1977	11.6	14.4	21.2	21.8	23.6	24.9	25.9	25.7	25.2	22.4	19.6	13.7
1978	-	-	-	-	-	-	-	-	-	-	-	-
1979	12.7	14.0	19.2	23.4	25.8	25.9	26.0	25.9	25.6	23.0	19.8	15.1
1980	12.6	15.7	21.0	24.3	22.8	25.7	25.4	25.5	25.5	23.0	16.8	13.6
Ave.	12.3	15.0	19.9	23.3	24.5	25.2	25.4	25.2	25.3	23.6	19.1	13.8

Table 1.2.1(3/5) Meteorolgical Condition at Comilla Station

Relative Humidity (%)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	74	68	72	75	80	85	85	86	84	82	77	75
1962	70	67	59	74	79	87	87	87	85	81	78	81
1963	-	-	-	-	-	-	-	-	-	-	-	-
1964	72	71	71	83	87	93	94	91	90	85	81	80
1965	75	69	72	76	83	89	96	95	86	82	79	78
1966	77	67	68	78	85	94	92	93	90	84	84	86
1967	-	76	81	74	84	84	86	85	87	81	73	72
1968	69	73	67	78	79	88	87	88	86	83	79	-
1969	74	69	79	78	78	87	87	90	84	80	75	72
1970	86	70	69	90	92	93	93	86	87	85	90	-
1971	84	89	85	-	-	-	89	89	85	83	78	-
1972	-	-	66	73	77	82	82	84	78	72	67	64
1973	60	60	64	72	79	84	81	82	84	80	79	75
1974	69	58	69	76	77	83	89	83	82	79	72	67
1975	62	62	58	70	76	79	85	81	83	82	71	62
1976	60	64	67	70	78	85	85	85	78	77	70	62
1977	63	60	69	78	78	83	86	86	84	84	81	76
1978	-	-	-	-	-	-	-	-	-	-	-	-
1979	68	68	71	75	75	80	85	85	85	81	79	81
1980	72	73	76	77	80	83	85	86	86	83	75	74
Ave.	71	68	70	76	80	86	87	87	85	81	77	74

Table 1.2.1(4/5) Metcorolgical Condition at Comilla Station

Wind Speeds (Knots)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	4.5	5.9	11.1	6.3	7.0	7.7	5.7	8.1	5.3	4.0	5.5	6.0
1962	6.5	5.8	6.8	8.6	6.6	6.3	5.9	6.2	5.3	5.0	5.0	5.0
1963	-	-	-	-	-	-	-	-	-	-	-	-
1964	5.1	5.6	5.6	6.8	5.2	6.8	6.4	5.9	5.7	6.0	5.0	5.0
1965	0.0	6.4	5.0	7.3	7.4	6.7	5.6	5.8	4.7	2.5	2.6	3.3
1966	3.2	2.9	5.5	6.5	6.1	5.6	5.3	5.7	5.1	7.0	5.0	9.0
1967	-	4.9	4.8	7.9	6.1	5.5	5.4	5.4	5.7	5.0	5.0	4.8
1968	4.9	5.0	6.2	6.0	7.6	6.3	5.2	5.2	5.1	5.1	5.0	-
1969	5.0	5.0	5.0	5.6	5.2	4.9	5.0	5.3	5.1	5.0	5.0	5.0
1970	5.0	5.0	5.8	5.7	5.9	5.1	5.4	4.7	5.1	6.3	10.8	-
1971	5.4	5.0	5.0	-	-	-	5.7	6.1	7.8	5.9	4.5	-
1972	-	-	9.7	10.9	9.4	7.9	7.1	7.5	4.3	6.1	3.4	4.0
1973	4.8	6.1	3.4	11.6	6.9	6.6	6.9	6.3	6.0	7.8	7.1	4.1
1974	4.4	4.1	6.8	7.3	9.3	8.7	7.9	7.9	6.0	4.6	5.2	4.8
1975	4.8	6.0	6.2	13.6	12.2	8.7	8.7	7.9	6.6	5.4	3.0	4.1
1976	4.7	5.6	7.2	10.1	7.8	9.4	8.7	8.4	8.4	5.3	5.7	5.9
1977	6.5	7.5	11.1	14.0	10.9	9.5	9.7	8.4	5.9	4.5	3.6	3.9
1978	-	-	-	-	-	-	-	-	-	-	-	-
1979	3.9	4.6	8.0	4.7	5.7	8.0	7.2	4.4	4.6	4.3	2.4	2.6
1980	3.6	4.3	4.1	8.7	6.1	5.1	4.6	4.4	2.8	3.8	2.6	2.7
Ave.	4.5	5.3	6.5	8.3	7.4	7.0	6.5	6.3	5.5	5.2	4.8	4.7

Note : 1 Knot = 1.85325 km

Table 1.2.1(5/5) Meteorolgical Condition at Comilla Station

Monthly Evaporation (mm)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1976	-	-	-	136.9	108.2	80.0	82.3	85.9	90.4	77.2	58.4	57.4
1977	56.6	69.6	112.3	82.3	89.7	73.2	80.3	77.2	79.2	72.1	55.4	51.3
1978	55.9	75.7	122.9	110.0	91.9	66.8	76.2	88.9	67.6	80.5	75.4	58.4
1979	67.1	77.0	110.7	134.9	147.6	109.7	69.6	86.9	98.3	68.8	70.1	36.1
1980	32.5	44.2	119.9	-	-	-	-	-	-	-	-	-
Ave.	53.0	66.6	116.5	116.0	109.4	82.4	77.1	84.7	83.9	74.7	64.8	50.8

Dairy Evaporation (mm)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1976	-	-	-	4.6	3.5	2.7	2.7	2.8	3.0	2.5	2.0	1.9
1977	1.8	2.5	3.6	2.7	2.9	2.4	2.6	2.5	2.6	2.3	1.8	1.7
1978	1.8	2.7	4.0	3.7	3.0	2.2	2.5	2.9	2.3	2.6	2.5	1.9
1979	2.2	2.8	3.6	4.5	4.8	3.7	2.2	2.8	3.3	2.2	2.3	1.2
1980	1.1	1.6	3.9	-	-	-	-	-	-	-	-	-
Ave.	1.7	2.4	3.8	3.9	3.6	2.8	2.5	2.8	2.8	2.4	2.2	1.7

Table 1.2.2 (1/5) Meteorological Condition at Dhaka Station

Maximum Temperature (°C)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	26.1	25.4	33.2	34.5	31.8	30.6	31.0	30.8	30.7	30.4	27.9	24.6
1962	25.1	29.0	34.8	35.3	32.5	31.2	31.7	30.8	31.7	30.4	28.5	25.7
1963	25.5	30.6	33.5	33.7	31.8	31.2	31.1	31.2	31.9	30.3	28.3	26.1
1964	24.3	28.7	33.9	32.9	32.6	31.6	30.3	31.2	31.3	30.3	28.1	26.2
1965	25.3	27.5	32.5	34.2	33.3	30.9	30.6	30.3	31.0	31.1	29.3	25.5
1966	-	-	-	36.5	35.4	31.1	30.8	30.9	30.6	29.9	29.0	25.2
1967	25.3	29.2	29.2	33.3	33.2	32.4	31.5	31.1	30.4	30.8	28.4	26.5
1968	25.0	27.5	33.0	33.7	33.8	30.3	30.7	31.2	32.3	30.6	28.8	25.7
1969	25.2	29.2	32.4	34.1	34.0	31.5	31.1	30.3	31.7	31.0	29.2	26.2
1970	24.8	28.8	32.4	34.1	34.4	31.9	31.1	31.0	31.3	29.8	27.9	25.6
1971	24.8	27.4	-	-	31.3	30.3	30.3	29.5	30.7	30.5	27.5	-
1972	25.9	26.0	32.7	33.2	33.9	32.0	31.7	30.4	32.3	31.7	29.7	26.5
1973	26.6	29.8	30.7	34.8	31.2	31.4	-	31.3	31.0	30.6	27.4	24.5
1974	-	-	-	-	-	-	-	-	-	-	-	-
1975	25.2	28.3	33.2	34.8	32.7	32.1	29.8	31.1	30.5	30.7	27.4	25.3
1976	25.9	28.0	31.5	34.8	32.4	30.9	30.8	30.4	31.6	31.3	15.0	26.0
1977	25.0	27.7	33.3	31.4	31.0	30.3	31.2	31.5	32.2	30.1	28.7	25.7
1978	24.4	27.3	31.9	33.0	31.4	31.2	31.2	31.7	31.3	31.9	30.1	27.1
1979	26.8	27.3	33.0	34.9	35.8	32.4	31.5	31.6	31.5	31.4	30.3	25.3
1980	24.7	28.0	32.0	35.7	31.9	31.6	31.0	31.4	31.5	30.5	29.5	26.6
Ave.	25.3	28.1	32.5	34.2	32.9	31.3	31.0	30.9	31.3	30.7	27.9	25.8

Table 1.2.2 (2/5) Meteorological Condition at Dhaka Station

Minimum Temperature (°C)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	13.2	13.5	22.1	23.8	25.3	26.0	26.4	26.2	25.7	23.8	16.3	11.3
1962	9.6	14.3	18.2	23.7	24.0	25.9	26.7	26.1	25.8	23.1	16.7	12.4
1963	10.6	15.2	18.8	22.0	24.1	25.9	26.5	26.6	26.2	23.5	17.7	13.5
1964	11.0	15.2	21.2	23.7	24.6	25.7	25.9	26.4	26.1	24.8	19.6	13.9
1965	11.8	14.3	18.0	23.4	25.7	25.7	26.0	25.4	25.8	23.2	18.0	14.3
1966	-	-	-	24.4	25.7	25.9	26.2	26.8	25.6	22.6	19.4	13.8
1967	12.9	15.8	19.4	22.0	25.0	26.0	26.4	26.2	25.5	22.8	15.9	13.4
1968	12.1	13.6	19.7	23.3	24.0	25.1	26.4	26.2	26.5	23.8	18.8	13.8
1969	11.8	14.4	20.6	23.6	25.5	26.0	26.5	25.5	26.3	23.3	18.3	13.9
1970	12.0	15.4	20.6	24.4	25.6	26.2	26.3	26.2	26.2	23.9	18.7	12.9
1971	12.9	14.5	-	-	23.7	25.7	25.6	24.6	25.3	24.2	17.3	-
1972	12.0	12.9	20.1	22.8	25.9	25.8	26.3	25.5	25.9	23.5	18.3	13.5
1973	12.4	16.5	19.3	24.7	23.6	25.7	-	25.9	25.5	24.1	19.1	14.1
1974	-	-	-	-	-	-	-	-	-	-	-	-
1975	12.3	15.6	19.9	23.9	24.7	26.0	25.7	25.9	25.3	24.4	18.0	12.1
1976	12.4	16.5	21.3	24.1	23.9	25.1	25.9	25.4	25.8	23.3	20.1	12.2
1977	11.7	15.0	22.2	22.2	23.1	25.2	26.3	26.7	26.1	22.8	20.2	13.3
1978	10.6	14.2	18.3	22.2	23.9	25.7	25.9	26.6	25.8	24.5	19.3	12.6
1979	12.4	14.1	19.8	24.0	26.3	26.5	26.6	26.5	26.1	23.9	20.9	14.5
1980	12.0	15.3	20.8	25.1	22.9	26.4	26.1	26.5	26.3	23.4	17.8	16.1
Ave.	11.9	14.8	20.0	23.5	24.6	25.8	26.2	26.1	25.9	23.6	18.4	13.4

Table 1.2.2 (3/5) Meteorological Condition at Dhaka Station

Relative Humidity (%)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	70	66	70	70	80	88	86	87	86	84	76	76
1962	70	66	49	68	79	87	85	86	85	78	74	74
1963	67	56	55	67	80	86	86	85	85	83	77	74
1964	69	66	63	76	79	86	88	85	85	86	77	72
1965	69	63	56	69	78	88	86	87	86	80	77	79
1966	-	-	-	66	72	86	85	87	86	82	75	76
1967	71	65	70	63	79	84	85	85	87	77	69	71
1968	68	60	56	69	76	88	86	85	82	80	74	73
1969	66	60	65	72	74	86	86	88	82	78	73	72
1970	70	62	62	72	75	86	87	86	85	85	74	71
1971	71	59	-	-	76	84	85	87	81	78	71	-
1972	69	63	60	73	77	83	86	87	81	77	71	68
1973	64	62	62	74	85	87	-	85	87	83	82	78
1974	-	-	-	-	-	-	-	-	-	-	-	-
1975	69	63	57	71	79	84	89	85	87	85	77	70
1976	66	67	64	66	80	87	87	87	83	79	74	71
1977	66	66	68	81	83	88	87	84	85	79	78	73
1978	67	61	53	73	84	88	86	83	86	80	72	68
1979	80	75	70	75	80	89	90	90	91	88	85	87
1980	69	66	64	69	81	85	86	85	85	81	70	69
Ave.	69	64	61	71	79	86	86	86	85	81	75	73

Table 1.2.2 (4/5) Meteorological Condition at Dhaka Station

Wind Speed (Knots)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	2.9	3.1	5.6	5.1	7.6	6.4	8.0	7.5	6.0	3.4	2.9	3.6
1962	4.6	4.1	5.0	8.4	5.3	5.8	6.4	5.2	7.6	2.3	2.6	3.7
1963	2.6	3.7	4.1	4.8	5.2	5.6	5.9	4.4	4.7	6.1	2.8	3.4
1964	3.2	3.4	5.3	8.3	4.8	5.3	4.5	5.6	6.0	5.0	4.1	3.6
1965	3.6	4.0	5.4	6.7	6.3	5.2	5.8	5.7	4.6	3.3	3.7	3.3
1966	-	-	-	8.5	5.8	9.1	5.3	4.5	3.8	6.3	3.0	2.8
1967	3.3	3.2	3.9	6.5	6.6	5.2	4.9	5.0	4.5	2.0	3.4	2.6
1968	3.1	3.0	4.4	5.4	4.8	4.1	4.6	4.5	3.7	2.9	3.2	3.0
1969	3.4	2.9	4.8	5.1	4.1	4.5	5.0	4.4	5.6	3.0	2.4	2.9
1970	3.3	3.1	5.0	5.8	6.4	4.7	4.4	4.5	3.6	3.6	3.5	3.0
1971	3.3	3.4	-	-	3.0	4.8	4.9	4.3	3.8	3.8	2.5	-
1972	3.0	3.3	5.5	6.0	6.0	4.4	7.2	4.8	3.4	4.5	3.1	3.1
1973	2.8	3.1	3.6	4.8	4.5	3.3	-	4.0	3.8	2.2	6.5	3.0
1974	-	-	-	-	-	-	-	-	-	-	-	-
1975	2.8	3.5	4.2	6.5	5.1	3.8	3.8	4.7	3.7	3.4	2.8	2.6
1976	2.8	3.8	5.5	5.8	5.0	5.1	5.4	5.0	4.5	2.9	2.9	2.0
1977	2.9	3.8	4.6	7.5	5.6	5.6	4.4	5.6	5.4	4.2	3.8	2.2
1978	3.4	4.3	5.5	4.7	5.0	5.2	4.1	5.5	3.0	4.0	3.1	3.7
1979	3.2	3.0	5.0	4.3	4.8	4.5	3.9	5.5	3.2	3.7	5.2	3.4
1980	2.7	2.9	5.2	7.4	4.5	4.0	4.5	3.6	4.2	5.9	2.0	2.6
Ave.	3.2	3.4	4.9	6.2	5.3	5.1	5.2	5.0	4.5	3.8	3.3	3.0

Table 1.2.2 (5/5) Meteorological Condition at Dhaka Station

Monthly Evaporation (mm)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1976	-	-	-	117.1	78.7	81.3	76.7	77.7	83.1	87.1	129.5	118.4
1977	105.9	95.0	105.4	98.0	86.4	72.9	70.1	81.5	78.0	67.8	45.2	30.2
1978	37.6	52.1	104.4	104.4	100.1	77.2	86.1	95.5	70.4	68.1	37.3	37.3
1979	36.8	48.3	113.0	-	-	-	-	-	-	-	-	-
Ave.	60.1	65.1	107.6	106.5	88.4	77.1	77.6	84.9	77.2	74.3	70.7	62.0

Daily Evaporation (mm)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1976	-	-	-	3.9	2.5	2.7	2.5	2.5	2.8	2.8	4.3	3.8
1977	3.4	3.4	3.4	3.3	2.8	2.4	2.3	2.6	2.6	2.2	1.5	1.0
1978	1.2	1.9	3.4	3.5	3.2	2.6	2.8	3.1	2.3	2.2	1.2	1.2
1979	1.2	1.7	1.6	-	-	-	-	-	-	-	-	-
Ave.	1.9	2.3	2.8	3.6	2.8	2.6	2.5	2.7	2.6	2.4	2.3	2.0

Table 1.2.3 Loss and Damage Caused by Different Cyclonic Storm in Bangladesh during 1960-86

No.	Disturbance	Date of occurrence	Loss and damage
1.	Severe cyclonic storm	11/10/'60	-
2.	Severe cyclonic storm	31/10/'60	People killed = 5,149
3.	Severe cyclonic storm	9/5/'61	People killed = 11,468
4.	Severe cyclonic storm	30/5/'61	-
5.	Severe cyclonic storm	28/5/'63	People killed = 11,520 Homestead lost = 1,000,000
6.	Severe cyclonic storm	11/5/'65	People killed = 19,279
7.	Severe cyclonic storm	5/11/'65	People killed = 873
8.	Severe cyclonic storm	15/12/'65	-
9.	Severe cyclonic storm	1/10/'66	People killed = 850
10.	The great November severe cyclonic storm (hurricane intensity)	12/11/'70	People killed = 500,000
11.	Severe cyclonic storm	28/11/'74	-
12.	Cyclonic storm	10/12/'81	People killed = 72
13.	Cyclonic storm	15/10/'83	-
14.	Severe cyclonic storm	9/11/'83	-
15.	Severe cyclonic storm	24/5/'85	People killed = 4,264 People missing = 6,805 Population affected = 1,310,935 Damage to crops in acres = 132,860 House damaged: Fully = 90,915 Partly = 34,611 Livestock lost = 135,033 Road damaged = 40 miles
16.	Cyclonic storm	9/11/'86	People killed = 14 Crop damaged in acres = 240,000

Table 1.2.4 Monthly Total Rainfall at Comilla Station

Unit : mm

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	6	30	21	116	182	639	382	577	114	134	0	0
1962	12	12	5	189	237	446	456	230	98	231	0	0
1963	-	-	-	-	-	-	-	-	-	-	-	-
1964	20	30	44	233	381	544	867	451	428	533	28	0
1965	0	0	14	0	53	756	595	810	261	49	99	14
1966	14	0	29	44	127	676	300	326	528	348	28	58
1967	-	0	130	212	186	204	393	295	443	272	0	0
1968	0	0	45	197	418	524	497	442	185	88	10	-
1969	0	0	57	237	41	791	559	562	366	26	27	0
1970	20	9	63	134	187	129	546	240	55	284	74	-
1971	5	10	-	-	-	-	291	307	172	166	57	-
1972	-	-	15	117	239	369	206	385	69	57	1	0
1973	10	30	53	72	445	489	332	138	127	198	160	0
1974	0	0	84	234	242	488	763	277	442	150	65	0
1975	0	43	6	84	194	259	517	143	273	171	128	0
1976	0	10	49	44	266	521	517	435	17	96	10	0
1977	0	78	7	359	392	417	435	116	149	132	35	5
1978	-	-	-	-	-	-	-	-	-	-	-	-
1979	7	8	35	20	26	173	167	486	344	157	29	6
1980	0	41	50	82	429	195	532	428	219	199	0	2
Ave.	6	18	39	140	238	448	464	369	238	183	42	6

Table 1.2.5 Monthly Total Rainfall at Dhaka Station

Unit : mm

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	1	12	20	205	219	856	296	288	221	52	0	0
1962	0	15	6	116	205	191	355	273	395	180	0	0
1963	0	0	51	98	219	621	404	186	201	182	7	3
1964	9	42	18	275	236	354	629	155	269	283	41	0
1965	0	28	22	55	305	442	304	480	300	50	131	0
1966	-	-	-	34	127	270	291	306	496	261	14	15
1967	23	13	168	185	216	241	363	504	266	74	1	0
1968	0	5	121	27	194	590	480	207	128	69	74	0
1969	0	1	65	86	95	249	198	540	201	103	2	0
1970	16	8	23	45	192	276	496	280	200	427	32	0
1971	3	28	-	-	344	339	550	540	259	118	95	-
1972	0	11	12	248	340	353	249	380	110	105	0	0
1973	0	21	32	131	621	414	-	238	348	128	64	86
1974	-	-	-	-	-	-	-	-	-	-	-	-
1975	1	29	13	98	317	235	559	307	329	232	25	0
1976	0	7	117	34	459	627	346	361	165	114	8	0
1977	0	66	71	255	381	252	306	92	131	273	10	24
1978	0	20	18	194	454	529	320	426	192	98	0	0
1979	3	13	6	17	114	258	267	525	382	146	55	51
1980	3	32	54	147	414	323	380	269	296	300	0	0
Ave.	3	20	48	125	287	391	377	335	257	168	29	10

Table 1.2.6 Monthly Rainfall at Daudkandi Station

Unit : mm

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1965	-	-	-	120.9	148.3	794.9	514.7	308.3	353.4	137.1	21.4	3.0	-
1966	3.3	0.0	24.6	80.0	53.6	522.2	531.7	390.8	321.3	425.4	63.3	50.1	2,466.3
1967	68.2	0.0	264.1	257.6	159.2	367.2	384.4	515.1	496.6	164.5	0.0	0.0	2,676.9
1968	0.0	0.0	68.0	175.4	516.4	361.3	894.8	451.7	104.3	171.4	76.2	0.0	2,819.5
1969	0.0	32.5	208.0	240.6	197.6	889.9	428.0	814.1	210.4	139.3	124.0	0.0	3,284.4
1970	20.3	33.8	176.0	173.4	156.4	535.2	575.0	378.0	490.6	640.5	99.0	0.0	3,278.2
1971	34.8	21.1	33.7	497.8	473.0	557.1	733.3	779.4	208.7	155.0	-	-	-
1972	-	0.0	43.2	105.4	98.6	91.5	652.2	197.9	159.9	58.9	0.0	0.0	-
1973	0.0	33.2	113.0	85.1	436.2	438.1	574.1	198.2	259.1	96.5	145.8	106.7	2,486.0
1974	0.0	0.0	213.4	65.9	196.9	419.1	661.7	379.7	323.8	213.4	10.2	0.0	2,484.1
1975	0.0	11.4	0.0	81.4	191.8	364.4	455.8	79.9	308.7	179.0	24.1	0.0	1,696.5
1976	0.0	3.8	68.5	121.9	251.3	665.4	496.6	425.4	302.9	80.1	76.2	0.0	2,492.1
1977	0.0	95.0	18.3	654.0	737.7	825.4	578.7	155.9	140.4	330.2	31.0	35.5	3,602.1
1978	0.0	62.2	88.9	302.3	738.4	503.9	358.1	408.9	518.2	107.9	0.0	0.0	3,088.8
1979	17.8	53.3	0.0	38.1	317.5	772.4	448.3	522.0	488.9	144.8	218.4	80.0	3,101.5
1980	0.0	128.3	86.4	181.6	749.3	509.3	574.0	586.7	505.5	66.0	0.3	0.0	3,387.4
1981	35.6	80.0	310.1	795.0	449.6	629.9	1077.0	881.4	602.0	23.1	0.0	99.1	4,982.8
1982	0.0	29.5	116.8	-	-	-	-	-	-	-	-	-	-
Ave.	11.3	34.4	107.8	233.9	345.4	544.0	584.6	439.6	340.9	184.3	55.6	23.4	3,219.0

Table 1.3.1 Water Level in Meghna River at Daudkandi Station

(Average between 1960 to 1988)

Unit : meter in PWD

Month	1st 10 Daily Average				2nd 10 Daily Average				3rd 10 Daily Average				Monthly Average				Max	Min.
	H	L	R	M	H	L	R	M	H	L	R	M	H	L	R	M		
Jan.	1.81	1.37	0.44	1.59	1.73	1.28	0.45	1.51	1.58	1.13	0.45	1.36	1.71	1.26	0.45	1.49	2.80	0.61
Feb.	1.60	1.12	0.48	1.36	1.50	1.00	0.50	1.25	1.44	0.94	0.50	1.19	1.52	1.03	0.49	1.28	2.26	0.22
Mar.	1.57	1.03	0.54	1.30	1.67	1.12	0.55	1.40	1.74	1.20	0.54	1.47	1.66	1.12	0.54	1.39	2.55	0.32
Apr.	2.02	1.43	0.59	1.73	2.16	1.60	0.56	1.88	2.26	1.71	0.55	1.99	2.15	1.58	0.57	1.87	3.20	0.64
May	2.43	1.92	0.51	2.18	2.64	2.15	0.49	2.40	2.93	2.46	0.47	2.70	2.67	2.18	0.49	2.43	3.69	1.07
Jun.	3.22	2.82	0.40	3.02	3.55	3.21	0.34	3.38	4.02	3.74	0.28	3.88	3.60	3.26	0.34	3.43	5.07	1.92
Jul.	4.40	4.16	0.24	4.28	4.67	4.48	0.19	4.58	4.90	4.72	0.18	4.81	4.66	4.46	0.20	4.56	5.66	3.20
Aug.	5.14	5.00	0.14	5.07	5.15	5.02	0.13	5.09	5.11	4.97	0.14	5.04	5.13	4.99	0.14	5.06	6.27	3.96
Sept.	5.08	4.95	0.13	5.02	4.89	4.73	0.16	4.81	4.79	4.64	0.15	4.72	4.92	4.77	0.15	4.85	6.34	2.22
Oct.	4.56	4.40	0.16	4.48	4.18	4.00	0.18	4.09	3.67	3.46	0.21	3.57	4.13	3.90	0.23	4.02	5.37	2.26
Nov.	3.13	2.88	0.25	3.01	2.75	2.47	0.28	2.61	2.52	2.18	0.34	2.35	2.79	2.51	0.28	2.65	4.18	1.58
Dec.	2.28	1.86	0.42	2.07	2.08	1.66	0.42	1.87	1.94	1.50	0.44	1.72	2.10	1.67	0.43	1.89	3.44	0.94

Note; H: High Water Level, L: Low Water Level, M: Mean Water Level, R: Range (High water level - Low water level)

SOURCE : BWDB

Table 1.3.2 (1/12) Water Level in Meghna River at Daudkandi Station

January

Unit : meter in PWD

Year	1st 10 Daily Average				2nd 10 Daily Average				3rd 10 Daily Average				Monthly Average				Max	Min.
	H	L	R	M	H	L	R	M	H	L	R	M	H	L	R	M		
1960																		
1961	1.77	1.24	0.53	1.51	1.64	1.05	0.59	1.35	1.60	1.02	0.58	1.31	1.67	1.10	0.57	1.39	2.13	0.82
1962	1.72	1.24	0.48	1.48	1.60	1.20	0.40	1.40	1.58	1.13	0.45	1.36	1.63	1.19	0.44	1.41	2.07	0.94
1963																		
1964	1.87	1.39	0.48	1.63	1.59	1.12	0.47	1.36	1.47	1.03	0.44	1.25	1.63	1.18	0.45	1.41	2.32	0.88
1965	1.83	1.26	0.57	1.55	1.59	1.02	0.57	1.31	1.55	0.99	0.56	1.27	1.65	1.09	0.56	1.37	1.95	0.79
1966																		
1967																		
1968																		
1969	1.49	0.95	0.54	1.22	1.73	1.16	0.57	1.45	1.61	1.02	0.59	1.32	1.61	1.04	0.57	1.33	1.86	0.79
1970																		
1971	1.86	1.42	0.44	1.64	1.92	1.34	0.58	1.63	1.76	1.28	0.48	1.52	1.85	1.35	0.50	1.60	2.16	1.62
1972									1.66	1.19	0.47	1.43						
1973									1.48	1.05	0.43	1.27						
1974	2.14	1.58	0.56	1.86	1.88	1.42	0.46	1.65	1.75	1.09	0.66	1.42	1.92	1.35	0.57	1.64	2.33	1.01
1975	1.82	1.25	0.57	1.54	1.87	1.26	0.61	1.57	1.81	1.35	0.46	1.58	1.84	1.29	0.55	1.57	2.21	0.98
1976	2.02	1.77	0.25	1.90	1.85	1.60	0.25	1.73	1.81	1.47	0.34	1.64	1.89	1.61	0.28	1.75	2.27	1.33
1977	1.72	1.20	0.52	1.46	1.78	1.23	0.55	1.51	1.53	1.09	0.44	1.31	1.67	1.17	0.50	1.42	2.04	0.91
1978	1.85	1.35	0.50	1.60	1.97	1.45	0.52	1.71	1.56	1.14	0.42	1.35	1.78	1.31	0.47	1.55	2.13	1.07
1979	1.75	1.38	0.37	1.57	1.62	1.22	0.40	1.42	1.54	1.10	0.44	1.32	1.64	1.23	0.41	1.44	2.10	0.61
1980																		
1981																		
1982	1.95	1.57	0.38	1.76	2.11	1.71	0.40	1.91	1.91	1.54	0.37	1.73	1.99	1.61	0.38	1.80	1.91	1.43
1983	1.66	1.37	0.29	1.52	1.53	1.32	0.21	1.43	1.44	1.20	0.24	1.32	1.54	1.30	0.24	1.42	2.05	1.11
1984	1.51	1.18	0.33	1.35	1.41	1.13	0.28	1.27	1.38	1.07	0.31	1.23	1.43	1.12	0.31	1.28	1.72	0.80
1985	1.53	1.19	0.34	1.36	1.30	0.88	0.42	1.09	1.15	0.78	0.37	0.97	1.32	0.94	0.38	1.13	1.70	0.65
1986	1.70	1.17	0.53	1.44	1.71	1.12	0.59	1.42	1.58	0.95	0.63	1.27	1.66	1.08	0.58	1.37	2.02	0.87
1987	2.47	2.09	0.38	2.28	2.12	1.72	0.40	1.92	1.46	1.14	0.32	1.30	2.00	1.63	0.37	1.82	2.80	0.96
1988	1.85	1.62	0.23	1.74	1.28	1.19	0.09	1.24	1.14	1.04	0.10	1.09	1.41	1.28	0.13	1.35	2.04	0.92
Ave.	1.82	1.38	0.44	1.60	1.71	1.27	0.44	1.49	1.56	1.13	0.43	1.34	1.69	1.26	0.43	1.47	2.80	0.61

Note; H: High Water Level, L: Low Water Level, M: Mean Water Level, R: Range (High water level - Low water level)

Table 1.3.2 (2/12) Water Level in Meghna River at Daudkandi Station

February

Unit : meter in PWD

Year	1st 10 Daily Average				2nd 10 Daily Average				3rd 10 Daily Average				Monthly Average				Max	Min.
	H	L	R	M	H	L	R	M	H	L	R	M	H	L	R	M		
1960																		
1961	1.62	1.05	0.57	1.34	1.45	0.85	0.60	1.15	1.31	0.84	0.47	1.08	1.47	0.92	0.55	1.20	1.86	0.55
1962	1.78	1.22	0.56	1.50	1.58	1.11	0.47	1.35	1.68	1.16	0.52	1.42	1.68	1.17	0.51	1.43	2.07	0.91
1963																		
1964	1.59	1.10	0.49	1.35	1.51	1.10	0.41	1.31	1.59	1.10	0.49	1.35	1.56	1.10	0.46	1.33	1.86	0.88
1965	1.64	1.15	0.49	1.40	1.53	0.94	0.59	1.24	1.47	0.82	0.65	1.15	1.55	0.98	0.57	1.27	1.72	0.64
1966																		
1967																		
1968																		
1969	1.54	0.88	0.66	1.21	1.53	0.97	0.56	1.25	1.48	0.97	0.51	1.23	1.52	0.94	0.58	1.23	1.74	0.73
1970																		
1971	1.78	1.14	0.64	1.46	1.71	1.01	0.70	1.36	1.68	0.92	0.76	1.30	1.72	1.02	0.70	1.37	2.26	0.76
1972	1.55	1.10	0.45	1.33	1.58	1.09	0.49	1.34	1.35	0.89	0.46	1.12	1.50	1.03	0.47	1.27	1.94	0.73
1973	1.63	1.10	0.53	1.37	1.60	1.05	0.55	1.33	1.44	0.98	0.46	1.21	1.57	1.05	0.52	1.31	1.94	0.75
1974	1.74	1.28	0.46	1.51	1.59	1.06	0.53	1.33	1.80	0.98	0.82	1.39	1.70	1.12	0.58	1.41	1.94	0.88
1975	1.70	1.23	0.47	1.47	1.67	1.12	0.55	1.40	1.42	0.65	0.77	1.04	1.61	1.02	0.59	1.32	2.03	0.37
1976	1.67	1.27	0.40	1.47	1.79	1.40	0.39	1.60	1.63	1.32	0.31	1.48	1.70	1.33	0.37	1.52	2.24	1.14
1977	1.94	1.34	0.60	1.64	1.92	1.27	0.65	1.60	1.88	1.28	0.60	1.58	1.91	1.30	0.61	1.61	2.07	1.13
1978	1.45	1.05	0.40	1.25	1.41	0.92	0.49	1.17	1.31	0.79	0.52	1.05	1.40	0.93	0.47	1.17	1.71	0.67
1979	1.16	0.93	0.23	1.05	1.24	0.79	0.45	1.02	1.46	1.01	0.45	1.24	1.29	0.91	0.38	1.10	1.89	0.64
1980																		
1981																		
1982	1.68	1.35	0.33	1.52	1.39	1.00	0.39	1.20	1.25	1.00	0.25	1.13	1.44	1.12	0.32	1.28	1.83	0.88
1983	1.54	1.18	0.36	1.36	1.39	1.09	0.30	1.24	1.28	1.05	0.23	1.17	1.40	1.10	0.30	1.25	1.98	0.91
1984	1.44	1.04	0.40	1.24	1.03	0.58	0.45	0.81	0.86	0.32	0.54	0.59	1.12	0.66	0.46	0.89	1.52	0.22
1985	1.38	0.88	0.50	1.13	1.23	0.82	0.41	1.03	1.20	0.85	0.35	1.03	1.28	0.85	0.43	1.07	1.95	0.60
1986	1.63	1.00	0.63	1.32	1.38	0.89	0.49	1.14	1.57	0.90	0.67	1.24	1.52	0.93	0.59	1.23	1.84	0.66
1987	1.59	1.23	0.36	1.41	1.61	1.10	0.51	1.36	1.31	1.12	0.19	1.22	1.51	1.15	0.36	1.33	1.88	0.84
1988	1.50	1.19	0.31	1.35	2.08	1.69	0.39	1.89	1.67	1.40	0.27	1.54	1.75	1.43	0.32	1.59	2.19	0.94
Ave.	1.598	1.129	0.469	1.363	1.534	1.04	0.494	1.287	1.459	0.969	0.49	1.214	1.533	1.05	0.483	1.292	2.26	0.22

Note; H: High Water Level, L: Low Water Level, M: Mean Water Level, R: Range (High water level - Low water level)

Table 1.3.2 (3/12) Water Level in Meghna River at Daudkandi Station

March

Unit : meter in PWD

Year	1st 10 Daily Average				2nd 10 Daily Average				3rd 10 Daily Average				Monthly Average				Max	Min.
	H	L	R	M	H	L	R	M	H	L	R	M	H	L	R	M		
1960																		
1961	2.06	1.32	0.74	1.69	2.16	1.51	0.65	1.84	1.94	1.50	0.44	1.72	2.05	1.45	0.60	1.75	2.50	0.98
1962	1.71	1.14	0.57	1.43	1.56	1.06	0.50	1.31	1.64	1.04	0.60	1.34	1.63	1.08	0.55	1.36	2.07	0.85
1963																		
1964	1.64	1.06	0.58	1.35	1.68	1.17	0.51	1.43	1.63	1.05	0.58	1.34	1.65	1.09	0.56	1.37	1.84	0.91
1965	1.62	0.97	0.65	1.30	1.48	0.89	0.59	1.19	1.52	0.93	0.59	1.23	1.54	0.93	0.61	1.24	1.77	0.76
1966																		
1967																		
1968																		
1969	1.46	0.99	0.47	1.23	1.78	1.16	0.62	1.47	1.83	1.23	0.60	1.53	1.70	1.13	0.57	1.42	2.13	0.70
1970																		
1971	1.70	0.91	0.79	1.31	1.66	1.01	0.65	1.34	1.89	1.22	0.67	1.56	1.75	1.05	0.70	1.40	2.23	0.76
1972	1.47	0.97	0.50	1.22	1.78	1.26	0.52	1.52	1.62	1.14	0.48	1.38	1.62	1.12	0.50	1.37	2.07	0.76
1973	1.71	1.01	0.70	1.36	1.54	1.12	0.42	1.33	1.60	1.16	0.44	1.38	1.62	1.10	0.52	1.36	1.84	0.87
1974	1.76	1.29	0.47	1.53	1.70	1.08	0.62	1.39	1.81	1.28	0.53	1.55	1.76	1.22	0.54	1.49	2.23	0.82
1975	1.60	1.06	0.54	1.33	1.54	1.07	0.47	1.31	1.60	1.10	0.50	1.35	1.58	1.08	0.50	1.33	2.01	0.99
1976	1.59	1.06	0.53	1.33	1.71	1.12	0.59	1.42	1.63	1.21	0.42	1.42	1.64	1.13	0.51	1.39	2.12	0.94
1977	1.81	1.29	0.52	1.55	2.06	1.38	0.68	1.72	1.97	1.24	0.73	1.61	1.95	1.30	0.65	1.63	2.29	1.13
1978	1.35	0.80	0.55	1.08	1.59	0.91	0.68	1.25	1.66	0.97	0.69	1.32	1.54	0.90	0.64	1.22	1.89	0.67
1979	1.39	1.04	0.35	1.22	1.60	1.09	0.51	1.35	1.80	1.26	0.54	1.53	1.60	1.13	0.47	1.37	2.06	0.76
1980																		
1981																		
1982	1.36	0.92	0.44	1.14	1.49	1.04	0.45	1.27	1.50	1.24	0.26	1.37	1.45	1.07	0.38	1.26	1.94	0.84
1983	1.32	1.15	0.17	1.24	1.51	1.32	0.19	1.42	1.99	1.53	0.46	1.76	1.61	1.34	0.27	1.48	2.55	1.11
1984	1.11	0.62	0.49	0.87	1.49	0.83	0.66	1.16	1.83	1.41	0.42	1.62	1.49	0.96	0.53	1.23	2.20	0.32
1985	1.56	1.03	0.53	1.30	1.60	1.09	0.51	1.35	1.73	1.25	0.48	1.49	1.63	1.12	0.51	1.38	1.95	0.80
1986	1.63	0.96	0.67	1.30	1.86	1.20	0.66	1.53	2.01	1.30	0.71	1.66	1.83	1.16	0.67	1.50	2.38	0.86
1987	1.67	1.15	0.52	1.41	1.69	1.14	0.55	1.42	1.69	1.12	0.57	1.41	1.69	1.14	0.55	1.42	2.29	0.80
1988	1.63	1.32	0.31	1.48	1.71	1.40	0.31	1.56	1.84	1.37	0.47	1.61	1.73	1.36	0.37	1.55	2.21	1.15
Ave.	1.579	1.05	0.528	1.315	1.676	1.136	0.54	1.406	1.749	1.217	0.532	1.483	1.67	1.136	0.533	1.403	2.55	0.32

Note; H: High Water Level, L: Low Water Level, M: Mean Water Level, R: Range (High water level - Low water level)

Table 1.3.2 (4/12) Water Level in Meghna River at Daudkandi Station

April

Unit : meter in PWD

Year	1st 10 Daily Average				2nd 10 Daily Average				3rd 10 Daily Average				Monthly Average				Max	Min.
	H	L	R	M	H	L	R	M	H	L	R	M	H	L	R	M		
1960	1.46	0.82	0.64	1.14	1.83	1.11	0.72	1.47	1.80	1.07	0.73	1.44	1.70	1.00	0.70	1.35	1.98	0.64
1961	2.08	1.50	0.58	1.79	2.02	1.45	0.57	1.74	1.92	1.40	0.52	1.66	2.01	1.45	0.56	1.73	2.26	1.19
1962	2.16	1.53	0.63	1.85	1.89	1.30	0.59	1.60	2.29	1.56	0.73	1.93	2.11	1.46	0.65	1.79	2.44	1.04
1963	1.72	1.13	0.59	1.43	1.78	1.22	0.56	1.50	2.20	1.52	0.68	1.86	1.90	1.29	0.61	1.60	2.32	1.07
1964	1.85	1.12	0.73	1.49	2.39	1.69	0.70	2.04	2.35	1.65	0.70	2.00	2.20	1.49	0.71	1.85	2.68	1.04
1965																		
1966																		
1967																		
1968	1.97	1.31	0.66	1.64	2.40	1.65	0.75	2.03	2.33	1.52	0.81	1.93	2.23	1.49	0.74	1.86	2.61	1.25
1969	1.83	1.25	0.58	1.54	2.04	1.21	0.83	1.63	2.19	1.33	0.86	1.76	2.02	1.26	0.76	1.64	2.41	1.04
1970	2.05	1.51	0.54	1.78	2.19	1.54	0.65	1.87	2.26	1.62	0.64	1.94	2.17	1.56	0.61	1.87	2.38	1.37
1971	2.02	1.37	0.65	1.70	2.03	1.43	0.60	1.73	2.12	1.51	0.61	1.82	2.06	1.44	0.62	1.75	2.23	1.28
1972	1.90	1.37	0.53	1.64	2.17	1.63	0.54	1.90	2.18	1.52	0.66	1.85	2.08	1.51	0.57	1.80	2.59	1.07
1973	2.01	1.15	0.86	1.58	2.23	1.57	0.66	1.90	2.28	1.76	0.52	2.02	2.17	1.49	0.68	1.83	2.65	0.93
1974	2.18	1.67	0.51	1.93	1.98	1.54	0.44	1.76	2.49	1.95	0.54	2.22	2.22	1.72	0.50	1.97	2.59	1.33
1975	1.83	1.26	0.57	1.55	2.06	1.39	0.67	1.73	2.43	1.86	0.57	2.15	2.11	1.50	0.61	1.81	2.70	1.22
1976	1.56	1.18	0.38	1.37	2.16	1.71	0.45	1.94	1.98	1.59	0.39	1.79	1.90	1.49	0.41	1.70	2.50	1.08
1977	2.87	2.15	0.72	2.51	2.98	2.36	0.62	2.67	2.84	2.45	0.39	2.65	2.90	2.32	0.58	2.61	3.20	1.34
1978	1.77	1.07	0.70	1.42	1.92	1.41	0.51	1.67	2.25	1.68	0.57	1.97	1.98	1.39	0.59	1.69	2.44	0.88
1979																		
1980																		
1981	1.94	1.32	0.62	1.63	2.33	1.57	0.76	1.95	2.30	1.85	0.45	2.08	2.19	1.58	0.61	1.89	2.59	0.94
1982	2.39	1.99	0.40	2.19	2.21	1.88	0.33	2.05	2.42	2.02	0.40	2.22	2.34	1.96	0.38	2.15	2.88	1.56
1983	2.10	1.70	0.40	1.90	1.74	1.52	0.22	1.63	2.41	2.15	0.26	2.28	2.09	1.79	0.30	1.94	2.75	1.18
1984	2.31	1.96	0.35	2.14	2.37	1.90	0.47	2.14	2.34	1.95	0.39	2.15	2.34	1.94	0.40	2.14	2.84	1.35
1985	2.53	1.83	0.70	2.18	2.24	1.91	0.33	2.08	1.60	1.36	0.24	1.48	2.12	1.70	0.42	1.91	2.82	1.07
1986	2.05	1.38	0.67	1.72	2.43	1.84	0.59	2.14	2.77	2.15	0.62	2.46	2.42	1.79	0.63	2.11	3.08	1.13
1987	1.83	1.32	0.51	1.58	2.24	1.83	0.41	2.04	2.33	1.92	0.41	2.13	2.13	1.69	0.44	1.91	2.55	1.20
1988	2.02	1.51	0.51	1.77	2.20	1.68	0.52	1.94	2.21	1.70	0.51	1.96	2.09	1.63	0.46	1.86	2.46	1.32
Ave.	2.02	1.43	0.58	1.73	2.16	1.60	0.56	1.88	2.26	1.71	0.55	1.99	2.15	1.58	0.56	1.86	3.20	0.64

Note; H: High Water Level, L: Low Water Level, M: Mean Water Level, R: Range (High water level - Low water level)

Table 1.3.2 (5/12) Water Level in Meghna River at Daudkandi Station

May

Unit : meter in PWD

Year	1st 10 Daily Average				2nd 10 Daily Average				3rd 10 Daily Average				Monthly Average				Max	Min.
	H	L	R	M	H	L	R	M	H	L	R	M	H	L	R	M		
1960	1.85	1.18	0.67	1.52	2.16	1.40	0.76	1.78	2.48	1.79	0.69	2.14	2.18	1.47	0.71	1.83	2.90	1.13
1961	2.42	1.79	0.63	2.11	2.55	1.82	0.73	2.19	2.81	2.32	0.49	2.57	2.60	1.99	0.61	2.30	3.29	1.65
1962	2.45	1.81	0.64	2.13	2.19	1.59	0.60	1.89	2.75	2.09	0.66	2.42	2.47	1.84	0.63	2.16	3.14	1.43
1963	2.08	1.49	0.59	1.79	2.12	1.50	0.62	1.81	2.51	1.87	0.64	2.19	2.25	1.63	0.62	1.94	2.59	1.40
1964	2.63	1.83	0.80	2.23	3.21	2.92	0.29	3.07	3.12	2.57	0.55	2.85	2.99	2.44	0.55	2.72	3.26	1.71
1965																		
1966																		
1967																		
1968	2.37	1.55	0.82	1.96	2.78	2.15	0.63	2.47	3.04	2.45	0.59	2.75	2.73	2.05	0.68	2.39	3.10	1.48
1969	2.32	1.35	0.97	1.84	2.25	1.36	0.89	1.81	2.66	1.91	0.75	2.29	2.42	1.55	0.87	1.99	3.13	1.19
1970	2.66	1.99	0.67	2.33	3.02	2.45	0.57	2.74	3.37	2.89	0.48	3.13	3.03	2.46	0.57	2.75	3.51	1.77
1971	2.22	1.60	0.62	1.91	2.54	1.91	0.63	2.23	3.28	2.73	0.55	3.01	2.70	2.10	0.60	2.40	3.69	1.49
1972	2.22	1.90	0.32	2.06	2.88	2.39	0.49	2.64	3.06	2.70	0.36	2.88	2.73	2.34	0.39	2.54	3.14	1.80
1973	2.73	2.43	0.30	2.58	2.93	2.53	0.40	2.73	3.15	2.95	0.20	3.05	2.94	2.65	0.29	2.80	3.40	2.24
1974	2.81	2.58	0.23	2.70	2.78	2.48	0.30	2.63	3.08	2.79	0.29	2.94	2.90	2.62	0.28	2.76	3.32	2.13
1975	2.21	1.89	0.32	2.05	2.60	2.31	0.29	2.46	2.82	2.52	0.30	2.67	2.55	2.25	0.30	2.40	2.97	1.65
1976	2.39	1.87	0.52	2.13	2.71	2.35	0.36	2.53	2.53	2.18	0.35	2.36	2.54	2.14	0.40	2.34	2.87	1.65
1977	3.05	2.48	0.57	2.77	3.18	2.70	0.48	2.94	3.22	2.87	0.35	3.05	3.15	2.69	0.46	2.92	3.51	2.32
1978	2.37	1.79	0.58	2.08	2.47	1.87	0.60	2.17	3.39	2.68	0.71	3.04	2.74	2.11	0.63	2.43	3.57	1.07
1979																		
1980																		
1981	2.42	1.84	0.58	2.13	2.53	1.91	0.62	2.22	2.78	2.30	0.48	2.54	2.57	2.01	0.56	2.29	2.86	1.71
1982	2.46	2.06	0.40	2.26	2.41	1.98	0.43	2.20	2.69	2.24	0.45	2.47	2.52	2.09	0.43	2.31	2.91	1.76
1983	2.41	2.20	0.21	2.31	2.70	2.46	0.24	2.58	2.98	2.45	0.53	2.72	2.70	2.37	0.33	2.54	3.30	2.15
1984	2.79	2.20	0.59	2.50	3.11	2.68	0.43	2.90	3.47	3.17	0.30	3.32	3.14	2.70	0.44	2.92	3.60	2.07
1985	2.10	1.77	0.33	1.94	1.99	1.71	0.28	1.85	2.50	2.15	0.35	2.33	2.20	1.89	0.31	2.05	2.77	1.30
1986	2.66	2.12	0.54	2.39	2.77	2.29	0.48	2.53	3.14	2.52	0.62	2.83	2.87	2.32	0.55	2.60	3.28	1.98
1987	2.04	1.90	0.14	1.97	2.42	1.97	0.45	2.20	2.42	2.06	0.36	2.24	2.30	1.98	0.32	2.14	2.65	1.80
1988	2.85	2.58	0.27	2.72	3.10	2.91	0.19	3.01	3.27	3.02	0.25	3.15	3.08	2.84	0.24	2.96	3.43	1.96
Ave.	2.438	1.925	0.513	2.181	2.642	2.152	0.49	2.397	2.938	2.468	0.471	2.703	2.679	2.189	0.49	2.434	3.69	1.07

Note; H: High Water Level, L: Low Water Level, M: Mean Water Level, R: Range (High water level - Low water level)

Table 1.3.2 (6/12) Water Level in Meghna River at Daudkandi Station

June

Unit : meter in PWD

Year	1st 10 Daily Average				2nd 10 Daily Average				3rd 10 Daily Average				Monthly Average				Max	Min.
	H	L	R	M	H	L	R	M	H	L	R	M	H	L	R	M		
1960	2.73	2.14	0.59	2.44	3.22	2.90	0.32	3.06	3.38	3.19	0.19	3.29	3.11	2.74	0.37	2.93	3.45	1.92
1961	3.30	2.88	0.42	3.09	3.58	3.37	0.21	3.48	3.65	3.48	0.17	3.57	3.51	3.24	0.27	3.38	3.84	2.68
1962	3.42	3.08	0.34	3.25	3.57	3.25	0.32	3.41	3.93	3.62	0.31	3.78	3.62	3.31	0.31	3.47	4.11	2.83
1963	3.08	2.47	0.61	2.78	3.65	3.24	0.41	3.45	4.32	4.01	0.31	4.17	3.68	3.24	0.44	3.46	4.42	1.98
1964	3.16	2.54	0.62	2.85	3.65	3.05	0.60	3.35	4.08	3.52	0.56	3.80	3.63	3.04	0.59	3.34	4.27	2.44
1965																		
1966																		
1967																		
1968	3.27	2.80	0.47	3.04	3.69	3.30	0.39	3.50	4.01	3.67	0.34	3.84	3.69	3.26	0.43	3.48	4.38	2.49
1969	3.29	2.78	0.51	3.04	3.53	3.06	0.47	3.30	3.96	3.78	0.18	3.87	3.59	3.21	0.38	3.40	4.15	2.65
1970	3.44	3.00	0.44	3.22	3.69	3.25	0.44	3.47	4.15	3.74	0.41	3.95	3.76	3.33	0.43	3.55	4.46	2.87
1971	3.57	2.94	0.63	3.26	3.93	3.45	0.48	3.69	4.27	3.90	0.37	4.09	3.92	3.43	0.49	3.68	4.34	2.87
1972	3.06	2.88	0.18	2.97	3.26	3.13	0.13	3.20	4.18	3.81	0.37	4.00	3.50	3.27	0.23	3.39	5.07	2.68
1973	3.34	3.06	0.28	3.20	3.71	3.52	0.19	3.62	4.65	4.47	0.18	4.56	3.90	3.68	0.22	3.79	4.95	3.00
1974	3.36	3.03	0.33	3.20	3.52	3.21	0.31	3.37	4.09	3.94	0.15	4.02	3.65	3.39	0.26	3.52	4.40	2.96
1975	2.87	2.62	0.25	2.75	3.24	2.92	0.32	3.08	3.57	3.39	0.18	3.48	3.22	2.97	0.25	3.10	3.79	2.44
1976	2.93	2.66	0.27	2.80	3.76	3.59	0.17	3.68	4.08	3.93	0.15	4.01	3.59	3.39	0.20	3.49	4.21	2.44
1977	3.90	3.44	0.46	3.67	4.05	3.76	0.29	3.91	4.30	4.06	0.24	4.18	4.09	3.75	0.34	3.92	4.48	3.02
1978	3.41	3.10	0.31	3.26	3.62	3.39	0.23	3.51	4.30	4.10	0.20	4.20	3.78	3.69	0.09	3.74	4.48	3.05
1979																		
1980																		
1981	3.17	2.71	0.46	2.94	3.27	2.76	0.51	3.02	3.60	3.07	0.53	3.34	3.34	2.95	0.39	3.15	3.69	2.44
1982	2.73	2.23	0.50	2.48	3.33	2.93	0.40	3.13	4.21	3.93	0.28	4.07	3.42	3.03	0.39	3.23	4.30	2.04
1983	3.02	2.50	0.52	2.76	3.29	2.71	0.58	3.00	3.83	3.39	0.44	3.61	3.38	2.87	0.51	3.13	4.40	2.40
1984	3.71	3.46	0.25	3.59	4.04	3.82	0.22	3.93	4.55	4.28	0.27	4.42	4.10	3.85	0.25	3.98	4.75	3.20
1985	3.49	3.24	0.25	3.37	3.65	3.43	0.22	3.54	4.02	3.80	0.22	3.91	3.72	3.49	0.23	3.61	4.21	2.50
1986	2.85	2.29	0.56	2.57	3.29	2.75	0.54	3.02	3.90	3.46	0.44	3.68	3.35	2.84	0.51	3.10	4.23	2.18
1987	2.49	2.19	0.30	2.34	2.74	2.44	0.30	2.59	3.52	3.29	0.23	3.41	2.92	2.64	0.28	2.78	3.73	2.09
1988	3.88	3.64	0.24	3.76	4.01	3.82	0.19	3.92	4.13	4.00	0.13	4.07	4.01	3.82	0.19	3.92	4.21	3.48
Ave.	3.228	2.82	0.408	3.024	3.554	3.21	0.343	3.382	4.028	3.743	0.285	3.886	3.603	3.268	0.335	3.436	5.07	1.92

Note; H: High Water Level, L: Low Water Level, M: Mean Water Level, R: Range (High water level - Low water level)