亜西８５－４４

郡（ウパジラ）制度の概略
（在バングラデシュ大使館報告）

昭和６０年４月

アジア局南西アジア課

１９８２年３月エルシャド政権発足以来の懸案である民政移管への実現については，先般行われたエルシャド大統領の政策に係わる国民の信を問う国民投票に続き同民政移管政策の一環として来る５月１６日及び２０日の両日，郡（ウパジラ）議会議長選挙が実施される予定のところ，今般在バングラデシュ大使館より郡（ウパジラ）制度の概略につき報告越した。右報告はバングラデシュの地方行政組織を知るうえで有益な資料と思料されるので印刷の上御覧に供することとした。

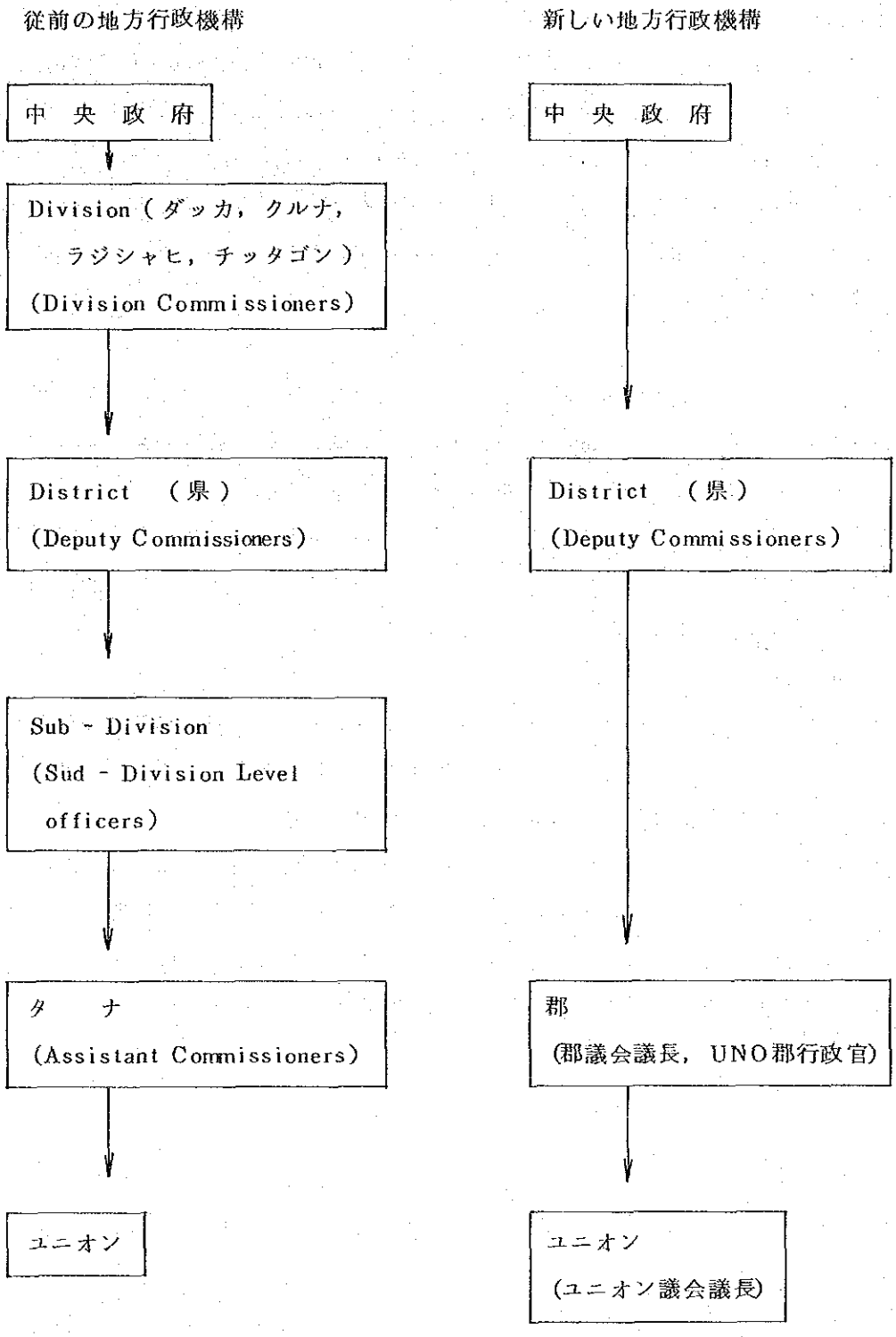
南西アジア課長

1. 経　緯

エルシャド大統領は農村部の経済開発に不可欠であるとして行政の地方分権化を重点政策の一つとして掲げてきた。行政の地方分権化は従来中央政府と農村人口との間に地方行政機関が幾層にも重なり（下表参照）農村部の経済開発が必ずしも円滑に実施されていなかったことを反省して，地方行政機関の簡素化と農村開発の核となるべき郡（Upazilla）の機能強化を目ざしたものである。

郡は郡議会（構成等は後述）を持ち，議長は直接選挙によって選ばれる。エルシャド政権は８４年３月に郡議会議長選の実施を予定していたが，右選挙が現政権の地方での基盤作りに利用されるとの野党側の激しい反対にあい，中止を余儀なくされた。

しかし「エ」大統領は，本年３月の国民投票で自身の政策に国民の圧倒的支持が得られたとして，５月１６，２０日の両日に分け郡議会議長選を実施する予定である。なお同選挙は非政党ベースで行われ立候補者の所属政党は明らかにされないのが建前である。


従前の地方行政機構
中 央 政 府
Division（ダッカ，クルナ，
ラジシャヒ，チッタゴン）
(Division Commissioners)
District （県）
(Deputy Commissioners)
Sub - Division
(Sud - Division Level
officers)
タ ナ
(Assistant Commissioners)
ユニオン
新しい地方行政機構
中 央 政 府
District （県）
(Deputy Commissioners)
郡
(郡議会議長，UNO郡行政官)
ユニオン
(ユニオン議会議長)

2. 郡制度の概略

郡は全国で４６０（４月１２日現在）あり，地方によって差はあるものの，面積約１２５平方マイル人口約２０万人程度が典型的な郡の大きさである。郡庁所在地には郡議会がおかれ，ウパジラ内の行政を執行する為にUNO（Upazilla Nirbahi Officer　郡行政官）を長としてその下に中央政府各省庁よりの出向者等からなる農業，教育，保健等各分野の担当官が配置される。これら出向の行政官の任免権は中央省庁にあるものの，職務の遂行に関し郡議会に責任を負うものとされる。

(1) 郡議会の構成

郡議会議長は，当該郡に住居を有する２５才以上の者に被選挙権があり，直接選挙によって選ばれる。任期は５年，俸給は月1,２５０タカ。議長は中央省庁のDeputy Secretary（課長レベル）又は陸海空軍の少佐と同等のランクとみなされる。郡議会は，議長の他，郡内のユニオン議会議長（民選）女性３名，男性１名の政府指名議員，郡中央協同組合委員長，及び郡内で政府が定める公職に就いている者を議員として，いるが，議長及びユニオン議会議長のみが議決権を有する。

(2) 郡議会の機能

郡議会の果たす重要な役割としては，(イ)Food for Work Proqram 等個々の郡限りの重要性を有する開発計画の策定及び実施，(ロ)政府年次開発計画のうち広域に亘らず，分割し得る部分（食糧倉庫の建設，地域林業の振興等）の実施が挙げられる。

財源としては，郡議会は市場税，興行税，橋，フェリー使用税等の地方税を徴収することができることになっているが８１／８２会計年度ですべての地方行政機関の地方税収入が6.４６億タカ（８４年世銀資料）に過ぎないことから，中央政府からの交付金（１ウパジラ当りの平均約５００万タカが大部分を占めることとなろう。

主管部長	文書管理課長	主管課長	情報管理課長	図書資料室受付印

収集資料リスト

昭和　　年　　月　　日　作成

地域		調査団		調査の種類		作成部課	
国名		等名称		現地調査期間	年　月　日～　年　月　日	担当者氏名	

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1	Ground Water Invcs igation in Rajshahi, Pabna, and Bogra Districts						Ground Water Circle Bangladesh						
	for the Years 1971 — 1976						Water Development Board, Dacca						
2	Ground Water Investigation in Rajshahi, Pabna and Bogra Districts						Ground Water Circle Bangladesh						
	for the Years 1971 — 1976 # 11						Water Development Board, Dacca						
3	Recennaissance Soil Survey, Rajshahi District 1968 # 6B						Departuent of Soil Survey,						
							Govemment of The Peoples						
							Republic of Bangladesh.						
4	Reconnaissance Soil Survey, Rajshahi District 1966 # 6A						Deppartment of Soil Survey,						
							Govermment of The Peoples						
							Republic of Bangladesh						
5	Ground Water Inrestingation in Rajshai, Pabra, and Bogra Districts						Groud Water Data Processing &						
	for The Years 1979 — 1981 # 13						Research Cirde, Bangladesh Water						
							Development Board, Dhaka						
6	Ground Water Investigation in Rajshai, Pabna, and Bogra Districts						Ground Water Circle, Bangladesh						
	for The Years 1977 — 1978 # 12						Water Development Board, Dalla						
7	Daily & Monthly Evaporation in Bangladesh(April 1976 to March 1980)						Hydrological Survey of Bangladesh						
							Bangladesh Water Development						
							Booard, Dhaka						
8	North Rajshahi Irrigation Project, Preliminary Report						Raishahi Water Development						
							Division — Ⅱ, Bangladesh						
9	Inventory of Works as of June, 1981 # 16						Directorate of River Morphology,						

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							Research,and Trainig, Bangladesh						
							Water Development Board,Della						
10	Climatological Data and Charts 1961－1980						Bangladesh Mereorological						
							Department						
11	Ground Water Investigation in Rajsbahi, Dinajpar, Rangpus, Pabna						Grand Water Circle-Ⅱ,						
	& Bogra Districts for The Years 1982－1983						Bangladesh Water Devebpment						
							Board, Dhaka						
13	Ground Water Investigation investigation in Dinajpur, Rangpur,						Ground Water Circle-Ⅱ,						
	Bogra, Rajshahi, Pabna, Kushtia, Jessore and Khulna Districts for						Bangladesh Water Development						
	The Year－1984 ＃14						Board, Dbaka						
14	Rain Fall Director, Planning general						Bangladesh Water Development						
							Board						
15	Map of Bangladesh ＃4						Government of Bangladesh						
16	Bangladesh, Rice Area Planted by Culture Type						The international Rice						
							Restarcbiosntutc						
17	Bangladesh, Hydrogical Network (Bangladesh Water Development						United Nations Department of						
	Board, United Nations Development Programme)＃15						Technical Co-operation for						
							Development						
18	W.L Director, Planning General ＃10						Bangladesh Water Development						
							Board						
19	Discharge Director, Planning General ＃10						Bangladesh Water Development						
							Board						
20	1986 Statistical Yearbook of Bangladesh ＃1						Bangladesh Bureau of Statistics						
21	Evaluation of Second Five Year Plan And Proposal for Tbird						Ministry of Irrigation, Water						
	Five Year Plon 1985－1990 ＃2						Derelopment and Flood Control						
22	Socio Economic Indicators of Bangladesh ＃1A						Bangladesh Bureau of Statistics						
23	Hydrogeological Mop of Rajshahi District ＃5						Ground Water Circle-Ⅱ,						
							Bangladesh						

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24	Schedule of Rates for Ralshahi Circle (Chalan Beel & Sirdp)						Water Development Board,						
							Dhaka Bangladesh Water						
							Development Board						
25	North Rajshahi Irrigation Project						Bangfadesh Water Development						
							Board						
26	Jarisdiction Map of Rajshahi Circle(CBP & Sirdp), Rajshahi						Bangladesh Water Development						
27	The great Divide, Britain-Indiu-Pakistan						H.V.Hodson						
28	Capital Accumulation and Agrarian Structure in Bangladesh						Mahmudul alam						
	(A Study on tubewell irrigated villages of rajshahi and Comilla)												
29	Whose Water ?—Michael Howes						Bangladesh Institute of						
							Development studies						
30	Development The Upazila Way						Yusuf Hyder						
31	Mop—Bangladesh						Kiosk-Sundry stare						
32	Agricultural Production Value												
33	Potential in Rainfed Translated Rice Production in North-East						Bangladesh Rice Research						
	Bangladesh (Report of Research Findings and Pilot, Production						Institute						
	Programme, Kamalganj Tbana 1979-1983)												
34	Report on Planting/Harvesting Condition & Recommended Variety						Directorate of Land and Water						
	of Main Crops # 18						Lise, Bangladesh Water						
							Development Board						
35	Literature Review of Insect Pests and Diseases of Rices in						Bangladesh Rice Research						
	Bangladesh						Institute						
36	Proceedings of the first BRRI-Extension Maltilocation Working						Bangladesh Rice Research						
	Group Meeting on Rice-based on Cropping Systems						Institute						
37	Drainage Desigh Criteria												
38	Annual Report for 1984						Bangladesh Rice Research						
							instituce						
39	Current Status and Prospects for Rainfed Foodgrain Production						Bangladesh Rice Research						

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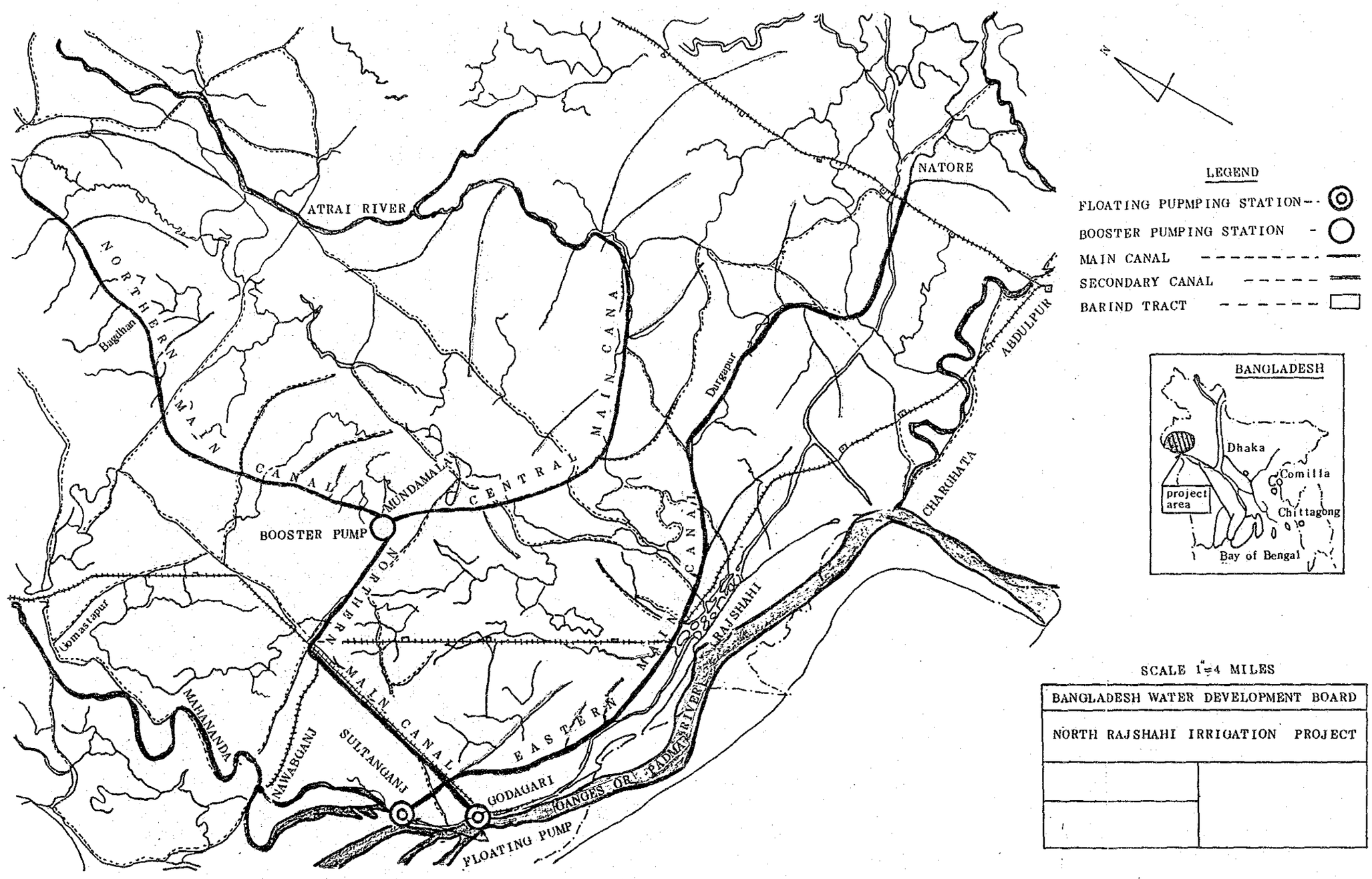
	in Bangladesh						Institute						
40	Bangladesh Jute Desearch institute						Bangladesh Jute Research						
							Institute						
41	Some Research Achievements of Bangladesh Jute Research Institute						Bangladesh Juti Research						
	and Their Prospeots						Institute						
42	Ten years of Sugarcone Researob						Sugar cane Research and						
							Training institute						
43	Office of The Superintending Engineer Rajsbahi Circle						WDB, Rajshahi						



LEGEND

FLOATING PUPMPING STATION

BOOSTER PUMPING STATION

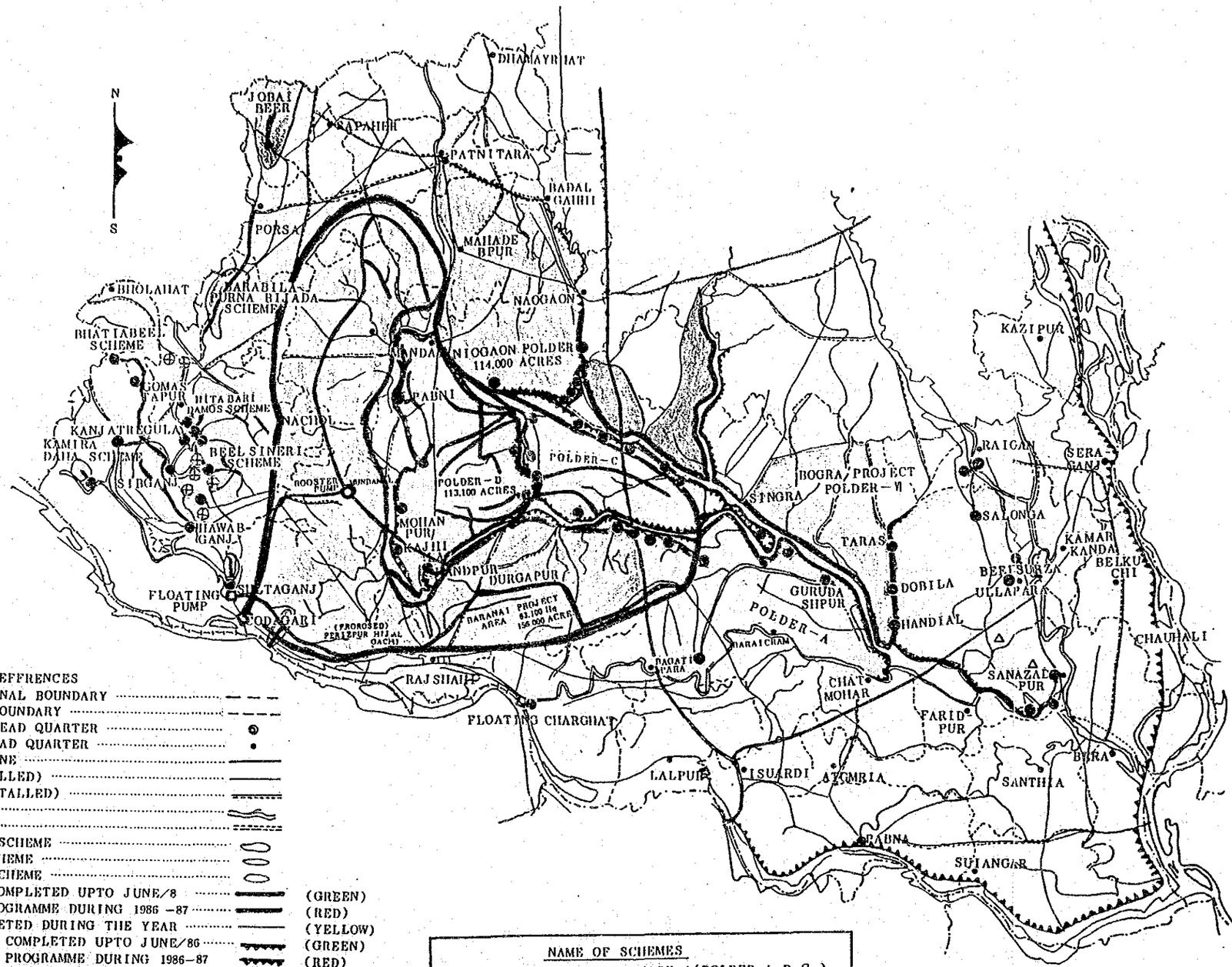
MAIN CANAL

SECONDARY CANAL

BARIND TRACT

SCALE 1"=4 MILES

BANGLADESH WATER DEVELOPMENT BOARD	
NORTH RAJSHAHI IRRIGATION PROJECT	



REFFRENCES

1.	INTERNATIONAL BOUNDARY	
2.	DISTRICT BOUNDARY	
3.	DISTRICT HEAD QUARTER	
4.	UPOLILA HEAD QUARTER	
5.	RAILWAY LINE	
6.	ROADS(METALLED)	
7.	ROADS(UNMETALLED)	
8.	LIVER	
9.	BEELS	
10.	COMPLETED SCHEME	
11.	QNGOING SCHEME	
12.	PROPOSED SCHEME	
10.	CHANNELS COMPLETED UPTO JUNE/8	(GREEN)
11.	CHANNEL PROGRAMME DURING 1986 -87	(RED)
12.	WORK COMPLETED DURING THE YEAR	(YELLOW)
13.	EMBANKMENT COMPLETED UPTO JUNE/86	(GREEN)
14.	EMBANKMENT PROGRAMME DURING 1986-87	(RED)
15.	REGULATOR COMPLETED UPTO JUNE/85	(GREEN)
16.	REGULATOR PROGRAMME DURING 1986-87	(RED)
17.	W.C.STRUCTURE COMPLETED UPTO JUNE/86	(GREEN)
18.	W.C.STRUCTURE PROGRAMME DURING 1986-87	(RED)
19.	OUTLET COMPLETED UPTO JUNE/85	
20.	OUTLET PROGRAMMS DURING 1986-87	

NAME OF SCHEMES

1. CHALANBEEL PROJECT PHASE-I(POLDER-A.B.C.)
2. POLDER-D(DFC I)
3. GANGES BASIN, RAJSHAHI
4. BARNAI CORE SUB-PROJECT, NATOR
5. SIRDP PABNA
6. NAOGAON POLDER
7. CONSTRUCTION OF REGULATOR AT JUBILEE KHAL
8. CONSTRUCTION OF REGUTATOR AT BIDIRPUR KHAL

DT. F A R I D P U R

BANGLADESH WATER DEVELOPMENT BOARD

JURISDICTION MAP
OF RAJSHAHI CIRCLE(CBP&SIRDP)
RAJSHAHI

SCALE:- 1" = 4MILES

SUPERINTENDING ENGINEER,
RAJSHAHI CIRCLE (C.B.P&
SIRDP) RAJSHAHI

事前調査報告書
付属資料

BANGLADESH WATER DEVELOPMENT BOARD

NORTH RAJSHAHI IRRIGATION PROJECT
PRELIMINARY REPORT

RAJSHAHI WATER DEVELOPMENT DIVISION-II,
MARCH 1985

CONTENTS

SUMMARY AND RECOMMENDATION

This report presents a preliminary study on an irrigation project to serve the northern part of Rajshahi district including a portion of Barind tract by utilising the waters of the Ganges.

The project will provide irrigation to a net area of 138,500 acres, of which 48,000 acres is in Barind tract. Irrigation will be achieved by lifting 3,200 cusecs of water from the river Ganges by two (2) pumping stations, one located at Godagari on the left bank of the Ganges and the other at Sultanganj near the confluence of river Mahananda with the Ganges. One Booster pumping station is to be setup at Mundamala to irrigate high lands of the Barind tract. Water will be conveyed through a net work of canal system.

Ground contour and direction of slope both in Barind tract and alluvial plain within project area offer a favourable condition for surface water irrigation from the Ganges. Possibility of ground water utilisation being limited in the area, surface water calls for immediate attention by Engineers and planners in order to boost up food production by irrigating highly potential agricultural lands.

One important aspect of the project is the irrigation of well elevated and uneven area of Barind tract. Barind tract, inspite of having a good agricultural potentiality, could not be fully explored for scarcity of surface water, as there is no perennial water body intersecting an area which is so vast that on its west is the Mohananda and on the east the Atrai. The agricultural practice in rest of the project area in alluvial plain is also very backward. The irrigation facility will therefore contribute immensely towards food production.

However, there are two problems which stand in the way of planning and implementing such an irrigation scheme, which are:-

(i) Considerably high lifting head required for the pumps to include Barind area.

(ii) Siltation of pumping plant on a migratory bank of a river like the Ganges.

In order to overcome the problem of pumping head required for Barind tract it is suggested that water will be lifted firstly upto 70 ft R.L. and at Mundamala one Booster pumping station will be setup to lift the water upto 90 ft R.L. to cover irrigable area of the Barind tract

The problematic experience of operation and maintenance of intake channel of Bheramara pumping station of G-K Project on account of heavy siltation and consequent expensive dredging operations is the major factor to be considered while proposing pumping plant for North Rajshahi Irrigation Project. To overcome siltation of intake channel on migratory bank of river it is suggested that Barge-mounted floating pumps be installed for the North Rajshahi Irrigation Project. Barge-mounted Floating Pumping Station has the following specific advantages over traditional permanent and fixed pumping station;

a) The barge mounted pumping station is always ready for use when it reaches the site if power supply is available.

b) The pumping station is always afloat and as such it is not affected due to lack of suction head.

c) The pumping station is always afloat and so it is not affected by siltation.

d) The floating pumping station is movable and can easily be shifted to new locations if it be necessary.

SPECIFIC RECOMMENDATIONS

In view of the above facts the following specific proposals are put forward for lifting and supplying water to the project area;

i) One barge mounted pumping station having a capacity of around 800 cfs with delivery head of about 40 ft is to be stationed at Sultanganj on the left bank of river Mahananda near the confluence with the Ganges.

ii) Another barge mounted pumping station having a capacity of around 2,400 cfs with delivery head of about 40 ft is to be stationed at Godagari on the left bank of the Ganges river.

With delivery head of 40 ft irrigable area upto 70 ft R.L. can be covered during dry season.

iii) To irrigate lands upto 90 ft R.L. in the Barind Tract one boobster pumping station having a capacity of about 800 cfs is proposed to be set up at Mundamala.

iv) The railway track from Godagari to Amnura having a length of about 14 miles has been abandoned and all rails and slippers have been removed. This abandoned railway track can be utilised as initial main irrigation canal thereby minimising land acquisition.

v) Irrigation canal network system and water control structures should be constructed utilizing existing roadside borrow pits, natural canals and khas lands as far as practicable in order to keep the land acquisition to the minimum.

COST AND BENEFIT

Cost of the project has been preliminarily assessed at Tk.1,200 million. Net annual benefit is estimated to be Tk. 280 million from additional yield of all categories of agriculture produce and increase in the production of paddy and wheat alone has been estimated at 70,000 tons a year.

North Rajshahi Irrigation Project

1. Location

The project is located on the northern side of Rajshahi district, between altitude 24°-15' & 25°-0' North and latitude 88°-15' amd 89°-15' East. The gross project area is 320,000 acres of which net irrigable area is 1,38,500 acres. The project area extends mainly over 11(eleven) Upazilla/police stations of Rajshahi district viz. Godagari, Tanor, Niamatpur, Mohadebpur, Manda, Mohanpur, Paba, Durgapur, Bagmara, Puthia and Natore. The project is bounded by the Ganges on the south east, by the Boral-Nandakuja on the south, by Atrai river on the north east and by the Barind tract on the north.

2. Climate

The climatic factors affecting irrigation development are rainfall and evaporation. The project area belongs to that part where mean annual rainfall is 55 inches which is less compared to other regions of Bangladesh. The distribution of rainfall is non-uniform with 80-90% of rain occuring in 5 months from May to September.

Mean annual evaporation is 47 inches. In average year, evaporation exceeds rainfall from last week of October to middle of May. Rainfall and evaporation data of Rajshahi are given in Table-1 below:

Table-1

MONTHLY RAINFALL AND EVAPORATION AT RAJSHAHI

Month	Rainfall (inches) 1/				Evaporation- 2/ (inches)
	Max	Min	Mean	90% dry year	
Jan	5.09	0.00	0.55	0.00	2.36
Feb	5.05	0.00	0.67	0.00	3.15
Mar	5.62	0.00	1.16	0.00	5.32
Apr	7.85	0.00	1.49	0.00	6.38
May	16.18	0.00	5.16	2.00	6.06
Jun	26.44	1.91	10.16	5.30	4.33
Jul	22.57	2.95	11.97	6.20	3.54
Aug	24.41	2.87	10.39	4.80	3.25
Sep	19.07	1.30	8.90	3.75	3.59
Oct	20.07	0.00	4.35	0.05	3.44
Nov	5.00	0.00	0.43	0.00	2.86
Dec	2.03	0.00	0.11	0.00	.239
Annual			55.34		46.67

Note :- 90% dry year rainfall means that the rainfall will be available in 9 out of 10 years.

Source:- 1/ Project report of the Groundwater and Low-lift pump Irrigation Project in the Northern districts of Bangladesh by IECO (Year 1965).

2/ South-west Regional plan, Suppl.C-Hydrology (Dec,1980).

3.a) Topography

The project area displays a variation fron the general relief of alluvial plain of the delta having high ridges and distorated contour to the west of 88°-30' longitude with adjacent alluvial plain in the east and south. The raised topography which is called Barind tract is most uneven and its soil type is also distinct from the general soil type of the delta. It consists of deeply weathered older alluvial deposits of clay. The major part of the project area consists of alluvial plains situated on the eastern and southern portions of the project area.

b) Land slope

General land slope is from West and North-West to East and South-East and offers a favourable slope for gravity irrigation in Barind and alluvial plains. The alignment in Barind has been restricted below elevation 90 ft. R.L. to avoid excessive lifting head. The alluvial plain is flat and has gentle slope, whereas the Barind tract is most uneven with steep slope.

4. Soils

The soils of the project area as a whole can be classified into older alluvium (Barind tract) & newer alluvium. Occuring in the form of uneven and undulating areas in high ridges and moderately levelled in lower areas in between the ridges, extensive fairly levelled areas are encountered on the eastern portion of the project area.

Barind soil is characterised by high impermeability and rapid drying of the soil to a hard and stiff condition. These condition impose a high degree of limitation in utilising these lands for agricultural uses in natural condition. Only single crop is now generally possible with natural rainfall. Therefore, given the inputs of irrigation water, fertilizers, etc. these lands can be turned into 2-3 crops producing area.

5. Water Resources

a) Groundwater

Recharge condition being doubtful in Barind tract, and tubewells requiring deeper depths, exploitation of ground-water offers a very limited as well as expensive possibility. At the present state of knowledge of ground water condition in the area, tubewell irrigation may be possible on a very limited scale.

b) Surface water

The topography favours the idea of bringing Ganges water into use in Barind tract for irrigation. Besides, Ganges there is no other source and the Mohananda which is a perennial one has but very meagre flow during dry season.

6. Current land use

It is estimated that about 75% of the project area is under cultivation. 85% of the cultivable land is under rice crop. The present cropping intensity is 125%. The cropping intensity is severely restricted; one crop of rice is only possible and is still then susceptible to dry spells in monsoon. IRRI or High Yielding varieties are not possible without irrigation. The scope of producing wheat, oil seeds, pulses, fodder and other varities of nutritional and cash crops are severely curtailed and there is little or no possibility of production of fodder to improve the work output of draft animals. In short, the level of production, economic return, or the standard of living are among the lowest with very little prospect for improvement without irrigation. The average size of farm holding is 3.5 acres.

7. Population

Population of the district has increased from 42,68,499 in 1974 to 52,62,600 in 1981, giving an annual growth rate of 3.3%. The average population density in the district as of 1981 is 1437 per sq. miles (Bangladesh'81 census primary results). Almost entire population (90%) is directly or indirectly dependent on agriculture. Average family size is 6 members per family.

The density of population in the Barind tract of the project area is thinner than the rest of the project area lying in the alluvial plain. A portion of the population belongs to ancient tribe known as "Santhal".

8. Project planning

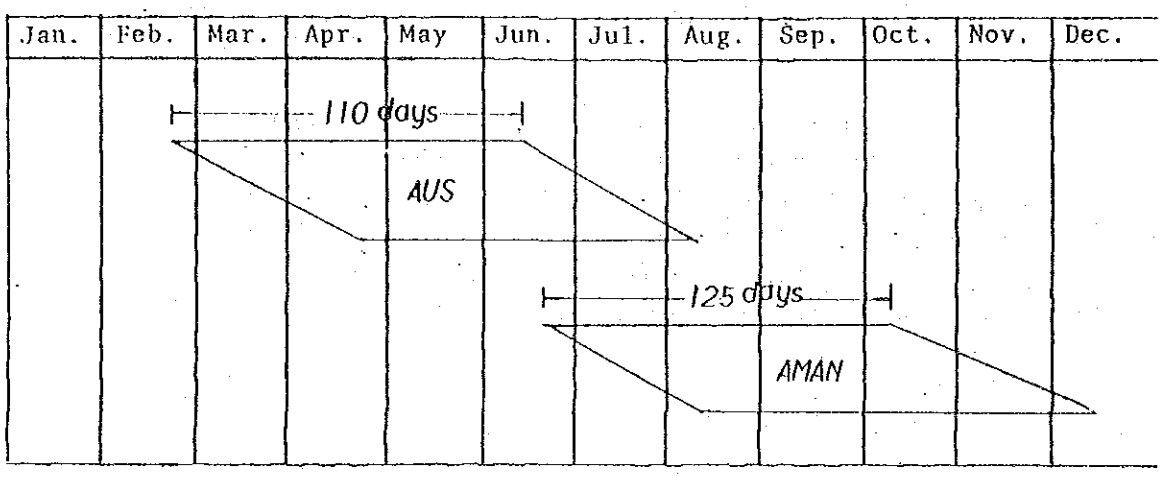
a) Agricultural planning

i) Cropping pattern

The land is good for rice and based on present knowledge, it is not considered suitable for other purposes, though pulses, oilseeds and wheat can be grown to a satisfactory degree. Two crops of rice are recommended in general and 3rd rice crop is discouraged for the land will be virtually under water whole the year round with a risk to the change in the chemical properties of the soil. Therefore two rice crops one in early summer (Aus) and the other in late summer (Aman) are preferred. Both should be transplanted and short term varieties in both the cases should be introduced with Nursery period of 30 days for Aus and 25 days for Aman as advocated by Amla experimental station. The cropping pattern would be as shown in Table-II below:-

Table-II

SUGGESTED CROPPING PATTERN (Major Corps)



Note:- Crop calendar includes;
Nursery 30 days for Aus
" 25 " Aman
Land preparation proceeds simultaneously with Nursery period.

ii) Irrigation requirements

Irrigable area

In view of uneven topography in the Barind tract, conveyance of irrigation water through gravity canals will be limited to narrow strips along the secondary canals and net irrigable area has been determined accordingly except for areas where valley expanse is wide and in such cases 15% deduction has been made for homesteads, roads, canals, other water bodies, etc.

In the light of probable extensive use of low lift pumps for irrigation, it has been taken care to include an assumed irrigable area under low lift irrigation from Main canals; scattered along its length.

Duties/Consumptive Use (water requirements) of the crops:-

Rainfall that is estimated to be sufficiently reliable is to be deducted from water requirements in different periods in the life of a crop starting from land preparation, nursery, growth to flowering and efficiency with which irrigation water is applied to the crops including conveyance losses, wastage in farm distribution system, have been considered in calculating the duties, as elaborated below.

Consumptive use

Water requirements of crops and necessary frequencies of irrigation are determined basically by evapotranspiration from the crops throughout the growth period and available moisture held in soil within plant root range. Evapotranspiration has been calculated by multiplying the evaporation with crop co-efficient.

Rainfall

Monthly rainfall from November to March is generally below one inch and therefore taken as ineffective. Rainfall during June to September is generally sufficient to meet the crop requirement. During the remaining months i.e. April to May and October, the dependable rainfall has been taken as effective and deducted from crop requirement.

Irrigation efficiency : Irrigation efficiencies have been calculated on the following basis;

Irrigation efficiency :-	75%
Irrigation requirement at farmer's turnout	$\frac{U}{0.75} = 1.33\ U$
Taking canal lossess 15%, ex-Pump requirement	$\frac{1.33\ U}{0.85} = 1.56\ U$
Overall efficiency (crop water deficit: ex-pump requirement)	$\frac{U}{1.56\ U} = .64$ say 60%

From Appendix A & B, it is found that critical water requirement occurs in March and the requirement for the crops during this period is 22.9 cusecs per 1000 acres. Based on this figure, water requirement for the project has been calculated and planning and design of pumps, canals, and ancilliary structures have been developed.

b) Engineering Planning

(i) Canal lay out:

The Barind tract in Rajshahi district lies mainly in the Upazillas of Porsha, Gomastapur, Nachol, Nawabganj, Godagari, Tanor, Niamatpur and to some extent in Paba. The maximum elevation of Barind tract is in the range of 140-150 ft R.L. in Gomastapur and Nachol Upazillas; it gradually falls to 60-65 ft in eastern and south-eastern direction where the plain starts from its foot hills.

This high elevation with very much distorted contours of Barind tract and on the other hand low elevation of water surface on the Ganges and Mohananda specially during dry season, preclude any idea of an extensive irrigation system. However, a natural ridge is found to exist along Godagari-Nachol- Porsha road running approximately towards north dividing the slope pattern of the Barind tract into west, east and south east. Considering this natural division and the physiographic potential of the Barind area for development of irrigation through available surface water of the Ganges, the area lying east of Godagari-Dinajpur road appears feasible. An irrigation system based on feeding this Barind area will be able to irrigate a vast area in the plains also.

Two barge-mounted floating pumping stations one at Godagari and the other at Sultanganj with an additional booster pumping station at Mundamala can irrigate an area of 1,38,500 acres with a pumping capacity of 3200 cusecs with the following main canals.

A. Northern main canal (M 1)

This will have a total length 42 miles from Godagari/ Sultanganj to Katna in Upazilla Niamatpur running below 90 ft contour lines.

B. Eastern main canal (M 2)

It takes off from northern main canal at Rasulpur about 4 miles from pumping plants. Its total length is 48 miles and for 10 miles from starting point it runs on high Barind tract along 72 -80 ft (PWD) contours; for next 10 miles it runs along 58 ft contours upto Rajshahi Town and for next 28 miles it runs along 55 ft to 40 ft contour.

C. Central main canal

It takes off from Northern canal at Mundamala at a distance of 20 miles from Godagari/Sultanganj pumping plants and runs south east for 33 miles.

Eastern and central canals have natural advantage to serve alluvial plains on the east of Rajshahi - Mohadebpur road by receiving irrigation supply from pumping plants.

(ii) Supply head at pumping plant

The Ganges generally registers the lowest water level in the months of April to June. The following table gives the monthly water level extremes of the Ganges at Godagari.

Table-III
MONTHLY W.L. EXTREMES

	Jan.	Feb	Mar.	Apr.	May	June
Highest	35.85	33.65	32.70	32.45	34.55	44.84
Lowest	33.60	32.65	32.30	32.15	32.30	33.65

	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Highest	65.32	70.12	70.32	61.07	47.32	41.15
Lowest	44.14	64.07	61.42	47.47	41.25	37.45

The average Ground level at the pumping plants is in between 66 ft to 68, and the Northern canal from this elevation will run into high lands of Barind tract (elev. 80.00). The Northern canal for all its entire length of 42 miles passess through the foot hills of Barind tract in between elevation 70 to 90 ft. The eastern canal for about 15 miles passess through Barind tract and afterwards passess through the plains. Similarly the central canal after passing for about 10 miles through Barind tract, drops into the plains.

There are two distinct land shapes as already discussed, Barind & plains. The Irrigable area under Barind lies between elev. 60 to 80 and that of plain between 40 to 60. For such a wide difference in two categories of irrigable area, planning of supply head becomes a very difficult task. From a plotting

of supply head profile along main canals showing also the elevations of irrigable areas (Plate-II) the following alternative solutions are derived;

Alternate - I Full area irrigation from pumping plants with 90 ft supply level at the source. Head difference from the lowest water level available is 90-32 = 58 ft, say 60 ft.

Alternate - II Part area irrigation, mostly belonging to the plains of area 105,500 acres with relatively low supply level of 70 ft at the source.
The reqd. head is 70-32 = 38 ft. Say 40 ft.

Alternate - III Alternate - II with Booster pumping station at mileage 20 immediately after the issue of central canal from the Northern canal at Mundamala, can serve full area. The capacity of the booster pumps required is 800 cusecs.

Depending upon the engineering knowledge and technology that can be brought into to provide the required pumping head, at the source, the alternate-III is by far the best solution.

Irrespective of what category of area can be irrigated, it is needless to re-emphasize the urgency and importance of conveying irrigation water to the starved fields may it be Barind or alluvial plain. But, upto-date knowhow must be brought to play in the design of an appropriate system capable to serve the Barind as well as plains.

Description of canal layouts are shown on an index map. Statements showing the network of main and secondary canals along with water requirements are furnished in Appendices D to F.

Appendix-D Water requirement at the head of secondaries and main canals.

Appendix-E Supply levels at the head of secondaries and main canals.

Appendix-F Details of canals and irrigable areas.

9. Preliminary estimate of project
(As per alternative III)

Item	Taka in lac
I. Head works	
A. Preliminary including Survey and Design	20.00
B. Two floating pumping stations with pumps, stilling basins, etc.	1,800.00
C. Booster pumping station with pump house, pumps, etc.	600.00
D. Camps and buildings	100.00
E. Transports	50.00
F. Power supply	100.00
G. River training and other works	100.00
Sub-total-I	2,770.00
II. Main canals and secondaries	
A. Preliminary including survey and design	40.00
B. Canal earth work 308 miles	1,800.00
C. Canal lining	200.00
D. Regulators:	
a) Main canal - 2 Nos.	800.00
b) Secondary - 40 Nos.	200.00
E. Cross drainage works	400.00
F. Bridges :	
a) Main canal - 25 Nos.	1,000.00
b) Secondaries- 60 Nos.	120.00
G. Railway crossing	200.00
H. Escapes	400.00
I. Camps and Buildings	400.00
J. Transport & Machinery	200.00
K. Misc.	400.00
L. O & M during execution	200.00
Sub-total - II	6,360.00

Total Field cost I + II		9,130.00
Contingencies @ 5%		410.00
	Sub-total	9,540.00
Engineering @ 8%		763.00
	Sub-total	10,303.00
Land acquisition 2500 acres		1,500.00
	Sub-total	11,803.00
Headquarters overhead 2½%		295.00
	Grand Total	12,098.00

Say 12,000.00 lac Taka.

10. Benefit

After completion of the project the yield and cropping intensity will increase. The assessment of agricultural benefits is given in Appendix G and H. From the tables it will be seen that value of extra produce due to irrigation, drainage and improved varieties of seeds will be Tk.2,789 lac per annum. Indirect benefits from this project will be in the field of communication, health, livestock and poultry.

APPENDIX - A

CROP WATER DEFICITS IN INCHES
DEPTH OF WATER FOR T. AUS & T. AMAN

Month/period		Rainfall at Rajshahi in inches/10 day period	Evaporation at Rajshahi in inches/10 day period	Irrigation requirement in inches per 10 day period		Remarks
				Nursery	Field	
Feb	I	0	1.0			
	II	0	1.06	3.00		
	III	0	1.09	1.09 (1.00)		
Mar	I	0	1.35	1.35 (1.00)	3.5	110 day for Aus
	II	0	2.00	2.00 (1.00)	3.5	
	III	0	1.97		2.07(1.05)	
Apr	I	0.36	2.10		1.95(1.10)	
	II	0.56	2.10		1.86(1.15)	
	III	0.57	2.18		2.05(1.20)	
May	I	1.5	2.2		1.36(1.30)	
	II	1.6	2.1		1.55(1.50)	
	III	2.02	1.76		0.71(1.55)	
		MONSOON (JUNE - SEPTEMBER)				
Oct	I	1.85	1.10		- (1.15)	
	II	0.50	1.20		- (1.25)	125 day for Aman.
	III	1.00	1.24		0.74(1.40)	
Nov	I	0	1.00		1.50(1.50)	
	II	0	1.00		1.55(1.55)	
	III	0	0.86		1.29(1.50)	
Dec	I	0	1.00			
	II	0	0.70		Harvest	
	III	0	0.69			

Note: 1) Land Preparation indicated by underlined figures.

2) Crop co-efficient indicated by ( )

3) Nursery 2% of the total area

APPENDIX - B

IRRIGATION REQUIREMENT EX-PUMP IN CUSECS PER 1000 ACRE

Month/Period		Irrigation Requirement ex-pump in cusecs per 1000 acres
Feb	I	-
	II	0.4
	III	0.14
Mar	I	22.8
	II	22.9
	III	13.4
Apr	I	12.6
	II	12.0
	III	13.2
May	I	8.8
	II	10.0
	III	4.6
		MONSOON (JUNE-SEPTEMBER)
Oct	I	-
	II	-
	III	4.8
Nov	I	9.7
	II	10.0
	III	8.3
Dec	I	-
	II	-
	III	-

Note:- 1) Deficit in inches converted into cusecs by multi-plying deficit in inches by 4.2

2) To determine ex-pump requirement, divide the figure in 1 by 0.65 (overall efficiency)

APPENDIX - C

TOTAL IRRIGATION REQUIREMENTS EX-PUMP IN CUSECS

Month	10 day period	Irrigation requirements ex-pump in cusecs			Total (1,38,500 acres)
		Northern canal (44500 acres)	Eastern canal (45000 acres)	Central canal (49000 acres)	
Feb	I	-	-	-	-
	II	18	18	20	56
	III	6	6	7	19
Mar	I	1015	1026	1117	3158
	II	1019	1030	1122	5171
	III	596	603	657	1856
Apr	I	561	567	617	1745
	II	534	540	588	1662
	III	587	594	647	1828
May	I	392	396	431	1219
	II	445	450	490	1385
	III	205	207	225	657
		MONSOON (JUNE-SEPTEMBER)			
Oct	I	-	-	-	-
	II	-	-	-	-
	III	214	216	235	665
Nov	I	432	436	475	1343
	II	445	450	490	1385
	III	369	375	407	1151
Dec	I	-	-	-	-
	II	-	-	-	-
	III	-	-	-	-

APPENDIX - D

WATER REQUIREMENT AT THE HEAD OF SECONDARIES AND MAIN CANALS

Alternative-I Full irrigation from primary pumping plants with 90 ft. supply level at source.

Name Secondaries	Irrigable area in 1000 Acres	Water requmt. in cusecs.	Areas under subsidiary pump		
			Name of secondaries	Area in 1000 acres	Water Requirement
Northern canal					
Secondary S8	12	276			
S7	4	92			
S6	3.5	81			
S4	4.00	92			
S3	2.00	46			
S2	2.00	46			
	27.50	633	S5	6.00	138
Add for utilisation along Main Canal 20m to 42 miles				3.00	69
Central Canal					
S10 to S3	42	966	S1 - S2	4	92
Add for utilisation along main canal				3	69
Eastern Canal					
S9 to S3	36	828	S1 to S2	4	92
Add for utilisation along main canal				5	115
Northern Canal			S1	6	138
Add for utilisation along main canal from 0 to 20 miles				2	46
	105.50	2427		33	759

Capacity of primary pumps

Irrigable area	W.R.
105.50	2427
33.00	759
138.50	3186
Say 138.50	3200 cusecs

Alternative-II Part irrigation from primary pumping plants with S.L. at 70 ft.

Name of Secondaries	Irrigable area in 1000 acres	Water requirements in cusecs
Central canal	3	69
-Do- Secondaries S10 to 42	42	966
-Do- S1 & S2 S 3 ..	4	92
Eastern canal	5	115
-Do- S9 to S3	36	828
-Do- S1 to S2	4	92
Northern canal		
M 0 to 20	2	46
-Do- Secondary S1	6	138
	102	2346
Say	100	2350

Note: Northern canal from mile 20 onwards has been omitted in this alternative, and all the rest from alternative-I have been included to be served by gravity or low lift pumps, as per necessity.

Alternative-III Full irrigation through primary pumping plants and booster pumper plant.

CAPACITY OF BOOSTER PUMP

Name of Secondaries	Irrigable area in 1000 acres	Water requirements in cusecs.
Northern Canal		
S8 to S6 and S4 to S2	27.00	600
S5	6.00	133
Main canal mile 20 to 42	3.00	67
	36.00	800

These are to be added to those of Alternative II to cover the whole irrigable area.

APPENDIX - E

SUPPLY LEVELS AT THE HEAD OF SECONDARIES AND MAINS

Millage	Average G.L.	Location of secondaries (mileage)	Average G.L. of irrigable area	Remarks
Northern Canal (M 1)				
0	68			
4	85			At mileage 4, eastern canal (M2) starts
5	85	S1	80	
16	85	-	-	
20	75	S2	70	At mileage 20 central canal (M3) starts.
24	80	S3	70	
26	97	S4	70	
29	86	S5	73	
36	85	S6	66	
42	71	S7	66	
42	71	S8	58	
Eastern Canal (M 2)				
0	85			
9	80	S1	76	
12	72	S2	68	
16	59	S3	55	
17	58	S4	53	
	Irrigable areas under secondaries S4 - S9 are well below any of the supply level proposed; and hence note shown.			
48	40			
Central Canal (M 3)				
0	75			
5	68	S1	66	
7	66	S2	65	
17	50	S3	45	
19	40	S4	40	
	Irrigable areas under Secondaries S4 - S10 are well below any of the supply level proposed; and hencenot not shown .			
33	40			

APPENDIX - F

CANALS AND IRRIGABLE AREA

Name of Canal	Length in miles	Irrigable area in 1000 acres	Remarks
1. a) Northern canal (M1)	42	5.0	
b) Secondary canal M1 (M1 S1 to M1 S8) = 8 Nos	59	39.5	
Sub-total	101	44.5	
2.a) Eastern canal (M2)	48	5.0	
b) Secondary canals of M2(M2 S1 to M2 S4) = 4 Nos.	57	40.0	
Sub-total	105	45.0	
3.a) Central canal (M3)	33	3.0	
b) Secondary canals of M3 (M3 S1 to	69	46.0	
Sub-total	102	49.0	
Grand-total	308	138.5	

Statement of Secondary canals

Name of secondary canal	Location from starting of main canals in miles	Lengh in miles	Irrigable area in 1000 acres
Northern canal (M1)			
M1 S1	4	9	6.0
S2	20	3	2.0
S3	24	3	2.0
S4	26	6	4.0
S5	29	9	6.0
S6	36	5	3.5
S7	42	6	4.0
S8	42	18	12.0
Sub-total		59	39.5

APPENDIX-F (contd.)

Name of canal	Irrigation from starting of main canal in miles	Lengh in miles	Irrigable area in 1000 acres
Eastern canal (M2)			
M2 S1	9	3	2.0
S2	12	2	2.0
S3	16	6	4.0
S4	17	6	4.0
S5		8	6.0
S6		6	4.0
S7		7	5.0
S8		7	5.0
S9		12	8.0
Sub-total		57	40.0
Central canal (M3)			
M3 S1	3	3	2.0
S2	5	3	2.0
S3		6	4.0
S4		3	2.0
S5		4	3.0
S6		6	4.0
S7		14	9.0
S8		6	4.0
S9		12	8.0
S10		12	8.0
		69	46.0

APPENDIX-G

NORTH RAJSHAHI IRRIGATION PROJECT

Preproject

Acreage, production and value

Name of crop	Area in acres	Yield mds/ acre	Total production mds.	Price Tk/ . Mds.	ross value of production lakh taka
1.(a) Aus (Local)	34,600	8	276,000	140/-	387.52
(b) " (HYV)	1,000	23	23,000	140/-	32.20
2.(a) T.Aman(Local)	56,000	12	672,000	140/-	940.80
(b) " (HYV)	3,000	23	69,000	140/-	96.60
(c) B.Aman	31,000	9	279,000	140/-	390.60
3.(a) Boro (Local)	2,700	9	24,300	140/-	34.02
(b) " (HYV)	6,000	23	138,000	140/-	193.20
4.(a) Wheat (Local)	1,100	8	8,800	140/-	12.32
(b).Wheat (HYV)	8,700	23	200,100	140/-	200.14
5. Pulses	8,500	8	68,000	200/-	136.00
6. Sugar cane	6,700	480	3216,000	10/-	321.60
7. Jute	1,700	15	25,500	70/-	17.85
8. Potato	2,000	70	140,000	60/-	84.00
9. Sw. Potato	400	100	40,000	40/-	16.00
10. Oil seeds	4,200	6	25,200	150/-	37.80
11. Vegetable	1,800	40	72,000	40/-	28.00
12. Onion	600	45	27,000	60/-	16.20
13. Turmeric	400	15	6,000	160/-	9.60
14. Chillies	400	6	2,400	100/-	2.40
15. Fruits	2,200	30	66,000	100/-	66.00
Total	173,000	-			3103.65

Net sown area 138,500 acre
cropping intensity 125%

APPENDIX-H

NORTH RAJSHAHI IRRIGATION PROJECT

Post project.

Acreage, production and value

Name of crop	Area in Acres	Yield mds/ acre	Total production mds.	Price Tk. mds.	Gross value of production Lakh Taka
1.(a) Aus (Local)	50,000	12	600,000	140/-	640.00
(b) " (HYV)	20,000	22	460,000	140/-	600.00
2.(a) T.Aman (Local)	40,000	13	720,000	140/-	1,095.00
(b) " (HYV)	20,000	23	160,000	140/-	640.00
(c) B.Aman	31,000	16	496,000	140/-	694.00
3.(a) Boro (Local)	2,700	9	24,300	140/-	34.02
(b) " (HYV)	6,000	23	138,000	140/-	193.20
4.(a) Wheat (Local)	-	-	-	140/-	-
(b) Wheat (HYV)	30,000	23	690,000	140/-	966.00
5. Pulses	12,000	8	960,000	200/-	192.00
6. Sugar cane	6,700	500	3350,000	10/-	335.00
7. Jute	1,700	16	27,200	70/-	19.04
8. Potato	2,000	100	200,000	60/-	120.00
9. S.W. Potato	400	100	40,000	40/-	16.00
10. Oil seeds	4,200	7	29,400	150/-	44.10
11. Vegetables	2,500	40	100,000	40/-	40.00
12. Onion	800	50	40,000	60/-	24.00
13. Turmaric	400	16	6,400	160/-	10.24
14. Chillies	400	7	2,800	100/-	2.80
15. Fruits	2,200	30	66,000	100/-	66.00
Total :	233,000	-			5,892.20

Net sown area 138,500 acres

Cropping intensity 168%

GANGES KABADAK PROJECT (G.K. PROJECT)
KUSHTIA, JESSORE & KHULNA UNIT

Introduction :

South-western region of Bangladesh experiences serious water shortage during dry season. Agricultural development in the area is largely dependant on the development of an irrigation system.

The Ganges and a number of its distributaries such as Mathabhanga, Gorai-Madhumati, Chandana-Barasia, Bhubaneswar, Arial Khan etc. are the principal sources of surface water in the area. But most of the distributaries turn high and dry at their offtakes during dry season and few of them which remain active during this period can draw only an insignificant quantity of water from the Ganges. As a result irrigation demand of the area can only be met by diversion of the Ganges waters

Background of the G. K. Project :

Since the Ganges dependent area of the South-west region of Bangladesh has tremendous potential for agricultural development through irrigation, FAO as back as in early fifties, had provided assistance for examining the feasibility of irrigation and flood control in a large area, west of the Gorai-Madhumati river and extending upto International border on the west and the Sundarbans on the south. The area to be developed was roughly 1 million hectare (2.6 million acres)

Kushtia Unit :

The area is divided into different units. To start with, Kushtia Unit covering a gross area of 1.94 lac ha (4.79 lac acres) was taken up for execution from 1954-55. Phase-I of Kushtia Unit was completed in 1969-70. The next phase i.e. Phase-II was taken up in 1960-61 and completed in 1983-84.

Kushtia unit is located close to the river Ganges. The area is served by 2 pumping plants located on the bank of the Ganges at Bheramara;

a) Main pumping plant - 3 - 1300 cusec pumps; completed in 1969

b) Subsidiary pumping "-12-125 cusec pumps; completed in 1961

The net irrigable area under Kushtia unit is 1.28 lac ha (3.15 lac acres). However, it has not been possible to bring all the irrigable area under command. About 40,000 ha in Kharif-I & 80,000 ha in Kharif-II are irrigated at present. Of the many problems the main constraint has been the low water level since 1976 caused due to withdrawal of waters of the Ganges at Farakka by India about 160 km north of G. K. Pumping plants at Bheramara.

Pumping Plants :

The existing pumps of G. K. project which were designed long before the present disruption in the historical flow of the Ganges, have now proved quite insufficient to deliver the estimated discharge during critical Months of March & April. During these months static head has increased due to lower level of water in the Ganges than what was considered during the design of pumps.

Drop in water level and pump discharge :

The average low water level as encountered prior to diversion by India has now gone down by about 4.5 ft. in March-April. The position is illustrated below;

	March, April	Level in ft. P. W. D.		
Av.W.L. as considered at design of pumps	III-10 day	1st-10 day	2nd 10 day	3rd 10 day
	22.25	22.25		
Av. W. L. in 1976	16.77	16.77	16.80	16.95
1977	20.63	20.72	21.20	21.25
1978	20.48	21.03	21.42	21.63
1979	20.81	20.46	20.78	21.11
1980	18.20	18.10	18.12	18.34
1981	20.55	20.34	20.79	21.92
1982	19.51	19.68	20.28	21.00
1983	18.03	17.84	18.08	18.55

Above figures being average values, on 10-day basis in the months of March and April, the lowest water levels were further low. In 1976 when the water level at Hardinge Bridge went as low as 16.51 ft. P.W.D., the pumps recorded serious vibrations and were about to shut down to avoid serious damage to pumps.

Now in critical months of March & April, the pumps operate under strain and can only draw together 3600 cusecs under the present sharing arrangement with India. However, when exceptionally low flow will occur, the capacity of pumps will further go down Such a situation coupled with the reduced efficiency of pumps i.e. say if the pumps run at 90% efficiency, expected discharge in critical month of March-April will be 3350 x 0.9 = 3105 cusec only.

Requirement of Kushtia Unit :

It has been estimated that if careful planning for cropping pattern is done and the system is improved appreciably the demand of Kushtia Unit during March-April alone is 3400 cusecs. However it is much more at present and may be so for another few years.

Need for New Pumps :

The present pumps are not in a position of meeting the demand of Kushtia unit in March-April whereas the main canal capacity is of 5400 cusecs at Bheramara. Under such a situation, there is no alternative left but to think of providing new sets of pumps. These pumps can be installed separately in a new pump house for an estimated capacity of 3000 cusecs. The design for the same to be worked out taking into account changed situation after the Farakka.

Further extension of GK Project :

If a new pumping plant is provided and thereby year-round delivery of 5400 cusecs is maintained, the irrigation system can well be extended byond Kushtia unit. It has been roughly estimated that areas under

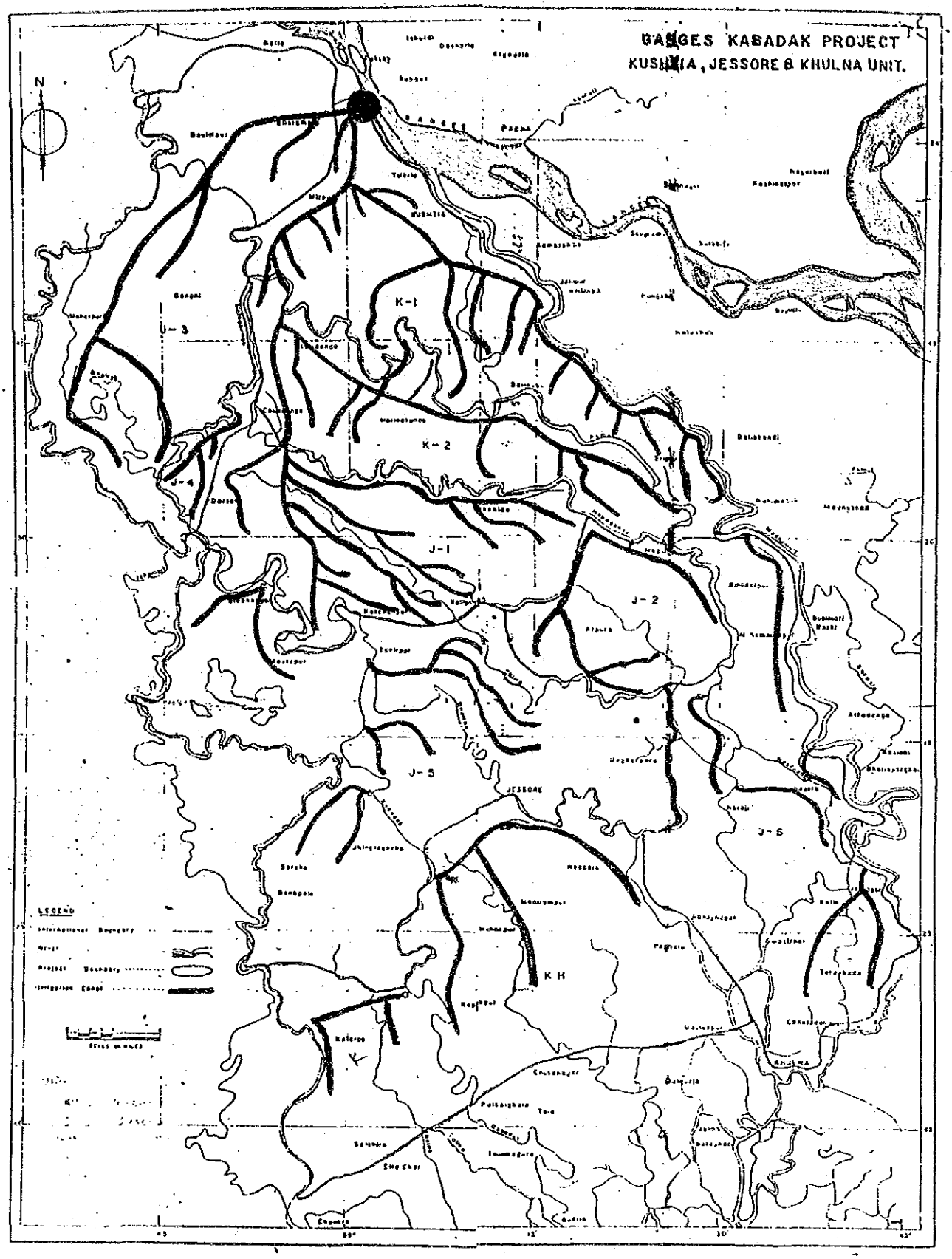
Jessore unit phase-I, II & part of III can also be brought under irrigation. The gross cammand will increase from present 4.79 lac acres to 10.38 lac acres. Out of which it is estimated that about 70% area i.e. 725000 acres are cultivable and irrigation can be provided to;

5.10 lac acres in Kharif-I
6.80 " " in Kharif-II.

Conclusion :

Rehabilitation of Kushtia unit under ADB's assistance is being carried out at present. It is expected that the efficiency of the project will increase. Still then, the existing pumps will not be able to meet the full demand of peak irrigation requirement in Kharif-I under Kushtia unit. There will be a shortfall and it is liekly to increase in future with long use of pumps as well as decreasing water level.

It is therefore suggested to make optimum use of the existing irrigation networks by supplementing the supply in the canals which will be capable of meeting the demand of Kushtia unit as will other units as mentioned above. A new pumping plant is a matter of serious consideration till such time when we are not in a position to develop another irrigation system/systems in South-west region of Bangladesh sufficient enough to cover the entire Ganges dependent area in this region.


GANGES KABADAK PROJECT
KUSHTIA, JESSORE & KHULNA UNIT.
N
K-1
K-2
J-1
J-2
J-3
J-4
J-5
J-6
KH
K
KUSHTIA
JESSORE
KHULNA
LEGEND

JICA