Capacity : 12.5 cusec (21.2 m^3/min)
Total Head : 40 feet (12.0 m)
Engine : 105 ps

The pump's disadvantages are 1)proper anchorage or removal of the pump is necessary during the flood season when the river's velocity is high, 2)pipes must also be removed during the flood season, 3)a cross-embankment should be provided in the discharged canal and it should be removed before the flood season begins.

A floating pump has a larger capacity than a low lift pump while the total heads of both pumps are almost the same. The following shows a comparison of the initial costs and running costs of both pumps.

Pump	Initial Cost (TK)	(per cusec) (TK)	Running Cost (TK/cusec/day)
FLP(12.5 cusec, 105HP)	10,000,000	800,000	800
LLP(2 cusec, 15HP)	125,000	62,500	720

This shows that the initial cost per cusec of FLP is more than ten times of LLP's. Besides, the running cost of the FLP is also higher.

Assuming that a floating pump is running for 24 hours to irrigate 290ha of paddy field which consumes 10mm of water a day, the fuel consumed is 670 l (=TK 10,000) a day. Moreover, additional LLPs are required to lift water from the canal to the field.

If FLPs are introduced in this project, the UCCA must manage the relatively intricate operation and maintenance as well as the running costs.

Apart from the mobility, if six LLPs are operated in parallel, the total discharge becomes as much as that of one FLP while the total initial cost is less than one tenth of one FLP.

Accordingly, FLPs will not be introduced in this project as equipments to lift water from natural rivers to the irrigation canals.

4-2-2 Design Criteria

(1) Design Standard

The following design standards are referred to for the irrigation system.

Third Flood Control And Drainage Project

Design Manual Vol I, BWDB
(Chapter 2 - Drains)
(Chapter 3 - Irrigation Canals)

(2) Draughty Water Levels

Natural river draughty water levels for irrigation design is set at 1.0 m (PWD) from the record of the Meghna river average lowest water level.

(3) Unit Water Requirement

For the design, unit water requirements are adopted in conformity with the Master Plan Study as follows.

		Boro	T.Aus	T.Aman	W. Vegetable
Net Daily Water Requirement	(mm)	6.4	5.4	4.4	3.1
Irrigation Efficiency	(%)	65	65	65	65
Gross Water Requirement	(mm)	9.9	8.3	6.7	4.7
Irrigation Hours	(hr/day)	16	16	16	12
Unit Water Requirement	(lps/ha)	1.71	1.44	1.17	1.09

(4) Command Area

The command area of the re-excavated canal is measured on the topographic maps (scale of 1/15,840) using a planimeter.

4-2-3 Basic Design

(1) Canal Re-execavation

With respect to the fifteen canals listed in the priority list given by the Bangladeshi side, the scope of the re-excavation has been determined based on field investigations and the survey results as follows.

1) Canals in Daudkandi

D-1 Khirai

The total length is 25.5 km. The longest canal in the Project area. The Beginning point (B.P) is connected to the Gumti river. Re-excavation is difficult from the 4 km point to 12 km point because the ground level is high and the average canal bed elevation is as high as 2.7 m in this portion. At the 17 km point the canal is connected to the Dhuna Gadar river, where the canal bed elevation is about -0.5 m and the canal is also used for boat

transportation in the dry season. From this point to the end point the average bed elevation is 1.0 m.

The total length of the re-excavation is planned to be 17.5 km excluding the high bed portion of 4.0 km to 12 km points.

D-2 Asmania

The total length is 5.9 km from Asmania to Machhimpur located northeast of Daudkandi. The beginning point elevation level is as high as 3.2m followed by a down slope. The canal is connected to the Batakandi river at the end point.

The length to be re-excavated is 2.9 km of the last half. (Midpoint to Endpoint)

D-3 Daragkhola

The total length is 10.3 km from Jinglatali to Kalakopa located in the east part of Daudkandi. The canal is connected to the Khirai canal at the beginning point. The average E.L is 3.0 m from the B.P to the 6 km point and then becomes 1.0 to 2.0 m at the latter part. The length to be re-excavated is 4.3 km of the last half.

D-4 Noorpur

The total length is 4.4 km extending east from the Daudkandi Bazar. Between the B.P and 3 km point , the bed elevation is lower than 0.5 m and the canal width is wider than 15 m. This portion can be used for irrigation without re-excavation in the dry season.

Re-excavation will be carried out for 1.4 km of the last part.

D-5 Satani-Krishnapur

The total length is 3.4 km located in the northern part on Daudkandi taking water from the Kalatia river. The average E.l is 1.2 m with few undulations.

The whole length of canal will be re-excavated.

D-6 Amtali

Located in the southwest of Daudkandi connecting the Khirai canal. There are some undulations of about 2 m in depth.

The total length of 5.3 km will be re-excavated to supply all the water to the Khirai canal.

D-7 Mazibari

The total length is 14.7 km located north of the national highway crossing the feeder road A. The canal is wider than 20 m between the B.P and the 3.5 km point then becomes narrower than 10 m, beyond that point. Most parts of the canal are low and flat.

The whole length of canal will be re-excavated.

D-8 Lalpur-Sundulpur

The total length is 3.7 km located in the center of the Daudkandi. The canal is mostly low and flat except the portion of 2.5 km to 3.5 km points (Elevation Level =1.8-2.5 m).

The length of canal to be re-excavated is 3.7 km.

D-9 Rampur

The total length is 4.8 km located in the northwest part of Daudkandi. The canal width is more than 40 m with an bed elevation of about 0.5 m from the B.P to the 2.5 km point. The last part is up slope and the end point elevation level is 2.8 m.

The section to be re-excavated is between the 2.5 km point and the 4.5 km point.

(The most upstream 300 m length is excluded due to its small width.)

2) Canals in Homna

H-1 Latia

The total length is 3.0 km located west of the Homna headquarters. Most parts are low and flat though the last part is slightly higher.

The length of canal to be re-excavated is 3.0 km.

H-2 Mathabanga

The total length is 4.3 km connecting the Kalatia river. The average elevation of the canal bed is 0.6 m and the average width is 35 m.

This canal will not be re-excavated in this project because water is available in the dry season.

H-3 Ragnathpur

The total length is 2.0 km located east of Homna. The highest bed elevation is 4.4 m and the average bed elevation level of the beginning 1 km section is 2.8 m.

This canal will not be re-excavated because it is quite disadvantageous to excavate the canal due to its high bed elevation.

H-4 Omrabad

The total length is 2.0 km located in the southeast part of Homna. The canal bed elevation is 1.0-2.0 m with few undulations.

The length of canal to be re-excavated is 1.8 km.

(The last 200 m length is excluded due to its small width.)

H-5 Bhasania

The total length is 1.0 km located in the east part of Homna. The average elevation is as high as 3.0 m in the last part which is difficult to excavate.

The length of canal to be re-excavated is the first 200 m section.

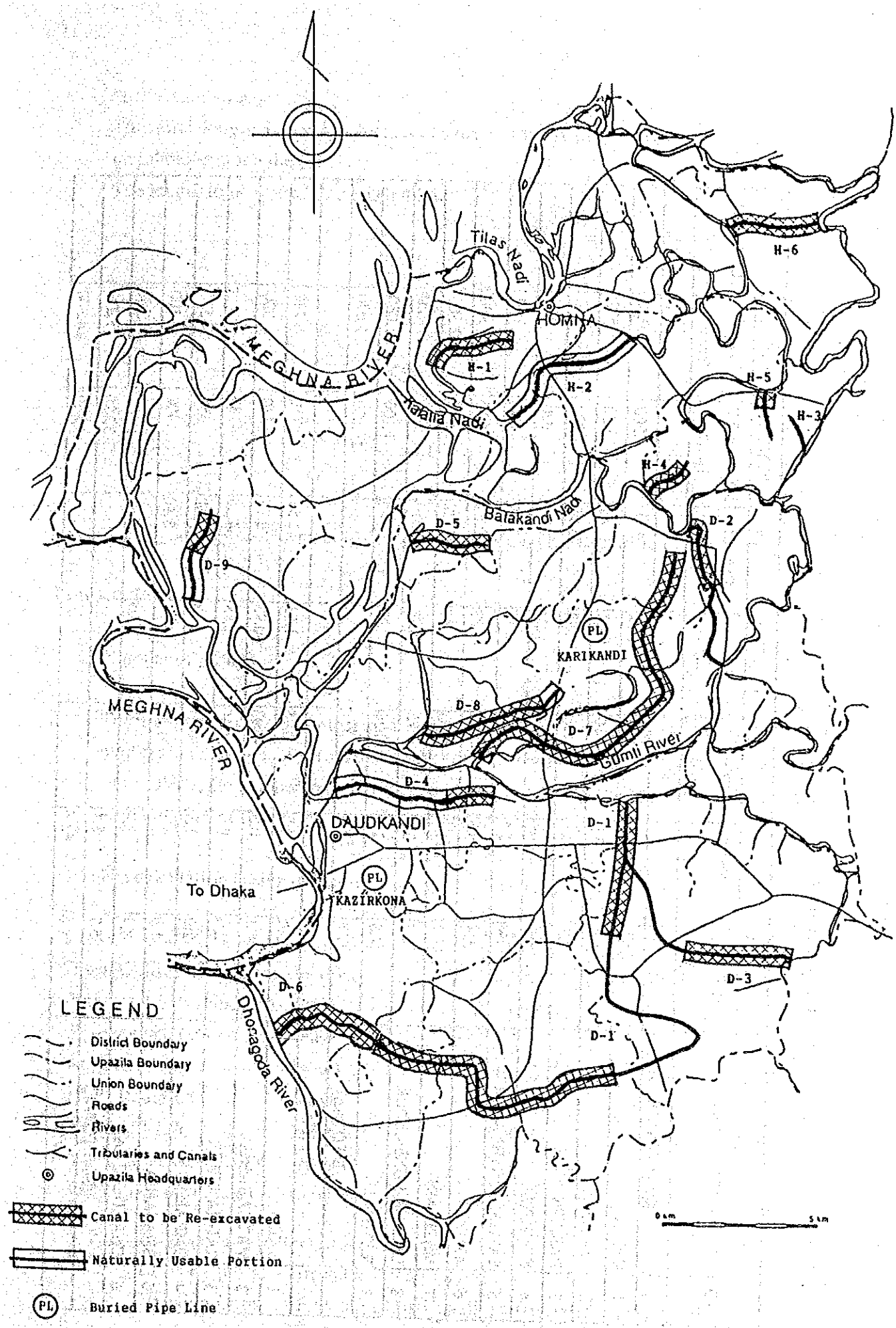


Fig. 4-2-1 Irrigation Development Plan

Table 4-2-1 Canal List for Re-excavation

NO	NAME OF CANALS	LENGTH		ELEVATION			IRRIGATION AREA		REMARKS
		SURVEYED (km)	PLANNED (km)	B.P (m)	E.P (m)	MAX. EL (m)	MEASURED (acre)	PLAN (acre)	
	DAUDKANDI								
1	KHIRAI	25.5	17.5	0.96	0.89	3.18	4,300	2,950	
2	ASMANIA	5.9	2.9	3.16	0.21	3.81	1,050	520	
3	DARAGKHOLA	10.3	4.3	1.16	1.92	3.95	1,800	750	
4	NOORPUR	4.4	1.4	0.04	1.27	1.27	920	920	
5	SATANI-KRISHNAPUR	3.4	3.4	1.27	1.72	1.84	780	780	
6	AMTALI	5.3	5.3	-0.18	2.03	2.61	900	900	
7	MAZIBARI	14.7	14.7	0.76	1.87	2.22	2,500	2,500	
8	LALPUR-SUNDULPUR	4.6	3.7	0.72	0.20	2.39	720	720	
9	RAMPUR	4.8	2.0	-0.26	1.47	2.83	1,100	1,030	
	(SUB TOTAL)	78.9	55.2				14,070	11,070	
	HOMNA								
1	LATIA	3.0	3.0	-0.95	1.53	1.59	730	730	
2	MATHABANGA	4.3	0.0	-0.93	-0.93	0.97	530	530	
3	RAGNATHPUR	2.0	0.0	1.44	1.18	4.35	180	-	
4	OMRABAD	2.0	1.8	0.91	2.53	2.62	650	570	
5	BHASANIA	1.0	0.2	1.18	2.65	3.40	400	100	
6	CHANDERCHAR	3.4	3.4	0.23	2.03	2.32	1,300	1,300	
	(SUB TOTAL)	15.7	8.4				3,790	3,230	
	TOTAL	94.6	63.6				17,860	14,300	

H-6 Chanderchar

The total length is 3.4 km located in the northeast part of Homna. There are few undulations along the canal.

The length to be re-excavated is 3.4 km.

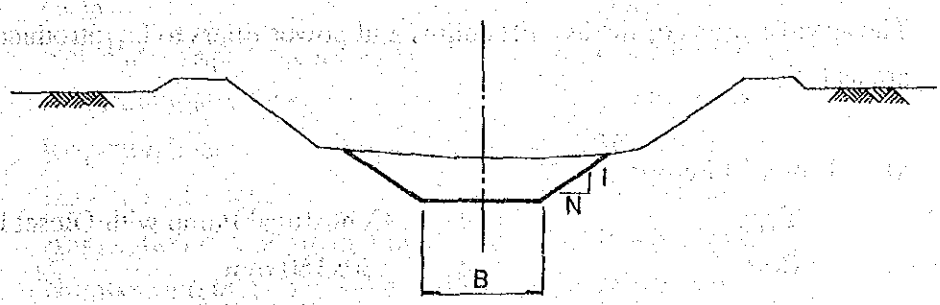


Fig. 4-2-2 Typical Cross Section for Canal Re-excavation

(2) Low Lift Pumps

1) Number of pumps

The maximum usable number of low lift pumps has been obtained by subtracting the number of existing LLPs from the number of LLPs required for the command area of each canal. Then, the number to be introduced has been determined to be 60% of the maximum usable number considering farmers' acceptability.

The calculation is shown below.

Item		Daudkandi	Homna	Total
Total Cultivated Land	(acre)	70,000	37,300	107,300
Existing LLPs (Upazila)	(nos)	665	211	876
Re-excavated Canal	(km)	55	8	63
Irrigated Area	(acre)	11,070	3,230	14,300
LLPs Required	(nos)	277	81	358
Existing LLPs	(nos)	105	18	123
Maximum usable LLPs	(nos)	172	63	235
LLPs to be introduced	(nos)	104	38	142

Note: Irrigated area by one LLP = 40 acre

LLPs Required = Irrigated Area / 40 acre

Existing LLps = Existing LLps(Upazila) x (Irrigated Area / Total Cultivated Land)

From the above the total number of LLPs to be introduced in this project is determined to be 142.

2) Equipment Specifications

The specifications of the low lift pumps and power tillers to be introduced in this project are as follows:

a) Low Lift Pumps

Type	:	Centrifugal Pump with Diesel Engine
Bore	:	150x150 mm
Discharge	:	3.4 m^3/min (2.0 cusec)
Total Head	:	7.0 m
Engine Output	:	10.5 ps
Number of pumps	:	142 nos

b) Power Tillers

Type	:	Power Tiller with Trailer (12.5 ps)
Number of Tillers	:	10 nos

(3) Buried Pipeline

1) Site selection

As for the sites for the buried pipeline system listed in the priority list given by the Bangladesh side, two sites, Karikandi along the Feeder Road A and Kazirkona near the Daudkandi headquarters, have been selected for the design taking into consideration the demonstration purposes. No site in Homna has been selected because there is only one existing deep tube well which is 7 km apart from the Homna headquarters and is less suitable for demonstrations and construction as well as maintenance. (See Table 4-2-2)

2) Irrigation Design

In this Project existing deep tube wells are to be connected with the buried pipeline systems. Pipes are installed instead of earthen ditches to minimize water conveyance loss as well as to convey water to higher lands. This pipeline system can cover 33 ha area, much larger compared with 18 ha area on an average covered by a deep tube will in the Project area. One site is divided into two blocks with twelve outlets each. Intermittent

irrigation is applied. One outlet per block is opened at a time while the other outlets are closed.

Design Criteria

1.	Irrigation area	:	A=33 ha (82 acre)
2.	Crop	:	Boro, Winter Vegetable
3.	Net Water requirement	:	d = 6.4 mm/day
4.	Irrigation interval	:	F = 6 days
5.	Irrigation hours	:	H = 16 hr/day
6.	Irrigation efficiency	:	Ef= 65 %
7.	Application rate per irrigation	:	E = 59.4mm
8.	Number of outlet operated at a time	:	N = 2 nos
9.	Irrigation hours per outlet	:	h = 8 hrs
10.	Discharge rate	:	q = 28 l/s (1 cusec)
11.	Irrigation area per outlet	:	a = 1.4 ha (3.4 acre)
12.	Total number of outlets	:	n = 24 (=12 x 2)

3) Water Source

A pressure tower (H=3.6 m) is installed by the existing deep tube well. Water discharged to the pressure tower from the pump is diverted into two pipelines from the pressure tower with equal water head. Concrete pipes are used for the pressure tower.

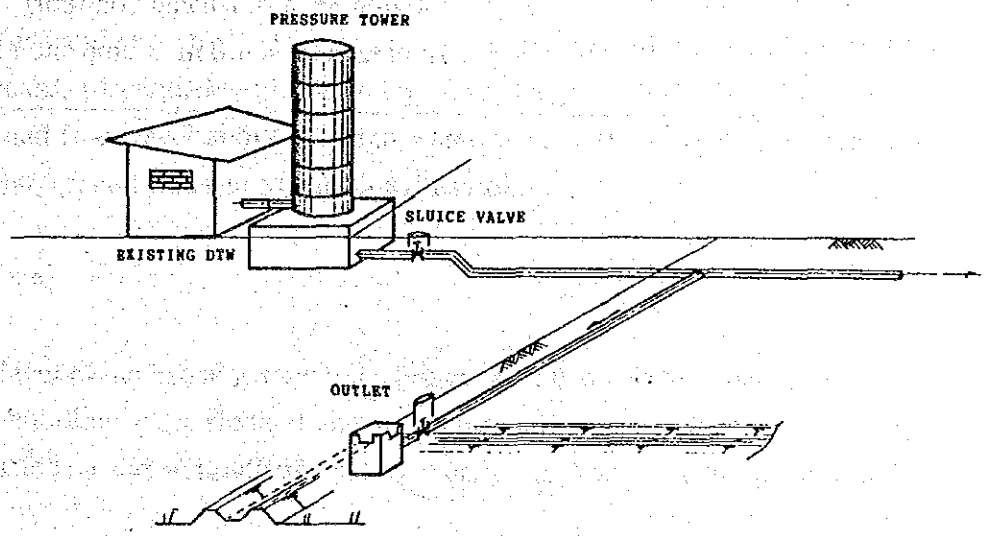


Fig. 4-2-3 Buried Pipeline System

Tabel 4-2-2 Sites Surveyed for Buried Pipeline System

No.	Name	Outline
Daudkandi		
1.	Karikandi	Along the Feeder Road A, 7 km from Gouripur Suitable for demonstration purposes Average ground level = 3.8 m Pump site E.L =4.2 m (Adopted for the design)
2.	Kazirkona	2 km southeast from Daudkandi headquarters Average G.L = 3.6 m Pump site E.L = 4.9 m (Adopted for the design)
3.	Srychil Mohammadpur	5 km southeast from Gouripur (B.P of Feeder A) Accessible by a jeep Average G.L = 3.9 m Pump site E.L = 5.5 m
4.	Horipur	Near the national highway, 1 km southeast from Gouripur Average G.L = 3.8 m Pump site E.L = 5.3 m
Homna		
1.	Kashinpur	7 km southeast from Homna headquarters, (50 min. by a rikisha and on foot) Average G.L = 4.0 m Pump site E.L = 6.4 m

4-3 Buildings

4-3-1 Basic Prerequisites

The location, scale and specifications of planned buildings will be determined in accordance with the current situation of the site, usage of the building and the numerical value shown in Chapter 3. In addition to this, examination will be given to the following conditions before basic design.

(1) Climate and Weather Conditions

The temperatures during the winter season, December to February, are approximately 10°C in the morning and evening and 20°C in the daytime; however, the rest of the time there is an average of 30°C. The humidity is generaly high throughout the year at 70% during the winter and 90% during the rest of the year, and therefore it is extremely muggy all the year round excluding the winter in the project area.

The average annual precipitation amounts to about 2,200 mm and most of that is concentrated in the period from April to October. In every rainy season, the Project area suffer floods from the Meghua river running along the project area and the tributary rivers running in the area. The highest water level by flooding was recorded at 6.17 m at Daudkandi in 1988 when most buildings in the area suffered damages.

The wind mainly blows north during the winter and the rest of the time the wind blows from the south and moreover cyclones hit the area several times a year.

The climate countermeasures to be considered will be thermal insulation, dehumidification, damp proofing and insulating. Design studies will cover employment of building paper, insulation board, suspended ceilings, ceiling fans, large size openings for windows, higher heights, ground floor level above the high water level (HWL), room scale which makes the cubic space larger, and water-proof finishing materials.

(2) Site Conditions

The ground level of the housing area in the project area is raised with earth. In 1988, however, the existing buildings were flooded above the ground floor. The buildings on the filled land were constructed on spread foundations; however, the buildings are not realized to have settled differently.

In the design the adoption of a ground floor above the HWL and with a direct foundation will be examined, and moreover foundation soil tests will be done before construction work.

(3) The Required Capacity for Training

It is planned to annually train leaders from a half number of the cooperatives to complete it during two years of their assignment terms. Therefore, in case of the Daudkandi UCCA, leaders from 242 (484 x 1/2) cooperatives are to be annually trained. The training room capacity is planned for 75 persons. With this capacity the respective numbers of managers, chairmen and model farmers need 3 training days for one-day training of each person. 47 days training is planned for a manager, 12 days for a chairman and 14 days for a model farmer. Accordingly, this capacity of 75 persons requires 219 training days to achieve the planned training for cooperative leaders.

$$(47 + 12 + 14) \text{ days} \times 3 = 219$$

In case of the Homna UCCA the same capacity requires 146 training days for cooperative leaders.

The maximum available training days will be 300 (6 days a week, 50 weeks a year), and the rest of the training days can be given to training programs for the UCCA's staff and general cooperative members. For more effective training, it is recommended for a class to have less than 25 trainees. Therefore, each training center is planned to have three training rooms with a capacity of 25 trainees. In addition, another room for women's trainig of sewing and dyeing is planned.

(4) Present Conditions and Choice of Primary School.

The government primary schools in Bangladesh consist of five Classes from I to V. The existing Class in every school consists of one to three sections. Each section adopts 50 pupils as the standard in the country. This standard, however, is not generally observed because the present schoolhouses are too small for the increased number of pupils. Most of the government schools in the Project area therefore take a double-shift system with the first shift at 10:00 a.m. to 12:00 noon and the second shift at 12:00 noon to 4:00 p.m. Nevertheless in several schools the number of pupils is too much for the scale of the school, therefore these schools adopt a triple-shift school system. There are government schools with coeducation and non-coeducation sections and these are determined by each school. Moreover most of the schools do not provide water and lavatory facilities.

School capacities are to be planned based on the criteria that the standard classroom with less than 50 pupils be employed and calasses be divided into two parts a day. Lavatories and water supply facilities will be considered in the design.

The numbers of pupiles and teachers at present and in prospect in government primary schools requested by the government of Bangladesh are shown in the following table.

Order	Name of Primary School	Current Situation		In the near future*	
		Nos. of Pupils	Nos. of Teachers	Nos. of Pupils	Nos. of Teachers
	Daudkandi Upazila				
1	TULATALI	267	5	310	To be increased according
2	ITAKHOLA	178	4	210	to the increased pupiles.
3	BHITIKANDI	205	4	240	"
4	JAMALKANDI	352	7	410	"
5	UJIARA	119	3	140	"
6	ELIOTGANJ	548	10	630	"
7	ICHAPUR	325	7	380	"
8	CHARGOALI	196	4	230	"
9	CHAKRATALA	207	5	240	"
10	NAYAKANDI	202	4	240	"
11	GONGAPROSHAD	107	3	130	"
12	BAYNAGAR	174	4	200	"
13	KHAMARPARA	203	5	240	"
	Homna Upazila				
1	HOMNA-I	804	11	1,000	"
2	RAMKRISHNAPUR	860	10	900	"
3	DULALPUR	380	6	700	"
4	PATHALIKANDI	274	4	600	"
5	CHANDANPUR	507	7	800	"
6	GARMORA	290	5	600	"
7	WEST KASHIPUR	534	7	800	"

Souce: Upazila Education Officer

* Value assumed after a compulsory primary education policy will have been put in practice.

Some of the requested school houses are temporary and are made of bamboo. Others are made of brick or reinforced concrete with brick chip aggregate. Even the reinforced concrete houses are superanaauated since they are more than 30 years old and are made of poor quality concrete with brick chip aggregate. Classroom scale is in general too small and varies from school to school.

Under these conditions, there is practically no difference in terms of urgency for school improvements. Accordingly, choice from the request list for government primary schools was made on the basis of the following items:

1) A rough construction cost allocated to the buildings in the Project,
2) Accessibility by trucks which carry construction materials and equipment onto the site,
3) The order of the requested priority list, and
4) The construction period and building methods.

Judging from these items, the Homna-I school in the Homna Upazila, and the Itakhola, Jamalkandi and Ichapur schools in the Daudkandi Upazila were selected to be planned. Each school in the Daudkandi Upazila, however, does not have enough room for a new extention onto the existing school. For this reason, the existing three school sites will have to be demolished and removed before the construction start. In addition to this, the Bangladeshi side must provide tentative schools for the pupils at the sites during the construction period.

The present situation of the selected schools are as follows.

	Structure	Total floor area (m^2)	Remarks
Itakhola	temporary house made of bamboo, soil floor	47.12 (3.1 x 15.2)	2 classrooms, 1teachers' room with chairs
Jamalkandi	one-storied house made of brick, soil floor	147.56 (6.2 x 23.8)	1 classroom, 1 teachers' room
Ichapur	one-storied house made of brick, soil floor	143.40 (6 x 23.9)	1 classroom, 1 teachers room without chairs
Homna-I	re-inforced concrete with brick wall, concrete floor	243.40 (4.2 x 18.6 + 6 x 25)	8 classroooms, 1 teachers room principal's room, with chairs

(5) Present Conditions and the Choice of Growth Centers

There are eight growth centers in the Project area as shown in the following table.

Growth center	Market area (ha)	Market day in a week (days)	Public shed space (m^2)	Number of buyers & sellers (x1000)
Homna				
Homna	2.86	2	264	25 ~ 30
Dulalpur	1.21	2	233	5 ~ 20
Manikchar	2.22		120	8 ~ 10
Daudkandi				
Daudkandi	2.01	2	320	15
Gouripur	2.32	1	670	20
Elliotganj	2.01	2	475	25
Batakandi	1.27	1	338	15
Goalmari	0.24	2	89	8

Source: The master plan for the Model Rural Development Project

Within the above eight growth centers, five centers being Dulalpur, Manikchar, Elliotganj, Batakandi and Goalmari, were surveyed and studied. The Manikchar Growth Center is located in the western part of the Homna Upazila. The feeder B road H-3, which connects this center with the feeder A road, has a 2 km gap at the river in the middle of the route and the road width is as narrow as 2 or 3 meters. Thus, this route is not planned for improvements within the Project as it will be difficult and inefficient to improve this road. The Eliiotganj and Batakandi growth centers even at present have favorable land transportation access, being that they are situated along the national highway and the feeder A road respectively. On the other hand, the Dulalpur and Goalmari growth centers, which are located apart from the national highway or the feeder A road and at present mostly depend on boat transportation due to the poor access road conditions, are to be remarkably improved in terms of land transportation routes to the national highway, when their connecting roads, routes H-2 and D-8, have been improved and paved in the Project. This will enhance the importance of and bring about rapid business expansion for both markets. Accordingly, the improvements of these two growth centers are judged to be the most urgent and effective within the Project.

The Dulalpur Growth Center and the Goalmari growth Center have 233 m^2 and 89 m^2 of public market sheds respectively, of which most are temporary. In addition, public open spaces are also fully used for marketing. Under these conditions, to make market operations smoother especially in the rainy season, it is planned to construct concrete-made sheds which have as much building area as possible in the public spaces with the partial replacement of existing temporary sheds. To improve pathways, which have poor traffic conditions due to muddiness in the rainy season, concrete pavement and drains are planned to be constructed. In addition, sanitation is planned to better the sanitary environment.

(6) Construction Conditions

Bangladesh has the following laws regarding building construction :

- The Government Buildings Act, 1899
- The Building Construction Act, 1952, which was amended in 1987
- The Building Construction Rules, 1953, which was amended in 1984
- Martial Law Order No. 112 of 1982-86

In addition to this, RAJUK which has jurisdiction over the Dhaka Metropolitan area, C.D.A. (Chittagong Development Authority) over the Chittagong Metropolitan area, K.D.A. over the Khulna town area and R.D.A. over the Rajshaki town area respectively have their own bylaws. With regard to the Project, however, the design approval will be given only by the LGEB.

The General Rules and Directions for the Guidance of Contractors which was arranged by the

leadership of the Public Works Department are prepared for tendering and general documents of government work. All contractors including the contractor of this Project are required to be subject to these Rules and Directions.

The labour force in the project area is easily available in the winter season which is the off-season for agriculture. The government works, including the Food for Work and Growth Centre Connecting Road (GCCR) projects, are usually executed during this period.

(7) Technical Levels of Local Contractors

Although the technical level of the constractors, judging from existing building details, is not very high, large-and-middle-scale contractors have concrete mixers, vibrators and compacting machines which are enough to execute the construction work of the Project's buildings which are rather small. Considering the project scale and usage of materials procured in the domestic markets, the structures of the Project might be composed of reinforced concrete foundations, columns, beams and slabs and brick walls which are popular in Bangladesh.

Most building materials and equipments are imported. Although cement is produced in the country, the production volume is not much enough to meet the domestic demand. Most round bars are of rerolled steel, and a little amount of deformed bars are imported into the metropolitan areas. Only brick is an available material in large quantities.

(8) Design Condition

A small local portion of the government of Bangladesh should be considered in addition to the conditions mentioned above. Priority therefore is given to the materials, goods and equipment procured in the country. Moreover low cost construction is required as well. Furthermore judging from the running cost prepared by the authorities concerned, the project facilities are required to save on the cost of maintenance and repair.

On the other hand, a low cost product in general means low quality. The building materials and equipment are to therefore be carefully studied in this design.

4-3-2 Basic Plan

The basic plan for the Homna UCCA Facilities is first outlined in this chapter.

Later on, basic plans for the UCCA Facilities in the Daudkandi Upazila, schools and growth centers will be mentioned.

4-3-2-1 Homna UCCA Facilities

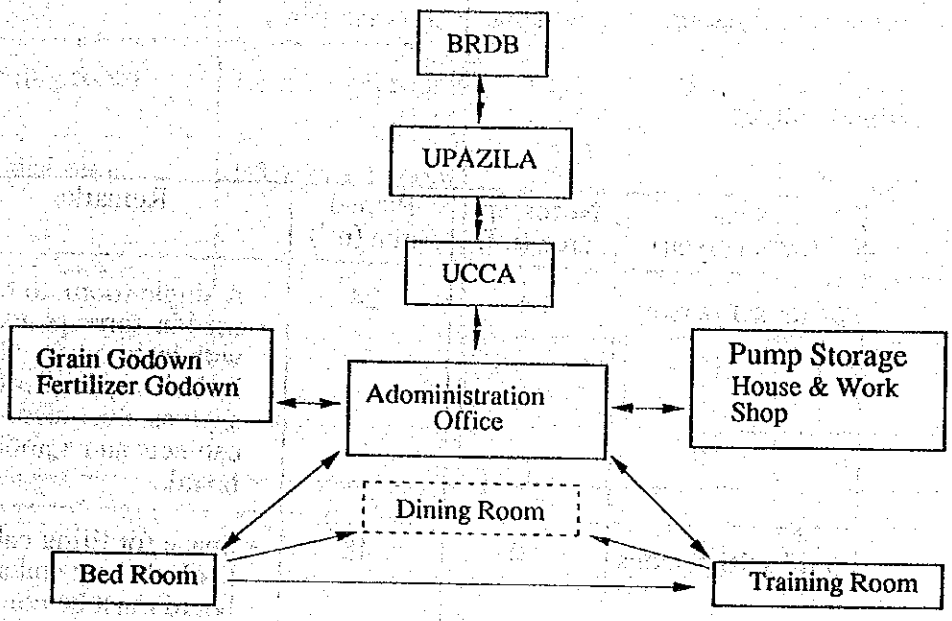
(1) Contents of the Facilities

The UCCA facilities are planned taking into consideration the following conditions.

Facility items	Contents	Room name
1) Administration section	• Training, operation and personnel plan etc. • Administration office (also for small conferences) • Common space	• Administration office • Office room • Preparation room • Teaching materials • Printing room • Kitchenette • Lavatory, shower room • Passage way
2) Training section	• Three training rooms and each room accomodates 25 people and a room for dyeing and sewing. • Common space	• Training room A --- 3 rooms • Training room B --- 1 room • Store • Wash basins for dyeing • Lavatory & washrooms • Passage way

Facility items	Contents	Room name
3) Pump Storage house	• Storage for low lift pumps. • Administration counter • Repair and storage of agricultural equipment • Storage space for spare parts • Common space	• Store room for low lift pumps • Administration room • Work shop • Kitchenette • Lavatory
4) Welfare section	• Lodging accomodations are necessary for instructors. • For boarders, dining and kichens must be provided. • Common space	• Bed rooms • Dining room • Kitchen, staff room • Passage way • Drying room
5) Godowns for cereals and fertilizers	• Storage for grain and materials is the main purpose .	

(2) Organization Chart for Each Section and Room



The basic arrangement for each section and rooms taking into consideration the administration plan and training components should be planned like the above.

The godown sites for grain and fertilizer are apart from the training center, therefore supervision is entrusted to godown neighbors.

(3) Scale of the Facilities

The decision on the scale of the facilities should take into consideration discussions with the BRDB and the current site situation.

1) Administration facilities

Room	Scale (m^2/a person)	Necessary area (m^2)	Planed area (m^2)	Remarks
1. Administrative office (room)	24 m^2 x 1 person	24	24	• A single room, to be used in correspondence with instructors, which includes space for book shelves, documents cabinets and a notice board.
2. Office room	5 m^2 x 10 persons	50	48	• Space for filing cabinets, book shelves and a black board must be considered. • Permanent staff is 7 persons • Casual staff is 3 persons
3. Teaching material and printing room		18	18	• Space for shelves for keeping texts and printing machinery
4. Preparation room		18	18	• Multi purpose space for instructor's waiting room, small meeting room, and reading room, etc.
5. Common space			130	• Kitchenette, shower room lavatory, passage way and stairs
Total			238	

2) Training facilities

Room	Scale (m^2/a person)	Necessary area (m^2)	Placed area (m^2)	Remarks
1. Training room	1.8 x 25 x 3 rooms	135	135	• Capacity is 25 persons per room
2. Practice room	1.8 x 25 x 1 room	75	69	• Equipment for dyeing and sewing practices should be considered. • Store • Washing
3. Common space			91	• Passage way, store
Total			295	

3) Accomodation facilities

Room	Scale (m^2/a person)	Necessary area (m^2)	Placed area (m^2)	Remarks
1. Bed rooms for instructors	20 x 1 x 3 20 x 2 x 2	60 80	54 72	• For long term instructors 3 rooms: 1 person/room 2 rooms: 2 persons/room
2. Dining	1.5 x 25	37.5	36	
3. Kitchen			18	
4. Cook's room (trainee)	8 x 3	24	13.5	• For 3 persons
5. Common space			201.5	• Passage way and store room.
Total			395	

4) Pump Storage House

Room	Scale (m^2/a pump)	Necessary area(m^2)	Placed area(m^2)	Remarks
1. Store room for low lift pump	1.8 x 38	68	58	
2. Workshop		120	74	• Space for shelves for spare parts and machinery are needed, and as an alternative the pump store room can be used.
3. Office		16	12	• Administration counter • Kitchenette • Lavatory
Total			144	

(4) Building Site and Arrangement Plan

The building site is located on the center of the east side in the Homna Upazila area (about 230m from east to west, 200 m from south to north) and next to the Upazila office.

Building arrangements should be planned taking into consideration their functions and the present situation.

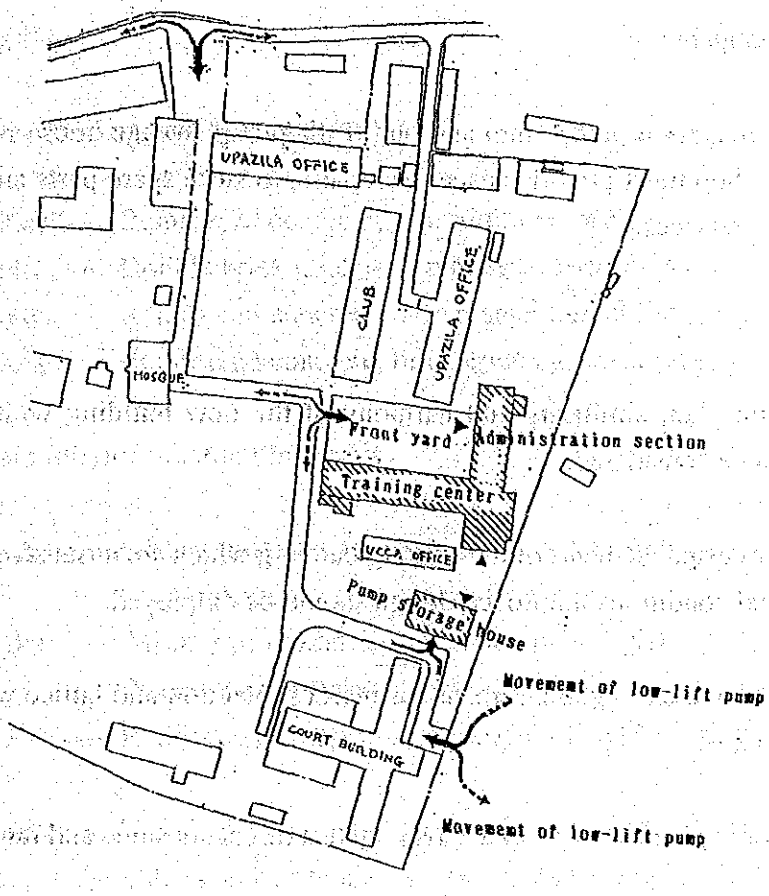
Arrangement plan criteria are as follows.

1) The location of the buildings must relate to the present facilities.

2) Natural environmental conditions such as wind, humidity, sun shine and soil properties should be considered. Special care to ventilation and protection from the western sun should be considered .

3) To determine the Ground level, the relationship between the present height of the site and the Flood level should be considered.

4) Although the pump storage house is planned to be located about 20 m to the south due to the small area, arrangements for pump administration, pump removal and workshop functions should be considered.



(5) Construction Plan

1) Basic plan

a) Administration and training facilities

The building's external appearances will basically be a L shape. Considering economical facters and the room space suitable for their purposes, beam spans were planned 3.0 m x 6.0 m for the administration facilities and 3.75 m x 6.0 m for the training facilities respectively.

And an L shape layout is advantageous for administration being that the flow of people and materials are easily observed.

Wide corridors also effectively help ventilation.

b) Accomodation facilities

The bed rooms are located upstairs of administration facilities considering security conditions and access.

c) Pump storage house

Carrying irrigation pumps into and out of the pump storage house is considered. The workshop must provide space for repairs, to store spare parts and to provide some user services.

2) Elevation plan

For an elevation plan, similarity and harmony of the new building with the present building should be considered.

However, as for design elements of the existing building which are unsatisfactory in terms of environmental conditions, improved design should be employed.

a) Windows have clear glass, screens for insect protection and lattice work for theft prevention.

b) Each floor is planned to provide eaves against direct sunshine and rainfall.

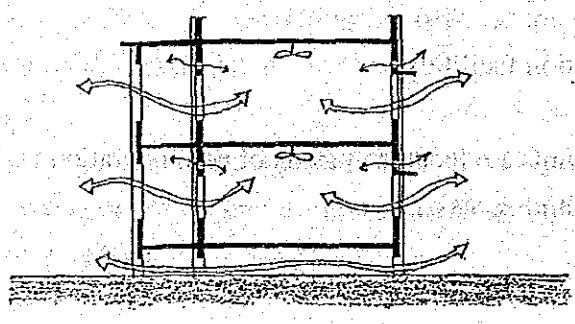
c) Protective covering for pillars, beams and walls is employed to withstand water. Finishing materials and colors should match the present building.

(6) Section Plan

1) To dampproof the building and to dehumidify the rooms, window sashes are planned to open as wide as possible with louvers for ventilation.

2) Floor to ceiling heights should be 3.45 m to permit natural ventilation and to keep adequate cubic space for each floor.

3) The ground floor level is determined to be at 6.7m above sea level (0.9m higher than the present ground level) to protect inundation (the past maximum flood level : 6.34m) and the space between the 1st floor and the ground floor is planned for natural ventilation and for dampproofing in the rainy season.



(7) Finishing Plan

1) Main exterior finishing materials

Pillars --- Reinforced concrete; waterproof snowcem
Walls --- Double brick thickness; mortar waterproof snowcem
Floors --- Reinforced concrete; mortar steel trowel finishing
Roofs --- Reinforced concrete; lime terracing finishing

2) Main interior finishing materials

Floors --- Office, training room, bedroom; terrazzo tiles
Place for water use; terrazzo finishing
Walls --- All rooms; mortar and emulsion paint finishing
Place for water usage; terrazzo finishing
Floors --- Reinforced concrete; mortar steel trowel finishing

Ceilings--- Training room on the 1st floor; partex board finishing
Others; concrete placing mortar prepairing emulsion paint finishing

(8) Structural Design

1) Basic policy

a) Construction methods are planned referring to popular methods in Bangladesh and existing building conditions in this area. Construction for the foundations, floor slabs, pillars, beams, and lintels with eaves drops are made with reinforced concrete. Outside walls are of double laid bricks. The foundations should remain separate from each other and in cases where necessary, bricks should also support.

b) In principle, materials available in domestic markets are to be used in this project. Brick chips are generally used for aggregate in this country. But, to keep the reliable concrete quality, gravel and sand supplied from the north-eastern and north-western areas should be used for aggregate.

c) Bed rooms on the second floor are planned to possibly be extended by Bangladeshi side in the future.

2) Sructural design conditions

a) Design load

Dead load and live loads will be calculated under Japanese design standards in the detail design.

b) Wind load calculations refering to Japanese standards should consider the effects of cyclones.

c) Foundations are planned to be direct foundations with the assumed bearing capacity of 5 t/m^2.

d) Structural materials

- Concrete design strength : F_0 = 210 kg/cm^2(JIS Standard)
  F_0 = 180 kg/cm^2(Lap joint of reinforcement and length of anchorage)
- Cement : Ordinary portland cement
- Reinforcement bars : SR 24 or same quality
- Brick : MB Brick Ceramic hard type produced domestically

(9) Facilities Plan

1) Basic policy

The policy for the facility planning are as follows.

a) The optimal facilities plan is to be made based on the analysis of required functions for facilities and site conditions taking into consideration the natural environment and customs of Bangladesh.

b) Facility plans for protection against cold, ventilation and sanitation are studied so as to make their operation and maintenance easy and inexpensive.

2) Water supply plan

Water is supplied by gravity from elevated water tanks after it is pumped from water source (about a 30 m deep well) and also is treated.

a) Water supply estimation

Per day 108 men x 60 *l*/day man = 6,480 *l*/day

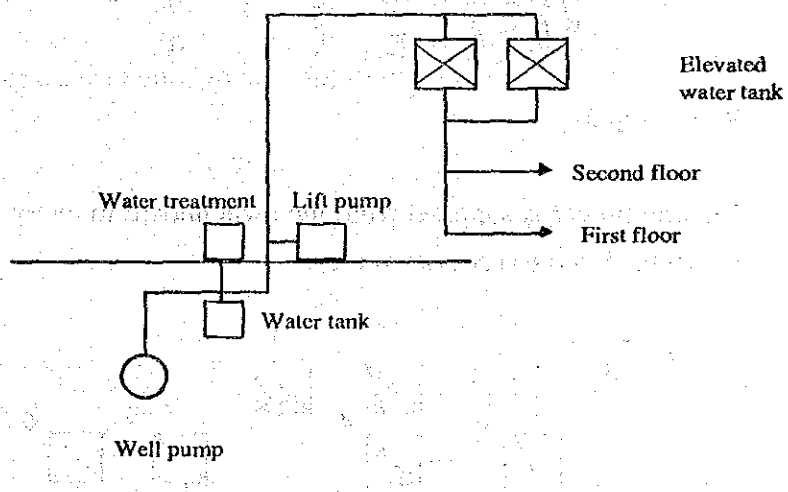
Per hour 6,480 x 1/8 hr = 810 *l*/h

Maximum amount of water per hour 810 *l* x 2 =1,620 *l*/h

The capacity of the elevated water tank is 3,240 *l* which is half the maximum amount of water used in a day.

b) Elevated water tank plan

2 sets of elevated water tanks with a capacity of 1,800 *l* each are needed. A well pump which is run automatically according to water levels, is to be installed.



3) Drainage plan

a) The waste and soiled water is drained into ditches after going through a sewage disposal process. Supply and drain pipes inside the building are arranged as an exposed setting system. Rainfall water is drained through gutters to U shaped ditches.

b) The amount of drainage is to be 80% of the amount of supplied water.

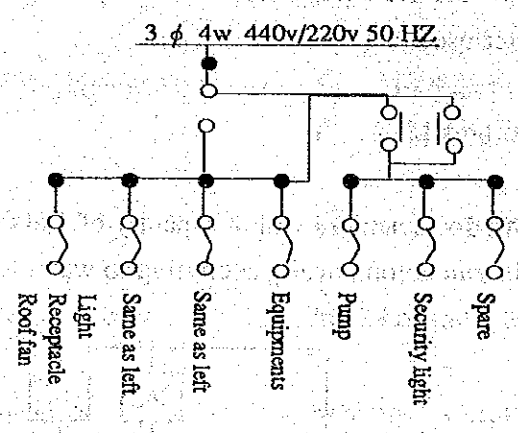
4) Ventilation plan

Ventilation is to be provided by natural wind and a ventilation register jalousie is supplied. Ceiling fans, size ϕ1,400 ~ ϕ1,500, are provided in the training rooms, office rooms, dining and bed rooms considering the cubic space.

5) Electrical service design

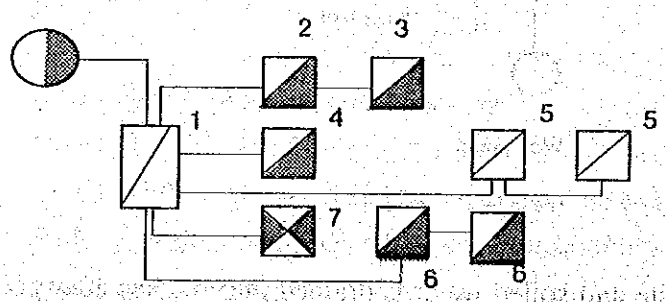
a) Receiving service

Receiving will be done by a phase four-wire system 440 V/220 V, 50 Hz from the existing substation to the planned swichboard through a leading-in pole.



b) Power supply

Electric power is supplied from the switchboard to every distribution board to be distributed in the accessary rooms.



1. Switch bord 2. Administration facilities 3. Training rooms
4. Accomodation 5. Training basis 6. Dining, store room
7. Power operation basis

Lead-in pole

Power operation basis

Light distribution bord

Training equipment basis

c) Lights and receptacles

Fluorescent lights will be used and the luminous intensity of main rooms will be as follows:

Rooms name	Light intensity (LX)
Director's room	300
Office	500
Training room	300
Bedrooms	75 ~100
Dining	300
Kitchen	300
Toilet, corridors	150

* Voltage is generally 220 V.
  Receptacles based on the Bangladesh standard are provided for their specific puposes, and earth work, where necessary, is considered. The equipment supplied in the training rooms and workshop is provided for 220 V.

d) Power service

Power will be supplied to the well pump.

4-3-2-2 Daudkandi UCCA Facilities

The training center and the pump storage house, which are to be planned for the Daudkandi UCCA, will be designed as having the same purposes and policies as those for the Homna UCCA. However, the required space for pump storage is larger due to a larger number of pumps to be stored and the layout is different due to the different site conditions. Those differences are given in this section.

(1) Scale of the Facilities

The administration, training and accommodation facilities, with all the other recommended and planned areas are to be the same as those for Homna UCCA. The recommended and planned areas for the pump storage house are given as follows.

Room	Scale (m^2/a person)	Necessary area (m^2)	Placed area (m^2)	Remarks
1.Store room for low lift pumps	1.8 x 104	187	155	
2.Workshop		120	108.5	-Space for shelves for spare parts and machinery are needed, and as an alternative the pump store room can be used.
3.Office		16	13.5	-Administration counter -Kitchenette -Lavatory
Total			277	

(2) Building Site and Arrangement Plan

The building site is located in the southern salient part of the Upazila headquarters. Building arrangements are to be planned taking into consideration their functions, relation with the neighboring buildings and the ground level that is 1.5 m lower than that of the existing building. The following points are considered.

1) It is prerequisite that, before construction starts, the ground will have been filled by the Bangladeshi side up to the same level as that of the neighboring existing buildings' on the site.

2) The space of the site and the connections with neighboring existing passages have been taken into consideration.

3) The location of the buildings must relate to the existing facilities.

4) Natural environmental conditions such as wind, humidity, sunshine and soil properties should be considered. Special attention should be paid on ventilation and protection from the western sun.

5) To determine the ground level around the buildings, the relationship between the present site conditions and the flood level should be considered.

The basic planning elements other than the above-given ones are the same as those of the Homna UCCA facilities.

4-3-2-3 Primary Schools

(1) Contents of the facilities

School capacities have been determined based on the estimated number of pupils for each school in the near future (See 4-3-1 (3)) as well as on the criterion that a classroom's capacity be of 50 pupils and classes be divided into two parts a day. As a result, the classroom numbers for the four schools are given as follows.

Name of primary schools	Number of classrooms
Homna	
Homna	12
Daudkandi	
Jamalkandi	5
Itakhola	3
Ichapur	5

Contents of the facilities are planned to satisfy the following conditions.

Facilities item	Contents	Room name
1. Administration room	· Event and operation plans	· Headmaster's room
	· Guidance meeting in the studies	· Staff room
	· Making teaching materials	· Teaching materials
		· Printing room
	· Common space	· Lavatory, kitchenette
2. Class room	· Basically one room has 50 pupiles	· Class room
	· Common space	· Lavatory
3. Meeting room	· Using class room and hall	· Class room, hall
	· For large number using front yard	
4. Common space	· Common space	· Passage way, lavatory and washroom

(2) Scale of the Facilities

The decision on the scale of the facilities should take into consideration discussions with the officials concerned and the current site situation. The following description is given for the Homna Primary School. Other schools are planned based on the same criteria and idea as those for the Homna Primary School.

1) Adominstration room

Room name	Scale (m^2/a person)	Necessary area(m^2)	Planned area(m^2)	Remarks
1. Headmaster's room	16m^2 x a person	16	18	Used also as reception room with a notice bord, desk and shelves.
2. Staff room	5m^2 x 13 persons	65	65	Space for 13 teachers, notice bord, desk, chair and cabinets
3. Teachers materials'		54	75	Cabinet for teachers materials and shelves
4. Print room		12	9	Space for printing machinenary and shelves
5. Common space			39	Wash room, lavatory shower and kitchnette
Total			206	

2) Class room

Room name	Scale (m^2/a person)	Necessary area(m^2)	Planned area(m^2)	Remarks
1. Class room	1.4m^2 x 50 persons x 12 rooms	840	778	Spase for desks, chairs, shelves and cabinets
2. Common space			86	Wash room and lavatory
Total			864	

3) Meeting room and common space

Room name	Planned area(m^2)	Remarks
1. Hall	81	Hall
2. Common space	337	Passage way, stairs
Total	418	

(3) Building site and Arrangement Plan

The building site is located next to the Homna Upazila headquarters and the growth center. The primary school coexists with a high school on the common lot. Building arrangements are to be planned taking into consideration their functions and the present situation of the existing building utilizations.

1) The location of the buildings must relate to the existing facilities.

2) Natural environmental conditions such as wind, humidity, sunshine and soil properties should be considered. Special attention should be paid on ventilation and protection from the western sun.

3) The opening of windows should be planned to take natural light into the rooms as much as possible.

4) To determine the ground level around the buildings, the relationship between the present site condition and the flood level should be considered.

(4) Construction Plan

1) Basic plan

The building's external appearances will basically be a L shape. Considering economical factors, beam spans were planned 3.0 x 6.0 m. The room spaces necessary for their functions were obtained and their layouts were done taking into consideration the movements of teachers, pupils and visitors. Administration rooms are located in the building center so that the building will be able to attach three more classrooms in the future.

2) Elevation plan

Each floor is planned to provide eaves against direct sunshine and rainfall. Windows have clear glass, screens for insect protection and lattice work for theft prevention.

(5) Facilities Plan

1) Basic policy

The basic policy is the same as that for the Homna UCCA Facilities.

2) Water supply plan

a) Water supply estimation

Per day 615 men x 45 l/day/man = 27,675 l/day
Per hour 27,675 x 1/6 = 4,600 l/hr

The capacity of the elevated water tank is 13,800 l, which is half the maximum amount of water used in a day.

b) Elevated water tank plan

3 sets of elevated water tanks with a capacity of 1,800 l each are planned. A well pump, which is run automatically according to the water level, is to be installed.

3) Drainage plan

The waste and soiled water is drained into ditches after going through a sewage disposal process. Supply and drain pipes inside the building are arranged as an exposed setting system, Drain pipes and pits are to be installed outside the building.

The amount of drainage is to be 80 % of the amount of supplied water.

4) Ventilation plan

Ventilation is to be provided by natural wind and a ventilation register jalousie is to be supplied. Ceiling fans with 1,400Å`1,500 mm diameter are provided considering the cubic space.

5) Electrical service design

Fluorescent lights are used and luminous intensity of main rooms is as follows.

Room name	Light intensity(LX)
Headmaster's room	300
Staff room	500
Teacher's materials	300
Class room	300
Common Space	150

A set of lightening protection fixtures is to be installed.

Other items are to be designed according to the same design policy and criteria as those for the Homna UCCA Facilities.

4-3-2-4 Growth Centers

(1) Contents of the facilities

In order to make market operations smoother especially in the rainy season, it is planned to construct market sheds on the government portions as well as paved pathways and drains in the market areas. Market sheds are planned to be adapted to the present conditions of the markets considering the following points.

a) Market sheds are planned to be compatibly used for foodgrain, vegetables, apparel and other commodities.

b) Aisles are planned to be wide enough for two way customer passage and commodity transportation.

Scale of facilities are planned as follows.

	Sheds		Pathways
Dulalpur:	23.3 m x 9.3 m x 1 shed	= 217 m²	2.0 ~ 3.0 m x 405 m
Goalmari:	23.3 m x 9.3 m x 2 sheds	= 434 m²	2.5 m x 111 m

(2) Building sites and Arrangement Plan

The building sites for sheds are located in the existing growth centers. Building arrangements are planned taking into consideration the area and shape of building sites, location and width of access pathways, movement of people and commodities and relationship with existing sheds.

(3) Construction Plan

The basic plan is based on the conventional type of market sheds in Bangladesh.

a) Marketing counters are planned to be rectangular and to make customer movement longer and circular.

b) The counter level is planned to be 450Å~500 mm lifted from the aisle level.

c) The ground floor is determined to be laid directly on the existing ground considering the relationship with the existing market facilies' floor level, convenience for customers' shopping and commodity transportation and no possible flood damage without any equipment on the floor

(4) Finishing Plan

Roofs ---------- Reinforced concrete, lime terracing finishing.
Pillars and beams -- Reinforced concrete, partly emulsion paint finishing.
Ceilings ---------- Reinforced concrete, emulsion paint finishing.
Aisles ---------- Reinforced concrete, steel trowel finishing.
Counters ---------- Reinforced concrete, mortar with steel trowel finishing.

(5) Structural Design

The basic policy on construction methods and material selection and the design conditions on design loads, foundation and structural materials are the same as those for the Homna UCCA facilities given in (8), 4-3-2-1.

(6) Facilities Plan

Sanitation with a sewage disposal tank, a tube well with a hand pump, electricity outlets and drains around sheds and along pathways for each growth center are planned.

4-3-3 Planned Equipment

(1) Policies

Necessary and sufficient equipment is planned in order that each function of the facilities will be operated in good order as soon as the facilities will be taken over by the authorities concerned in Bangladesh. Selected equipment will be examined economically looking at durability and whether or not an agent can repair it in Dhaka or near the project area during usage.

1) UCCA facilities

Equipment for the UCCA facilities are classified in the three categories: training equipment including administration equipment, godown equipment, and pump storage and workshop equipment.

The BRDB is promoting training with audio-visual education being that it is the most effective way considering the high illiteracy rate. The target persons in the Project area are not so literate therefore the equipment for this type of education will be provided. Equipment required for dyeing and sewing training will also be provided.

The BRDB intends to encourage the UCCA activities in the merchandise treatment field. For this, godowns for cereals and fertilizer are planned. Equipment necessary for storage and transportation for the business will therefore be considered.

Equipment required for storage and tranportation of low-lift pumps, which are to be supplied to encourage irrigated agriculture, as well as machinery and tools for repair of pumps and other agricultural machinery will be provided.

2) Government primary schools

Existing primary schools are supplied with their equipment including text books and test books for pupils by the government though it is not enough to implement their activities. Considering other primary schools which are out of the Project, a minimum amount of equipment to supplement teachers' lessons will be examined.

Equipment for Training

	Quantity	Remarks
• UCCA facilities		
(Training center)		
– Typewriter for business (Bengali)	2	Hand-operated type
(English)	2	
– Duplicating machine with accessories	2	Paper size : max. B4 Black ink & paper for typewriter
– Stapler machine with staples :		
Small	2	
Large	2	
– Color TV with video tape recorder	2	
– Extension cable	8	Double sockets, cable length : 5-6 m
– Dyeing kit	10	Including electric wax melter, brushes for wax, vessels, etc.
– Sewing machine with accessories	8	Hand-operated type
– Sewing machine for lockstitch	2	Small type
– Electric iron with work bench	10	Steam-dry switchover type
– Extension cable	10	Double sockets, 5-6 m length
– Motorcycle	4	
(Godown)		
– 2-ton truck	2	Capacity : 3 persons
– 100 kg weighing scale	2	

– Paddy-testing kit	1	5 portable seed sampler sets with canvas cases, 10 seed sample pans, granometer for paddy & grain moisture tester
– Wooden palette	200	
– Tarpaulin for 2-ton truck	4	
– Disinfection sprayer with accessories	2	Hand-operated shoulder type
(Pump storage house)		
– High speed cutter	2	
– Bench grinder with accessories	2	
– Gas cutting & welding tools with cylinder carrier	2	
– Vehicle repair equipment & tool set	2	Including chain block, electric drill, electric disc grinder, electric hand shear, avrasiv cutter, surface plate, garage jack, hydraulic press 5-ton compressor.
– Mechanical tool set	2	
– Measuring instruments	2	Including vernier caliber, outside micrometer, dial gauge with magnet star, straight rules, standard thickness gauge, & hand tachometer
– Parts shelves	6	Dimensions : 120 x 45 x 200 cm
– Workbench with vice	2	Wooden top Table size : 200 x 70 cm Jaw width : 150 mm
– Power tillers	10	With trailer, 12.5 ps

– Low-lift pumps	142	ϕ 150, 3.4m^3/min
• School		
– Terrestrial globe mentioned in English	8	
– The world map mentioned in English	4	Roll-up type
– The map of Bangladesh	31	Roll-up type
– Portable loud-speaker with shoulder belt & dry batteries	4	

4-4 Construction Plan

(1) Construction Policy

As a Japanese grant aid program, the following characteristics of this project must be taken into consideration, namely, a) many components are involved in the fields of road, irrigation, and buildings, b) there is a flood period every year so the timing for earthwork and the construction of concrete substructures is restricted, c) a large amount of labor for canal re-excavation must be properly supervised. The improvement of pavement along the specified routes will be conducted on the premise that all earthwork will have been completed before by the Bangladeshi side before the pavement implementation. Therefore actual conditions of such routes and locations should be reconfirmed prior to the project implementation.

The project implementation needs to be divided into three phases due to a large number of the project components, and hence local contractors should be involved in the project. Local consultants should also be involved to assist Japanese consultants with their supervision of the contractors. To keep close contact between Japanese and Bangladeshi Government authorities concerned, Japanese consultants should be dispatched as supervisors.

Two executing agencies, the BRDB and the LGEB, are to be in charge of the project components as follows:

Component		Executing Agency
Feeder Road A	:	LGEB (RHD)
Feeder Road B	:	LGEB
Growth Centers	:	LGEB
Canal Re-excavation	:	LGEB
Buried Pipeline System	:	LGEB
Low Lift Pump	:	BRDB
Primary School	:	LGEB
UCCA Facilities	:	BRDB
Godowns	:	BRDB
Pump Storage House	:	BRDB

(2) Current Construction Circumstances and Consideration

1) Roads

Paving work for a main road such as the Feeder Road A must be done with a half side of the road being usable for daily trafic. In the current condition, most of the roads do not have enough space for a vehicle to U-turn, therefore turning places must be furnished in temporary works. For bridge construction where there are disconnected access roads, materials are to be transported by boats when the water level is high enough.

2) Irrigation

a) Canal re-excavation

To expeditiously complete canal excavation several work parties which consist of one laborer for excavation and two or three laborers for soil removal are to be committed in a certain sections of the canal. It can be said farmers are accustomed to this kind of earthwork through projects by such as FFW. It is estimated that five hundred to one thousand laborers can be mobilized in this work at a excavation site during the farmers slack season.

b) Coffer dam and unwatering

In case the water level in the canal is still high coffer dams made with sand bags have to be provided prior to the excavation. Engine pumps are to be used for unwatering.

c) Soil removal

Excavated soil is removed from the canal bed with manual labor. Special soil-banks will not be prepared for the removed soil. Instead, the removed soil will be piled on the canal embankment to be used by farmers for soil dressing.

3) Buildings

The concerned executing agencies in Bangladesh are requested to improve the access roads to the sites, to fill the sites with earth and to carry the electricity into the sites in necessary places before the beginning of the work of the Project. In addition to the Project, the road improvement is to be executed at the same time by the Bangladeshi side and some buildings are planned to stand in a line along the roads. Arrangements between both jobs therefore will be needed before the commencement of the work.

(3) Supervising Plan

The number of supervisors required for building construction depends on the construction period. In case all construction work are started at the same time, at least two supervisors are necessary since the sites are scattered in the project area. The construction period is affected by the rainy season in which some interior work can be done. In this connection, two supervisors, one architect and one civil engineer, are required for the project's implementation judging from the later mentioned construction schedule. Besides, other specialists must be dispatched as spot supervisers depending on the work.

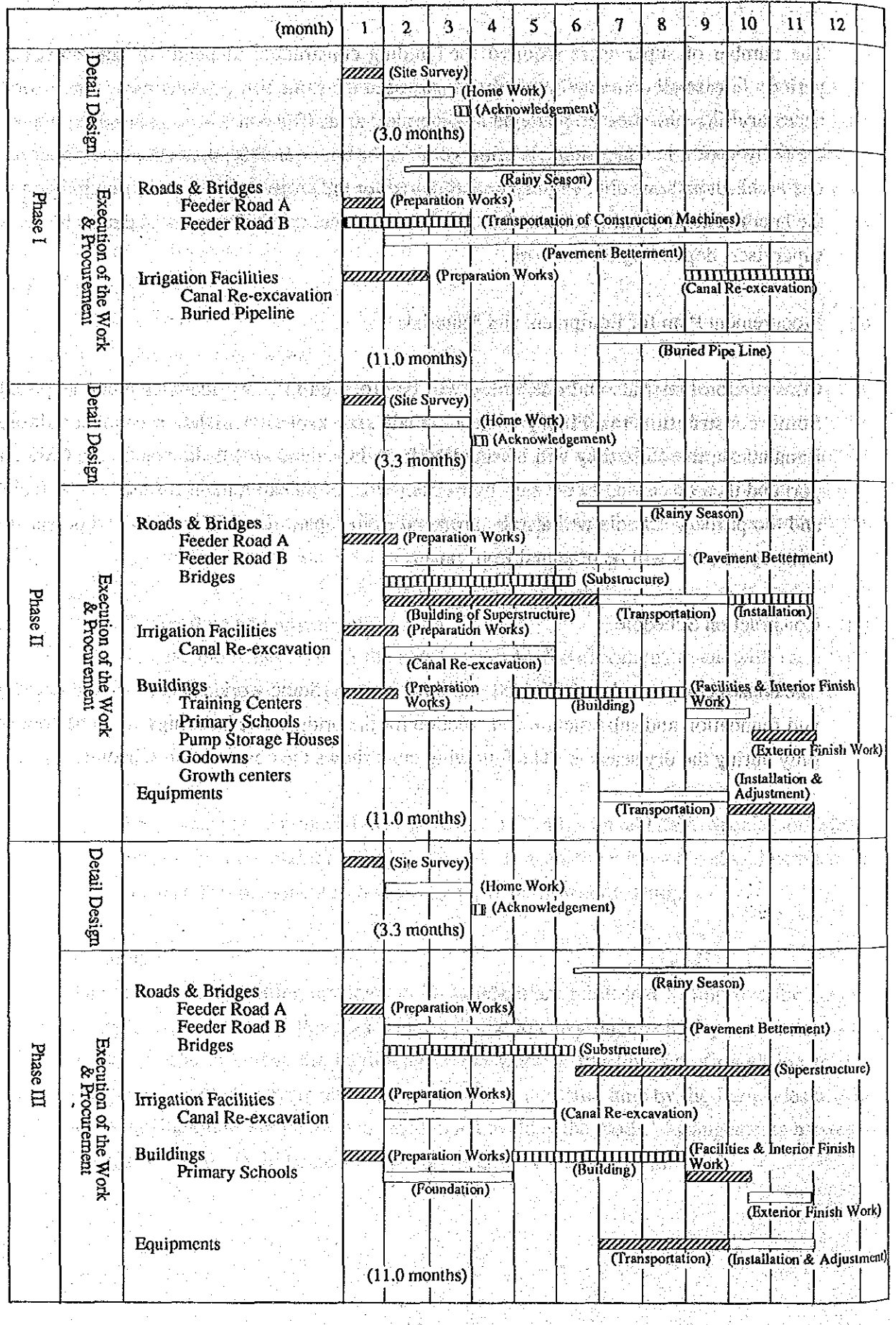
(4) Procurement Plan for Equipment and Materials

Construction materials and machinery will be procured in Bangladesh as much as possible. Some construction machinery such as small size asphalt finisher are not available in Bangladesh, therefore they will be supplied from Japan and will be landed on the Chittagong port and then be carried to the sites by trucks. Most of the equipment for the UCCA facilities and the primary schools will also be procured from Japan. Low lift pumps and power tillers with spare parts will be procured from Japan.

(5) Construction Schedule

The construction schedule is divided into three phases. Some work such as canal re-excavation and foundation and substructure construction for the bridges and buildings are to be conducted only during the dry seasons. The following table shows the construction schedule.

Construction Schedule



4-5 Project Cost to be born by the Government of Bangladesh

The project cost to be born by the Government of Bangladesh is estimated as follows.

Project Cost to be born by the Government of Bangladesh

				Unit: 1,000 TK
(1)	LGEB			
	1)	Construction cost;		1,567
		Site filling & access road for Jamalkandi Primary School	37	
		Electricity introduction; Itakhola Primary School	1,530	
	2)	Pay for staff (4 persons) and employees (9 persons); 3 years		1,750
	3)	Vehicles; 1,500 for 1 car, 150 for 3 moter-cycles		1,650
	4)	Office expenditures; furniture, equipments, rent, stationary, printing, telephone, electricity, etc.		5,850
	5)	Custum duty;		10,125
	6)	Bank commission;		572
		Total		21,514
(2)	BRDB			
	1)	Construction cost; Site filling & access road for Daudkandi UCCA		149
	2)	Pay for staff (4 persons) and employees (18 persons); 8 years (Personnel expenditures for training, pump rental & marketing bussinesses are included in 5) & 8).)		8,616
	3)	Vehicles; 2,000 for 2 Jeeps and 100 for 20 bicycles		2,100
	4)	Office expenditures; furniture, equipments, rent, stationary, printing, telephone, electricity, etc.		5,750
	5)	Traning; 1,100 / year x 6 years		6,600
	6)	Custom duty;		16,634
	7)	Bank commission;		85
		Sub-total		39,934
	8)	Profit from pump rental and marketing businesses; (175 + 460) / year x 6 years		3,175
		Net total expenditures		36,759

CHAPTER 5 PROJECT EVALUATION AND CONCLUSION

This Model Rural Development Project is aimed at realizing a remarkable comprehensive impact by means of making intensive investment for integrated rural development in a relatively small project area. Besides, the Project area is a typical Bangladesh rural area, which suffers annual floods, and is located in the Comilla District to which a leading role has been given for rural development in Bangladesh. Accordingly, this Project is expected to present an appropriate model for rural development in Bangladesh.

This Project is expected to bring about the following developmental impacts.

The work to make 52 km of important trunk roads durable for all weather through the paving of roads and bridge erections are to significantly improve not only the traffic conditions inside the Project area but also their access to Dhaka through the national highway, of which one gap was already connected by a new bridge and the remaining last gap is planned to be linked in the near future. This traffic improvement will greatly contribute to the development of agriculture and other industries as well as facilitate people's daily lives.

Two growth centers, which at present mostly depend on boat transportation due to the poor conditions of access roads, are planned to be provided with a land transportation route to the national highway through the road network improvements as well as to be rehabilitated for a smoother marketing business. This combined improvement of markets and their access roads is expected to bring about business expansion for both the growth centers and thus to significantly contribute to the development of the regional economy.

The re-excavation of 64 km of canals, the procurement of low-lift pumps and the installation of pipelines for deep tube well schemes are to make it possible to expand the irrigated area by 3800 ha in the dry season, when improved farming with the growing of high yield varieties can effectively be introduced without inundation problems. This enlarged irrigation will increase annual production by 15000 tons in the case of paddy cropping and thus upgrade farmers' incomes. In addition, the canal excavation is planned to be made through manual labor so that it will contribute to the increase of employment opportunities during the construction period.

A training center, which has four training rooms, is planned for each UCCA to strengthen its training actiyities on cooperative activities, improved farming technology, family welfare, vocational skills, etc.. This center will be able to provide about 25,000 man-day training a year. Low-lift pumps together with a storage house for them are to be procured to each UCCA to rent them to cooperative members, which will not only promote irrigated agriculture but also financially support UCCA activities through the providing of income from pump rental fees. The construction of godowns for

grain and fertilizer for the Homna UCCA will be instrumental for the supply of fertilizer and marketing of products for its members. These measures to be provided through the Project will be able to support and strengthen the UCCAs' activities. Furthermore, it will be extremely effective to encourage UCCAs' activities, if technical cooperation through the dispatch of JICA experts and JOCV members to the BRDB and Daudkandi and Homna UCCAs is implemented in concert with the Project.

The rehabilitation of four primary schools is planned to contribute to the promotion of compulsory primary education, which is a key national policy, as well as to be used for community activities. It is said that upgrading people's educational level through primary education brings about their productivity increase in farming in the long run, which a great deal will contribute to rural development.

The above-mentioned project components are related to each other. Improved roads will provide better traffic conditions for activities relevant to other project components. Improved canals and provided pumps for irrigation will bring about sufficient productivity increases, only when it is connected with improved farming practices, which is to be supported by the training of farmers on appropriate irrigation management and improved techniques and input supply through UCCA activities. Accordingly, the execution of this Project, whose components are integrated in harmony with each other, will be significantly effective to promote rural development.

This Project, as mentioned above, is expected to be remarkably fruitful as a model rural development project according to the key policy of the Government of Bangladesh as well as to contribute a great deal to upgrading living standards of rural people including the poor. Therefore, it is judged to be appropriate that this Project is executed as a grant aid project.

In order to successfully implement the Project, the Government of Bangladesh is requested to post the required personnel and to secure the neccessary budget. Furthermore, it is needed that the Government of Bangladesh will fully conduct the planned operation and necessary maintenance for the facilities and equipment to be constructed or procured through the Project. In addition, it is recommended that JICA experts and JOCV members will be dispatched to cooperate with the BRDB to support UCCA activities in connection with this Project. The combined implementation of the technical cooperation and this grant aid project, which is to improve only physical infrastructures due to its institutional nature, is considered to produce the most fruitful results for integrated rural development.