JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

LOCAL GOVERNMENT ENGINEERING DEPARTMENT,
MINISTRY OF LOCAL GOVERNMENT,RURAL DEVELOPMENT
AND COOPERATIVES,
THE PEOPLE'S REPUBLIC OF BANGLADESH

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR THE CONSTRUCTION OF
MULTIPURPOSE CYCLONE SHELTERS (II)
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

JUNE , 1994

JAPAN ENGINEERING CONSULTANTS CO.,LTD.

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PREFACE

In response to a request from the Government of the People's Republic of Bangladesh, the Government of Japan decided to conduct a basic design study on the Project for the Construction of Multipurpose Cyclone Shelters (II) in the People's Republic of Bangladesh and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Bangladesh a study team headed by Mr. Masayuki Watanabe, International Cooperation Specialist of JICA and constituted by members of Japan Engineering Consultants Co., Ltd., from January 23 to March 1, 1994.

The team held discussions with the officials concerned of the Government of Bangladesh, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Bangladesh in order to discuss a draft report, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the Project (II) and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the People's Republic of Bangladesh for their close cooperation extended to the teams.

June, 1994

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

June, 1994

Mr. Kensuke Yanagiya,
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

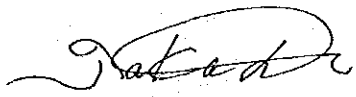
We are pleased to submit to you the basic design study report on the Project for the Construction of Multipurpose Cyclone Shelters (II) in the People's Republic of Bangladesh.

This study was conducted by Japan Engineering Consultants Co., Ltd., under a contract to JICA, during the period January 17, 1994 to June 30, 1994. In conducting the study, we have examined the feasibility and rationale of the Project (II) with due consideration to the present situation of Bangladesh and formulated the most appropriate basic design for the Project (II) under Japan's grant aid scheme.

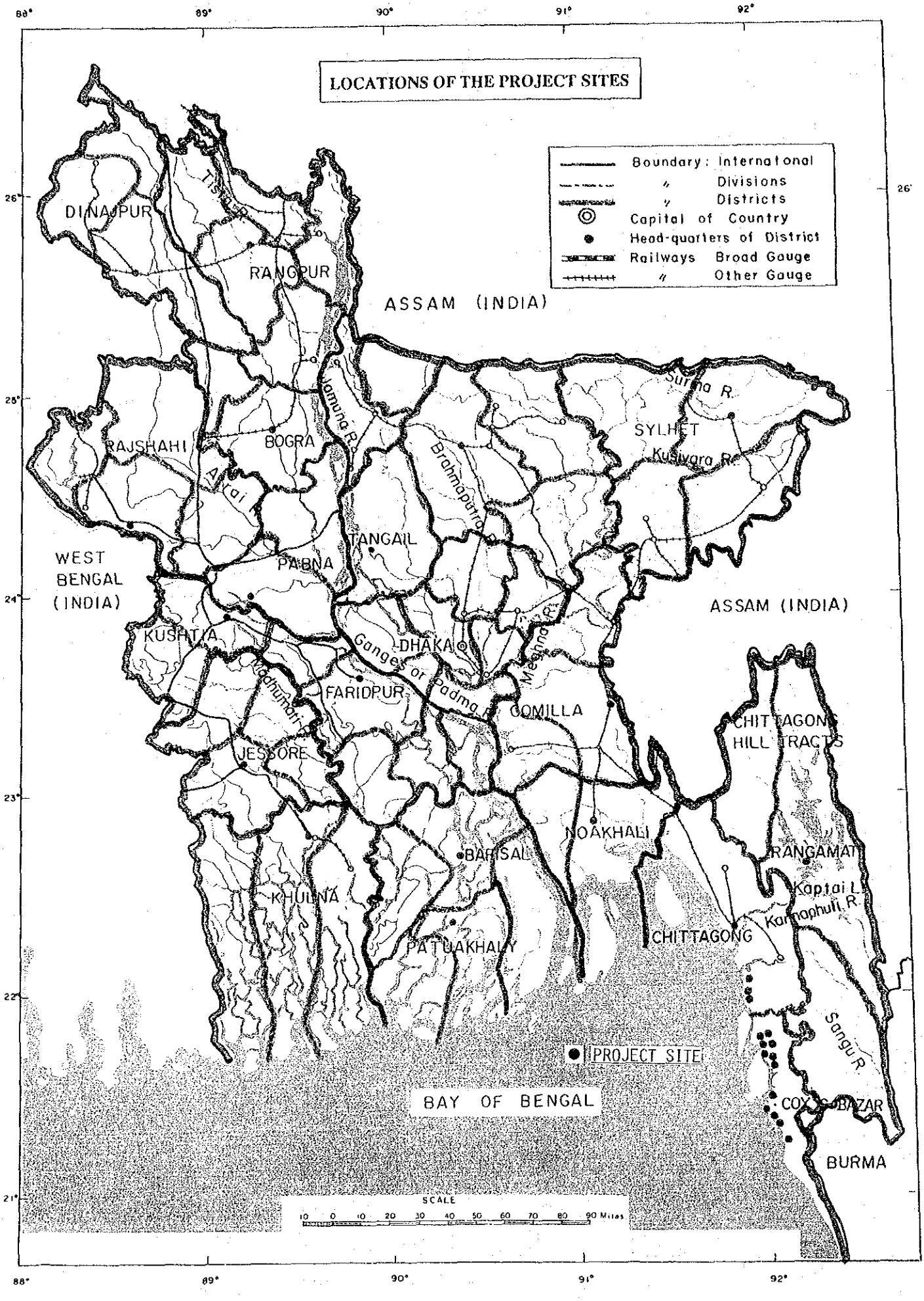
We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA and the Ministry of Foreign Affairs. We would also like to express our gratitude to the officials concerned of Economic Relations Division, Local Government Engineering Department, Primary and Mass Education Division, the JICA Bangladesh office, the Embassy of Japan in Bangladesh for their cooperation and assistance throughout our field survey.

Finally, we hope that this report will contribute to further promotion of the Project (II).

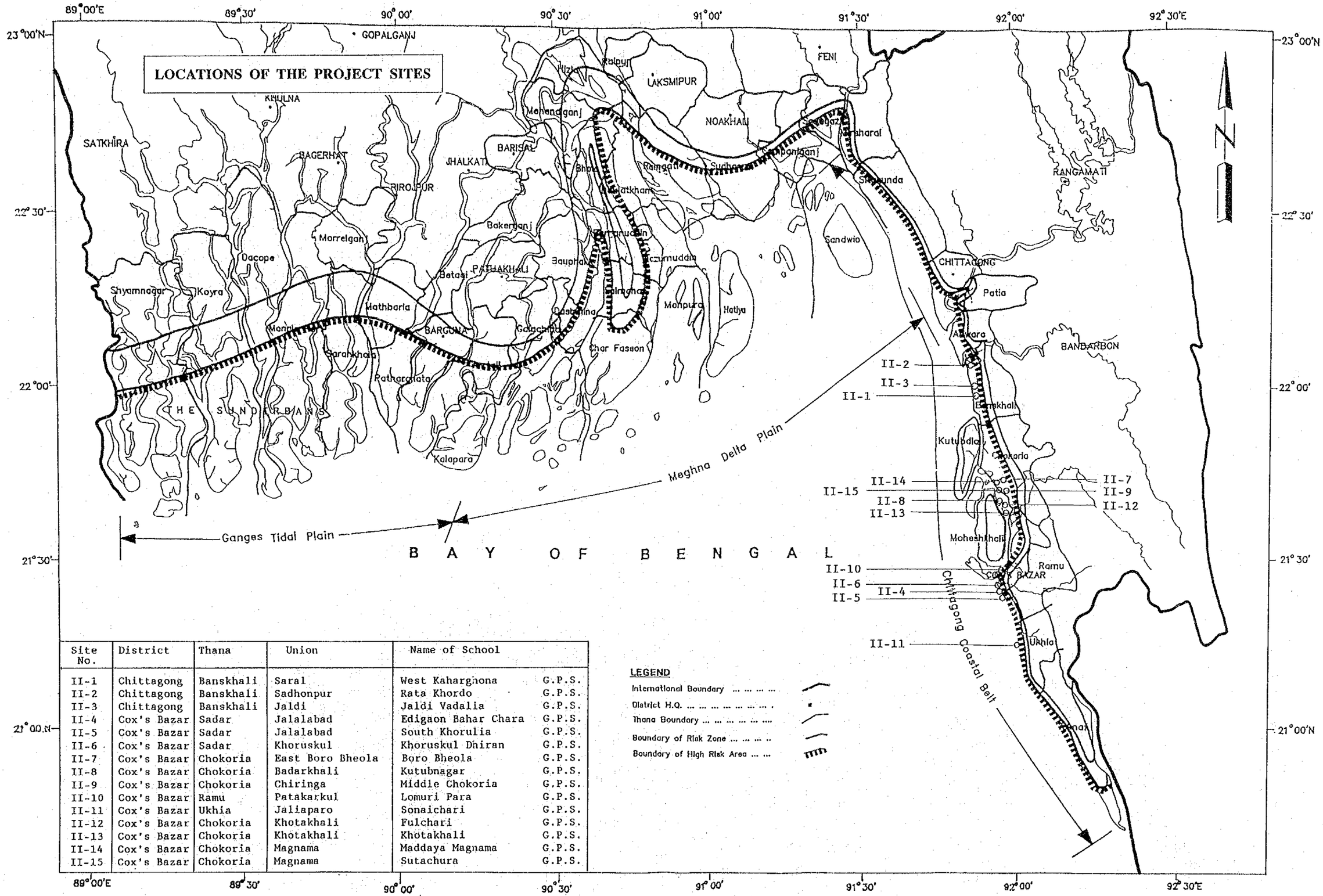
Very truly yours,



Hisashi Takada
Project Manager
Basic Design Study Team on the Project for the Construction of Multipurpose Cyclone Shelters (II)
Japan Engieering Consultants Co., Ltd.


LOCATIONS OF THE PROJECT SITES
Boundary : International
Divisions
Districts
Capital of Country
Head-quarters of District
Railways Broad Gauge
Other Gauge
DINAJPUR
RANGPUR
ASSAM (INDIA)
RAJSHAHI
BOGRA
Jamuna R.
Surma R.
SYLHET
Kushiyara R.
Brahmaputra R.
Ajkai R.
TANGAIL
PABNA
WEST BENGAL (INDIA)
ASSAM (INDIA)
KUSHTIA
DHAKA
Meghna R.
Ganges or Padma R.
Madhumati R.
FARIDPUR
COMILLA
CHITTAGONG HILL TRACTS
JESSORE
NOAKHALI
BARISAL
RANGAMATI
Kaptai L.
Karnaphuli R.
KHULNA
CHITTAGONG
PATUAKHALY
Sangu R.
PROJECT SITE
BAY OF BENGAL
COX'S BAZAR
BURMA
SCALE
10 0 10 20 30 40 50 60 70 80 90 Miles
88°
89°
90°
91°
92°
26°
25°
24°
23°
22°
21°

LOCATIONS OF THE PROJECT SITES



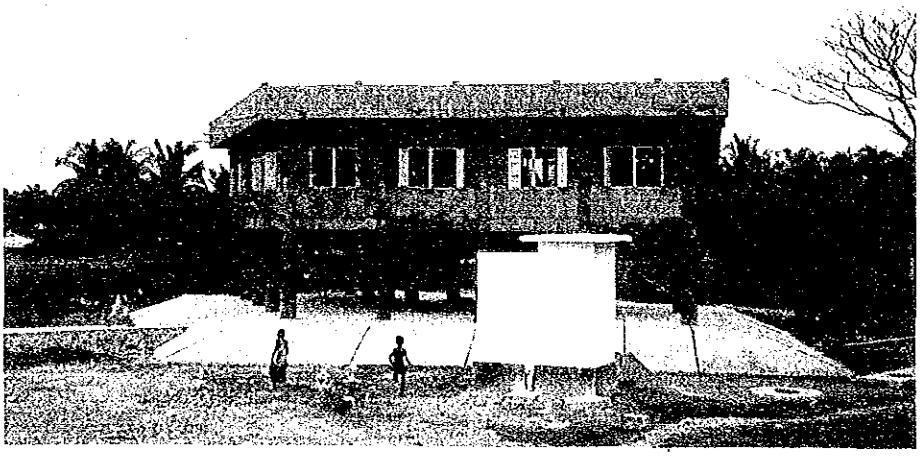
Site No.	District	Thana	Union	Name of School	
II-1	Chittagong	Banskhali	Saral	West Kaharghona	G.P.S.
II-2	Chittagong	Banskhali	Sadhonpur	Rata Khordo	G.P.S.
II-3	Chittagong	Banskhali	Jaldi	Jaldi Vadalia	G.P.S.
II-4	Cox's Bazar	Sadar	Jalalabad	Edigaon Bahar Chara	G.P.S.
II-5	Cox's Bazar	Sadar	Jalalabad	South Khorulia	G.P.S.
II-6	Cox's Bazar	Sadar	Khoruskul	Khoruskul Dhiran	G.P.S.
II-7	Cox's Bazar	Chokoria	East Boro Bheola	Boro Bheola	G.P.S.
II-8	Cox's Bazar	Chokoria	Badarkhali	Kutubnagar	G.P.S.
II-9	Cox's Bazar	Chokoria	Chiringa	Middle Chokoria	G.P.S.
II-10	Cox's Bazar	Ramu	Patakarkul	Lomuri Para	G.P.S.
II-11	Cox's Bazar	Ukhia	Jaliaparo	Sonaichari	G.P.S.
II-12	Cox's Bazar	Chokoria	Khotakhali	Fulchari	G.P.S.
II-13	Cox's Bazar	Chokoria	Khotakhali	Khotakhali	G.P.S.
II-14	Cox's Bazar	Chokoria	Magnama	Maddaya Magnama	G.P.S.
II-15	Cox's Bazar	Chokoria	Magnama	Sutachura	G.P.S.

LEGEND

- International Boundary ... ...
- District H.Q. ... ...
- Thana Boundary ... ...
- Boundary of Risk Zone ... ...
- Boundary of High Risk Area ... ...

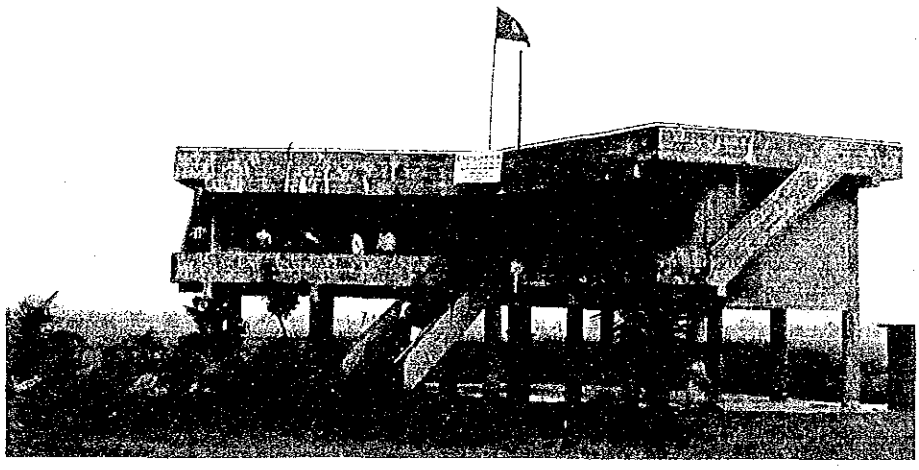
[VARIOUS CYCLONE SHELTERS IN PROJECT AREA]

Cyclone Shelter
by FD



Cyclone Shelter
by Caritas

Cyclone Shelter
by BDRCS



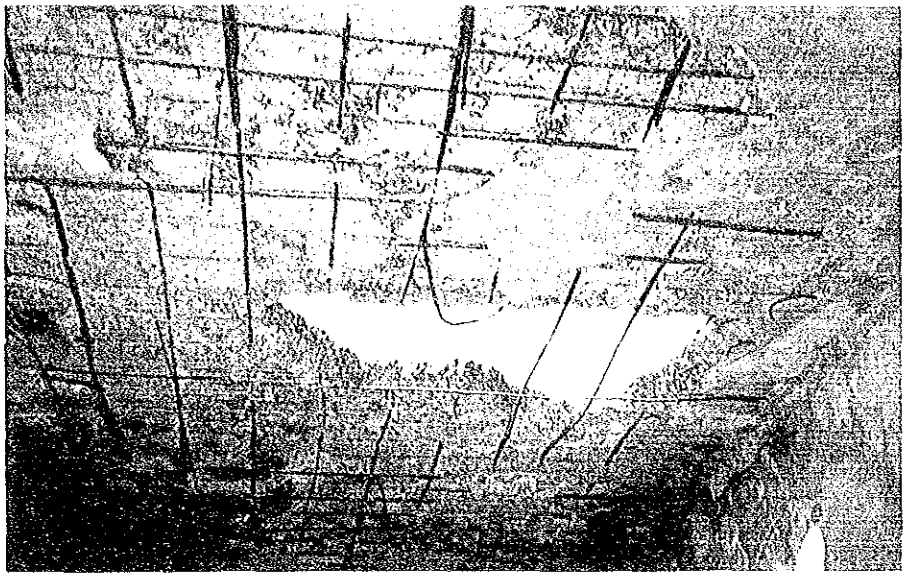
[CURRENT STATE OF PRIMARY SCHOOLS IN PROJECT SITES]

Primary School at Site No.II-2
(Almost demolished by a cyclone.)

Primary School at Site No.II-1
(Dangerous to use because of the severe deterioration of the structure.)

Primary School at Site No.II-5
(Relatively well maintained.)

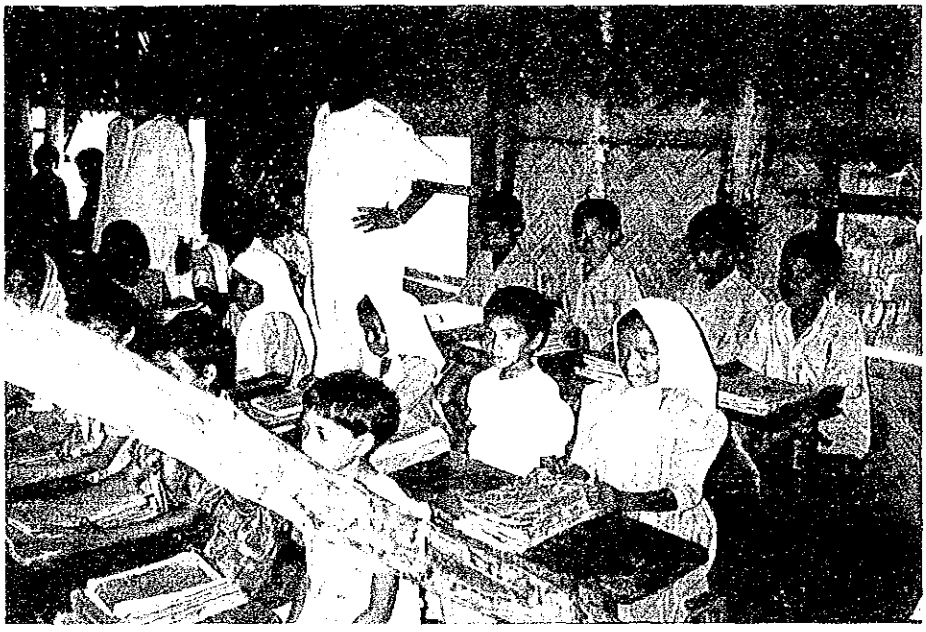
Primary School at Site
No.II-12
(Ceiling)



Primary School at Site
No.II-1
(Ceiling)

Exterior of the Above
(Corridor)

Primary School at Site
No.II-8
(Teaching scene)



Primary School at Site
No.II-13
(Teaching scene)

SUMMARY

The People's Republic of Bangladesh (Bangladesh) has the world's largest delta formed by the Ganges, Brahmaputra and Meghna rivers which covers as much as 90% of the total national land area. Because of the delta's topographical conditions and an elevation of less than 10m above sea level, many natural disasters, particularly flooding and cyclones, have a devastating effect on the country.

While the primary characteristic of cyclones which hit Bangladesh is extremely strong wind often exceeding 60 m/sec, the frequent storm surges which are caused by the cyclones are, in fact, much more dangerous than the wind. Storm surges along the coast can be as high as 5 - 9m, killing a number of people living in the delta plain every year.

Some 5.2 million people currently live in Bangladesh's High Risk Area (HRA) which is the most vulnerable area to cyclone damage. Because of the topographical conditions, high population density and land ownership system, a large part of the rapidly increasing population has no alternative but to live in the newly created or developed areas in the coastal low plains despite the eminent risk. Two-thirds of those living in the coastal low plains have no protection against storm surges in the form of natural hills or multi-story RC buildings for evacuation purposes. The result is the loss of many lives.

With the intent of mitigating/preventing possible damage due to cyclones, some 400 cyclone shelters have been constructed by various aid organizations since the 1960's. Despite the need to construct many more shelters, the speed at which actual construction has taken place has been very slow. Following the great disaster in April, 1991, the Government of Bangladesh made an urgent request to donor countries for assistance for the construction of additional cyclone shelters. Assisted by the strong concern expressed by the international community, there has been a marked increase in the pledging of aid by donor countries and aid organizations and the speed at which international aid has been made available has accelerated. Some 220 cyclone shelters are currently under construction and the construction of an additional 340 cyclone shelters (sites already confirmed) has been pledged by various aid organizations. Nevertheless, the number of completed cyclone shelters, those under construction and those of which construction has been pledged are still far below the original target of 2,500 envisaged by the Multipurpose Cyclone Shelter Programme (Master Plan) which was prepared by the Government of Bangladesh in July, 1993 with the assistance of the World Bank and UNDP with the purpose of protecting the estimated population in the HRA in 2002. The construction of as many cyclone shelters as possible to save human lives is, therefore, urgent.

As part of the efforts to achieve the objective of the Master Plan, the Government of Bangladesh made a request via its Local Government Engineering Department (LGED) in January, 1992 to the Government of Japan for the construction of new cyclone shelters at 40 sites.

In response to this request, the Government of Japan sent the Preliminary Study Team and the Additional Study Team, mainly consisting of former Japan Overseas Cooperation Volunteers (JOCV) members, to Bangladesh in March, 1992 to check the conditions of the requested sites and other aspects of the request. The Study Teams found 18 of the originally requested 40 sites to be suitable for the construction of cyclone shelters but found the remaining 22 sites to be unsuitable due to the non-existance of houses nearby, the too far distance (more than 2km) from nearby houses, the location on a dry riverbed and/or the existence of a hill or cyclone shelter for evacuation purposes in the vicinity.

Based on these study findings, the Basic Design Study for the Project (I) was conducted between October, 1992 and February, 1993 and the Government of Japan subsequently agreed to provide grant aid for the construction of a cyclone shelter at 10 different high priority sites and concluded the E/N in August, 1993. The actual construction work commenced in December, 1993.

During the Basic Design Study period of the Project (I), the 2 countries agreed that it would be sound and effective for the planned cyclone shelters to be used as school buildings during normal times in view of ensuring their proper maintenance. In view of the opinion expressed by the Bangladesh side that the construction cost of Japan's cyclone shelters was much higher than that of cyclone shelters constructed by other donors and the Government of Bangladesh, both sides further agreed to select project sites, which had been scattered in the Project (I), in a relatively small number of areas to reduce the construction cost.

Based on this agreement, the Government of Bangladesh made a new request to the Government of Japan in September, 1993 for the rebuilding of 30 primary school buildings which were either damaged or very likely to be damaged by cyclones as cyclone shelter-cum-school buildings.

In response to this renewed request, the Government of Japan decided to conduct the Basic Design Study and the Japan International Cooperation Agency (JICA) subsequently sent the Basic Design Study Team to Bangladesh for the period between January 23 and March 1, 1994.

The Basic Design Study Team conducted field surveys, collected relevant data and information and discussed the possible contents of the Project (II) with the Government of Bangladesh. Upon the Study Team's return to Japan, further analysis of the collected data and information was conducted and the draft contents of the report were explained to the Bangladesh counterparts between April 6 and April 22, 1994 before finalizing the present report.

As 10 of the 30 sites originally proposed by the Government of Bangladesh were outside the HRA and as the overall geographical distribution of the sites was rather too extensive, the Japanese side requested that the Government of Bangladesh nominate an additional 20 candidate sites.

Of the 50 candidate sites, 23 sites located in the HRA in the Chittagong and Cox's Bazaar Districts were selected as subject sites for the detailed study to achieve a fair degree of site concentration as agreed during the Basic Design Study period of the Project (I).

In selecting the actual Project Sites from these 23 sites, the application of the following main criteria was agreed by the 2 sides.

① High cyclonic storm surge height

② Absence of 2 or more story public buildings or high ground (hills) with the required evacuee accommodation capacity in the neighbourhood

③ Densely populated area without a cyclone shelter in the neighbourhood

Based on the above criteria, the following 15 sites were selected as Project Sites for the construction of cyclone shelters.

Site No.	District	Thana	Union	School (GPS)
II-1	Chittagong	Banskhali	Saral	West Kaharghona
II-2	Chittagong	Banskhali	Sadhonpur	Rata Khordo
II-3	Chittagong	Banskhali	Jaldi	Jaldi Vadalia
II-4	Cox's Bazar	Sadar	Jalalabad	Edigaon Bahar Chara
II-5	Cox's Bazar	Sadar	Jalalabad	South Khorulia
II-6	Cox's Bazar	Sadar	Khoruskul	Khoruskul Dhiran
II-7	Cox's Bazar	Chokoria	East Boro Bheola	Boro Bheola
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II-9	Cox's Bazar	Chokoria	Chiringa	Middle Chokoria
II-10	Cox's Bazar	Ramu	Patakarkhul	Lomuri Para
II-11	Cox's Bazar	Ukhia	Jaliaparo	Sonsichari
II-12	Cox's Bazar	Chokoria	Khotakhali	Fulchari
II-13	Cox's Bazar	Chokoria	Khotakhali	Khotakhali
II-14	Cox's Bazar	Chokoria	Magnama	Maddaya Magnama
II-15	Cox's Bazar	Chokoria	Magnama	Sutachura

GPS: Government primary school

The construction of the following facilities is planned.

(1) Cyclone Shelter Functions

Taking into consideration the guidelines provided by the Master Plan for the Multipurpose Cyclone Shelter Programme formulated by the World Bank and UNDP, the minimum accommodation of a planned cyclone shelter is set at 1,650 persons which corresponds to the 3-classroom (50 pupils/classroom) type of school with one teachers' room (4 teachers). Therefore, the rebuilt schools will have at least 3 classrooms.

- Floor Area (column centre distance) (in the case of 3-classroom type)

Ground Floor (piloti)	: 262 m^2
First Floor	: 262 m^2
Total	: 524 m^2

- Height

Floor Height of First Floor	: GL +3.5m, 5.5m or 7.0m (3 types)
Roof	: floor height of first floor + 4.0m

- Structure, etc.

Main Structure (pillars, beams and floor)	: reinforced concrete

Walls	: brick masonry
Number of Floors	: 2 (piloti for ground floor) staircase to the roof to allow evacuation to the roof top
• Killa	: A killa, the size of which corresponds to the accommodation capacity and height of the cyclone shelter, will be constructed at each site by the Bangladesh side and this is a condition to be met by the Bangladesh side for Japanese assistance.

(2) Primary School Functions

The current 4th 5-Year Plan (1990/91 - 1994/95) primarily aims at achieving accelerated economic growth (target average annual GDP growth of 5% in the Plan period), the mitigation of poverty through employment creation and manpower development and increased self-reliance. It intends to further stimulate the private sector through the active promotion of inward foreign investment and emphasizes rural development, the participation of women in development programmes and education to arrest the population explosion. The expansion and consolidation of primary education in particular is currently one of the highest priority tasks together with agricultural promotion, rural development, health care and family planning, development of the transportation network and industrial development. The Government of Bangladesh is, therefore, promoting the construction of primary schools equipped with a sufficient number of classrooms to accommodate the existing pupils in order to consolidate the physical side of primary education.

Based on the total number of pupils currently attending Classes 1 and 2 in the morning at each Project Site, 3 school sizes are adopted, i.e. 3, 4 and 5-classroom schools. The school type and number of teachers for each Project Site are listed as follows.

Site No.	(School Type) No. of Classrooms	No. of Teachers
II-1	3	4
II-2	3	4
II-3	4	5
II-4	5	6
II-5	5	6
II-6	5	6
II-7	4	5
II-8	3	4
II-9	4	5
II-10	3	4
II-11	5	6
II-12	5	6
II-13	5	6
II-14	5	6
II-15	5	6

Based on the planned school sizes given above, an increase of the teacher strength by one teacher for Site Nos. II-5 and II-12 and by 2 teachers for Site No. II-15 will be required for the proper operation of primary education.

- School Furniture, etc.

[For Each Classroom]

Pupils' Desks and Chairs (3 seaters) : 17 sets
Teacher's Desk and Chair : one set
Blackboard : one

[For Teachers' Room]

Teachers' Desks and Chairs : one set for each teacher
Blackboard : one

[Toilets]

3 and 4-Classroom Schools : 3 cubicles each for boys and girls
5-Classroom Schools : 4 cubicles each for boys and girls

(3) Auxiliary Facilities

- Hand Pump : one
- Borehole (GL - 300/-400m) : one
- Septic Tank : one

(4) Land Acquisition

Additional land is required in the case of Site Nos. II-3 and II-10 for the proper functioning of the planned facilities as cyclone shelters and primary school buildings.

The estimated project cost to be borne by the Government of Bangladesh is Taka 27.5 million (approximately 75 million yen). The project implementation period is scheduled to be 15 months, i.e. 5 months for the detailed design work (including the tender procedure) and 10 months for the actual construction work.

The project implementation agency is the Local Government Engineering Department (LGED) of the Ministry of Local Government, Rural Development and Cooperatives (MLCRD&C). The LGED is responsible for all public civil engineering works and similar building construction works in local areas, including the construction and repair of government schools, government offices and housing for civil servants. The LGED has also been managing 10 cyclone shelters on Kutubdia Island in recent years with the financial assistance of the International Fund for Agricultural Development (IFAD). It is also the implementation agency for the Cyclone Shelter Construction Project (I) for which Japanese grant aid has been provided.

The maintenance responsibility for the new facilities will fall on the Primary and Mass Education Division (PMED) of the Prime Minister's Office which will commission the LGED to conduct the actual maintenance work. The annual maintenance cost and personnel cost (for additional teachers) of the 15 cyclone shelters (primary school buildings) is estimated to be Taka 0.74 million (approximately 2 million yen) which should be easily met by the PMED in view of its current budget size.

The implementation of the Project (II) will protect the lives of some 300,000 people living in the HRA. The cyclone shelters will also serve as school buildings during normal weather conditions for as many as some 6,000 pupils, greatly assisting the consolidation of education in Bangladesh through the provision of safe and pleasant educational facilities. Moreover, the implementation of the Project (II) will encourage the settlement of inhabitants in the HRA due to the additional safety provided by the cyclone shelters. The consolidation of access roads will contribute to improving the economic development and the living standard of local

communities. The implementation of the Project (II) with grant aid provided by the Government of Japan is, therefore, deemed viable.

The Project (II) envisages the construction of a cyclone shelter at 15 different sites, following the construction of similar shelters at 10 sites under the Project (I) compared to the original request of the Government of Bangladesh for the construction of cyclone shelters at 40 sites. As the viability and necessity of these cyclone shelters are without question, the approval and implementation of the Basic Design Study for the Project (III) for the remaining 15 sites is highly recommended as soon as appropriate sites have been selected by the Government of Bangladesh. In view of the fact that the Project Concept Paper (PCP) relating to the Project (II) requires revision by the Bangladesh side, the Project (II) can only be implemented following approval of the revised the PCP by the Executive Committee for the National Economic Council (ECNEC).

The Project (II) is in line with the objectives of the International Decade for Natural Disaster Reduction (IDNDR) and is appropriate vis-a-vis Japan's policy to actively provide international aid for the prevention of natural disasters world-wide, particularly in developing countries.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ADB	:	Asian Development Bank
ADP	:	Annual Development Programme
ATEO	:	Assistant Thana Education Officer
BDRCS	:	Bangladesh Red Crescent Society
BRAC	:	Bangladesh Rural Advancement Committee
BTTB	:	Bangladesh Telephone & Telegraph Board
BWDB	:	Bangladesh Water Development Board
CCC	:	Coastal Community Center
CCDB	:	Christian Commission for Development in Bangladesh
CDC	:	Community Development Committee
CEC	:	Commission of European Communities
CPP	:	Cyclone Protection Project
CPP	:	Cyclone Preparedness Programme
CSCO	:	Cyclone Shelter Construction Organization
DANIDA	:	Danish International Development Agency
DPE	:	Directorate of Primary Education
ECNEC	:	Executive Committee for the National Economic Council
E/N	:	Exchange of Notes
ERD	:	Economic Relations Division
FAP	:	Flood Action Plan
FD	:	Facilities Department
GEP	:	General Education Project
HF	:	High Frequency
HRA	:	High Risk Area
IDA	:	International Development Agency
IDNDR	:	International Decade for Natural Disaster Reduction
IFAD	:	International Fund for Agricultural Development
IGA	:	Income Generating Activity
JICA	:	Japan International Cooperation Agency
JOCV	:	Japan Overseas Cooperation Volunteers
LGED	:	Local Government Engineering Department
MCSP	:	Multipurpose Cyclone Shelter Programme
M/D	:	Minutes of Discussions
MLGRD & C	:	Ministry of Local Government, Rural Development & Cooperatives
MOE	:	Ministry of Education
MOW	:	Ministry of Works

NAEM	:	National Academy for Educational Management
NDP	:	New Development Perspective
NFP	:	National Flood Programme
NGO	:	Non-Government Organization
O&M	:	Operation and Maintenance
OPEC	:	Organization of Petroleum Exporting Countries
PCP	:	Project Concept Paper
PMED	:	Primary and Mass Education Division
PTI	:	Primary Training Institute
PV	:	Photo Voltaic
PWD	:	Public Works Department
PWP	:	Priority Works Programme
RHD	:	Roads and Highways Department
RZ	:	Risk Zone
SMC	:	School Management Committee
SPD	:	Society for Peace and Development
UHF	:	Ultra High Frequency
UNDP	:	United Nations Development Programme
UNICEF	:	United Nations Children's Fund
UPE	:	Universal Primary Education
VHF	:	Very High Frequency
WFP	:	World Food Programme
WVB	:	World Vision of Bangladesh

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

Approximately 90% of the land area of the People's Republic of Bangladesh (Bangladesh) consists of the world's largest delta formed by the Ganges, Brahmaputra and Meghna rivers with most of the delta land being less than 10 meters in elevation. Given such topographical conditions, Bangladesh is subject to two types of serious natural disasters, i.e. flooding and cyclones.

Several million people live in the coastal High Risk Area (HRA) along the Bay of Bengal which is prone to cyclone damage. In addition to the recent great disasters in 1970 and 1985, the cyclone which hit Bangladesh on the night of the 29th and early morning of the 30th of April, 1991 took the lives of some 140,000 people in addition to causing extensive damage to buildings and other structures, mainly in and around Chittagong.

In view of the likelihood of similar disasters in the future, the Government of Bangladesh has requested various aid organizations to assist its efforts to employ disaster prevention measures. In response to this request, many aid organizations have prepared cyclone shelter construction plans, some of which are already at the construction stage. The urgent response of aid organizations, however, appears to lack coordination between the various projects based on a plan to cover the entire HRA and to improve its disaster prevention potential. To rectify this situation, the Government of Bangladesh prepared the Cyclone Shelter Master Plan with the assistance of the UNDP and World Bank to provide guidelines for the future construction of cyclone shelters.

Meanwhile, the Government of Bangladesh in the name of the LGED made a request to the Government of Japan for the construction of new cyclone shelters at 40 sites and the construction of 10 cyclone shelters-cum-educational facilities in the Project (I) commenced in December, 1993 with Japanese grant aid.

During the basic design study period for the Project (I), both the Bangladesh and Japanese sides came to the conclusion that the new cyclone shelters would be better maintained and more useful if they are used as primary school buildings during normal times. Based on this conclusion, the Government of Bangladesh made a revised request to the Government of Japan in September, 1993 for the rebuilding of existing primary school buildings which have been damaged or which are likely to be damaged by cyclones at the remaining 30 sites for cyclone shelters.

In response to this request, the Government of Japan decided to conduct the Basic Design Study for the Project (II). According to the decision by the Government of Japan, the Japan International Cooperation Agency (JICA) sent the Basic Design Study Team led by Masayuki Watanabe, International Cooperation Specialist of JICA, to Bangladesh for the period between January 23 and March 1, 1994, in order to examine the viability of the Project (II) as a grant aid project of the Government of Japan and carry out the basic design to determine the appropriate contents for Japanese cooperation.

The Basic Design Study Team discussed the contents of the request with officials of the Government of Bangladesh, conducted field surveys at 23 sites in the Study Area (15 sites for the survey on natural conditions) and gathered relevant information and data. The items agreed upon by the Japanese and Bangladesh sides through the discussions were then compiled in the Minutes of Discussions (M/D) which were officially signed and exchanged by the representatives of both sides on February 2, 1994 at the office of the Economic Relations Division (ERD) of the Ministry of Finance in Bangladesh.

Upon its return to Japan, the Basic Design Study Team examined the findings of the field surveys and commenced the planning of the Project (II), basic design of the planned facilities, estimation of the project cost, preparation of the operation and maintenance plan and assessment of the viability of the Project (II). The results of these analyses, examinations and planning work were then compiled in the Draft Report.

Upon completion of the Draft Report, JICA sent a team headed by Mr. Masayuki Watanabe, International Cooperation Specialist, to Bangladesh between April 6 and April 22, 1994 to explain the contents of the Report to the Bangladesh side and the Final Report has now been completed.

The list of the Study Team members, field survey schedule, list of interviewees (interviewed officials of the Government of Bangladesh) and the M/D, etc. are included in the appendices of this report.

The site conditions results and natural conditions survey results can be found in Appendices 6 and 7 respectively which are compiled in the Supplementary Volume of the main report.

CHAPTER 2

BACKGROUND OF THE PROJECT (II)

CHAPTER 2 BACKGROUND OF THE PROJECT (II)

2.1 General Review of Cyclone Shelters

2.1.1 Current State of Cyclone Shelters

(1) Cyclones

The cyclones which develop in the Bay of Bengal mainly hit Bangladesh in two periods, i.e. (i) between April and June and (ii) between September and November. While the predominant feature of the cyclones assaulting Bangladesh is strong winds (wind velocity of more than 60 m/sec), the storm surges caused by the strong winds are, in fact, more dangerous. The coastal sea level can be raised by as much as 0.6 - 1.0m due to the southwesterly wind. Together with a flood tide of 3 - 5m above the low tide level, a storm surge along the coastal area can be as high as 5 - 9m, causing many casualties. The following table provides a glimpse of the high death tolls of cyclones in coastal countries along the Bay of Bengal.

Table 2-1-1 Death Toll of Severe Cyclones in Countries Along Bay of Bengal

Year	Country	Deaths
1970	Bangladesh	300,000
1737	India	300,000
1897	Bangladesh	175,000
1991	Bangladesh	138,868
1876	Bangladesh	100,000
1882	India	100,000
1864	India	50,000
1833	India	50,000
1822	Bangladesh	40,000
1839	India	20,000
1789	India	20,000
1965	Bangladesh	19,270
1963	Bangladesh	11,520
1961	Bangladesh	11,468
1985	Bangladesh	11,069
1977	India	10,000

As shown in Fig. 2-1-1, while serious cyclone damage in Bangladesh used to occur every 2 years prior to 1960, it has become almost an annual event since 1969, most often in May, June and October. Fig. 2-1-2 shows the path of severe cyclones, indicating that no coastal area along the Bay of Bengal is spared from cyclone damage. The following table shows prominent storm surges recorded since 1960.

Table 2-1-2 Prominent Storm Surges Since 1960

Date	Max. Wind Velocity (km/hr)	Storm Surge Height (m)	Date	Max. Wind Velocity (km/hr)	Storm Surge Height (m)
9-10-1960	162	-	3-5-1971	-	2.5 - 4.0
30-10-1960	210	4.5 - 6.0	30-9-1971	-	2.5 - 4.0
9-5-1961	146	2.5 - 3.0	6-11-1971	-	2.5 - 5.5
30-5-1961	146	6.0 - 9.0	18-11-1973	-	2.5 - 4.0
28-5-1963	203	4.0 - 5.0	9-12-1973	122	1.5 - 7.5
11-4-1964	-	-	15-8-1974	97	1.5 - 6.5
11-5-1965	162	3.5	28-11-1974	162	2.0 - 5.0
31-5-1965	-	6.0 - 7.5	21-10-1976	105	2.0 - 5.0
14-12-1965	210	4.5 - 6.0	13-5-1977	122	-
1-10-1966	146	4.5 - 9.0	10-12-1981	97	2.0
11-10-1967	-	2.0 - 8.5	15-10-1983	97	-
24-10-1967	-	1.5 - 7.5	9-11-1983	122	-
10-5-1968	-	2.5 - 4.5	3-6-1984	89	-
17-4-1969	-	-	25-5-1985	154	3.0 - 4.5
10-10-1969	-	2.5 - 7.0	29-11-1988	162	1.5 - 3.0
7-5-1970	-	3.0 - 5.0	29-4-1991	225	6.0 - 7.5
23-10-1970	-	-	2-6-1991	100	2.0
12-11-1970	223	6.0 - 9.0	–	–	–

Source: Multipurpose Cyclone Shelter Project

The cyclone causing the most damage in recent years was in November, 1970 which had a maximum wind velocity of 61.9 m/sec, causing a storm surge of 6.0 - 9.0m in height and claiming an estimated 300,000 - 500,000 lives. Human losses of an estimated 11,000 and 2,000 lives due to cyclones were also recorded in 1985 and 1988 respectively. The cyclone which hit Bangladesh on the night of April 29th, 1991 and the morning of the following day recorded a maximum wind velocity of 62.5 m/sec with a storm surge of 6.0 - 7.5m. The Chittagong Region was the worst hit in terms of casualties and property damage and the estimated death toll was approximately 140,000 lives.

One of the reasons why cyclones hitting Bangladesh cause so much devastation, particularly in terms of human lives, is that geographically the trumpet shape of the Bay of Bengal creates high storm surges which in turn tend to claim excessive casualties in the densely populated, flat delta area.

(2) Existing Cyclone Shelters

Due to the almost incessant cyclone damage in the 1960's, a total of 132 cyclone shelters were constructed to serve as Union Offices (Coastal Community Centres). Of these, 118 were located in the High Risk Area (HRA), 9 in the Risk Zone (RZ) and the remaining 5 in other areas. In the 1970's, cyclone shelters were constructed at 238 sites by the Public Works Department (PWD) using funds provided by the International Development Association (IDA) in order to increase the coastal resistance to cyclone damage. Of these, 12 shelters were washed away in subsequent years. Of the surviving 226 shelter sites, 196 are located in the HRA, 19 in the RZ and 12 in other areas. Following the severe cyclone in 1985, the Bangladesh Red Crescent Society (BDRCS) constructed additional cyclone shelters at 62 sites. The Facilities Department (FD) of the Ministry of Education has also constructed 37 cyclone shelters, which also act as primary schools, as part of the initial phase of the general primary education improvement programme (24 in the RZ and 13 outside the RZ).

In addition, 12 cyclone shelters using the same design adopted by the BDRCS have been constructed by Caritas which is a NGO. Other existing shelters include one constructed by the Danish International Development Agency (DANIDA), 6 constructed by assistance provided by the Netherlands, one with Indian assistance and 4 with Swiss assistance. Bangladesh currently has a total of some 400 cyclone shelters.

(3) Cyclone Shelters Under Construction

The BDRCS is currently implementing a programme to construct cyclone shelters at 41 sites. While the FD is constructing shelters at 101 sites with the financial support of Saudi Arabia and at another 16 sites out of a total of 200 sites planned under the EC funded cyclone shelter construction programme, the LGED is conducting similar work at 10 sites with funding by the IFAD and at an additional 10 sites with Japanese grant aid. Moreover, Caritas and other NGOs are supervising the construction of cyclone shelters at 58 sites. In total, cyclone shelters are being constructed in the HRA at 220 sites.

2.1.2 Outline of Cyclone Shelter Construction Plans

(1) Outline of Previous Cyclone Shelter Construction Plans

Bangladesh suffers chronic damage in terms of the loss of human lives and livestock due to regular cyclones which hit the country. Having experienced serious cyclone damage throughout the 1960's, the Government of Bangladesh authorised a plan to construct cyclone shelters at 2,000 sites which would serve as Union Offices (Community Centres) during normal weather conditions. This plan was, however, abandoned due to financial problems after completing the construction of cyclone shelters at only 132 sites. Cyclone shelters (cum-school buildings) have since been constructed at some 300 sites with the assistance of NGOs as well as the IDA and BDRCS.

(2) Current Cyclone Shelter Construction Plans

While the construction of cyclone shelters was hampered, Bangladesh was severely damaged by heavy flooding in 1987 and also by flooding and cyclonic storm surges in 1988. The government urgently prepared the National Flood Programme (NFP) which consequently stimulated international aid activities. With the coordination of the World Bank, the Flood Action Plan (FAP) has since been prepared and 16 donor countries, including Japan, are currently working to implement the Plan from 1995. The construction of cyclone shelters is included in the FAP under the Cyclone Protection Project (CPP). One of the largest cyclones ever recorded which hit Bangladesh in April, 1991, recording a death toll of some 140,000 lives, further illustrates the urgent need for cyclone shelters and many international aid organizations, donor countries and NGOs have commenced individual projects to construct these necessary shelters.

As the Government of Bangladesh believes it necessary to coordinate all the cyclone shelter construction plans of international aid organizations, it commenced preparation of a Master Plan for the construction of multipurpose cyclone shelters in February, 1992 with the assistance of the World Bank and UNDP and completed the Final Report in July, 1993. The contents of this Multipurpose Cyclone Shelter Programme are outlined below.

1) Subject Area

The initial survey for the Master Plan was conducted in 2 identified areas, i.e. (i) the RZ with a high risk of being hit by storm surges and (ii) the HRA with a high risk of loss of human lives due to large-scale flooding with a

storm surge height of upto 1m. The latter (HRA) is the subject area for the construction of cyclone shelters under the Master Plan. The HRA consists of 44 Thanas (235 Unions) and covers an area of 8,093 km^2, accounting for 5.6% of the total land area of Bangladesh (Fig. 2-1-3).

2) Population

Based on population census data for 1991, the estimated population of the HRA as of 1992 is 5.2 million (approximately 4.5% of the total population of Bangladesh). The population of the HRA in the year 2002 is estimated to be approximately 6.35 million based on an assumed average annual population increase of 2.12% between 1992 and 2002. The distribution of the shelter capacity by different types of shelters is shown in Table 2-1-3.

3) Livestock

It is estimated that some 1.26 million head of cattle and 0.85 million sheep (including goats) are raised in the HRA and these figures are expected to increase to 1.41 million and 1.13 million respectively in the year 2002.

4) Existing Cyclone Shelters

Refer to 2.1.1 - (2) for the state of existing cyclone shelters.

5) Existing Killas

While the BDRCS has constructed 180 killas for use as animal shelters, 24 of these are said to have been washed away. Only 146 killas were, however, identified by the survey team.

6) Secure Public and Private Buildings

There is a total of 626 government or community buildings in the HRA which are capable of providing shelter for a total of 511,485 people. In addition, 235 private buildings can also shelter 93,572 people. One disadvantage of these structures is that almost all of them are concentrated in the area in which the main Thana municipal office is located.

7) Cyclone Shelter Construction Plan

New cyclone shelters are only planned for the HRA. As the total capacity of all cyclone shelters (existing shelters, those under construction and those for which concrete construction plans have already been prepared) and

secure public and private buildings (existing buildings and planned buildings) is 2.16 million, serving approximately one-third of the HRA's total population in 2002, new shelters are required to meet the needs of the remaining 4.25 million people. A construction plan for some 2,500 new cyclone shelters has been prepared (Table 2-3-1), assuming an accommodation capacity of 1,750 people/shelter. These shelters are designed to be used as school buildings during normal times and the longest distance to a nearby shelter from any point in the HRA (the longest distance to travel to find shelter to avoid a cyclone) is set at 1.5 km. In addition, the construction of killas above the flood tide level is also proposed to protect livestock.

The proposed use of the cyclone shelters as mainly primary school buildings during normal weather conditions is linked to a new law aiming at achieving compulsory primary education by the year 2000 which is the main pillar of the educational policy of the Government of Bangladesh. It is estimated that 3,000 or more primary schools are required in the HRA to achieve this target.

A standard primary school consists of 3 classrooms and one staff room for the teaching of 250 pupils in 2 shifts. The proposed design alternatives for these cyclone shelter-cum-school buildings are (1) on top of a killa, (2) on stilts on top of a killa and (3) on stilts next to a killa. The first alternative is said to be preferred from both the technical and financial point of view.

8) Operation and Maintenance of Cyclone Shelters

Each cyclone shelter requires a management committee for proper operation and maintenance. The BDRCS can be relied upon in this regard in view of its expertise in the management of such shelters.

The smooth operation and maintenance of a cyclone shelter can only be achieved by a combination of 3 factors, i.e. an organization responsible for such work, manpower and proper funding. As the existing shelter management committees lack both sufficient manpower and funds, their management activities fall short of what is required. The restructuring of government organizations in order to make adequate operation and maintenance funds available is necessary. The main government organizations associated with the operation and maintenance of cyclone

shelters are those involved in education and road construction in addition to the Bangladesh Water Development Board (the BWDB is responsible for flood control, irrigation and drainage). It is highly likely that most of the new cyclone shelters will be used as primary school buildings under the jurisdiction of Primary and Mass Education Division (PMED). It is, therefore, essential that PMED make the necessary arrangements to secure sufficient funds for the proper operation and maintenance of these buildings. In principle, the cyclone shelter operation and maintenance costs should be borne by government ministries and development boards while it is feasible to entrust the operation and management of the cyclone shelters to the community development committees (CDCs). If the operation and maintenance budget is insufficient, revenue could be generated through income generating activities, local donations and/or a charge for shelter use. Additional funds may be raised through the conversion of former killa excavation sites to fish culture ponds.

9) Related Projects

- Transport

  Access to cyclone shelters in the HRA is mainly provided by roads and water channels. In view of the relatively poor transport network compared to other areas, improvement of the road network in the HRA has been recommended. The design adopted for an approach road to a cyclone shelter envisages a sufficient road width to allow 3-wheeled rickshaw vans to pass each other in opposite directions.

- Planting of Trees

  The planting of coconut, Jhau and other trees around shelters and killas is proposed to prevent the collapse of killas due to storm surges caused by cyclones and to improve the general environment.

- Lighting

  The current lighting system using dry cell-operated torch lights satisfies the lighting requirement for evacuation to cyclone shelters. Depending on the use of the shelters during normal times, the use of a solar PV system and/or kerosene generators is feasible.

- Telecommunications

The existing BTTB telecommunications network is inadequate. The Master Plan recommends the introduction of a VHF/UHF fixed cellular-type network based on the examination results of various available technologies, including VSAT, HF and VHF/UHF, etc.

10) Implementation Programme

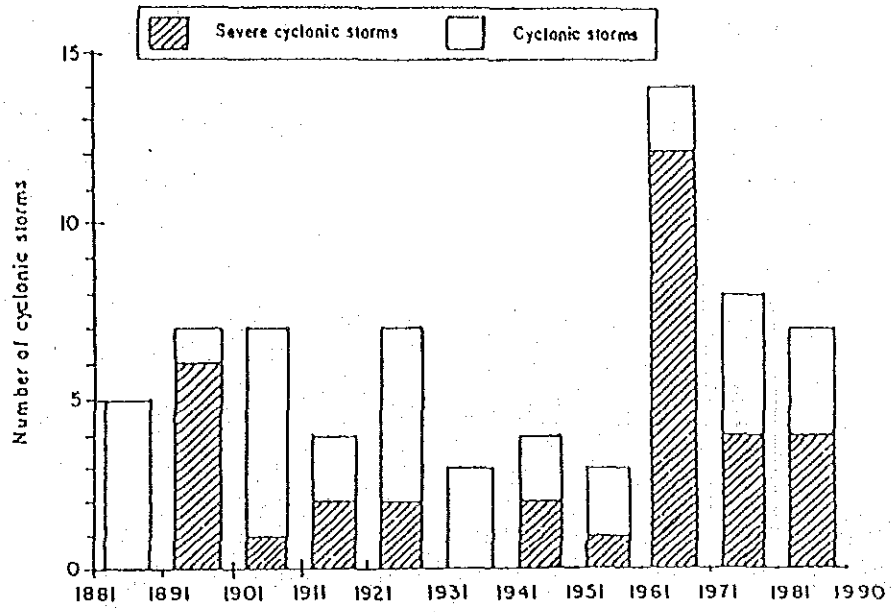
- Implementation Schedule

Implementation of the Master Plan for the Multipurpose Cyclone Shelter Programme is planned to commence in fiscal 1994/95 and the construction of all cyclone shelters and killas will be completed by the year 2000.

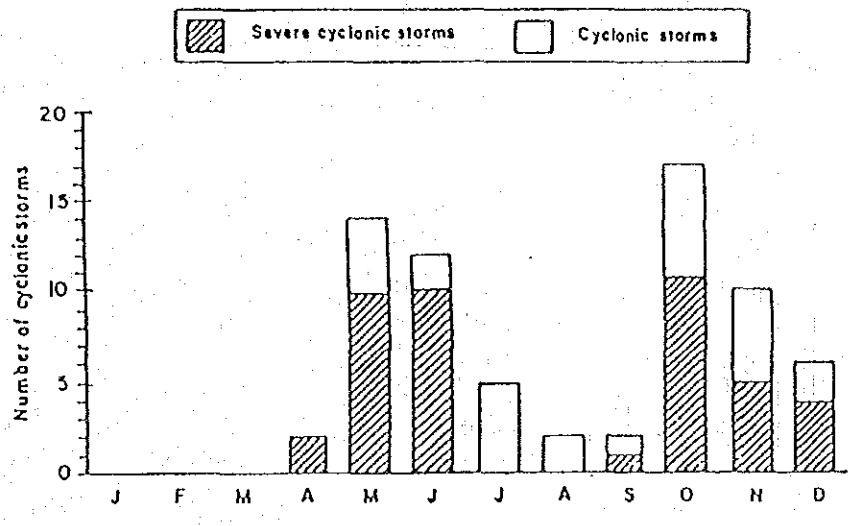
- Implementation Body

The establishment of the Cyclone Shelter Construction Organization (CSCO) responsible for the implementation of the Master Plan has been proposed. As the assistance of all government departments and agencies is required for the smooth completion of the Master Plan, the CSCO is likely to be placed under the jurisdiction of the Prime Minister's Office.

Fig. 2-1-1 Frequency of Cyclonic Storms



Number of Cyclonic Storms Landed on Bangladesh Coast in Different Decades (after Matsuda, 1991)



Monthly distribution of cyclonic storms landed on Bangladesh coast between 1877 and 1990 (after Matsuda, 1991)

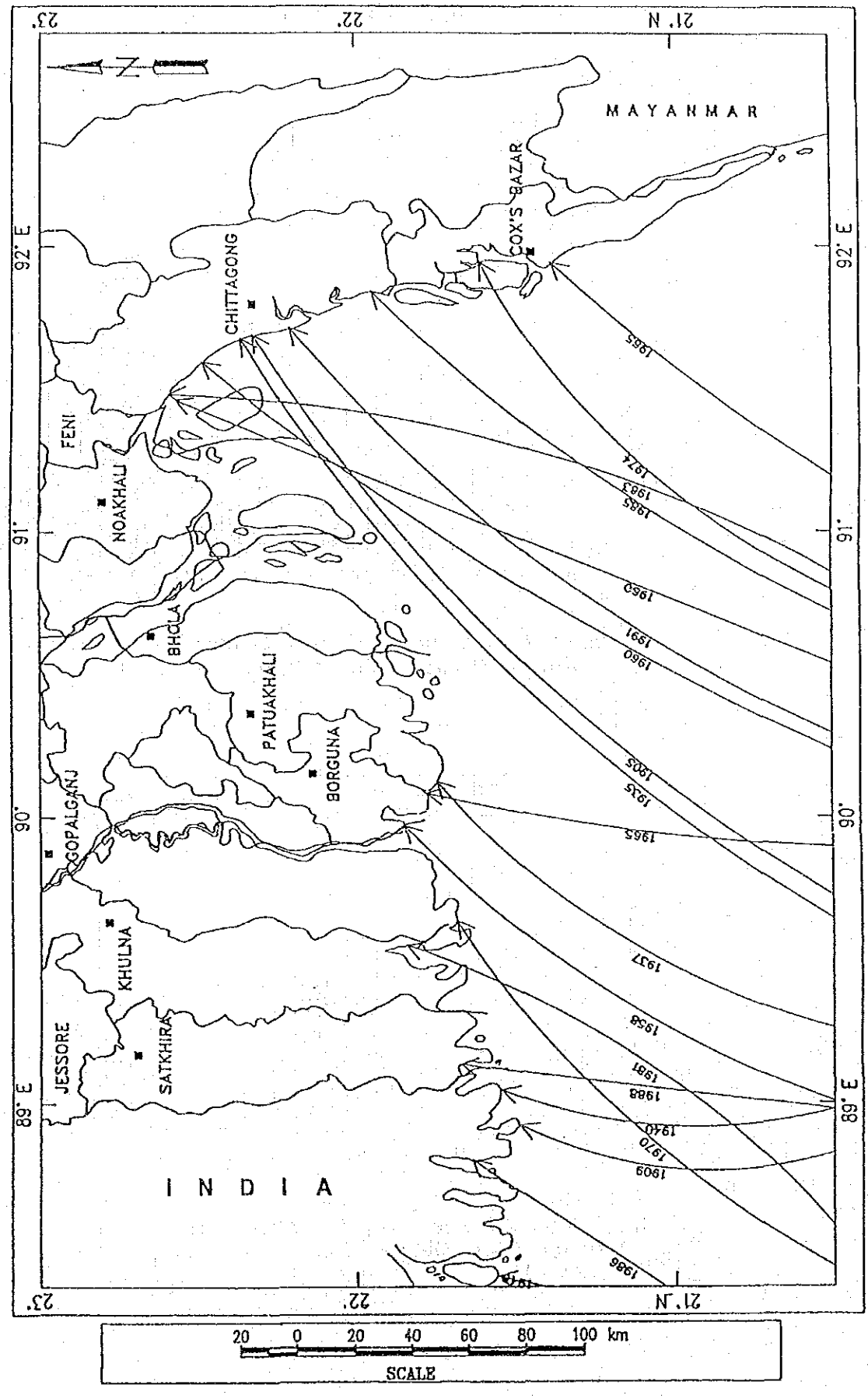


Fig. 2-1-2 Paths of Severe Cyclone

Fig. 2-1-3 Risk Zone and High Risk Zone

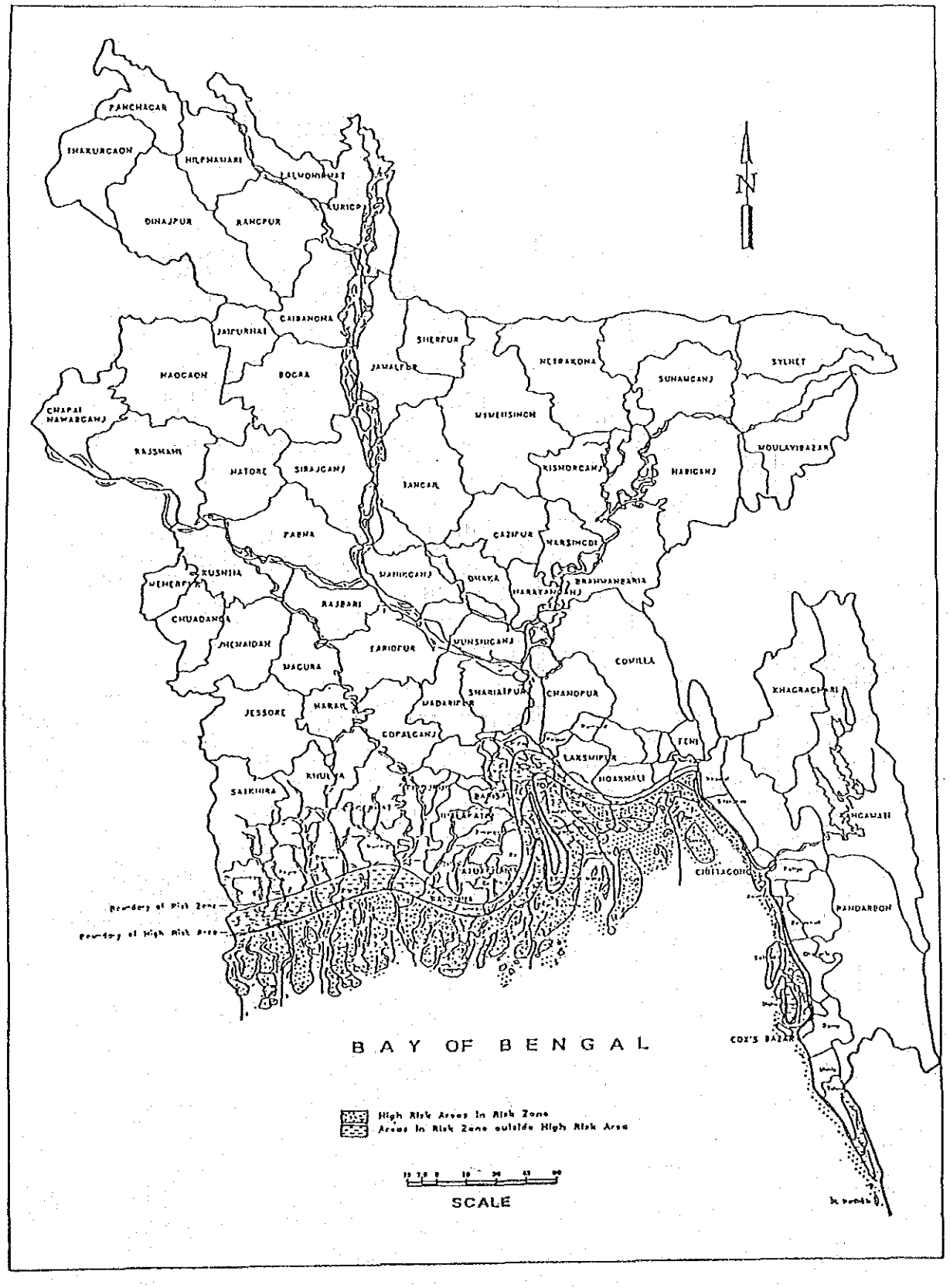


Fig. 2-1-4 Probable Movement of Population in HRA to Different Types of Shelter Accommodation

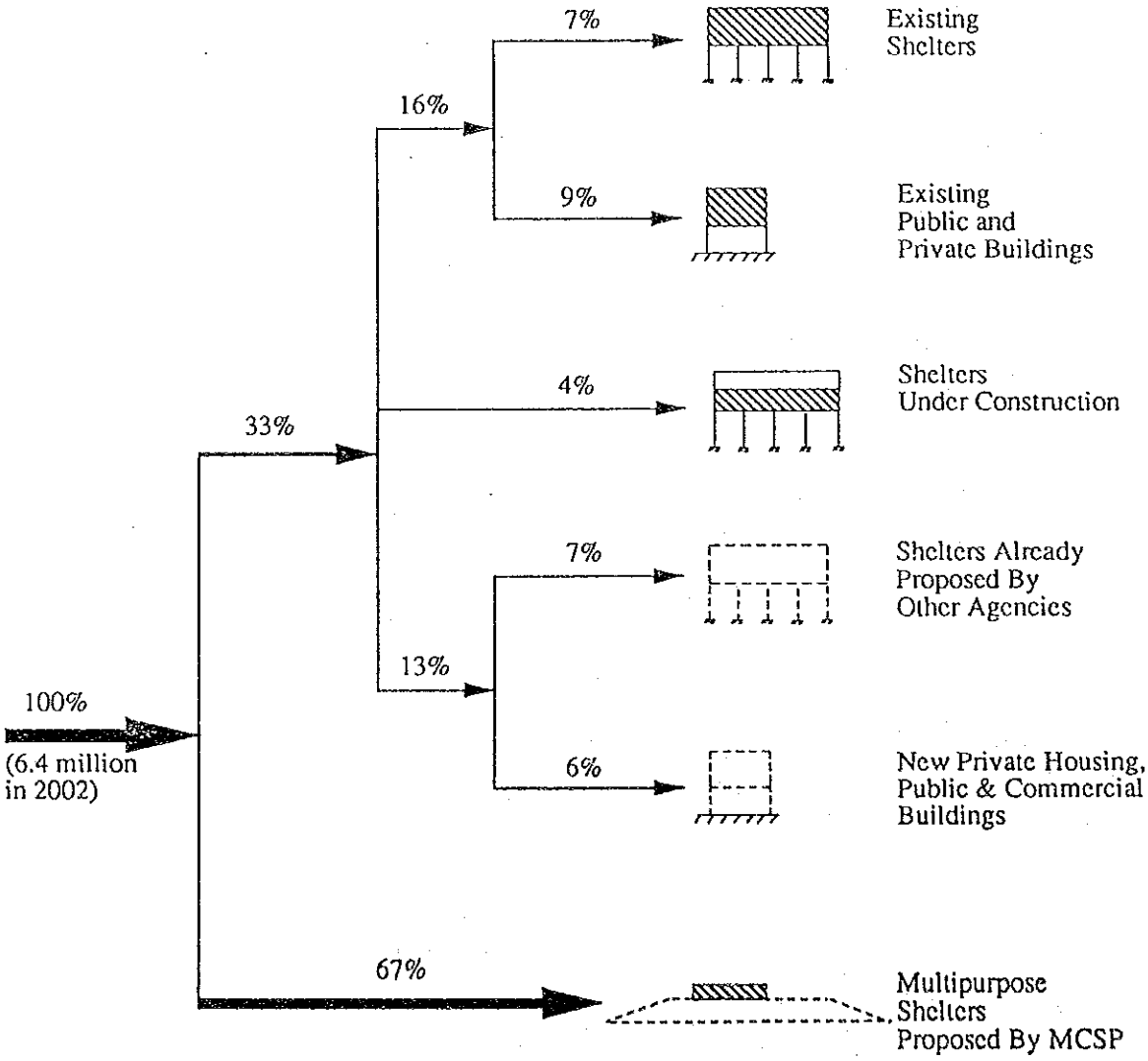


Table 2-1-3 Probable Distribution of Population in Various Types of Shelters

Sl. No.	Name of Thana	Total Population (July 1, 2002)	Probable Distribution of Population in Various Types of Shelters					
			Existing Cyclone Shelter	Existing Public & Private Buildings	Shelters Under-Construc-tion	New Public, Private and Commercial Buildings	Shelters Proposed by Other Agencies	Shelters Proposed by MCSP
1	2	3	4	5	6	7	8	9
	TOTAL (*)	6,353,760	425,430	601,765	265,980	415,537	452,820	4,253,301
1.	Dacope	48,514	0	430	1,000	3,026	0	44,058
2.	Koyra	37,497	0	5,050	1,000	2,875	0	28,572
3.	Sarankhola	41,323	0	9,500	0	2,366	2,000	27,457
4.	Monglaport	26,943	0	3,150	1,000	1,647	3,000	18,146
5.	Shyamnagar	52,549	0	600	1,000	3,428	1,000	46,521
6.	Mathbaria	87,195	2,010	1,950	0	5,660	0	77,575
7.	Amtali	98,993	5,010	3,097	1,000	6,749	7,000	76,137
8.	Barguna	162,688	4,010	1,575	1,000	10,535	2,000	143,568
9.	Patharghata	164,933	6,010	14,625	2,000	10,646	3,000	128,652
10.	Betagi	46,657	1,510	900	0	3,333	0	40,914
11.	Bamna	15,997	0	1,150	0	1,100	0	13,747
12.	Kalapara	224,539	37,710	8,992	3,000	14,228	14,000	146,609
13.	Bauphal	133,212	4,530	9,175	0	8,661	0	110,846
14.	Galachipa	260,225	44,240	26,725	3,000	15,511	7,000	163,749
15.	Dashmina	100,024	10,560	17,937	0	6,402	3,000	62,125
16.	Barisal Sadar	15,072	0	800	0	1,254	0	13,018
17.	Bakerganj	17,303	1,510	0	0	865	0	14,928
18.	Char Fasson	397,694	42,240	20,775	6,000	26,035	21,680	280,964
19.	Bhola Sadar	225,268	7,550	4,062	0	15,663	0	197,993
20.	Burhanuddin	131,283	1,510	4,300	0	9,563	0	115,910
21.	Lalmohan	224,881	20,130	2,360	0	14,744	20,680	166,967
22.	Manpura	65,477	13,560	9,975	13,000	4,273	5,920	18,749
23.	Daulatkhan	169,084	12,080	19,500	0	12,253	17,400	107,851
24.	Tazumuddin	138,799	16,590	10,855	0	8,540	19,040	83,774
25.	Sonagazi	140,416	8,030	10,812	0	8,521	5,000	108,053
26.	Ramgati	399,504	14,080	15,787	0	23,974	5,000	340,663
27.	Raipur	92,505	2,510	2,750	0	5,625	0	81,620
28.	Lakshmipur Sadar	93,572	3,510	1,350	0	5,678	0	83,034
29.	Hatiya	371,464	39,130	19,165	25,680	22,573	24,320	240,596
30.	Noakhali Sadar (Sudharam)	167,496	20,600	300	0	11,374	8,000	127,222
31.	Companiganj	56,193	11,530	8,300	0	4,309	6,000	28,886
32.	Sandwip	332,847	28,070	41,075	0	23,240	67,760	172,702
33.	Banshkhali	292,826	10,040	25,250	32,680	20,142	30,320	174,394
34.	Mirsarai	78,321	6,030	3,220	11,480	5,717	2,000	49,874
35.	Sitakunda	194,422	5,010	26,649	21,320	13,522	0	127,921
36.	Anwara	141,248	5,520	18,283	22,320	9,164	16,560	69,401
37.	Patiya	162,833	0	70,210	0	11,942	0	84,345
38.	Chandanaish	41,680	0	2,900	0	3,585	4,920	30,275
39.	Cox's Bazar Sadar	140,837	3,510	52,237	28,240	8,841	8,920	65,616
40.	Kutubdia	126,902	8,520	41,448	11,700	8,645	78,460	6,176
41.	Maheshkhali	165,329	10,030	18,941	22,000	10,767	12,840	90,751
42.	Chakaria	353,645	10,530	32,450	37,520	22,283	40,880	209,982
43.	Ramu	27,250	0	1,600	6,560	2,363	4,920	11,810
44.	Teknaf Thana	111,705	6,510	34,405	10,200	6,385	8,560	45,645
45.	Ukhia	34,292	1,510	1,200	3,280	2,215	6,560	19,527

(*) Since the capacity of various types of shelters other than those proposed by MCSP is higher than the population in some Unions (viz. Char Fakira, Char Patharghata, Sikalbaha, Jhilawnja, all unions of Kutubdia Thana other than Ali Akbar Deil and Khuniapalong), the total of Cols. 4 to 9 is slightly larger than Col. 3.

2.1.3 Project Implementation System

(1) Cyclone Shelter Projects in the Past

As described so far, the construction of cyclone shelters in Bangladesh is mainly conducted by the Government of Bangladesh and various NGOs.

1) Government Projects

a) Construction of Cyclone Shelters

Government projects to construct cyclone shelters have mainly been implemented by the PWD, a sub-organization of the Ministry of Works (MOW) using its own and IDA funds. The Building Commission of the MOW is responsible for the design and implementation of these projects and special operation cells have been established within the Commission to be responsible for the construction work for individual projects.

b) Management of Cyclone Shelters

The PWD-type cyclone shelters constructed in the 1980's are run by the Union Offices as coastal community centres but their poor maintenance has resulted in much deterioration and some of these shelters have become lifeless, abandoned buildings and are even dangerous to use.

Those cyclone shelters constructed in the 1970's have been transferred to the district authorities or the Ministry of Education for use as primary school buildings. Many of them, however, have deteriorated due to the lack of sufficient maintenance funds.

2) NGO Projects

a) Construction of Cyclone Shelters

Until the great cyclone disaster in April, 1991, the BDRCS and Caritas were the 2 NGOs involved in the construction of cyclone shelters. As the BDRCS does not have a construction department, the actual construction work is controlled by a tripartite system consisting of the BDRCS, the local contractor with which the BDRCS places a construction order and a local consultant which is entrusted with the design and supervisory work. In contrast, Caritas has a small technical section which supervises the construction of cyclone shelters. While a

local contractor is selected through open tender, a work supervisor is dispatched by Caritas.

b) Management of Cyclone Shelters

The cyclone shelters constructed by the BDRCS were originally designed to be community centres in normal times but are mainly used as school buildings today. Their management is efficiently conducted by the BDRCS and the buildings have been maintained in good condition. In the case of those shelters used as school buildings, the teachers are responsible for their proper management and maintenance. The cyclone shelters constructed by Caritas have the same design as those constructed by the BDRCS and are run by Caritas for such various purposes as schools, health clinics, training centres and community centres, etc.

(2) Current Cyclone Shelter Projects

1) Government Projects

a) Construction of Cyclone Shelters

While the PWD is no longer responsible for the construction of cyclone shelters, it does construct government buildings. The 2 organizations currently responsible for the construction of cyclone shelters are the LGED of the MLGRD&C and the FD of the MOE.

The LGED has a wide range of ability, from planning, construction and management to maintenance supported by numerous, well experienced engineers. Neverthless, for the construction of 10 cyclone shelters on Kutubdia Island using IFAD funds, the LGED used a local consultant for the design work and hired a local contractor through open tender.

In the case of the ongoing Project (I) for which Japanese grant aid has been provided, several engineers led by an executive class engineer have been appointed by the LGED to implement the project.

The FD has the sole responsibility for the construction of educational facilities in Bangladesh and, therefore, has a high level of skill vis-a-vis the construction of cyclone shelters. As the FD has been involved in a project to construct cyclone shelters with funds provided by the

Government of Saudi Arabia and the Islam Development Bank, it has internal sections dealing with various cyclone shelter projects. In addition, it has a section dealing with the Universal Primary Education Programme. As these sections have been involved in actual construction work under the respective projects. The FD plans to construct cyclone shelters using OPEC or EC funds and, should this project become a reality, further expansion of the FD's organization and manpower will become necessary.

b) Management of Cyclone Shelters

In principle, the LGED is responsible for the management and maintenance of any cyclone shelters it constructs. In the case of the Project (I), 2 planned cyclone shelters will replace existing government school buildings, serving as new school buidlings. The PMED will be responsible for the management and maintenance of these schools. At 8 other sites, the cyclone shelters will also be used as school buildings and their management and maintenance will be the responsibility of the bodies responsible for the said schools.

2) NGO Projects

a) Construction of Cyclone Shelters

The main NGOs involved in the construction of cyclone shelters in Bangladesh are the BDRCS, Caritas, BRAC and CCCB. All NGOs select a local consultant and contractor through open tender for the design and construction work respectively. The BRAC, however, has its own cyclone shelter construction section and engineers. This section is responsible for the procurement of materials, construction work and work supervision while recruiting labour through local contractors on a contract basis.

b) Management of Cyclone Shelters

Most NGOs construct multipurpose cyclone shelters and the management and maintenance of these shelters are conducted by the organizations responsible for their normal type of use.

2.2 Outline of Primary Education

2.2.1 Current State of Primary Education

The Government of Bangladesh introduced the Universal Primary Education Programme (UPE) in its 2nd 5-Year National Development Plan, aiming at improving the school enrolment rate for school age children to 91% by 2000 on the grounds that the development of human resources is a precondition for all aspects of economic development in Bangladesh. A series of measures have since been implemented through the 1st and 2nd Primary Education Projects to achieve this target. These measures include an improvement management system, simplification of the national curriculum, the revision of textbooks and the supply of highly qualified teachers. Despite these efforts, however, the Bangladesh's current literacy rate is still as low as 24.8% due to the rapid population increase, declining education budget, weakening of the administrative system, low recognition of the importance of education among parents and other economic reasons.

Although the school enrolment rate for primary education has improved to some 70%, the graduation rate is approximately 40% due to many drop-outs, resulting in a ratio of children completely primary education of just over 2 in 10. This rather poor achievement well reflects on the country's literacy level which slightly improved to 32.4% in 1991 from the low level of 34.6% in 1987 (15 years of age and older).

To resolve the situation, the Government of Bangladesh enforced a law making primary education compulsory in 1990 and has introduced various measures to achieve education for all by 2000 with a target enrolment rate of 95% and a graduation rate of 70%. It is estimated that 54,460 new primary school classrooms must be constructed by 1995 from the level of 50,314 classrooms in 1992, totalling 104,774 classrooms. A further 43,600 classrooms will be required between 1996 and 2000 to make a total of 148,374 classrooms.

2.2.2 General Education Project

As part of the efforts to achieve education for all, the General Education Project (GEP) is being implemented throughout the country with the assistance of the World Bank, ADB, Governments of Sweden and the Netherlands, UNICEF and UNDP, etc. The GEP has the following objectives.

1) Increased equal opportunities for primary and secondary education
2) Qualitative improvement of primary and secondary education
3) Improvement management of primary and secondary education
4) Structural improvement of higher education and preparation of relevant policies

The hardware components of the GEP in the field of primary education include projects to construct, rebuild or repair school buildings by the IDA and ADB and to construct, rebuild or repair administrative facilties by the IDA. The software components include the preparation of textbooks and curriculum development by various international organizations, a population control education project, a NAEM restructuring project and a project for strengthening the management information and statistical services of PMED and Ministry of Education. All these project are being implemented to achieve education for all in steps while improving the state of primary education in a comprehensive manner. The components of the above projects are given in Table 2-2-1.

All the projects under the GEP are supposed to be completed by December, 1995 and will be inherited by the GEP-II, the preparation of which is in progress by the Government of Bangladesh.

General information and data on primary education collected by the Basic Design Study Team are incorporated in Appendix 2 of this report.

Table 2-2-1 GEP Components by Finance Source (Facilities only)

Finance Source	Details			
(1) IDA Subject Divisions: Dhaka Rajshahi Khulna Barisal	Rural Primary Schools:	4,800	(rebuilding)	commenced in 1991, to be completed by December, 1995
	Rural Primary Schools:	2,880	(repair)	"
	Town Primary Schools:	180	(rebuilding)	"
	Town Primary Schools:	346	(repair)	"
	City Primary Schools:	90	(rebuilding)	"
	City Primary Schools:	115	(repair)	"
	Rural Low Cost Primary Schools:	2,880	(new)	"
	Satellite Primary Schools:	200	(new)	commenced in 1993, to be completed by December, 1995
(2) ADB Subject Division: Chittagong	Rural Primary Schools:	960	(repair)	commenced in 1991, to be completed by December, 1995
	Town Primary Schools:	48	(rebuilding)	"
	Town Primary Schools:	80	(repair)	"
	City Primary Schools:	622	(rebuilding)	"
	City Primary Schools:	40	(repair)	"
	Rural Low Cost Primary Schools:	976	(new)	"
(3) IDA	Teacher Training Schools (PTI): (including classrooms, teachers' accommodation, dormitories and offices)	38	(new/rebuilding/repair)	commenced in 1991, to be completed by December, 1995
	DPEO:	38	(new)	"
	DDO:	3	(new)	planned completed in December, 1995

2.3 Outline of Related Plans

2.3.1 National Development Plans

(1) Outline of Past National Development Plans

A series of 5-Year National Development Plans has so far been implemented in Bangladesh since the introduction of the First 5-Year Plan in 1973. The socialist-oriented economic development policies of the First 5-Year Plan (fiscal 1973/74 - fiscal 1977/78), of which the nationalization of the production, distribution and trade sectors was the main pillar, had unsatisfactory results due to the first oil crisis immediately after the Plan was launched, devastating flooding and a change of government following a coup d'etat.

Prior to the launching of the Second 5-Year Plan, the transitional 2-Year Development Plan (fiscal 1978/79 - fiscal 1979/80) was implemented to mark the change of government policies towards encouragement of private capital and restoration of the market mechanism. Some government-owned companies were sold to the private sector. The Second 5-Year Plan (fiscal 1980/81 - fiscal 1984/85) clearly emphasised private companies and aimed at promoting agricultural and industrial activities based on the increased production of agricultural products. The planned GDP growth rate was ambitiously set at 7.2% per annum which failed to be achieved due to the second oil crisis and drastic changes of the global economic environment thereafter.

The Third 5-Year Plan (fiscal 1985/86 - fiscal 1989/90) further called for the use of the vigour of the private sector which was in progress under the El Shad administration. During the Third 5-Year Plan period, industrial development policies were twice formulated and implemented. The components of these policies included the privatization of public companies and deregulation in the distribution and trade sectors, illustrating the active efforts to achieve national development through liberalization. The declared objectives of the Third 5-Year Plan were ① control of the population growth, ② creation and expansion of employment, ③ diffusion of basic education and the development of human resources, ④ reform of the economic structure and technological development to support such reform, ⑤ self-sufficiency in the supply of food, ⑥ achievement of the minimum BHN, ⑦ acceleration of economic growth and ⑧ promotion of self-help efforts. The basic theme running through the above 8 objectives was the alleviation of poverty. The actual achievement level at the

end of the Third 5-Year Plan period was unfortunately insufficient. The budget size of and GDP growth rate achieved by the above 4 Plans are given in Table 2-3-1.

Table 2-3-1 Budget Size and GDP Growth Rate of National Development Plans

	Budget (10 million TK)		GDP Growth Rate (%)	
	Planned	Result	Planned	Result
1st 5-Year Plan (1973 - 1978)	4,455	2,074 (47)	5.5	4.0
2-Year Plan (1978 - 1980)	3,861	3,359 (87)	5.6	3.5
2nd 5-Year Plan (1980 - 1985)	17,200	15,297 (89)	5.4	3.8
3rd 5-Year Plan (1985 - 1990)	38,600	26,639 (69)	5.4	3.8

Note : The figures in brackets show the actual achievement ratio vis-a-vis the planned budget size in percentages.
Source : Planning Commission: "Three Year Rolling Investment Programme (fiscal 1993 - 1995)"

(2) Current National Development Plan

The Fourth 5-Year Plan (fiscal 1990/91 - fiscal 1994/95) was originally launched by the former Ershad administration and mainly aims at achieving (i) accelerated growth of the economy (with a target annual GDP growth rate of 5%), (ii) alleviation of poverty through the creation of employment and the development of human resources and (iii) increased economic independence. Moreover, emphasis is also given to the further vitalization of the private sector by means of encouraging inward investment and to improving education to facilitate agricultural development, the participation of women in development programmes/projects and solving of the problem of over-population. The present Zia administration has revised the Fourth 5-Year Plan, including reducing the total budget size by 10% to Taka 620 billion. The strategic targets of the revised Plan are based on the 19-Point Programme formulated by the late President Zia and include the minimum provision of rice and bean curry for all nationals, development of human resources, effective implementation of family planning to control the population explosion and the active participation of women in national economic development efforts.

In order to make these targets feasible, the 3-Year Investment Programme commenced in 1991 with the investment priority given to agriculture, local development, manufacturing, transport, education (particularly primary education), health and population control. This is a 3-year rolling programme which is renewed every year, incorporating the achievements of the Annual Development Programme (ADP). The Third 3-Year Investment Programme (fiscal 1992/93 - fiscal 1994/95) is currently in progress following the First (fiscal 1990/91 - fiscal 1992/93) and Second (fiscal 1991/1992 - fiscal 1993/94) Programmes. These 3-Year Investment Programmes have been formulated within the general framework of the New Development Perspective (NDP) which was introduced by the present government to provide basic development principles for the implementation of the Fourth 5-Year Plan. The NDP gives the highest development priority to accelerating and maintaining the momentum of economic development by means of manpower development, participation in development programmes, social participation of women and alleviation of poverty. The main strategy to achieve this goal is to firstly create employment in the production sector to increase the income level of low income people and to supply the basic necessities so that the national levels of savings, investment and purchasing power are all improved. The following individual strategic objectives are also adopted.

① Manpower Development

The eradication of starvation and improvement of the literacy rate will be followed by the improvement of basic health and sanitation facilities together with appropriate population control.

② Increased Employment Opportunities

The improved efficiency of public finance and progress in manpower development, particularly in local areas, will lead to the improvement of all related organizations.

③ Strengthening of Economy

The development of the agricultural sector will be emphasised to strengthen the national economy in general and to develop local economies in particular.

④ Strengthening of Competitiveness

Technologies will be introduced to assist the agricultural and manufacturing sectors to strengthen their competitiveness.

⑤ Promotion of Jointly Invested Companies

The establishment of jointly invested companies by a large number of small investors will be promoted in the agricultural and small commercial, as well as industrial, sectors.

⑥ Promotion of Private Companies

The establishment of highly competitive private companies will be promoted in the export-oriented industrial sector.

Additional strategic objectives include ⑦ promotion of export-led economic growth, ⑧ strengthening of the linkage between various sectors of the national economy, ⑨ integration of macroscopic elements and microscopic elements in development planning and ⑩ harmony between economic development and environmental conservation.

Based on the above strategy and strategic objectives, the NDP sets forth the concrete targets for each sector. The targets for the educational sector, which is related to the Project (II), are quoted below.

[Targets for Educational Sector]

The priority targets for the educational sector are universal education by 2000, an improved literacy rate, rehabilitation of educational facilities damaged by natural disasters and the spread of science and technology education.

2.3.2 Flood Action Plan (FAP)

(1) Outline of FAP

Following the devastating damage caused by flooding in 1987 and 1988, the Government of Bangladesh conducted a fundamental review of the flood prevention measures with a series of studies commencing in June, 1989. Based on the findings of these studies, the Government of Bangladesh requested the World Bank's formulation and implementation of the 5-Year Flood Action Plan (fiscal 1990/91 - fiscal 1994/95). This request was subsequently approved by

the G7 Summit held in Paris in June, 1989 and the World Bank was entrusted to formulate the FAP.

The purposes of the FAP are to select and confirm high priority projects which are feasible from the technical, economic, environmental and social points of view and to conduct the planning, design and implementation of selected projects. The main body of the FAP consists of activities in 11 sectors and there is a total of 15 supplementary action programmes. Among these, the FAP-7 Cyclone Protection Project relates to the Cyclone Shelter Programme and this project is outlined next.

(2) Cyclone Protection Project (CPP)

Following the cyclone disaster in November, 1970, the Government of Bangladesh introduced the Coastal Area Rehabilitation Project with the financial assistance of the IDA and other donors to rehabilitate the economy in the devastated areas and to prevent future cyclone damage. The positive effects of disaster prevention investment under this project were proven when another cyclone hit the same area in May, 1985.

Encouraged by the above, the Government of Bangladesh prepared the National Cyclone Protection Plan in 1986. The components of this plan included the improvement of coastal embankments, protection of newly reclaimed land along the Bay of Bengal, forest improvement, improvement of the communications, road and coastal transport systems and the construction of improved, low cost cyclone shelters which could be used as school buildings or medical care facilities. The actual work for the Plan was repeatedly delayed, however, due to the 1987 and 1988 flood disasters and other reasons and the work to prepare a medium-term plan and the TOR for a long-term plan was eventually started by consultants using an EC loan.

While the work by these consultants was in progress, a huge cyclone caused extensive damage in April, 1991, prompting the Government of Bangladesh to request the World Bank's coordination of the aid efforts of donors. The Government of Bangladesh also asked the above consultants to prepare the Priority Works Programme (PWP) to pinpoint those sites where the rehabilitation of embankments was urgently required. This PWP was implemented using loans provided by Saudi Arabia, the EC and the IDA and Japanese grant aid and the rehabilitation of existing embankments (totalling 135

km) and the construction of embankments (totalling 55 km) at new locations was completed.

During the course of the above programmes, the Government of Bangladesh concluded an agreement for an EC loan in 1989 for the Cyclone Protection Project (II) (CPP II) which involved a feasibility study on and the design of protective facilities against cyclones and storm surges. In connection with the CPP II, consultancy agreements were concluded in February, 1990 to cover the construction of coastal embankments (with the BWDB) and roads (with the RHD). The consultancy work relating to the BWDB consists of the following.

- Feasibility study for the 5-Year Medium-Term Project which envisages the construction of coastal embankments
- Detailed design for those components to be implemented in the first year

This 5-Year Medium-Term Project intends the construction of a total of 23 embankments and consists of the following components.

- Rehabilitation and reinforcement of existing embankments together with re-sectioning (303 km)
- Reconstruction of embankments at relocated sites
- Protection work
- Construction of water utilization facilities
- Planting of trees

2.4 Outline of the Request

2.4.1 Background

(1) Necessity for Cyclone Shelters

As described in Chapter 1, Bangladesh is likely to suffer extensive damage due to cyclonic storm surges because of its location and climatic conditions. The inadequate level of national resources has made it difficult for the government to introduce concrete measures to prevent cyclone damage despite the loss of many lives in the past.

Against this background, the cyclone which hit Bangladesh in April, 1991 with a maximum wind velocity of 62.5 m/sec caused a storm surge of 6.0 - 7.5m, claiming some 140,000 lives, inflicting massive damage on both livestock and fishery resources and also causing extensive damage to embankments, roads and houses. The Government of Bangladesh has subsequently requested the assistance of many aid organizations and donor countries for the construction of new cyclone shelters. In response to this request, some donor countries and NGOs are now constructing new cyclone shelters as described in 2.1 - General View of Cyclone Shelters.

(2) Implementation Agency

As part of the world-wide appeal, the Government of Bangladesh requested the Government of Japan's assistance for the construction of cyclone shelters above killas at 40 sites which would be constructed by the LGED with the assistance of the WFP. Consequently, the implementation agency for the requested project is the LGED.

(3) Approval of Grant Aid

In response to the above request, the Government of Japan dispatched a team consisting mainly of former JOCV members to Bangladesh to conduct preliminary field surveys on the social, economic and technical background and conditions of the request. The team found 18 sites of the requested 40 sites to be suitable for the construction of cyclone shelters and the remaining 22 sites to be unsuitable. The team also concluded that the construction of a cyclone shelter on top of a killa, as suggested by the LGED, would be inappropriate and instead proposed free-standing shelters on stilts next to the identified killa sites.

Based on the preliminary findings, field surveys for the Basic Design Study were conducted between October 31st and December 9th, 1992 and between January 21st and February 19th, 1993 to examine the viability of the Project (I) as a grant aid project of the Government of Japan and to determine the optimal project scale. Through consultations with the Bangladesh side during the field survey periods, it was agreed that a cyclone shelter would be constructed at 10 sites. Based on the further agreement that it was desirable for the planned cyclone shelters to be used as educational facilities during normal times to ensure better maintenance, it was decided that the cyclone shelters would normally be used as primary school buildings.

Following confirmation of the Project's viability as a grant aid project, the Government of Japan decided to provide grant aid for the Project and the E/N was signed and exchanged by the Government of Japan and the Government of Bangladesh on August 2nd, 1993.

Confirmation by the Basic Design Study for the Project (I) of the appropriateness of using cyclone shelters as primary school buildings during normal times led the Government of Bangladesh to renew its request on September 14th, 1993 for the construction of cyclone shelters at the remaining 30 sites in the form of rebuilding the existing primary school buildings.

2.4.2 Contents

(1) Project Objectives

The primary objective of the Project (II) is the construction of cyclone shelters. As described earlier, the topography of Bangladesh makes the country extremely vulnerable to cyclone damage and, in fact, Bangladesh has suffered extensive cyclone damage many times. As assistance has been provided by many donor countries and aid organizations, the Government of Bangladesh has prepared the Master Plan for the Multipurpose Cyclone Shelter Programme with the help of the UNDP and World Bank to provide guidelines for the construction of cyclone shelters.

According to the Master Plan, the construction of 2,500 cyclone shelters capable of accommodating 1,750 people each is required in the HRA by 2002. The Project (II) is part of the national and international efforts to achieve this goal of the Master Plan.

The 3-Year Rolling Investment Plan is being implemented in Bangladesh to achieve the objectives of the National Development Plan while referring to the general framework of the NDP to formulate planning contents. The NDP upholds the rehabilitation of those school facilities destroyed by natural disasters as the most urgent task in the educational sector. Here lies the secondary objective of the Project (II) in that the rebuilding of existing primary school buildings which have been damaged by cyclones or which are highly vulnerable to cyclone damage will improve the physical environment for primary education in Bangladesh. This objective is also in line with the agreement reached during the Basic Design Study for the Project (I).

(2) Requested Facilities

The Government of Bangladesh originally requested the construction of cyclone shelters at 30 sites in line with the objectives of the Project described above and has subsequently added another 20 sites, totalling 50 sites. The requested sites and subject primary schools are given in Table 2-4-1 while the geographical distribution of the requested sites is as follows.

District	Thana	Number of Sites
Chittagong	Banskhali	3
Cox's Bazar	Sadar	5
Cox's Bazar	Chokoria	10
Cox's Bazar	Ramu	3
Cox's Bazar	Ukhia	2
Feni	Chagalniya	6
Feni	Sadar	7
Noakhali	Hatiya	5
Laximpur	Sadar	7
Laximpur	Ramgonj	2
Total		50

(3) Contents and Size of Requested Facilities

The Bangladesh request involves the construction of a cyclone shelter with the following contents and size at each site.

- Classrooms
  - Each classroom has a floor area of 37.15 m^2
  - Each classroom is equipped with the following items
    one blackboard
    desks and chairs for 50 pupils
    one teacher's desk and chair set
- Teachers' Room : one
- Storage : one
- Toilets : two (one for boys and one for girls)
- Water supply facilities (borehole and hand pump)
- Other essential facilities

Table 2-4-1 Requested Sites and School Names

District	Thana	Union	School
1. Chittagong	Banskhali	Saral	West Kahargona
2. Chittagong	Banskhali	Sadhonpur	Rata Khordo
3. Chittagong	Banskhali	Jaldi	Jaldi Vadalia
4. Cox's Bazar	Sadar	Jalalabad	Edigaon Bahar Chara
5. Cox's Bazar	Sadar	Jalalabad	South Khorulia
6. Cox's Bazar	Sadar	Khoruskul	Khoruskul Dhiran
7. Cox's Bazar	Sadar	Chawfaldang	Khonkar Khil
8. Cox's Bazar	Sadar	P.M. Khali	Parania Para
9. Cox's Bazar	Chokoria	East Boro Bheola	Boro Bheola
10. Cox's Bazar	Chokoria	Harbang	Harbang
11. Cox's Bazar	Chokoria	Badarkhali	Kutubnagar
12. Cox's Bazar	Chokoria	Chiringa	Middle Chokoria
13. Cox's Bazar	Chokoria	B.M. Char	B.M. Char
14. Cox's Bazar	Ramu	Kunia Palong	Goalia Palong
15. Cox's Bazar	Ramu	Patakarkul	Lomuri Para
16. Cox's Bazar	Ramu	South Mithashari	Chainda
17. Cox's Bazar	Ukhia	Jaliaparo	Sonaichari
18. Cox's Bazar	Ukhia	Rahmaterbil	Rahmaterbil
19. Noakhali	Hatiya	Tomoruddi	Madankhali
20. Noakhali	Hatiya	Char Keshor	Ishwar Pni Hallama
21. Feni	Chagalniya	Chagalniya	Chagalniya
22. Feni	Chagalniya	Matua	Matua
23. Feni	Chagalniya	Radhanagar	Kashipur
24. Feni	Chagalniya	South Satar	South Satar
25. Laximpur	Ramgonj	Noagaon	Noagaon
26. Laximpur	Ramgonj	Lamchar	Kasim Nagar
27. Laximpur	Sadar	Shakchar	Matabarhat
28. Laximpur	Sadar	Kushakhali	Kushakhali
29. Feni	Sadar	Forhadnagar	South Forhadnagar
30. Feni	Sadar	Kalidaha	Cheoria
31. Cox's Bazar	Chokoria	Khotakhali	Fulchari
32. Cox's Bazar	Chokoria	Khotakhali	Khotakhali
33. Cox's Bazar	Chokoria	Magnama	Maddaya Magnama
34. Cox's Bazar	Chokoria	Magnama	Sutachura
35. Cox's Bazar	Chokoria	Dulahazara	Ring Bong
36. Noakhali	Hatiya	-	Horni Ahmadia
37. Noakhali	Hatiya	-	Purbo Maijchora
38. Noakhali	Hatiya	-	Tamaroddi Sirajia
39. Feni	Chagalniya	-	Alokdia
40. Feni	Chagalniya	-	Uttor Haripur
41. Laximpur	Sadar	-	Chor Ruhita
42. Laximpur	Sadar	-	South Shakchor
43. Laximpur	Sadar	-	South Chor Romani Mohon
44. Laximpur	Sadar	-	South Tumchor
45. Laximpur	Sadar	-	East Chormanasha
46. Feni	Sadar	-	Sreepur
47. Feni	Sadar	-	Katalia
48. Feni	Sadar	-	Ratanpur
49. Feni	Sadar	-	Mothbaria
50. Feni	Sadar	-	Izzatpur

Note: All the schools are government primary schools (GPS)

2.5 Selection of Study Sites

As described in 2.4, the Government of Bangladesh has proposed a total of 50 candidate sites for the Project (II). The ministries concerned in Japan involved in the Project (II) examined and discussed the extent of the request and concluded that, in view of the likely implementation period for a Japanese grant aid project, the geographical distribution of the requested sites and the available period to complete the Basic Design Study, the selection of 23 sites located in the Chittagong and Cox's Bazar Districts, both of which are in the HRA, would be appropriate. A site survey would be conducted at these 23 sites with a view to selecting upto 15 priority sites and a natural conditions survey, etc. would then be conducted for these priority sites as part of the basic design for the planned facilities.

The rejection of the remaining 27 sites was mainly based on the fact that their locations are outside the HRA (22 sites in the Laximpur and Feni Districts). In short, 23 sites located in the Chittagong and Cox's Bazar Districts were selected (see Table 2-5-1) out of the originally requested 50 sites for the survey to confirm the site conditions.

Table 2-5-1 List of Selected Sites for Site Conditions Survey

Site No.	District	Thana	Union	School (GPS)
1	Chittagong	Banskhali	Saral	West Kahargona
2	Chittagong	Banskhali	Sadhonpur	Rata Khordo
3	Chittagong	Banskhali	Jaldi	Jaldi Vadalia
4	Cox's Bazar	Sadar	Jalalabad	Edigaon Bahar Chara
5	Cox's Bazar	Sadar	Jalalabad	South Khorulia
6	Cox's Bazar	Sadar	Khoruskul	Khoruskul Dhiran
7	Cox's Bazar	Sadar	Chawfaldang	Khonkar Khil
8	Cox's Bazar	Sadar	P.M. Khali	Parania Para
9	Cox's Bazar	Chokoria	East Boro Bheola	Boro Bheola
10	Cox's Bazar	Chokoria	Harbang	Harbang
11	Cox's Bazar	Chokoria	Badarkhali	Kutubnagar
12	Cox's Bazar	Chokoria	Chiringa	Middle Chokoria
13	Cox's Bazar	Chokoria	B.M. Char	B.M. Char
14	Cox's Bazar	Ramu	Kunia Palong	Goalia Palong
15	Cox's Bazar	Ramu	Patakarkul	Lomuri Para
16	Cox's Bazar	Ramu	South Mithashari	Chainda
17	Cox's Bazar	Ukhia	Jaliaparo	Sonaichari
18	Cox's Bazar	Ukhia	Rahmaterbil	Rahmaterbil
31	Cox's Bazar	Chokoria	Khotakhali	Fulchari
32	Cox's Bazar	Chokoria	Khotakhali	Khotakhali
33	Cox's Bazar	Chokoria	Magnama	Maddays Magnama
34	Cox's Bazar	Chokoria	Magnama	Sutachura
35	Cox's Bazar	Chokoria	Dulahazara	Ring Bong

Total: 23 sites

2.6 Finalization of Project Sites

2.6.1 Site Conditions Survey

The site conditions survey was conducted at the 23 selected sites. In view of the fact that all the selected sites were primary school premises run by the government, the survey tried to identify the following details.

① Locational Conditions
- Site access
- Land ownership
- Site area

② Items Related to School Education
- State of building(s)
- Number of pupils and teachers
- State of drop-out
- Available educational fittings
- Auxiliary facilities
- Maintenance system

③ Items Related to Cyclones
- Population within a 1.5 km radius
- Distance to nearest cyclone shelter
- Actual cyclone damage in the past (number of casualties, damage to housing, damage to farming and storm surge height, etc.)
- Cyclone warning system in the neighbourhood
- Availability of killa(s) in the neighbourhood

The findings of the site conditions survey are given in Table 2-6-1, while details of the findings are shown in Appendix 6 (Supplementary Volume).

2.6.2 Project Site Selection Criteria

As the primary objective of the Project (II) is the construction of cyclone shelters, the following criteria were, in principle, applied for the selection of the Project Sites using the survey findings given in Table 2-6-1.

① High storm surge height

② Non-existence of two-story or higher public buildings or hills capable of accommodating a sufficient number of evacuees in the neighbourhood

③ Non-existence of cyclone shelters in the neighbourhood despite a high population density in the area

2.6.3 Decision on Project Sites

Based on the criteria given in 2.6.2, the following 15 sites were selected as Project Sites for the construction of cyclone shelters as indicated in Table 2-6-1.

Site Nos.: 1, 2, 3, 4, 5, 6, 9, 11, 12, 15, 17, 31, 32, 33, 34

In the case of Site Nos. 3 and 15, additional land must be acquired as the existing sites are not sufficiently large enough to accommodate the planned cyclone shelters. The need for additional land at these 2 sites was explained to and agreed by the Bangladesh side.

Table 2-6-1 Outline of 23 Selected Sites for Site Conditions Survey

	Item \ Site No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	31	32	33	34	35	
As a Cyclone Shelter	Maximum Surge Height of Cyclone Shelter in the Past	6.0 ◎	4.3 ◎	2.5 ○	3.5 ◎	2.6 ○	2.5 ○	1.8 ○	A shelter is now under construction at the site.	3.6 ◎	A shelter is now under construction at the site.	4.0 ◎	3.0 ◎	3.0 ◎	2.0 ○	2.5 ○	3.0 ◎	3.0 ◎	2.1 ○	4.3 ◎	3.5 ◎	6.1 ◎	9.0 ◎	5.5 ◎	◎ : 3m or more ○ : 1m or more to less than 3m △ : Less than 1m
	Distance to the Nearest Cyclone Shelter	1.0	1.0	3.0	3.0	4.0	3.0	3.0		4.0		2.0	1.0	3.0	5.0	2.0	1.0	3.0	5.0	—	—	2.0	—	4.0	
	Population within a 1.5km Radius	5.000	7.000	8.000	9.000	4.500	15.000	6.550		7.000		3.500	5.675	8.000	4.000	4.000	5.000	10.000	8.000	6.000	6.663	8.000	6.000	5.000	
	Hilly Area within a 1.5km Radius	○	○	○	○	○	△	×		○		○	○	×	×	○	×	○	×	○	○	○	○	×	○ : Non-existing △ : Existing 1km away, evacuation with hindrance due to topographic conditions × : Existing behind the site
	Public Building (2-story) within a 1.5km Radius	○	○	○	○	○	△	○		○		○	△	○	○	○	○	○	○	○	○	○	○	○	○ : Non-existing △ : Existing, but not having capacity enough for evacuees
	Max. No. of Casualties by Cyclone in the Past	2.000 ◎	300 ◎	300 ◎	200 ◎	60 ○	65 ○	30 △		58 ○		125 ◎	150 ◎	107 ◎	50 ○	85 ○	45 △	60 ○	50 ○	1.200 ◎	800 ◎	2.600 ◎	1.800 ◎	2.500* ◎	◎ : 100 persons or more ○ : 50 persons or more to less than 100 persons △ : 1 person or more to less than 50 persons
	Existing Killa	×	×	×	×	×	×	×		×		×	×	×	×	×	×	×	×	×	×	×	×	×	× : Non-existing
	Necessity of Killa	○	○	○	○	○	○	×		○		○	○	×	×	○	×	○	×	○	○	○	○	×	○ : Needed × : Not needed, because a hilly area for killa exists.
As a School Building	Total No. of Pupils	204	200	320	338	520	851	582		308		294	372	622	279	249	278	444	400	502	416	458	370	371	
	School Building Area (m^2)	225.6	97.8	174.8	159.0	217.5	200.0	198.0		86.2		81.0	226.0	186.2	105.0	144.0	190.9	157.0	154.2	229.6	191.8	230.2	143.7	146.4	
	School Building Area/Student (m^2)	1.11 △	0.49 ○	0.55 ○	0.41 ○	0.42 ○	0.24 ○	0.34 ○		0.28 ○		0.28 ○	0.61 ○	0.30 ○	0.38 ○	0.58 ○	0.69 ○	0.35 ○	0.39 ○	0.46 ○	0.46 ○	0.50 ○	0.39 ○	0.39 ○	○ : Less than $0.74m^2$ △ : $0.74m^2$ or more
	Current State of School Building	○	○	△	○	×	△	○		○		○	×	△	○	○	△	△	×	○	△	○	○	△	○ : Bad △ : Not so bad × : Good
	Owner of the Site	○	○	○	○	○	○	○		○		○	○	○	○	○	○	○	○	○	○	○	○	○	○ : Government Owned
	Size of the Site	○	○	×	○	○	○	○		○		○	○	○	○	×	○	○	○	○	○	○	○	○	○ : Enough × : Not Enough
	Total Evaluation	○	○	○	○	○	○	×	×	○	×	○	○	×	×	○	×	○	×	○	○	○	○	×	○ : Qualified × : Disqualified

Note: *; 2,500 persons were killed by 1991 cyclone due to non-introduction of the cyclone warning system, dispite the fact that there was a hilly area behind the site. Now the above system has been introduced by BDRCS.

CHAPTER 3

OUTLINE OF PROJECT SITES

CHAPTER 3 OUTLINE OF PROJECT SITES

3.1 Locations and Social and Economic Conditions

3.1.1 Locations

The 15 sites of the Project (II) (Project Sites) are currently used as government-run primary school premises in Banskhali Thana in the Chittagong District and Sadar, Chokoria, Ramu and Ukhia Thanas in the Cox's Bazar District as listed in Table 3-1-1. Their locations are shown on the Location Map of the Project Sites at the beginning of this report. These sites have now been given new site numbers to avoid confusion with those sites where the Project (I) is taking place.

Table 3-1-1 Locations of Project Sites

Site No.	District	Thana	Union	School (GPS)
II-1	Chittagong	Banskhali	Saral	West Kaharghona
II-2	Chittagong	Banskhali	Sadhonpur	Rata Khordo
II-3	Chittagong	Banskhali	Jaldi	Jaldi Vadalia
II-4	Cox's Bazar	Sadar	Jalalabad	Edigaon Bahar Chara
II-5	Cox's Bazar	Sadar	Jalalabad	South Khorulia
II-6	Cox's Bazar	Sadar	Khoruskul	Khoruskul Dhiran
II-7	Cox's Bazar	Chokoria	East Boro Bheola	Boro Bheola
II-8	Cox's Bazar	Chokoria	Badarkhali	Kutubnagar
II-9	Cox's Bazar	Chokoria	Chiringa	Middle Chokoria
II-10	Cox's Bazar	Ramu	Patakarkhul	Lomuri Para
II-11	Cox's Bazar	Ukhia	Jaliaparo	Sonaichari
II-12	Cox's Bazar	Chokoria	Khotakhali	Fulchari
II-13	Cox's Bazar	Chokoria	Khotakhali	Khotakhali
II-14	Cox's Bazar	Chokoria	Magnama	Maddaya Magnama
II-15	Cox's Bazar	Chokoria	Magnama	Sutachura

3.1.2 Social Conditions

The general social conditions of the Chittagong and Cox's Bazar Districts (Project Area) where the Project Sites are located are described in this section.

(1) Population and Households

The land area, population, number of households, number of family members/household and population density of the Project Area are given in Table 3-1-2.

Table 3-1-2 Population Data for Chittagong and Cox's Bazar Districts

Item	Chittagong	Cox's Bazar	Bangladesh Total
Land Area (km^2)	5,283	2,492	143,999
Population (1,000)	5,296	1,419	109,877
- Male	2,819	743	-
- Female	2,477	676	-
- Rural	2,889	1,226	-
- Urban	2,407	193	-
Number of Households (1,000)	920	220	20,187
- Rural	495	189	-
- Urban	425	31	-
Number of Family Members (persons)	5.76	6.45	5.44
- Rural	5.84	6.49	-
- Urban	5.66	6.23	-
Population Density (persons/km2)	1,002	569	763

(2) Land Ownership and Housing Conditions

The land ownership and housing conditions in the Project Area are summarised in Table 3-1-3.

Table 3-1-3 Land Ownership and Housing Conditions

Item	Chittagong		Cox's Bazar	
Number of Households	919,677		219,937	
- Those Owning Land	683,062	(74.3%)	194,125	(88.3%)
- Those Renting Land	143,590	(15.6%)	8,839	(4.0%)
- Those Borrowing Land Free of Charge	27,798	(3.0%)	9,909	(4.5%)
- Public Housing	8,268	(0.9%)	1,356	(0.6%)
- Others	56,959	(6.2%)	5,708	(2.6%)
Number of Houses	854,450		212,873	
Wall Structure				
- Straw/Bamboo	413,751	(48.4%)	120,799	(56.7%)
- Earth	279,085	(32.7%)	76,870	(36.1%)
- Galvanised Steel Sheet	23,460	(2.7%)	2,635	(1.3%)
- Timber	5,318	(0.6%)	4,923	(2.3%)
- Cement/Bricks	132,836	(15.6%)	7,646	(3.6%)
Roof Structure				
- Straw/Bamboo	439,387	(51.4%)	162,594	(76.4%)
- Galvanised Steel Sheet	325,946	(38.2%)	46,950	(22.0%)
- Cement	89,117	(10.4%)	3,329	(1.6%)

(3) Number of School Age Children (Primary School)

The number of school age children (primary school) in the Project Area and their ratio vis-a-vis the district population are given in Table 3-1-4.

Table 3-1-4 School Age Children (Primary School)

Item	Chittagong		Cox's Bazar	
Total District Population	5,296,127		1,419,260	
5-9 Year Olds Total	800,148	(15.1%)	259,744	(18.3%)
5 Year Olds	147,865	(2.8%)	56,004	(3.9%)
6 Year Olds	165,390	(3.1%)	51,613	(3.6%)
7 Year Olds	175,193	(3.3%)	59,271	(4.2%)
8 Year Olds	179,738	(3.4%)	57,133	(4.0%)
9 Year Olds	131,962	(2.5%)	35,723	(2.5%)

3.1.3 Economic Conditions

(1) Farmland Ownership

The conditions of farmland ownership in the Project Area are given in Table 3-1-5.

Table 3-1-5 Farmland Ownership

Item	Chittagong		Cox's Bazar	
Number of Households	919,677		219,937	
- Those Owning Farmland	391,357	(42.6%)	77,162	(35.1%)
- Those Not Owning Farmland	528,320	(57.4%)	142,775	(64.9%)

(2) Main Household Income Sources

The main household income sources and their respective ratios in the Project Area are given in Table 3-1-6.

Table 3-1-6 Main Household Income Sources and Their Ratios

Item	Chittagong		Cox's Bazar	
Waged Employment	229,188	(24.9%)	11,187	(5.1%)
Commercial Activities	163,706	(17.8%)	35,455	(16.1%)
Farming	161,393	(17.6%)	55,142	(25.1%)
Farm Labour	104,481	(11.4%)	45,677	(20.8%)
Non-Farm Labour	31,262	(3.4%)	16,386	(7.5%)
Transport (Manual)	26,654	(2.9%)	2,442	(1.1%)
Fisheries	10,006	(1.1%)	8,601	(3.9%)
Others	192,987	(20.9%)	45,047	(20.4%)

(3) Land Use

Land use data for the Chittagong Region in which the Project Area is located is given in Table 3-1-7.

Table 3-1-7 Land Use in Chittagong Region

(Unit: km^2)

Region	Total Land Area	Area Unsuitable for Farming	Forest	Waste Land	Suspended Farming Land	Farming Land
Chittagong	8,140 (100%) (6)	2,404 (29.5%) (2)	2,276 (28.0%) (3)	256 (3.1%) (8)	556 (6.8%) (6)	2,648 (32.5%) (15)
Bangladesh	146,680	31,832	18,772	5,768	9,516	80,792

Note: Figures in brackets indicate the ranking of the Chittagong Region among the 23 regions.

(4) Agricultural Production

The value of agricultural production in the Chittagong Region is shown in Table 3-1-8.

Table 3-1-8 Agricultural Production Value (1990 - 1991)

(Unit: million TK)

Region/Product	Grain	Processed Food	Fruit	Oil Seeds	Beans	Seasonings
Chittagong	7,788	461	545	36	79	307
Bangladesh Total	157,766	4,955	10,783	4,468	6,139	6,395

Region/Product	Sugar Cane	Vegetables	Vegetable Fibre	Others	Total
Chittagong	35	482	-	53	9,786 ⑩
Bangladesh Total	7,496	7,945	9,351	591	215,889

Note: ⑩ The Chittagong Region ranks 10th in terms of the agricultural production value among the 23 regions.

(5) Livestock Production

The value of livestock production in the Chittagong Region is shown in Table 3-1-9.

Table 3-1-9 Livestock Production Value (1990 - 1991)

(Unit: million TK)

Region/Product	Milk	Meat	Edible Offal	Head and Legs	Animal Fat	Leather
Chittagong	283	727	14	19	2	57
Bangladesh Total	6,723	15,183	335	461	68	1,666

Region/Product	Eggs	Others	Total
Chittagong	150	4	1,256 ⑩
Bangladesh Total	2,239	22	26,717

Note: ⑩ The Chittagong Region ranks 10th in terms of the agricultural production value among the 23 regions.

3.2 Natural Conditions

3.2.1 Meteorology and Hydrology

(1) General Meteorological Conditions

The general meteorological conditions of the Chittagong and Cox's Bazar Districts in which the Project Sites are located are given below and are illustrated in Fig. 3-2-1. Data indicate the average values for the last 5 years.

1) Rainfall

Table 3-2-1 Mean Monthly Rainfall

(Unit: mm)

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Chittagong	1	18	56	215	177	515	1,025	325	292	247	74	15	2,960
Cox's Bazar	0	17	37	156	135	932	1,077	595	393	258	126	8	3,734

2) Temperature

Table 3-2-2 Mean Maximum and Minimum Monthly Temperatures

(Unit: °C)

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Chittagong	27.1	29.5	32.8	32.7	34.0	33.3	32.7	32.3	31.8	32.8	28.9	28.6	max.
	13.0	15.7	17.9	20.3	22.9	24.2	24.4	24.9	24.2	22.7	18.1	15.4	min.
Cox's Bazar	28.0	30.0	32.5	32.6	33.9	32.9	31.7	31.4	31.7	32.0	31.0	28.8	max.
	14.1	16.6	18.4	21.3	22.3	24.4	24.5	24.7	24.9	22.8	19.9	16.4	min.

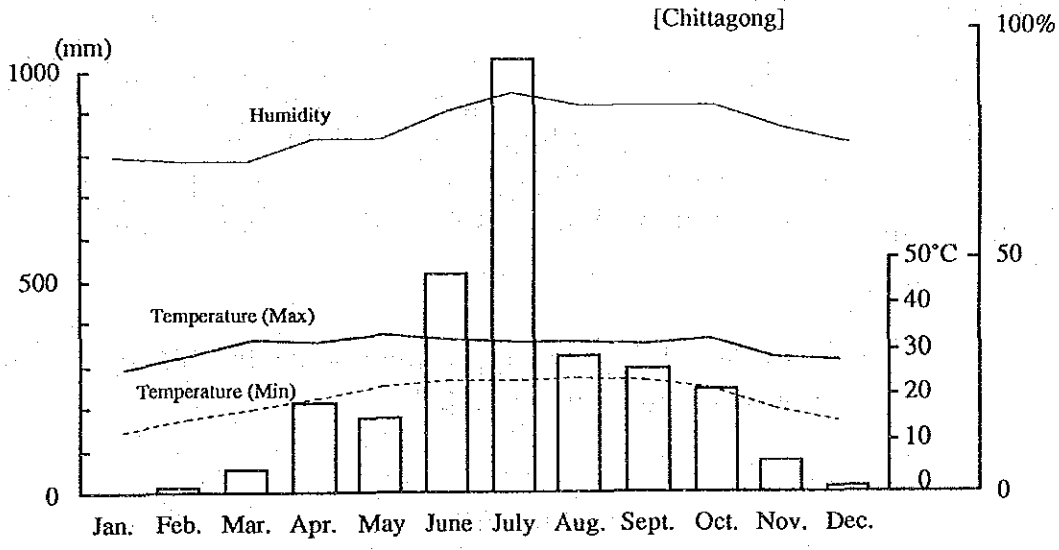
3) Humidity

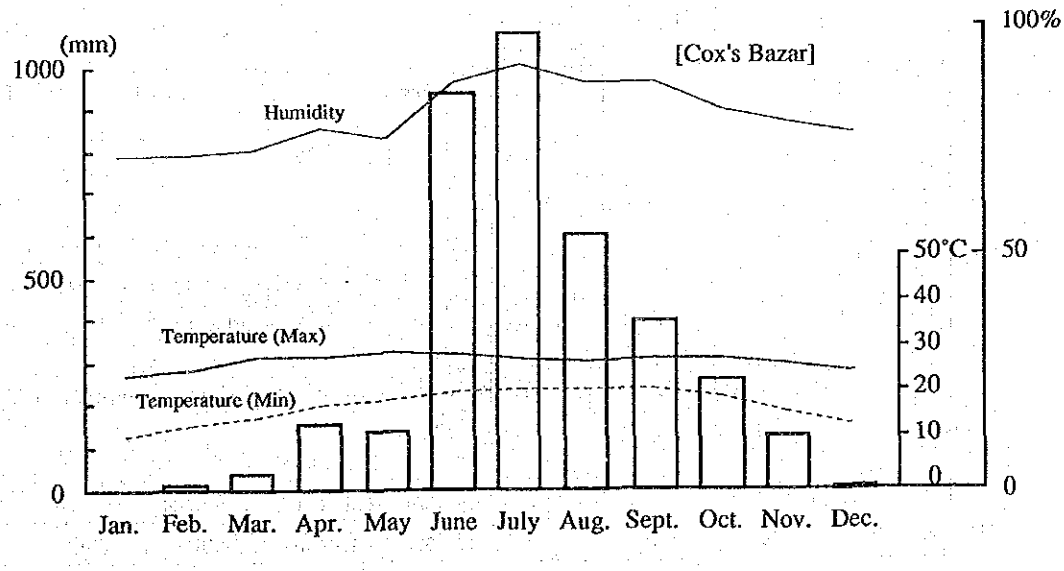
Table 3-2-3 Mean Monthly Humidity

(Unit: %)

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Chittagong	72	71	71	76	75	82	86	83	83	83	78	75
Cox's Bazar	71	71	72	77	75	87	91	87	87	81	78	76

Fig. 3-2-1 Mean Monthly Rainfall, Mean Max. And Min. Monthly Temperatures, Mean Monthly Humidity in Chittagong and Cox's Bazar





(2) Specific Meteorological Conditions

The specific meteorological conditions relating to the Project are discussed here.

1) Rainfall

The maximum daily rainfall and maximum hourly rainfall with a 5-year return period are given in Table 3-2-4.

Table 3-2-4 Maximum Daily Rainfall and Maximum Hourly Rainfall with 5-Year Return Period in Chittagong

(Unit: mm)

Item/Location	Chittagong
Maximum Daily Rainfall (5-Year Return Period)	280
Maximum Hourly Rainfall (5-Year Return Period)	117

Source: Multipurpose Cyclone Shelter Programme

The total rain duration and hourly average rainfall recorded by tropical cyclones are given in Table 3-2-5.

Table 3-2-5 Summary of Rainfall During Tropical Cyclones in Chittagong

Year	Station-Chittagong		Remarks
	Time (hrs)	Intensity (mm/hr)	
May 4 - 5, 1982	3	1.67	cyclone weakened considerably before crossing Bangladesh
Nov. 9 - 10, 1983	18	2.06	cyclone hit Kutubdia Island
June 2 - 3, 1984	33	3.06	
May 25 - 26, 1985	39	7.13	cyclone hit South Chittagong at 21:00 on the 25th
Nov. 8 - 9, 1986	30	4.03	cyclone crossed West Bengal coast at 03:00 on the 9th
June 4 - 5, 1987	33	6.03	deep depression crossed Southeast Patuakhali at 18:00 on the 4th
Nov. 29 - 30, 1988	21	2.76	cyclone hit Raimongol river in Khulna at 12:00 on the 29th
1989	-	-	no major cyclone
Dec. 18 - 19, 1990	24	1.42	cyclone weakened considerably
Apr. 29 - 30, 1991	n.a.	n.a.	cyclone hit Komira at 22:00 on the 29th

Source: Multipurpose Cyclone Shelter Programme

2) Wind Velocity

The cyclonic wind velocities for different return periods (10, 20, 50 and 100 years) in the Bangladesh coastal area are given in Table 3-2-6 based on the relevant records for the period between 1960 and 1991.

Table 3-2-6 Cyclonic Wind Velocities for Different Return Periods

Wind Velocity	Return Period (years)			
	10	*20*	*50*	*100*
km/hour	194	223	261	287
m/sec	53.9	61.9	72.5	80.3

Source: Multipurpose Cyclone Shelter Programme

The annual maximum wind velocities for different return periods at various observation stations are given in Table 3-2-7.

Table 3-2-7 Annual Maximum Wind Velocities for Different Return Periods

Observation Station	Observation Period	Wind Velocity for Specific Return Period (km/hr)			
		10 Years	20 Years	50 Years	100 Years
Chittagong	1971 - 1990	118	135	156	172
Cox's Bazar	1972 - 1988	135	159	190	214

Source: Multipurpose Cyclone Shelter Programme

3) Temperature

The annual maximum and minimum temperatures for different return periods at Chittagong are given in Table 3-2-8.

Table 3-2-8 Annual Maximum and Minimum Temperatures for Different Return Periods

Observation Station	Maximum/ Minimum	Temperature for Specific Return Period (°C)			
		10 Years	20 Years	50 Years	100 Years
Chittagong	Maximum	36.46	36.78	37.13	37.37
	Minimum	9.46	9.10	8.70	8.44

Source: Multipurpose Cyclone Shelter Programme

4) Tide Level

The prominent storm surge heights recorded by cyclones since 1960 are shown in Table 2-1-2. The predicted maximum storm surge heights for different return periods in different regions of the Project Area are given in Table 3-2-9.

Table 3-2-9 Predicted Area Average for Maximum Surge Heights

Coastal Region	Predicted Average Surge Height (m)					
	V = 165 T = 5	V = 195 T = 10	V = 223 T = 20	V = 233 T = 25	V = 261 T = 50	V = 289 T = 100
Teknaf - Cox's Bazar	2.00	2.71	3.44	3.71	4.53	5.40
Cox's Bazar - Chittagong	3.18	4.25	5.38	5.80	7.04	8.36
Chittagong - Noakhali - Bhola	3.55	4.75	5.99	6.50	7.83	9.29

T = Return Period (years) V = Wind Velocity (km/hr)
Source: Multipurpose Cyclone Shelter Programme

The design surge heights at beaches of the coastal regions listed in the previous table are given in Table 3-2-10.

Table 3-2-10 Design Surge Heights at Sea Coast (with 90% accuracy limit)

Region	Design Surge Height at Beaches (with 90% accuracy limit) (m)		
	20-Year Return Period	50-Year Return Period	100-Year Return Period
Teknaf to Cox's Bazar	2.7 ± 0.7	3.7 ± 0.8	4.5 ± 1.3
Chokoria to Anwara and Moheskhali - Kutubdia Islands	4.3 ± 0.9	5.8 ± 1.3	7.0 ± 1.6
Chittagong to Noakhali	4.8 ± 1.0	6.5 ± 1.4	7.8 ± 1.8

Source: Multipurpose Cyclone Shelter Programme

The extreme surface water levels at various locations in the coastal area during the monsoon season are given in Table 3-2-11.

Table 3-2-11 Extreme Surface Water Levels at Various Locations of Coastal Areas During Monsoon Season

(Unit: metres above PWD datum)

Location	20 Year Return Period	50 Year Return Period	100 Year Return Period
Cox's Bazar	3.78	3.84	3.88
Shaflapur (Chokoria)	4.23	4.67	4.87
Lemsikhali	4.62	4.95	5.19
Banigram (Banskhali)	4.80	5.05	5.24
Chittagong	4.50	4.72	4.88

Source: Multipurpose Cyclone Shelter Programme

3.2.2 Topography

Bangladesh mainly consists of an alluvial deltaic plain. The northeastern, eastern and southeastern borders are edged by hills. The alluvial plain extends as long as some 400 km in the northwest-southeast direction and the elevation at the northeastern corner is 90m, from where the land elevation gradually declines towards the southwest to less than 3m at the line connecting Khulna, Narayanganj, Chandpur and Noakhali. The land to the south of this line and the Chittagong coastal plains located in the southeast form the coastal area of Bangladesh. This coastal area is classified into the following physiographic units based on the physical characteristics.

(1) Chittagong Coastal Plain

This is a narrow area sandwiched between the Chittagong hills and the sea and has several flood plains with offshore islands. The area is characterised by gently sloping piedmont alluvials fans of loamy soil types. The offshore islands mainly consist of clay layers transported and deposited by sea currents. The area is shown under gray piedmont clay in Fig. 3-2-2.

(2) Estuarine Flood Plains

The estuarine flood plains spreading around the mouth of the old Meghna river contain sediment deposits originating from the Ganges and Brahmaputra rivers. Few undulations are observed and the soil type is silty soil. This area is shown under alluvial deltaic silt deposits in Fig. 3-2-2.

(3) Ganges Tidal Flood Plains

These plains are linked to the Ganges estuarine flood plains upstream but are less undulating. The tidal flood plains differ from the Ganges estuarine flood plains in that a well-developed network of numerous tidal creeks and river channels has been formed in the Ganges tidal flood plains. While deposits are mainly of non-calcareous clay, silt and peat are found in the east and west respectively. The area is shown under grey flood plain clay in Fig. 3-2-2.

(4) The Sundarbans

The Sundarbans are areas covered by mangrove forests which are under the influence of tidal floods of brackish or saline water. The land in this area is virtually flat with numerous tidal creeks and river channels.

The proposed cyclone shelter sites under the Project (II) are located in area (1) above.

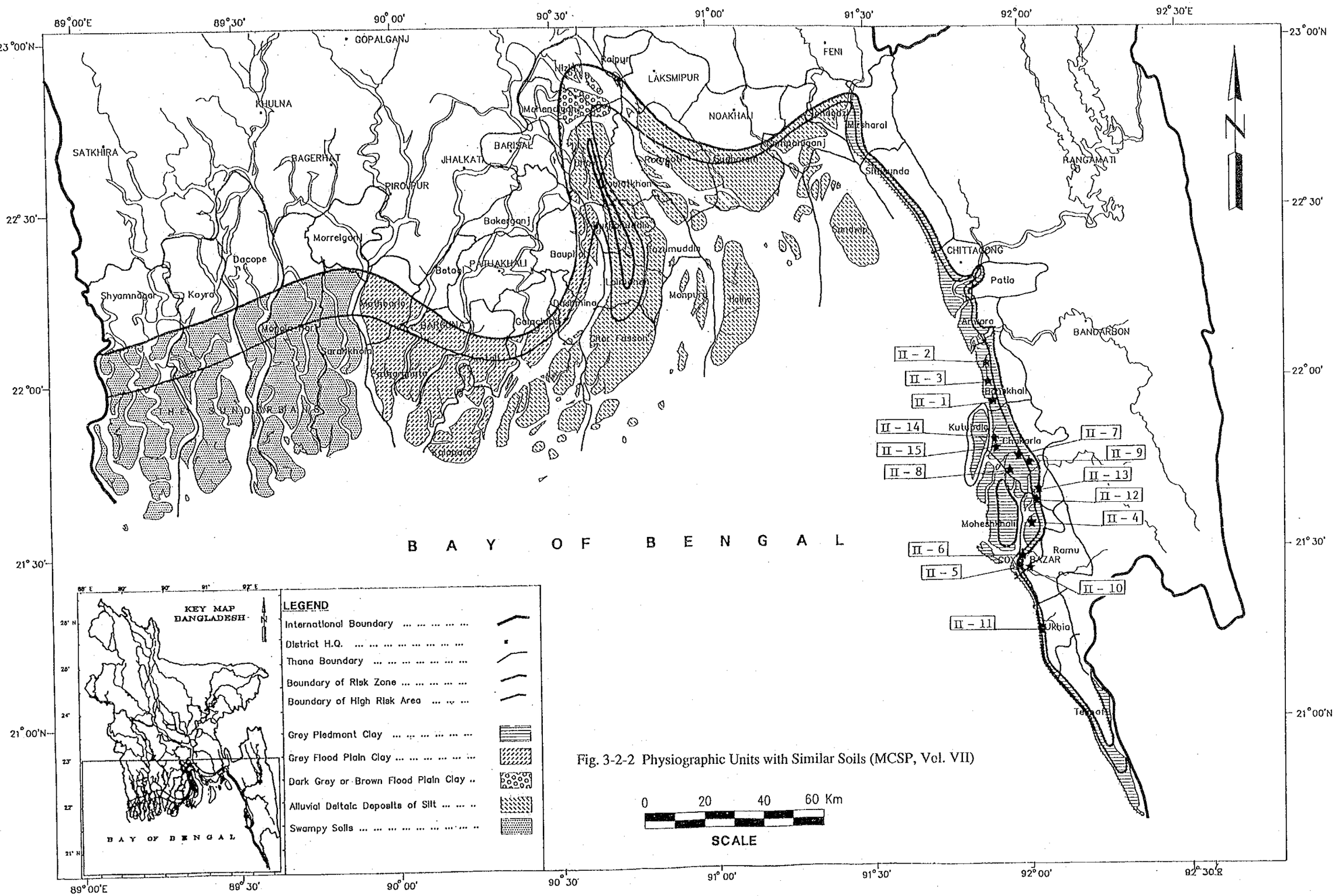


Fig. 3-2-2 Physiographic Units with Similar Soils (MCSP, Vol. VII)