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 (III)
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

OCTOBER, 1995

JAPAN INTERNATIONAL COOPERATION AGENCY
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 (III) 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 from March 17 to May 1, 1995.

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 basic disign, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the Project (III) 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.

October, 1995

Kimio Fujita
President
Japan International Cooperation Agency

October, 1995

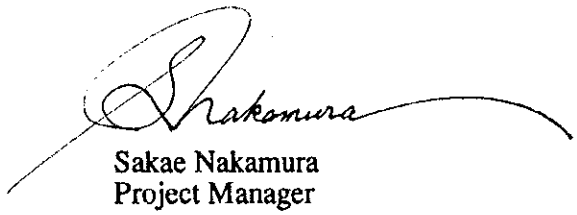
Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for the Construction of Multipurpose Cyclone Shelters (III) 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 from March 10, 1995 to October 9, 1995. In conducting the study, we have examined the feasibility and rationale of the Project (III) with due consideration to the present situation of Bangladesh and formulated the most appropriate basic design for the Project (III) under Japan's grant aid scheme.

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

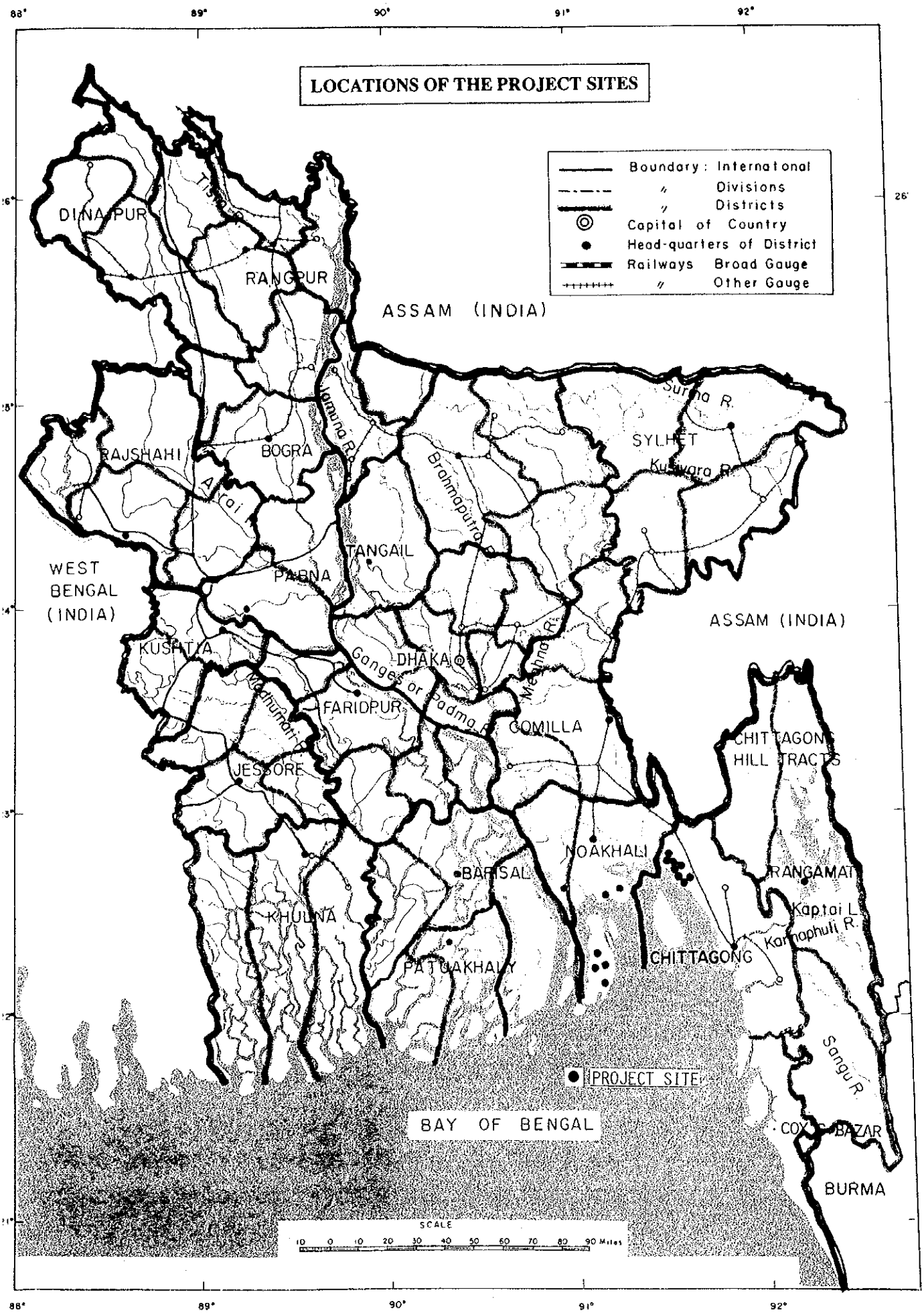
Very truly yours,

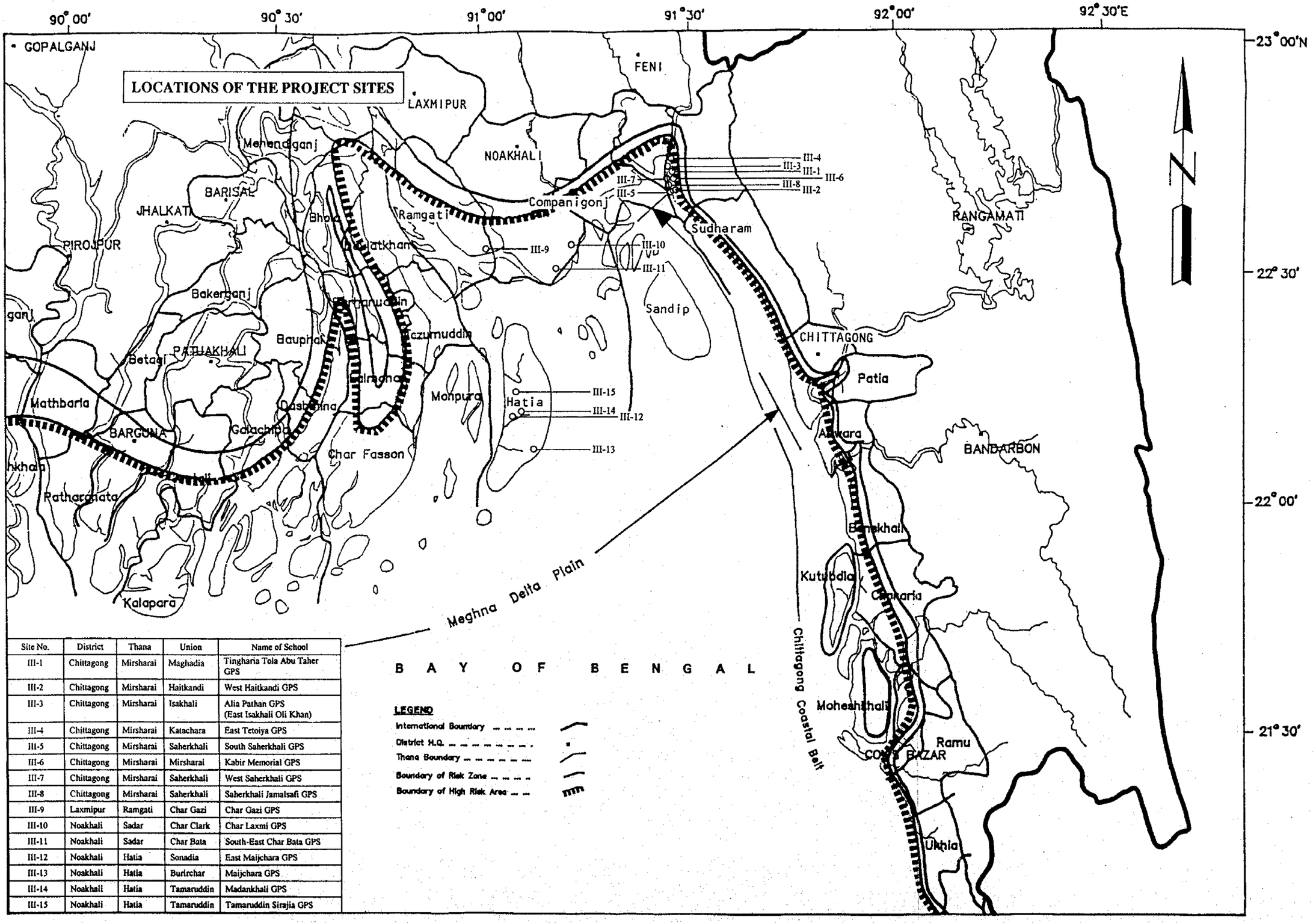


Sakae Nakamura
Project Manager

Basic Design Study Team on the Project for the Construction of Multipurpose Cyclone Shelters (III)

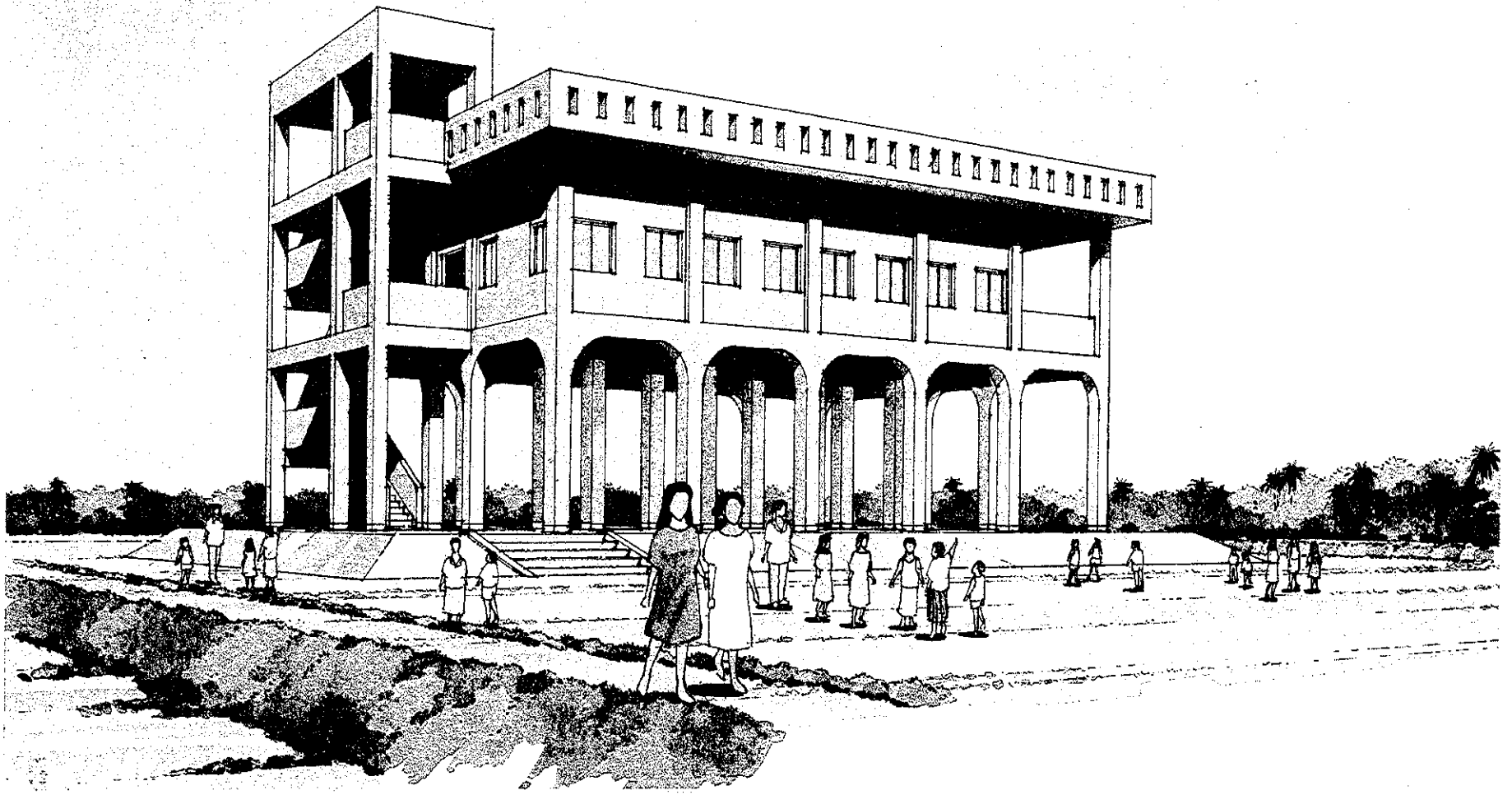
Japan Engieering Consultants Co., Ltd.


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)
Jamuna R.
Surma R.
SYLHET
Kushiara R.
RAJSHAHI
BOGRA
Atrai R.
Brahmaputra R.
TANGAIL
PABNA
WEST BENGAL (INDIA)
ASSAM (INDIA)
KUSHTIA
DHAKA
Ganges or Padma R.
Meghna 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°



Site No.	District	Thana	Union	Name of School
III-1	Chittagong	Mirsharai	Maghadia	Tingharia Tola Abu Taher GPS
III-2	Chittagong	Mirsharai	Haitkandi	West Haitkandi GPS
III-3	Chittagong	Mirsharai	Isakhali	Alia Pathan GPS (East Isakhali Oli Khan)
III-4	Chittagong	Mirsharai	Katachara	East Tetoiya GPS
III-5	Chittagong	Mirsharai	Saherkhali	South Saherkhali GPS
III-6	Chittagong	Mirsharai	Mirsharai	Kabir Memorial GPS
III-7	Chittagong	Mirsharai	Saherkhali	West Saherkhali GPS
III-8	Chittagong	Mirsharai	Saherkhali	Saherkhali Jamalsafi GPS
III-9	Laxmipur	Ramgati	Char Gazi	Char Gazi GPS
III-10	Noakhali	Sadar	Char Clark	Char Laxmi GPS
III-11	Noakhali	Sadar	Char Bata	South-East Char Bata GPS
III-12	Noakhali	Hatia	Sonadia	East Maijchara GPS
III-13	Noakhali	Hatia	Burirchar	Maijchara GPS
III-14	Noakhali	Hatia	Tamaruddin	Madankhali GPS
III-15	Noakhali	Hatia	Tamaruddin	Tamaruddin Sirajia GPS

PERSPECTIVE



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
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
JICA	:	Japan International Cooperation Agency
JOCV	:	Japan Overseas Cooperation Volunteers
LGED	:	Local Government Engineering Department
MCSP	:	Multipurpose Cyclone Shelter Programme
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
OPEC	:	Organization of Petroleum Exporting Countries
PCP	:	Project Concept Paper
PMED	:	Primary and Mass Education Division
PTI	:	Primary Training Institute
PWD	:	Public Works Department
PWP	:	Priority Works Programme
RHD	:	Roads and Highways Department
RZ	:	Risk Zone
SMC	:	School Management Committee
TEO	:	Thana Education Officer
UHF	:	Ultra High Frequency
UNDP	:	United Nations Development Programme
UNICEF	:	United Nations Children's Fund
UPE	:	Universal Primary Education
VHF	:	Very High Frequency
VSAT	:	Very Small Aperture Terminal
WFP	:	World Food Programme

CONTENTS

CHAPTER 1

BACKGROUND OF THE PROJECT (III)

CHAPTER 1 BACKGROUND OF THE PROJECT (III)

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 10 m above sea level, many natural disasters, particularly flooding and cyclones, have a devastating effect on the land.

The primary characteristic of cyclones which hit Bangladesh is storm surge caused by strong wind which is more dangerous than the tremendously strong wind which often exceed 60 m/sec. The water level along the sea coast is often raised by as much as 1 m or more above the normal level due to winds from the Bay of Bengal. Together with a high tide between 3 - 5 m above the normal tide level, storm surge along the coastal area can be as high as 5 - 9 m, inundating upto 5 - 8 km inland and causing many casualties, both human and livestock.

Some 5.2 million people currently live in Bangladesh's High Risk Area (HRA), two-thirds of which are without proper emergency shelter. There have been many cyclone disasters in recent years and the maximum wind velocities appear to be increasing. Recent death tolls include 300,000 people in 1970, 11,000 in 1985, 2,000 in 1988 and 140,000 in 1991.

With the intent of protecting human life, livestock and property, some 400 cyclone shelters were constructed by various aid organizations between the 1960's and around 1990. Despite the need to construct many more shelters, the speed at which actual construction has taken place has been quite slow. Following the great disaster in 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, international aid at last gained momentum and some 610 shelters (of which 500 shelters were accounted for when the Cyclone Shelter Master Plan was formulated) have been constructed since 1991 with a further some 170 shelters currently under construction. Moreover, an additional 140 shelters have been approved by various aid organizations and their sites have been confirmed. Despite these efforts, the construction of some 2,100 shelters from 1995 onwards is deemed necessary in accordance with the Multipurpose Cyclone Shelter Programme (Master Plan) prepared by the Government of Bangladesh with the assistance of the World Bank and UNDP in 1993.

Under these circumstances, the Government of Bangladesh made a request in January, 1992 for the construction of 40 cyclone shelters with the LGEG, a subordinate organization of the

Ministry of Local Government, Rural Development and Cooperatives, acting as the project implementation body.

In response to this request, the Government of Japan commissioned the Preliminary Study and Additional Study by two teams mainly consisting of former Japan Overseas Cooperation Volunteers (JOCV) members in March, 1992. The Study Team members subsequently found that 18 sites of the requested 40 were suitable for the construction of cyclone shelters but rejected the remaining 22 sites on the grounds that there were no households in the vicinity, that the sites were far from the nearest household (2 km or more), that they were situated on a dry riverbed and/or that a shelter or hill for evacuation purposes existed in the vicinity.

Based on these findings, the Basic Design Study for the Project (I) was conducted between October, 1992 and February, 1993 and it was concluded that the Government of Japan would provide grant aid for the construction of a cyclone shelter at 10 highest priority sites. Following the signing of the E/N in August, 1993, the construction work commenced in December of the same year and all 10 cyclone shelters were completed by the end of January, 1995.

During the basic design study period for the Project (I), the Japanese and Bangladesh sides jointly reached the conclusion that it would be more appropriate if the cyclone shelters were used as schools during normal times to ensure their proper maintenance.

Based on the opinion that the construction cost of the cyclone shelters built by Japanese grant aid was much higher than that of other donors and the Government of Bangladesh, it was agreed that the subject sites would be geographically concentrated rather than scattered as in the case of the Project (I). Following this agreement, the Government of Bangladesh made a new request for the provision of grant aid by the Government of Japan to rebuild 30 existing primary school buildings, which had been damaged in the past or which were likely to be damaged by cyclones, as cyclone shelters.

In response to this request, the Government of Japan commissioned the Japan International Cooperation Agency (JICA) to send the Basic Design Study Team for the Project (II) which was duly sent to Bangladesh for the period between January 23rd and March 1st, 1994. As 10 sites of the 30 sites originally requested by the Government of Bangladesh were found to be located outside the HRA and as the regional concentration of these sites was insufficient, the Basic Design Study Team requested that the Government of Bangladesh select 20 additional candidate sites. Of the total 50 sites, a site conditions survey was conducted at 23 sites located in the HRA in the Chittagong and Cox's Bazar Districts in view of the principle of

concentrating the subject sites agreed upon during the study for the Project (I). Finally, 15 sites were selected as project sites based on the conditions described below and the Basic Design Study was conducted for these 15 sites.

① High cyclonic storm surge (and within the HRA)

② Absence of 2-storey or more public buildings with a sufficient shelter capacity or hill for evacuation in the vicinity

③ Absence of a cyclone shelter despite the dense population

Based on the findings of the Basic Design Study for the Project (II), the E/N was signed on September 1st, 1994 to make the Project (II) a grant aid project of the Government of Japan in fiscal 1994. With the subsequent selection of the contractor, the cyclone shelter construction work at 15 sites commenced in January, 1995.

These 15 cyclone shelters under the Project (II) and 10 completed shelters under the Project (I) still fall short of the 40 shelters originally requested by the Government of Bangladesh. Due to their acute necessity, the Government of Bangladesh made a further request to the Government of Japan for the provision of grant aid for the construction of the remaining 15 cyclone shelters as the Project (III). As the table below shows, the selection of 15 sites from 63 candidate sites suggested by the Government of Bangladesh has been requested with a view to replacing existing primary school buildings which have already been or which are likely to be damaged by cyclones with cyclone shelters-cum-primary school buildings.

District	Thana	Number of Sites
Chittagong	Sandip	7
Chittagong	Mirsharal	14
Laxmipur	Ramgati	10
Laxmipur	Roypur	1
Feni	Sonagazi	9
Noakhali	Sadar	8
Noakhali	Companigonj	4
Noakhali	Hatia	10
Total		63

The contents and size, etc. of these multipurpose cyclone shelters requested by the Government of Bangladesh are outlined below.

-Classrooms

- Each classroom has a floor are of 37.15m^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

CHAPTER 2

FINALIZATION OF PROJECT SITES

CHAPTER 2 FINALIZATION OF PROJECT SITES

2-1 Selection of Study Sites

The Government of Bangladesh initially put forward 63 candidate sites for the Project (III) as shown in Table 2-1-1. Having examined and discussed the list of candidate sites in view of the actual implementation period of the construction work under the grant aid scheme of the Government of Japan, the local distribution of the listed candidate sites, the types of existing schools, the envisaged period for the basic design study and the findings of the preliminary study at Mirsharai Thana, the Japanese government organizations related to the Project (III) decided to select 25 sites located in the Chittagong, Laxmipur and Noakhali Districts, in turn situated inside the HRA, using the criteria listed in Table 2-1-2. The site conditions survey would then be conducted and, based on the findings of this survey, 18 sites would be identified as high priority sites. The number would finally be reduced 15 based on the results of the natural conditions survey and the basic plan regarding the actual construction of cyclone shelters would address these 15 high priority sites.

In accordance with the above decisions, the site conditions survey would firstly be conducted at 25 sites located in the Chittagong, Laxmipur and Noakhali Districts (Table 2-1-3) out of the 63 sites originally listed by the Government of Bangladesh.

Table 2-1-1 Requested Project Candidate Sites (63 Sites)

Site No.	District	Thana	Union	Name of School
1	Chittagong	Sandip	Sarikait	Bast Sarikait GPS
2	Chittagong	Sandip	Magdhara	North Magdhara GPS
3	Chittagong	Sandip	Magdhara	Magdhara Hajera Islam GPS
4	Chittagong	Sandip	Harispur	Sandip Town Pathshara GPS
5	Chittagong	Sandip	Harispur	Momena Sakander GPS
6	Chittagong	Sandip	Musapur	Musapur Adarsha GPS
7	Chittagong	Sandip	Haramia	Haramia North-East GPS
8	Chittagong	Mirsharai	Knaiachara	Knaiachara GPS
9	Chittagong	Mirsharai	Magdhara	Tingharia Tola GPS
10	Chittagong	Mirshrai	Mithanala	Rahmatbad GPS
11	Chittagong	Mirsharai	Haitkandi	West Haitkandi GPS
12	Chittagong	Mirsharal	Isakhali	Alia Pathan GPS
13	Chittagong	Mirsharai	Katachara	Tetoiya GPS
14	Chittagong	Mirsharai	Katachara	Muradpur Fatima GPS
15	Chittagong	Mirsharai	Katachara	Isakhali Kazigram GPS
16	Chittagong	Mirsharai	Katachara	East Briakhali GPS
17	Chittagong	Mirsharai	Saherkhali	South Saherkhali GPS
18	Chittagong	Mirsharai	Mirsharai	Kabir Memorial GPS
19	Chittagong	Mirsharai	Mirsharai	West Saherkhali GPS
20	Chittagong	Mirsharai	Mirsharai	Saherkhali Jamalsafi GPS
21	Chittagong	Mirsharai	Mirsharai	Mid-Mithanala GPS
22	Laxmipur	Ramgati	Char Aleckjander	South-West Char Alekjander Registered NGPS
23	Laxmipur	Ramgati	Char Aleckjander	Sabagram GPS
24	Laxmipur	Ramgati	Char Badam	East Poragacha Registered NGPS
25	Laxmipur	Ramgati	Char Badam	Azadngar GPS
26	Laxmipur	Ramgati	Char Badam	Harun Bazar (Char Kolakopa) Registered NGPS

Site No.	District	Thana	Union	Name of School
27	Laxmipur	Ramgati	Char Algi	East Char Algi Registered NGPS
28	Laxmipur	Ramgati	Hajirhat	Ganipur (Char Jangalia) Registered NGPS
29	Laxmipur	Ramgati	Hajirhat	East Tarabgonj Prokash Boiacepara Registered PS
30	Laxmipur	Ramgati	Char gazi	Char Gazi GPS
31	Laxmipur	Ramgati	Char Algi	South Char Algi GPS
32	Laxmipur	Roypur	Char Bangshi	South-West Char Kasia GPS
33	Feni	Sonagazi	Char Darbesh	Hossain Master Village NGPS
34	Feni	Sonagazi	Char Darbesh	South Char Shavikari Village NGPS
35	Feni	Sonagazi	Char Darbesh	Kashemul Ulum Madrasha beside the North-East Char Darbesh Village NGPS
36	Feni	Sonagazi	Char Chandina	South Char Chandina NGPS
37	Feni	Sonagazi	Char Chandina	Puraton Saudagar Hat Ismailia Madrasha
38	Feni	Sonagazi	Char Chandina	Sawdagar Hat Mahamudia Madrasha
39	Feni	Sonagazi	Char Darbesh	South-West Char Darbesh NGPS
40	Feni	Sonagazi	Amirabad	Char Krishnajoy Adarshagram NGPS
41	Feni	Sonagazi	Sonagazi	Haji Abdul Salam Mia NGPS
42	Noakhali	Sadar	Char Clark	Kerani Bazar Registered NGPS
43	Noakhali	Sadar	Char Clark	Char Laxmi GPS
44	Noakhali	Sadar	Char Jubeli	South Kacchopia Registered NGPS
45	Noakhali	Sadar	Char Jubeli	Golam Moula Registered NGPS
46	Noakhall	Sadar	Char Bata	Char Bata Registered Non-Govt. Girls School
47	Noakhali	Sadar	Char Bata	South-East Char Bata GPS
48	Noakhali	Sadar	Chaprashirhat	Mondolia Registered NGPS

Site No.	District	Thana	Union	Name of School
49	Noakhali	Sadar	Chaprashirhat	Jantabazar NGPS
50	Noakhali	Companigonj	Char Elahi	Model Village NGPS
51	Noakhali	Companigonj	Char Elahi	West Char Jatra NGPS
52	Noakhali	Companigonj	Char Fakira	Char Kocchopia NGPS
53	Noakhali	Companigonj	Char Parboti	Char Purbani NGPS
54	Noakhali	Hatia	Sonadia	South-East Sonadia Registered Ebtadia Mairchara GOVT. Primary Madrasa
55	Noakhali	Hatia	Sonadia	East Maijchara GPS
56	Noakhali	Hatia	Burir Char	Mairchara GPS
57	Noakhali	Hatia	Burir Char	Shatodal GPS
58	Noakhali	Hatia	Char Esar	Char Esar Ray Kayabulia Registered Ebtadia Madrasa
59	Noakhali	Hatia	Jahajmara	Char Hari GPS
60	Noakhali	Hatia	Tamaruddin	Madankhali GPS
61	Noakhali	Hatia	Tamaruddin	Tamaruddin Sirajia GPS
62	Noakhali	Hatia	Char Keshor	Ishwar Pni Hallama GPS
63	Noakhali	Hatia	Harani	Harani Abmadia GPS

Note) NGPS : Non-Government Primary School
Registered NGPS : Registered Non-Government Primary School
GPS : Government Primary School

Table 2-1-2 Selection Method of 25 Candidate Sites for Site Conditions Survey

Candidate sites of Bangladesh request (63 sites) →	Sites outside the HRA (13 sites)
	Site Nos. 24, 26, 28, 29, 32, 33, 34, 40, 48, 49, 51, 52 and 53

↓

Sites in the HRA (50 sites)
Site Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 27, 30, 31, 35, 36, 37, 38, 39, 41, 42, 43, 44, 45, 46, 47, 50, 54, 55, 56, 57, 58, 59, 60, 61, 62 and 63

↓

Removal of 7 sites on Sandip Island (Site No. 1 trough No. 7) due to the limited field survey period, difficult access and conditions of the island's infrastructure, etc., leaving the following 43 sites.
Site Nos. 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 27, 30, 31, 35, 36, 37, 38, 39, 41, 42, 43, 44, 45, 46, 47, 50, 54, 55, 56, 57, 58, 59, 60, 61, 62 and 63

↓

Removal of 7 non-government primary school sites (Nos. 35, 36, 37, 38, 39, 41 and 50) in view of the operation and management requirements following the complection of the multipurpose cyclone shelters, leaving the following 36 sites.
Site Nos. 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 27, 30, 31, 42, 43, 44, 45, 46, 47, 54, 55, 56, 57, 58, 59, 60, 61, 62 and 63

↓

Given the Preliminary Study finding that both Site No. 8 and Site No. 14 in Mirsharai have a two story secondary school building to provide shelter vis-a-vis cyclones, that the land area of Site Nos. 10 and 16 is inadequate and that there is a plan to construct a shelter at Site No. 21, the number of candidate sites is further reduced to 31 as follows.
Site Nos. 9, 11, 12, 13, 15, 17, 18, 19, 20, 22, 23, 25, 27, 30, 31, 42, 43, 44, 45, 46, 47, 54, 55, 56, 57, 58, 59, 60, 61, 62 and 63

↓

Considering the limited survey period, the construction conditions on Hatia Island, access to the island and cyclone season, etc. the survey sites on Hatiya Island will be 4 sites (Nos. 55, 56, 60 and 61) which are near to one another, omitting 6 sites (No. 54, 57, 58, 59, 62 and 63) to make a finalized total of 25 survey sites.
Site Nos. 9, 11, 12, 13, 15, 17, 18, 19, 20, 22, 23, 25, 27, 30, 31, 42, 43, 44, 45, 46, 47, 55, 56, 60 and 61

Table 2-1-3 Selected Candidate Sites for Site Conditions Survey (25 Sites)

Site No.	District	Thana	Union	Name of School
9	Chittagong	Mirsharai	Maghadia	Tingharia Tola Abu Taher GPS
11	Chittagong	Mirsharai	Haitkandi	West Haitkandi GPS
12	Chittagong	Mirsharai	Isakhali	Alia Pathan GPS (East Isakhali Oil Khan)
13	Chittagong	Mirsharai	Katachara	East Tetoiya GPS
15	Chittagong	Mirsharai	Katachara	Isakhali Kazigram GPS
17	Chittagong	Mirsharai	Saherkhali	South Saherkhali GPS
18	Chittagong	Mirsharai	Mirsharai	Kabir Memorial GPS
19	Chittagong	Mirsharai	Saherkhali	West Saherkhali GPS
20	Chittagong	Mirsharai	Saherkhali	Saherkhali Jamalsafi GPS
22	Laxmipur	Ramgati	Char Aleckjander	Soutk-West Char Aleckjander Registered NGPS
23	Laxmipur	Ramgati	Char Aleckjander	Sabagram GPS
25	Laxmipur	Ramgati	Char Badam	Azadnagar GPS
27	Laxmipur	Ramgati	Char Algi	East Char Algi Registered NGPS
30	Laxmipur	Ramgati	Char Gazi	Char Gazi GPS
31	Laxmipur	Ramgati	Char Algi	South Char Algi GPS
42	Noakhali	Sadar	Char Clark	Kerani Bazar Registered NGPS
43	Noakhali	Sadar	Char Clark	Char Laxmi GPS
44	Noakhali	Sadar	Char Jubeli	South Kacchopia Registered NGPS
45	Noakhali	Sadar	Char Jubeli	Golam Moula Registered NGPS
46	Noakhali	Sadar	Char Bata	Char Bata Registered Non-Govt. Girls School
47	Noakhali	Sadar	Char Bata	South-East Char Bata GPS
55	Noakhali	Hatia	Sonadia	East Maijchara GPS
56	Noakhali	Hatia	Burir Char	Mairchara GPS
60	Noakhali	Hatia	Tamaruddin	Madankhali GPS
61	Noakhali	Hatia	Tamaruddin	Tamaruddin Sirajia GPS

2-2 Finalization of Project Sites

2-2-1 Site Conditions Survey

The site conditions survey was conducted at the 25 selected sites. In view of the fact that all the selected sites were primary school premises, 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

(4) Others
- Items to be confirmed should the Project be implemented
  * Necessity for demolition of existing school building(s)
  * Construction body for temporary school building to be used during the construction of planned facilities
  * Neighboring inhabitants' participation in operation and maintenance
- Job capabilities of possible sub-contractors based near the sites
- Availability of procuring construction materials and equipment, etc. near the sites

The findings of the site conditions survey are given in Table 2-2-1, while details of the findings are shown in Appendix 9 (Supplementary Volume).

2-2-2 Project Site Selection Criteria

As the primary objective of the Project (III) 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 2-2-1.

(1) The subject site shall be site of a government primary school which is managed by the central government.

(2) The subject site shall be located in the HRA designated by the Master Plan for the Multipurpose Cyclone Shelter Programme.

(3) In principle, the subject site shall not have any solid building or hill of sufficient height to provide a reliable evacuation site vis-a vis storm surge caused by a cyclone within a 1.5 Km radius.

(4) The subject site shall have sufficient land area for the construction of a multipurpose cyclone shelter and has secure land ownership (owned by the central government).

(5) An exception to the above criteria (4) shall be made if sufficient land area is made available by the removal of a facility which is declared unfit for use and of which the removal by the Bangladesh side is assured.

(6) The subject site shall allow access by vehicle or cart for the transportation of construction materials to site.

(7) The subject site shall not be associated with a similar project or plan of the Government of Bangladesh, a foreign aid association or a donor country to construct a cyclone shelter.

(8) The subject site shall have an existing primary school where the number of teachers and pupils justifies the size of the school building to be constructed as a multipurpose cyclone shelter.

(9) The subject site shall have a suitable local community organization (for example, a school management committee) which is capable of maintaining the shelter and which is willing to do so.

(10) The subject site shall have a killa for the evacuation of animals within a radius of 0.3 Km (in principle, on land visible from the shelter site) or a feasible site for the construction of such a killa to be completed prior to the completion of the shelter construction work.

2-2-3 Decision on Project Sites

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

Site Nos.: 9, 11, 12, 13, 17, 18, 19, 20, 30, 43, 47, 55, 56, 60, 61

At Site No. 17 where there is a dilapidated school building on the site, it will be necessary to demolish the building to obtain land of the required size to construct the planned shelter.

2-2-4 Locations of Project Sites

The 15 sites of the Project (III) (Project Sites) are currently used as government primary school premises in Mirsharai Thana in the Chittagong District, Ramgati Thana in the Laxmipur District, and Sadar and Hatia Thanas in the Noakhali District as listed in Table 2-2-2. 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) and the Project (II) are taking place.

Table 2-2-1 Results of Site Conditions Survey for Selected 25 Candidate Sites

	Item \ Site No.	9	11	12	13	15	17	18	19	20	22	23	25	27	30	31	42	43	44	45	46	47	55	56	60	61	Remarks
As a Cyclone Shelter	Maximum Surge Height of Cyclone in the Past (m)	3.0	2.5	2.7	2.0	2.0	3.5	2.0	2.2	3.0	6.0	2.1		7.0	2.5	2.0	6.0	3.5	4.0	3.0	3.5	4.5	3.0	3.0	3.0	3.0	◎:3m or more ○:1m or more to less than 3m △:Less than 1m
		◎	○	○	○	○	◎	○	○	◎	◎	○		◎	○	○	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	
	Distance to the Nearest Cyclone Shelter (Km)	1.5	1.5	3.0	1.5	0.3	6.0	4.5	2.0	5.0	2.0	6.0		0.4	2.5	2.0	5.0	2.0	2.0	2.0	0.5	2.2	2.0	2.0	2.0	4.0	○:1.5km or more ×:Less than 1.5km
		○	○	○	○	×	○	○	○	○	○	○		×	○	○	○	○	○	○	×	○	○	○	○	○	
	Population within a 1.5Km Radius	7,000	7,500	10,000	12,000	10,000	4,500	25,000	5,000	4,000	5,000	5,000		4,500	6,000	5,000	4,000	3,000	5,000	3,000	6,000	3,000	3,000	2,000	3,000	3,000	
	Hilly Area within a 1.5 Km Radius	○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○:Non-existing ×:Existing
	Public Building (2-story) within a 1.5 Km Radius	○	○	○	○	○	○	○	○	○	○	×		○	○	○	○	○	○	○	○	○	○	○	○	○	○:Non-existing ×:Existing(2-storied Thana office exists next to the site)
	Maximum No. of Casualties by Cyclone in the Past	700	1,000	100	400	400	350	1,000	1,500	1,200	1,000	700		450	100	500	350	1,000	500	500	600	200	400	100	500	300	
	Existing Kills	×	×	×	×	×	×	×	×	×	×	×		×	×	×	×	○	×	×	×	×	×	×	×	×	○:Existing ×:Non-existing
	Necessity of Kills	○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	×	○	○	○	○	○	○	○	○	
	Outside of Embankment	–	–	–	–	–	–	–	–	–	–	–		–	–	○	–	–	–	–	–	–	–	–	–	–	
As a school Building	Type of School	○	○	○	○	○	○	○	○	○	△	○		△	○	○	△	○	△	△	×	○	○	○	○	○	○:GPS △:Registered NGPS ×:Non-Government Junior Girls High School
	No. of Pupils Class 1 & 2	175	103	164	119	117	161	255	139	110	139	266		210	133	112	105	134	153	101	※	112	231	150	256	235	※Single Shift Education
	No. of Pupils Class 3, 4 & 5	101	133	154	112	148	116	224	207	65	140	156		135	104	85	49	116	81	85	163	108	119	56	105	151	
	No. of Pupils Total	366	236	318	231	265	278	579	346	175	337	411		345	237	205	154	250	234	186		220	400	206	355	487	
	No. of Teachers	7	5	3	4	5	5	7	6	4	4	6		4	4	4	4	4	4	4	6	3	3	3	3	4	
	Current Conditions of School Building	×	×	×	×	×	○	○	△	×	×	△		×	×	△	×	×	△	×	○	×	×	×	×	×	○:Good △:No so bad ×:Bad
Means of Accessibility		○	○	○	○	○	○	○	○	○	○※1	○		○	○	× 2 km	× 2 km	○	○	○	○	○	○	○	△	○	○:4WD △:Pushcart ×:Foot ※Unsuitable site for evacuation because of existence of deep canal along the access road.
Existing Maintenance System		○	○	○	○	○	○	○	○	○	△	○		△	○	○	△	○	△	△	△	○	○	○	○	○	○:PWD ×:SMC(School Management Committee)
Owner of the Site		○	○	○	○	○	○	○	○	○	△	○		△	○	○	△	○	△	△	△	○	○	○	○	○	○:Government-owned △:SMC-owned
Size of the Site		○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○:Enough △:Not Enough
Total Evaluation		○	○	○	○	×	○	○	○	○	×	×	×	×	○	×	×	○	×	×	×	○	○	○	○	○	○:Qualified △:Disqualified

※1 A shelter is now under construction at the site.

Table 2-2-2 Locations of Project Sites

Site No.	District	Thana	Union	Name of School
III-1	Chittagong	Mirsharai	Maghadia	Tingharia Tola Abu Taher GPS
III-2	Chittagong	Mirsharai	Haitkandi	West Haitkandi GPS
III-3	Chittagong	Mirsharai	Isakhali	Alia Pathan GPS (Bast Isakhali Oli Khan)
III-4	Chittagong	Mirsharai	Katachara	East Tetoiya GPS
III-5	Chittagong	Mirsharai	Saherkhali	South Saherkhali GPS
III-6	Chittagong	Mirsharai	Mirsharai	Kabir Memorial GPS
III-7	Chittagong	Mirsharai	Saherkhali	West Saherkhali GPS
III-8	Chittagong	Mirsharai	Saherkhali	Saherkhali Jamalsafi GPS
III-9	Laxmipur	Ramgati	Char Gazi	Char Gazi GPS.
III-10	Noakhali	Sadar	Char Clark	Char Laxmi GPS
III-11	Noakhali	Sadar	Char Bata	South-East Char Bata GPS
III-12	Noakhali	Hatia	Sonadia	East Maijchara GPS
III-13	Noakhali	Hatia	Burir Char	Mairchara GPS
III-14	Noakhali	Hatia	Tamaruddin	Madankhali GPS
III-15	Noakhali	Hatia	Tamaruddin	Tamaruddin Sirajia GPS

CHAPTER 3

CONTENTS OF THE PROJECT (III)

CHAPTER 3 CONTENTS OF THE PROJECT (III)

3-1 Objectives of the Project (III)

Bangladesh suffers from adverse natural conditions which consistently cause natural disasters resulting in a high death toll. To improve this situation, many internationally assisted projects are in progress to prevent the disastrous outcome of natural phenomena, such as cyclones. The construction of cyclone shelters is believed to be the most technically and financially feasible and quickly achievable disaster prevention measure for cyclones and, as such, an official call for the urgent construction of the required number of cyclone shelters to protect human lives and livestock has been made. As many as some 2,100 cyclone shelters are required, the Government of Bangladesh is calling for further international aid efforts by donor countries and aid organizations to meet this massive task.

The Government of Bangladesh originally requested the Government of Japan's construction of 40 new cyclone shelters via the LEGD. In response to this request, the Project (I), under the Japanese grant aid project, involving the construction of 10 cyclone shelters-cum-educational facilities commenced in December, 1993 and was completed at the end of January this year. During the basic design study period of the Project (I), both governments agreed that the use of the cyclone shelters as primary school buildings during normal times would prove effective in terms of the good maintenance of the buildings. Based on this understanding, the Government of Bangladesh short-listed 50 new candidate sites for the remaining 30 cyclone shelters. Out of these 50 sites, 15 sites were considered to be suitable and the Project (II) was drafted to rebuild 15 primary schools which had been damaged or which were likely to be damaged by cyclones as cyclone shelters-cum-schools. The construction of these 15 cyclone shelters is currently in progress with grant aid provided by the Government of Japan. To follow the Project (II), the Government of Bangladesh has requested the Government of Japan's preparation of a plan for the Project (III) to construct the remaining 15 cyclone shelters which will replace existing primary school buildings and which will be used as new school buildings during normal times. The Project (III) aims at protecting human lives through the construction of cyclone shelters which will be used as school buildings under normal weather conditions. The Project (III) also intends the establishment of a reliable operation and maintenance system for these new cyclone shelters.

3-2 Basic Concept of the Project (III)

3-2-1 Viability and Necessity of the Project (III)

The Government of Bangladesh commenced preparation of the Master Plan for the Multipurpose Cyclone Shelters Programme in February, 1992 with the assistance of the World Bank and UNDP and completed the Final Report in July, 1993 and, has requested that aid organizations neither arbitrarily select the locations for new cyclone shelters nor rely on their own principles and methods when constructing shelters, but refer to the Master Plan for the construction of new cyclone shelters.

When examining the viability and necessity of the Project (III), it must be borne in mind that any cyclone shelter construction plan under the Project (III) must be compatible with and connected to the overall implementation of the Master Plan.

(1) Project Area

The Master Plan indicates that new cyclone shelters should be located within the HRA where storm surges can reach a height of 1m. It is, therefore, necessary that all the Project Sites be located within the HRA.

(2) Viability of Project (III)

The present Project (III) is viewed as the most feasible measure to protect the lives of more than 5 million people living in the HRA from both the technical and financial viewpoints and is judged both necessary and viable from a humanitarian point of view. The feasibility of the Project (III) is supported in terms of the topographical conditions, population density, social infrastructure and all other related factors.

The Project (III) aims at rebuilding those existing primary school buildings which have been either damaged or which are likely to be damaged by cyclones as cyclone shelter-cum-primary school buildings to ensure their proper maintenance during normal weather conditions and to improve the country's availability of physical facilities for primary education. While the successful completion of the Project (III) will far from satisfy the need to construct more than 3,000 new primary schools in the HRA as envisaged by the Master Plan, it must be pointed out that the primary objective of the Project (III) is the construction of cyclone shelters. The use of these shelters as primary schools will, however, definitely improve the level of physical facilities for primary

education and will motivate not only school age children to attend school but will also motivate parents to send their children to school, in turn leading to further improvement of the school enrolment rate.

The fact that the Project (III) is also in line with the objective of the International Decade for Natural Disaster Reduction (IDNDR) is an additional advantage of the implementation of the Project (III) in view of its appeal vis-a-vis the international community.

(3) Planned Number of Cyclone Shelters

The Master Plan predicts that the total population of 5.2 million people in the HRA in 1992 will increase to 6.4 million in 10 years which is also the target population of the Master Plan in the year 2002.

The total accommodation capacity of all cyclone shelters (including those currently under construction or planned) and secure public and private buildings (including those planned) at the time of launch of the Master Plan is calculated to be 2.16 million, leaving 4.25 million people unprotected. Assuming a capacity of some 1,750 people/shelter, the further construction of some 2,500 shelters is called for by the Master Plan.

The number of new cyclone shelters anticipated by the Master Plan for the 4 Thanas in the Project Area is given in Table 3-2-1.

Because of the progress of cyclone shelter construction since 1991 upto the present with some 110 shelters being completed (excluding some 500 shelters accounted for at the time of the formulation of the Master Plan from the 610 shelters completed so far), some 170 shelters under construction and some 140 shelters of which the sites have been finalized, totaling approximately 400 shelters, the number of cyclone shelters to be constructed at present stands at approximately 2,100.

Table 3-2-1 Necessary Number of Cyclone Shelters in Project Area

District	Thana	Shelters Planned by Master Plan			Shelters Planned Under the Project (III)
		Priority A	Priority B	Total	
Chittagong	Mirsharai	24	4	28	8
Laxmipur	Ramgati	75	120	195	1
Noakhali	Sadar	58	8	66	2
Noakhali	Hatia	131	8	139	4
Total		288	140	428	15

The required number of new cyclone shelters in these 4 Thanas is 428, of which 288 are Priority Grade A shelters (to be constructed in the 3-year period from 1994 to 1996). The planned shelters under the Project (III) account for approximately 3.5% of the total shelter requirement.

Based on the above argument, the Project (III) has significant importance from the humanitarian point of view and the construction of cyclone shelters at 15 sites out of the remaining 15 requested sites by the Government of Bangladesh under the Project (III) is deemed appropriate for Japanese grant aid.

3-2-2 Implementation and Operation Plans

(1) Implementation Agency

Given the objective of the Project (III) to provide safe public shelters in cyclone-prone areas to improve local welfare by means of protecting human lives and livestock, it is deemed appropriate for the Ministry of Local Government, Rural Development and Cooperatives to be assigned the responsibility for the overall implementation of the Project (III) while the LGED, a subordinate organization of the above Ministry and responsible for the technical aspects of regional development, should be assigned the task of the actual implementation of the Project (III).

[LGED]

The LGED is a national organization responsible for regional development. Its Head Office is in Dhaka and the LGED has 64 District Offices and 460 Thana Offices, employing a total of 9,600 people. Each District Office consists of 12 employees, including the manager, while each Thana Office consists of 19 employees, including the manager. The scope of work of the LGED includes the consolidation of local infrastructure, the construction of roads, the construction of government buildings and the construction and/or repair of government-owned school buildings, etc. in rural areas. Because of its rich experience in these fields, the LGED is deemed to be appropriate to act as the project implementation agency.

Upon completion of the Project (III), each Thana Office in the Project Area will be commissioned by the PMED to conduct the maintenance work for 1 - 7 cyclone shelters under the supervision of the LGED Headquarters. As these

cyclone shelters will have a concrete structure, requiring infrequent maintenance, the present staff level of the LGED is deemed adequate for the extra maintenance work.

(2) Organization Responsible for Management of Cyclone Shelters (Primary School Buildings)

While the project implementation agency will be the LGED as described in (1) above, the Directorate of Primary Education (DPE) will be responsible for the management of those shelters under the supervision of the PMED (which controls all primary schools in Bangladesh) in view of the fact that the cyclone shelters will be used as primary school buildings under normal circumstances.

The DPE is controlled by the Secretary responsible for the day-to-day business of the PMED under the overall supervision of the Prime Minister. Within the DPE itself, a Deputy Director, Primary Education Officer (PEO) and Thana Education Officer (TEO) are appointed under the Director General for each Division, District and Thana respectively. Assistant Thana Education Officers (ATEO), each responsible for the direct management of 15 - 20 primary schools, are under the above officers to ensure the smooth daily operation of primary schools. The day-to-day running of the individual primary schools is conducted by teaching staff, mainly principals, under the guidance of ATED.

Apart from the above official administrative arrangements, a School Management Committee (SMC) has been established for each primary school as required by the regulations introduced by the PMED in 1992 and the key members of these committees are local residents. These committees are designed to facilitate the active participation of local communities in the management of primary schools and have positively contributed to improving school management. Given the existing organization and experience of the PMED and SMCs described above, they are deemed to be well capable of maintaining the cyclone shelters as primary schools under normal circumstances.

[Budget of PMED]

The budget of the PMED for the last three fiscal years is shown in Table 3-2-2.

Table 3-2-2 Budget of PMED

(Unit: million TK)

Fiscal Year	Total	Education Total	Primary Education
1992/1993	166,810	22,674.3	11,649.7
1993/1994	190,500	27,155.0	13,608.2
1994/1995	209,480	34,033.6	17,271.1

In recent years, the budget for primary education, i.e. TK 11.64 billion (24.91 billion yen) in fiscal 1992/93, TK 13.60 billion (29.13 billion yen) in fiscal 1993/94 and TK 17.27 billion (36.96 billion yen) in fiscal 1994/95, has accounted for more than half of the total educational budget.

The annual operation and maintenance costs of the planned 15 cyclone shelters are estimated to be TK 2 million which is approximately 0.011% of the current primary education budget and which can be easily afforded by the PMED. The actual maintenance work will be entrusted to the LGED which is responsible for the construction and repair of government primary schools in local areas.

With regard to the management cost (teachers' wages and cost of stationary, etc.), no new budgetary items will be generated due to the nature of the Project (III) which is the rebuilding of existing school buildings. Nevertheless, appropriate budgetary appropriation will be required to cover the cost of news, i.e. 3 teachers for Site No. III-12 and III-15 and 2 for Site No. III-14.

(3) Cyclone Forecasting and Warning System

The protection of human lives, property and livestock in the Project Area, even with the successful completion of new cyclone shelters under the Project (III), will largely depend on an effective cyclone warning system. The 15 cyclone shelters to be constructed will be placed under the Cyclone Preparedness Programme which was jointly introduced in 1978 by the BDRCS and Ministry of Relief and Rehabilitation. The Programme has 2,430 Units (one Unit covering 2 - 3 villages) in 215 Unions in 25 Thanas along the Bay of Bengal and each Unit consists of 10 volunteers, i.e. one leader and one assistant for each of 5-activity areas (warning, guiding to shelters, rescue, first-aid and emergency relief). A two-way radio communication system has been set up between the Headquarters in Dhaka and 4 zonal offices (Chittagong, Cox's

Bazar, Barisal and Barguna), as well as 25 relay stations at the Thana level. When a warning is issued by the Storm Warning Centre and USAID, the Thana level relay stations use short distance radios or communication volunteers to forward the warning to the Union team leaders of an approaching cyclone. These Unit team leaders confirm the information using transistor radios and, together with other volunteers (Unit team members), warn the villagers using hand sirens and megaphones.

Actual warnings consist of 10 different signal levels which are largely classified into 3 groups, i.e. Signals 1 - 3, Signals 4 - 7 and Signals 8 - 10, as described below.

1) Signals 1 - 3 : These are early warning signals which are conveyed by a single flag hoisted on the roofs of cyclone shelters. Villagers are informed verbally of the birth of a cyclone.

2) Signals 4 - 7 : These are danger warnings which are conveyed by 2 flags hoisted on the roofs of cyclone shelters. Villagers are informed verbally of the direction and size of the storm area of the cyclone.

3) Signals 8 - 10 : These are ultra danger warnings which are conveyed by 3 flags hoisted on the roofs of cyclone shelters. Villagers are guided to the cyclone shelters by volunteers using a megaphone, hand siren and signalling torch.

The use of the above cyclone warning system operated by the BDRCS appears appropriate to evacuate local inhabitants to the new cyclone shelters to be constructed under the Project (III).

3-2-3 Requested Facilities

(1) Examination of Requested Facilities

1) Construction of Cyclone Shelters

In principle, the requested cyclone shelters will inherit the design used for those cyclone shelters constructed under the Project (I) and the Project (II) with Japanese grant aid. These are RC, 2-story buildings with pile

foundations (free standing on stilts) and with a capacity of a minimum of 1,650 persons.

2) Improved Primary School Facilities

The following facilities will be secured in view of the use of the cyclone shelters as primary school buildings during normal times.

① Classrooms: minimum floor area of 37.15m^2 for a single classroom with the following furniture

- one teacher's desk and chair set
- desks and chairs for 50 pupils
- one blackboard

② Teacher's Room: one desk and chair set for each teacher

③ Storage: one storage room

3) Auxiliary Facilities

① Toilets (separate toilets for boys and girls) and one septic tank with one soak well for each school

② Water supply facilities (one borehole and one high head manual pump)

The requested cyclone shelters are judged to be appropriate as, in addition to the following principles set by the Master Plan, they not only satisfy the normal construction standards for primary schools set by the PMED but also have a minimum accommodation capacity of 1,650 persons each in line with the shelter size adopted by the Project (I) and the Project (II). As such auxiliary facilities as educational equipment and plumbing and sanitary installations are essential for school life, the request for these auxiliary facilities is also deemed appropriate. In regard to the construction period, as it will be difficult for the Bangladesh side to construct the killa, as in the Project (I) and the Project (II), which requires a sufficiently compacted foundation before construction, it has been decided that the "base of pillar" method (free standing method) will be appropriate.

Although the minimum shelter (school building) size for each site is as described earlier, there is no mention of the maximum number of classrooms per shift required at each site. In the case of the Project (II), the shelter size for

each site was determined by calculating the maximum number of classrooms per shift in the following manner in view of the fact that the Project (II) basically intended the rebuilding of existing primary school buildings damaged by cyclones as new cyclone shelter-cum-school buildings.

[Calculation of Maximum Number of Classrooms per Shift]

As described in 2-2-1, the site conditions survey identified the total number of pupils of the existing primary schools, most of which employ the 2-shift system due to the classroom shortage. The maximum number of classrooms per shift can be calculated by dividing the number of pupils of the first shift or the second shift (Table 3-2-3), which is attended by more pupils, by the standard class size of 50 pupils as shown in Table 3-2-4.

In the case of the Project (III), however, the Bangladesh side requires a substantial reduction of the Project cost. This requirement will be met by the introduction of a 3 classroom building at all the sites. Consequently, Site Nos. III-1, III-6, III-7, III-12, III-14 and III-15 will be short of 1, 3, 1, 3, 2 and 4 classrooms respectively following the construction of three classrooms under the Project (III). This shortage will be met by the efficient use of the existing classrooms. As it is impossible to use the existing classrooms at Site Nos. III-12 and III-14, the piloti section on the ground floor will be used to provide extra classrooms.

The maximum number of classrooms at Site Nos. III-4, III-8 and III-11 is set at 2 but has been increased to 3 to provide the minimum cyclone shelter capacity of 1,650 people.

(2) Increase of teachers

Indulging from the present teacher strength shown in Table 3-2-4, the number of teachers should be increased by these teachers for site No. III-12 and III-15 and by two for Site No. III-14.

(3) Removal of Existing Abandoned Building

As there is are abandoned school building at site No. III-5 which will obstruct the construction of a planned shelter, it should be removed by the Bangladesh side before the common of the construction.

Table 3-2-3 Number of Pupils by Class Type

Site No.	Total Number of Pupils	Shift 1		Shift 2			Shifts	Number of Teachers
		Class 1	Class 2	Class 3	Class 4	Class 5		
III-1	366	90	85	84	60	47	2	7
		175		191				
III-2	236	56	52	45	40	43	2	5
		108		128				
III-3	318	88	76	64	55	35	2	3
		164		154				
III-4	231	73	46	44	37	31	2	4
		119		112				
III-5	278	90	72	40	44	32	2	5
		162		116				
III-6	579	135	120	160	94	70	2	7
		255		324				
III-7	346	64	75	70	65	72	2	6
		139		207				
III-8	175	60	50	30	19	16	2	4
		110		65				
III-9	237	71	62	57	26	21	2	4
		133		104				
III-10	250	87	47	53	40	23	2	4
		134		116				
III-11	218	54	58	56	28	22	2	3
		112		106				
III-12	400	166	115	72	30	17	2	3
		281		119				
III-13	200	100	50	30	10	10	2	3
		150		50				
III-14	355	150	100	50	30	25	2	3
		250		105				
III-15	487	254	82	72	46	33	2	4
		336		151				
Total	4,676	2,628		2,048			—	65

Legend: Maximum number of pupils under 2-shift system

Table 3-2-4 Maximum Number of Classrooms per Shift and School Type Adopted by the Project (III)

Site No.	Max. Number of Pupils under 2-shift System	Number of Exiting Teachers	Max. Number of Classrooms per Shift	Shortage of Teachers for the Max. Number of Classrooms	Number of Classrooms Adopted by the Project (III)	School Type Adopted by the Project (III)
III-1	191	7	4	-	3	3-class type
III-2	128	5	3	-	3	3-class type
III-3	164	3	3	-	3	3-class type
III-4	119	4	2 (3*)	-	3	3-class type
III-5	162	5	3	-	3	3-class type
III-6	324	7	6	-	3	3-class type
III-7	207	6	4	-	3	3-class type
III-8	110	4	2 (3*)	-	3	3-class type
III-9	133	4	3	-	3	3-class type
III-10	134	4	3	-	3	3-class type
III-11	112	3	2 (3*)	-	3	3-class type
III-12	281	3	6	3	3	3-class type
III-13	150	3	3	-	3	3-class type
III-14	250	3	5	2	3	3-class type
III-15	336	4	7	3	3	3-class type

Notes *: Minimum number of classrooms to provide the required accommodation capacity for a cyclone shelter.

3-2-4 Basic Concept of the Project (III)

The necessity and viability of the cyclone shelters to be constructed under the Project (III) have been verified through examination of the above items. Their necessity from the humanitarian point of view and their significance in terms of acting as primary school building, replacing buildings damaged by cyclones, to improve the quality of primary education in Bangladesh have also been confirmed. With regard to project implementation and the actual maintenance work of the cyclone shelter-cum-school buildings commissioned by PMED, the LGED is best judged to have the necessary manpower and expertise in the necessary fields among government organizations in Bangladesh. The schools will be run by the PMED in accordance with the efficient, existing school management system. The implementation of the Project (III) as a grant aid project of the Government of Japan is, therefore, deemed highly appropriate as the expected effects of the Project (III)

meet the criteria of Japan's grant aid system. Having comprehensively examined the background, objectives and viability, etc. of the Project (III), the basic concept of Project (III) has been determined to be the construction of 15 new cyclone shelters at 15 sites located in the Chittagong, Laxmipur and Noakhali Districts in the HRA to contribute to the realization of the Multipurpose Cyclone Shelter Programme prepared by the Government of Bangladesh with the assistance of the World Bank and UNDP, under which a further 2,100 cyclone shelters should be constructed in the coming years to protect the estimated population of the HRA in the year 2002.

(1) Number of Cyclone Shelters to be Constructed

As described in 2-1 and 2-2, the site conditions survey conducted at 25 sites out of the originally chosen 63 candidate sites identified 15 sites as being suitable for the construction of cyclone shelters under the Project (III). Accordingly, these 15 sites are now declared the Project Sites.

(2) Cyclone Shelter Accommodation Capacity

The cyclone shelter design size depends on the envisaged cyclone shelter accommodation capacity. At present, there is no uniform standard for the capacity or design of shelters which have already been constructed, which are under construction or which are planned to be constructed by various international aid organizations and NGOs.

The Master Plan prepared by the World Bank and UNDP concludes that the construction of 2,500 cyclone shelters, each capable of accommodating 1,750 people, is necessary by the year 2002. As already described in 3.2.1-(3), with the progress of shelter construction, the number of shelters to be constructed has now been reduced to approximately 2,100. The UNDP excepts other aid organizations planning to construct cyclone shelters in Bangladesh to refer to the Master Plan as the proper construction manual. Consequently, in addition to the following principles set by the Master Plan, the cyclone shelters to be constructed under the Project (III) will meet the normal construction standards for primary schools set by the PMED and will have a minimum accommodation capacity of 1,650 persons each in line with the shelter size adopted by the Project (I) and the Project (II).

(3) Use of Cyclone Shelters During Normal Weather Conditions

The proper maintenance of the cyclone shelters during normal weather conditions is essential in order to ensure their good conditions at times of emergency. Therefore, it is desirable that all the cyclone shelters should be maintained and used on a daily basis. Given the desirable use conditions during an emergency, i.e. orderly and well-kept space for easy evacuation, their use as primary school buildings, is planned.

(4) School Size

The planned cyclone shelters will be used as school classrooms during normal times and all the cyclone shelters to be constructed under the Project (III) will be equal to the combined size of 3 classrooms as indicated in 3-2-3.

Table 3-2-5 Number of Classrooms at Each Project Site

Site No.	Number of Classrooms
III-1	3-classroom type
III-2	3-classroom type
III-3	3-classroom type
III-4	3-classroom type
III-5	3-classroom type
III-6	3-classroom type
III-7	3-classroom type
III-8	3-classroom type
III-9	3-classroom type
III-10	3-classroom type
III-11	3-classroom type
III-12	3-classroom type
III-13	3-classroom type
III-14	3-classroom type
III-15	3-classroom type

(5) Lighting System

The site conditions survey found that none of the existing primary schools have a lighting system and that none of the schools provide evening classes. As there appears no specific initiative and leadership, or incentives, and no target

community for providing evening classes (including the mass literacy programme and community welfare programme) by the Bangladesh side, lighting systems will not be installed under the Project (III).

(6) Killa Size

The main function of a cyclone shelter is to facilitate the swift and smooth evacuation of local inhabitants at the time of an approaching cyclone and it is also essential that the killas located next to shelters have sufficient capacity to accommodate the livestock and household goods belonging to the evacuees. Accordingly, the Government of Bangladesh plans to construct killas next to the cyclone shelters to be constructed under the Project (III). The different sizes of the planned killas are given in Table 3-2-6.

Table 3-2-6 Killa Size

Site No.	Killa Size (m)
III-1	61 × 72 × 4.5
III-2	61 × 72 × 4.5
III-3	61 × 85 × 4.5
III-4	61 × 72 × 4.5
III-5	61 × 76 × 4.5
III-6	61 × 72 × 4.5
III-7	61 × 76 × 4.5
III-8	61 × 76 × 4.5
III-9	61 × 55 × 6.0
III-10	61 × 64 × 4.5
III-11	61 × 95 × 6.0
III-12	61 × 83 × 6.0
III-13	61 × 84 × 6.0
III-14	61 × 76 × 6.0
III-15	61 × 76 × 6.0

Notes: 1) Bottom Width × Bottom Length × Bottom Height
2) Slope Gradient 1:2.0

The killa size is determined based on the livestock holding data for each Thana given by the Master Plan, the accommodation capacity of each shelter and the killa specifications adopted by the Project (I) and the Project (II) (see Appendix 7 for details).

(7) Outline of Envisaged Facilities

Based on the thorough examination results of the request made by the Government of Bangladesh, the following items are deemed appropriate as facilities to be constructed in the case of the Government of Japan's provision of grant aid.

1) Cyclone Shelters

While the main purpose of the cyclone shelters is to provide shelter for local inhabitants to protect them from frequent cyclones, their daily use is essential to maintain them in good order for a long period of time. In this context, both the Bangladesh and Japanese sides have agreed to their use as primary school buildings to ensure their proper maintenance and also to achieve efficient building use.

Facilities	- classrooms (3)	: 50 pupils/class
	- teacher's room (1)	: for 4 teachers
	- storage room (1)	: for emergency materials
	- toilets facilities	: separate toilets for boys and girls
	- others	: verandah
Structure	- main body (pillars, beams and floors)	: reinforced concrete
	- walls (interior and exterior)	: brick masonry
Number of Stories		
	- 2	
Floor Area (measured	- ground floor	: 261.9 m^2
between pillar	- first floor	: 261.9 m^2
center lines)	- roof floor	: 21.9 m^2
	Total	: 545.7 m^2
Floor Height	- first floor	: GL + 4.5 or 6.0 m
	- roof	: 4 m above the first floor height
Fixtures	- "long desks" and chairs (3 pupils each)	: 51 units
	- teachers desks and chairs	: 7 units
	- blackboards	: 4

2) Auxiliary Facilities

Hand Pump

Borehole (GL -300 to -400 m)

Septic Tank with a Soak Well

3-3 Basic Design

3-3-1 Design Concept

(1) Natural Conditions

The design policies of the Project (III) vis-a-vis the relevant natural conditions are discussed here.

1) Wind Velocity

Based on the analysis results of cyclone wind velocities recorded in the past and wind velocities with various return periods, the wind velocity with a 50-year return period of 260 km/hr (72.0 m/sec) used as the standard design wind velocity in the Master Plan is also used in this report.

2) Earthquakes

While there are no detailed architectural standards relating to earthquakes in Bangladesh, the country is classified into 3 zones and each zone has a separate standard earthquake factor (F).

Zone 1 (North)	:	F = 0.08
Zone 2 (Central and East)	:	F = 0.05
Zone 3 (Central and South)	:	F = 0.04

The Chittagong, Laxmipur and Noakhali Districts belong to Zone 2 (F = 0.05).

3) Tide Level

The wave force associated with high tide is not considered here because it has little impact on cyclone shelters on stilts. In comparison, however, the tide level is important to determine the required floor height of these shelters. The method used for the preparation of the Master Plan (based on a tide level with a 50-year return period) is also used here for the analysis of storm surges. The following equation is suggested to calculate the storm surge height at the cyclone shelter sites.

$$H = h_{50} - (x - 1) K + h_w \quad \text{..... (3-1-1)}$$

h_{50} : Design surge height with a 50-year return period (m)
X : Distance of shelter from the beach (km)
K : Rate of decrease in surge height (m/km)
h_w : Amplitude of local wave in meters from mean water level
h_w : $[h_{50} - (x - 1) K] \cdot 1/4$ h_w is 1 if $h_w < 1$

4) Temperature and Lighting

While the maximum temperature reaches more than 35°C at all the sites, no air-conditioning, mechanical or otherwise, or ventilation system will be provided. As no lighting system will be provided, as many windows as possible will be designed for ventilation and lighting purposes.

5) Geology

① Geological and Soil Conditions

Survey Subject: one boring test will be conducted at each site; a laboratory soil test will be conducted on the soil samples taken from each borehole

② Foundation Design

Based on the results of the boring and laboratory soil tests, either pile foundations or direct foundations will be decided as the foundation structure. The design allowable pile bearing capacity will be the end-bearing pile capacity.

(2) Soil Conditions

Project (III) aims at rebuilding existing primary schools located within the HRA to improve the quality of educational facilities as well as to use the new facilities as cyclone shelters. In this context, the new buildings will meet the basic needs of the people and society, serving public welfare regardless of the customs or cultural traditions of local communities. Their primary use as cyclone shelters necessitates a RC structure with a high floor.

(3) Construction Conditions

1) Construction Method

In general, low buildings in Bangladesh are made of brick masonry while larger/taller buildings are made of rigid frame reinforced concrete with brick masonry walls. The popularity of these methods can be justified by (i) the general availability of the required materials, equipment and skills, (ii) the high cost of other methods due to the necessity to import the required materials (structural steel and timber, etc.) and (iii) the absence of the necessary skills to employ other methods.

The Basic Design Study Team has confirmed that all cyclone shelters constructed or proposed by aid organizations or the Government of Bangladesh are or will be made of reinforced concrete. Given this confirmation, all the cyclone shelters to be constructed under the Project (III) will have a rigid frame reinforced concrete structure.

2) Project Authorization System

No specific approval or authorization is required for construction of general facilities in Bangladesh.

3) Relevant Laws and Standards

While there are no specific laws or standards relating to architectural design in Bangladesh, the following provision exists for seismic force.

Horizontal force of inertia : F = 0.05 - 0.1
(equivalent to the standard modulus of rigidity in Japan)

The following conditions are adopted for the present basic design purposes based on the conditions used in the Master Plan and those commonly used in Japan.

Floor Live Load	:	480 kg/m^2
Wind Load	:	Mean wind velocity - 72 m/sec (50-year return period)
Water Load	:	Revolution coefficient - 1.5 inertia coefficient - 2.5
Design Concrete Strength	:	210 kg/cm^2

Tensile Strength of Reinforcing Rods : 2,100 kg/cm^2

4) Technical Level of Local Construction Companies

The technical level of local construction companies in the Dhaka metropolitan area is adequate in terms of common construction methods. The cooperation of local construction companies is essential for the successful completion of the Project (III). Fortunately, there are many companies which have been employed as sub-contractors for Japanese aid projects in the past. The use of local companies is, therefore, assumed for the implementation of the Project (III).

5) Quality and Quantity of Local Labour

As few special skills are involved in the construction of the facilities envisaged by the Project (III), the local construction level is deemed adequate. However, it must be made certain that any construction method employed by the Project (III) can be handled by local workers. With regard to the labour quantity, all general workers can be recruited from near each site although some skilled workers must be recruited from the Dhaka metropolitan area.

6) Procurement and Quantity of Local Construction Materials and Equipment

The use of locally available construction materials and equipment is planned as long as the quantities and specifications satisfy the design conditions in order to keep the construction cost as low as possible. In short, all construction materials and equipment required for the Project (III) are available locally, the use of which is expected to stimulate the local economy. Nevertheless, the remote locations of the Project Sites along the Bay of Bengal and the difficult access by transport vehicles to the sites make it necessary to rely on the manual transportation (pushcarts, etc.) of the materials to some sites. The primary materials and planned procurement locations are listed below.

Material	Place of Procurement
Cement	Chittagong, Dhaka
Sand	North (Sylhet)
Pit Sand	North (Sylhet)
Cobble Stones	North (Sylhet)
Reinforcing Bars	Chittagong, Dhaka
Bricks	Chittagong, Noakhali, Hatia
Wooden Forms	Chittagong, Noakhali, Hatia

Paint	Chittagong, Dhaka
Fittings	Chittagong, Dhaka
Pumps	Chittagong, Dhaka
Furnishings	Chittagong, Dhaka

(4) Maintenance of Cyclone Shelters

It has been confirmed that the PMED will be responsible for the maintenance of the cyclone shelters which will normally be used as primary school buildings. The maintenance cost will be appropriated from the PMED budget although the actual maintenance work will be conducted by the LGED.

As the new buildings will be used as cyclone shelter-cum-primary school buildings, no technical or financial problems are anticipated in regard to their maintenance. Important points are the selection of construction materials which can be procured locally, selection of high quality materials and ensuring of high level quality control of the construction work.

(5) Scope and Quality of Cyclone Shelters

1) Scope

The scope of the buildings to be constructed under the Project (III) has been determined as follows.

① The size of the new buildings will be 3 classrooms which is the standard size employed by the PMED.

② As a cyclone shelter, each building will have a minimum accommodation capacity of 1,650 people.

③ Each building will be provided with school furniture (desks, chairs and blackboards) in view of its use as a primary school building.

④ Each building will be provided with a water supply system using a borehole and hand pump.

⑤ Each building will be provided with toilet facilities and a septic tank which can be used at the time of a disaster.

2) Quality

As stated earlier, the construction materials and equipment to be used for Project (III) will, in principle, be those produced locally and, therefore, the building structure will be rigid frame, concrete structure which is

commonly used in Bangladesh. As far as the structural strength of the new cyclone shelters is concerned, the relevant Japanese standards will be used. No special materials will be used for the finishing and other aspects of the buildings to keep the maintenance cost low.

(6) Construction Schedule

The decision on the construction schedule must take the conditions of the local construction industry (including the labour and material supply conditions) and the meteorological conditions in Bangladesh into proper consideration. In addition to the above conditions, the construction schedule will also be largely affected by the building structure and construction method. The fact that the planned construction sites are scattered over a wide area due to the nature of the cyclone shelters must also be taken into consideration in the preparation of the construction schedule. The extremely poor accessibility of these sites should also be considered.

Based on the above circumstances as well as the actual work performance in the Project (I) and the Project (II), it will be necessary to allocate 12 months for the actual construction work. Moreover, it is essential that the work commence in November at the beginning of the dry season.

(7) Design Criteria

1) Planned Facilities

The buildings to be constructed under the Project (III) will be cyclone shelters which will be used as primary school buildings during normal times. Consequently, these buildings will, in principle, be designed to function as primary schools. With the incorporation of a high floor, they will be able to function perfectly as cyclone shelters. The planned facilities consist of classrooms, teacher's room, storage room, toilets (boys and girls) and common use areas, such as corridors, staircases and verandah.

2) Estimate of Required Facility Size

In principle, the size of the planned building for each site is determined by the required number of classrooms. However, it is essential to secure the minimum size required for a cyclone shelter as proposed in the Master Plan.

The basic standards to determine the size of different rooms are given below.

① Classroom

- Number of Pupils : approximately 50 pupils
- Floor Area/Pupil : 8 ft^2 (≒ 0.74 m^2)
- Floor Area : approximately 37 m^2 (0.74 × 50)

② Teacher's Room

- Number of Teachers : number of classrooms plus one
- Floor Area/Teacher : 50 ft^2 (≒ 4.6 m^2)

③ Toilets

As there are no specific design standards for school toilets in Bangladesh, the school facilities constructed by the LGED are referred to in order to determine the size of toilets. The LGED provides 2 cubicles each for boys and girls for a school with 3 classrooms. In the case of the Project (III), 3 cubicles each for boys and girls will be provided for a school with 3 classrooms respectively. In addition, a hand-washing area for common use will be provided.

The floor area per new building will be as follows.

- Ground floor (open space) : 261.9 m^2
- First floor (classrooms, teachers' room and toilets, etc.) : 261.9 m^2
- Roof top : 21.9 m^2

Total : 545.7 m^2

④ Shelter Capacity

The shelter capacity of each school building when used as a cyclone shelter based on the building size given above is as follows.

- Indoor area : 232 m^2
- Roof top area : 298 m^2
- Shelter capacity : 1,656 persons (approximately 1,650 persons)

The required floor area per person is based on the relevant criteria employed by the Master Plan.

- Indoor : 2 ft^2 (0.185 m^2)

· Roof Top : 8 ft^2 (0.74 m^2)

3) Design Strength

The following design strength and other standards are adopted for the design of the cyclone shelters.

· Floor Live Load : 0.48 tons/m^2
· Wind Load : mean wind velocity - 72 m/sec
(50-year return period)
· Water Load : revolution coefficient - -1.5
inertia coefficient - -2.5
· Design Concrete Strength : 210 kg/cm^2
· Tensile Strength of Reinforcing Rods : 2,100 kg/cm^2

3-3-2 Basic Design

(1) Site Plan

As the Project (III) intends the rebuilding of existing primary school buildings in the HRA as cyclone shelter-cum-school buildings, the existing school premises can be used. The demolition of existing buildings means that temporary classrooms should be constructed or rented to ensure the continuation of school activities. Given the difficulty of finding alternative buildings, it has been decided that new buildings will be constructed in empty space on the existing premises while school activities will continue at the existing buildings. Those buildings which have been extensively damaged or the use of which is dangerous will be demolished and new buildings will be constructed on the same site. The construction or renting of temporary school buildings following the demolition of damaged or unusable buildings will be the responsibility of the Government of Bangladesh to ensure the continuation of school education.

(2) Architectural Design

The architectural design of the planned facilities (cyclone shelter-cum-primary school buildings) will be based on the Master Plan for the Multipurpose Cyclone Shelters Programme, the agreed details by the Government of Bangladesh and Japan, the relevant design under the Project (I) and the Project (II) and the findings of the Survey on the Actual Use of Project (I) Shelters and

will also be in line with the relevant standards and criteria set by the PMED and LGED, etc.

1) Facilities

The facilities at each site consist of the following and the ground floor is designed to be piloti (open space) throughout.

- Classrooms : 3 (50 pupils each)
- Teacher's Room : one (4 teachers)
- Toilets : separate toilets for boys and girls (3 cubicles each)
- Storage Room : one
- Common Use Areas : corridor, staircase and verandah

2) Floor Area

· Classrooms	3 Classroom School	: 37.6 m^2
· Teacher's Room	4 Teachers	: 18.8 m^2
· Toilets	3 Classroom School	: 18.8 m^2

3) Floor Plan

The buildings will have a simple rectangular shape with a central corridor in view of the efficient use of space. The central corridor will be fairly wide to facilitate the smooth passage of pupils while the verandah can be used for relaxation during breaks. Toilets will be provided at an approximate rate of 3 cubicles/100 pupils. The building will have 2 stories and the ground floor will have a piloti (open space) structure to be used for various activities.

4) Cross-Sectional View

The height of the first floor must be high enough so as not to be inundated by storm surges caused by cyclones. The tide level calculated for each site based on the principles vis-a-vis the natural conditions described in 3-3-1 (1) is given in Appendix 6 of this report. The examination results of the flood level in the rainy season suggest that it is necessary to raise the ground floor level by 1 m from the existing ground surface. The design floor height for the first floor at each site is given in Table 3-3-1, taking the necessity to provide at least 3.5 m between the ground floor height and the first floor height to ensure convenient use of the building into consideration.

Table 3-3-1 Design Floor Height by Site

(Unit: m)

Site No.	District	Thana	Design First Floor Height (GL+)	Estimated First Floor Height (GL+)
III-1	Chittagong	Mirsharai	4.5	3.5
III-2	Chittagong	Mirsharai	4.5	3.5
III-3	Chittagong	Mirsharai	4.5	3.5
III-4	Chittagong	Mirsharai	4.5	3.5
III-5	Chittagong	Mirsharai	4.5	3.5
III-6	Chittagong	Mirsharai	4.5	3.5
III-7	Chittagong	Mirsharai	4.5	3.5
III-8	Chittagong	Mirsharai	4.5	3.5
III-9	Laxmipur	Ramgati	6.0	6.0
III-10	Noakhali	Sadar	4.5	3.5
III-11	Noakhali	Sadar	6.0	6.0
III-12	Noakhali	Hatia	6.0	6.0
III-13	Noakhali	Hatia	6.0	6.0
III-14	Noakhali	Hatia	6.0	6.0
III-15	Noakhali	Hatia	6.0	6.0

(3) Foundations

The geological survey (boring) depth at each site is given in Table 3-3-2 while the survey results are given in Appendix 10-2 (Supplementary Volume). The examination of the required type of foundations at each site based on the survey data confirmed the necessity to employ pile foundations at all the sites. The expected pile length at each site is shown in Table 3-3-3.

The bearing strength of the foundation piles can be calculated using the following equation.

$$Ra = \frac{1}{3} \cdot 15 \cdot \overline{N} \cdot Ap \quad \text{..... (3-3-2)}$$

Where, Ra : Allowable bearing capacity of piles (t/pile)
$\overline{N}$: Average N value at pile end
Ap : Cross-sectional area at pile end (m^2)

Table 3-3-2 Geological Survey Depth and Number of Soil Samples

Site No.	District	Thana	Union	No. of Boring Sites	Boring Depth (m)
III-1	Chittagong	Mirsharai	Moghadia	1	16.0
III-2	Chittagong	Mirsharai	Haitkandi	1	20.0
III-3	Chittagong	Mirsharai	Isakhali	1	20.0
III-4	Chittagong	Mirsharai	Katachara	1	14.0
III-5	Chittagong	Mirsharai	Saherkhali	1	21.0
III-6	Chittagong	Mirsharai	Mirsharai	1	13.0
III-7	Chittagong	Mirsharai	Saherkhali	1	22.0
III-8	Chittagong	Mirsharai	Saherkhali	1	22.0
III-9	Laxmipur	Ramgati	Char Gazi	1	16.0
III-10	Noakhali	Sadar	Char Clark	1	16.0
III-11	Noakhali	Sadar	Char Bata	1	14.0
III-12	Noakhali	Hatia	Sonadia	1	20.0
III-13	Noakhali	Hatia	Burirchar	1	20.0
III-14	Noakhali	Hatia	Tamaruddin	1	20.0
III-15	Noakhali	Hatia	Tamaruddin	1	20.0

Table 3-3-3 Type of Foundations by Site

Site No.	District	Thana	Type of Foundations	Pile Length (m)
III-1	Chittagong	Mirsharai	Pile Foundations	10.0
III-2	Chittagong	Mirsharai	Pile Foundations	20.0
III-3	Chittagong	Mirsharai	Pile Foundations	14.5
III-4	Chittagong	Mirsharai	Pile Foundations	8.5
III-5	Chittagong	Mirsharai	Pile Foundations	15.5
III-6	Chittagong	Mirsharai	Pile Foundations	7.5
III-7	Chittagong	Mirsharai	Pile Foundations	9.0
III-8	Chittagong	Mirsharai	Pile Foundations	8.5
III-9	Laxmipur	Ramgati	Pile Foundations	11.0
III-10	Noakhali	Sadar	Pile Foundations	9.0
III-11	Noakhali	Sadar	Pile Foundations	8.5
III-12	Noakhali	Hatia	Pile Foundations	20.0
III-13	Noakhali	Hatia	Pile Foundations	20.0
III-14	Noakhali	Hatia	Pile Foundations	6.5
III-15	Noakhali	Hatia	Pile Foundations	8.0

To get the allowable bearing capacity per pile of 30 tons with a pile diameter of 600mm which can be managed by local workers, the N value should be 22 using the above equation. The soil layer with the minimum N value of 22 is, therefore, considered the suitable pile bearing layer. The pile length is determined by evaluating the geological profile at each boring test point.

(4) School Furniture

The following school furniture will be provided.

[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 : four sets
- Blackboard : one

(5) Auxiliary Facilities

- Borehole : one/site (depth: approximately 400m)
- Pump : one manual pump/site
- Septic Tank : one of local design/site with a Soak Well

(6) Basic Design Drawings

The basic design drawings are given in the following pages.

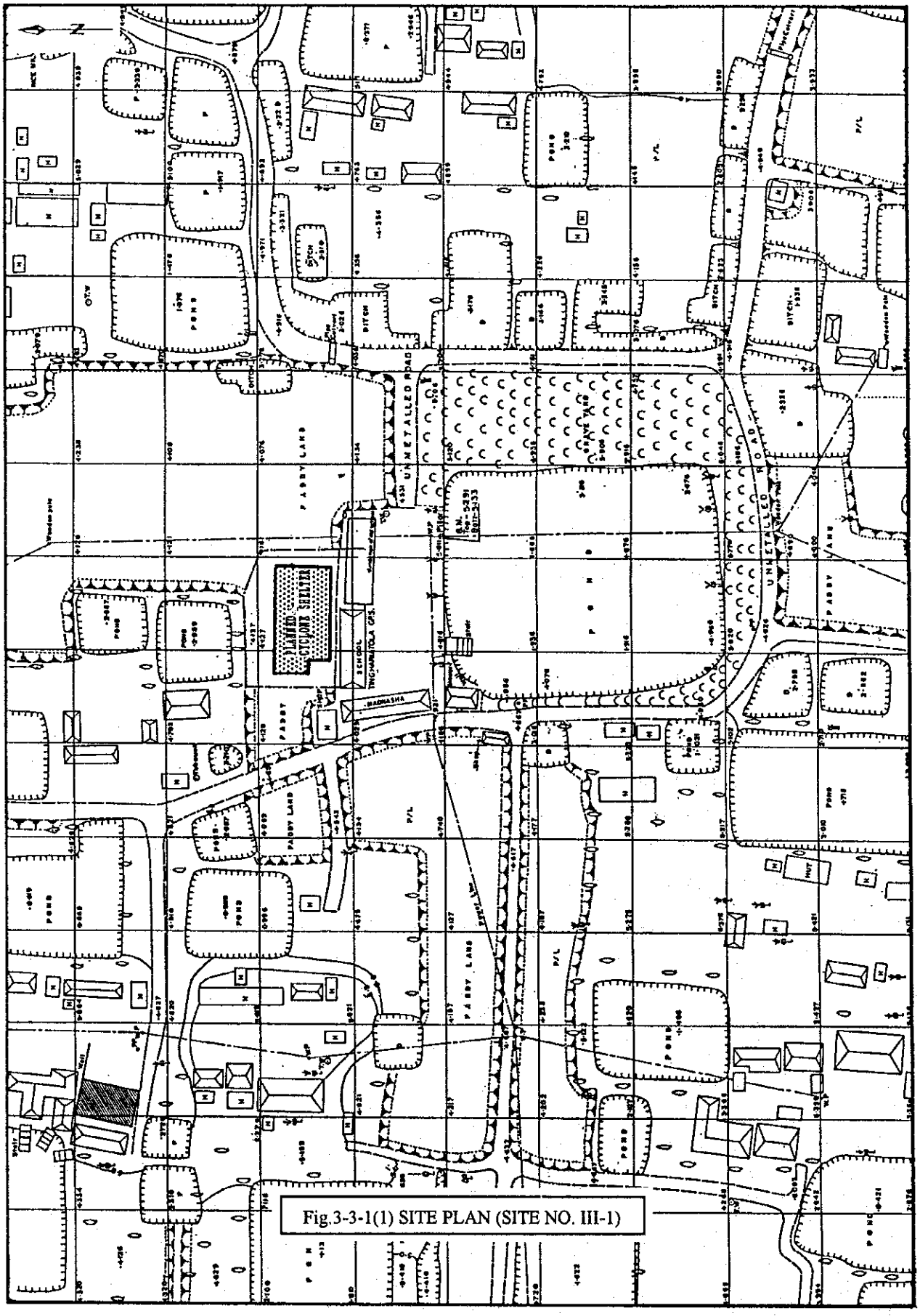


Fig.3-3-1(1) SITE PLAN (SITE NO. III-1)

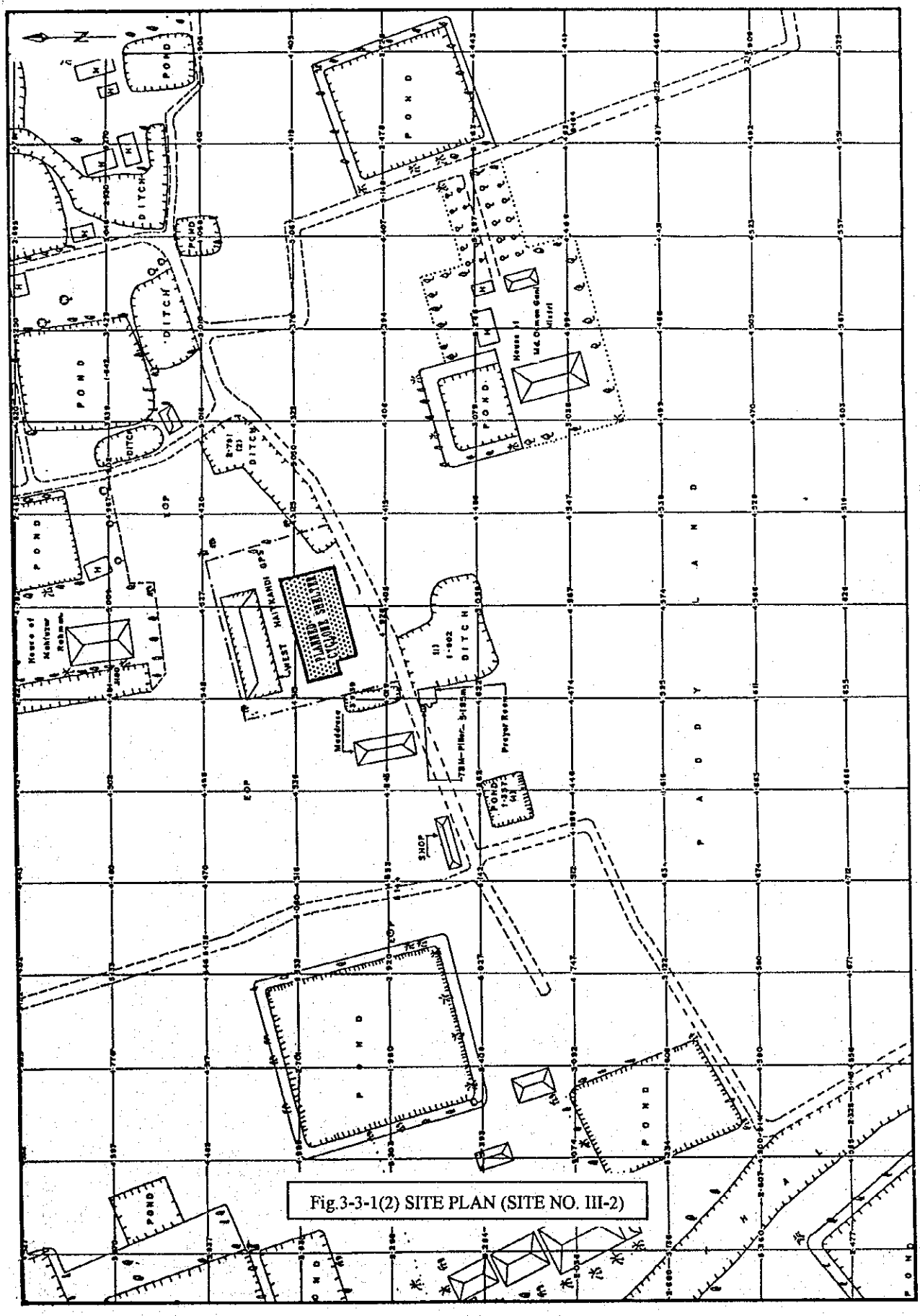


Fig.3-3-1(2) SITE PLAN (SITE NO. III-2)

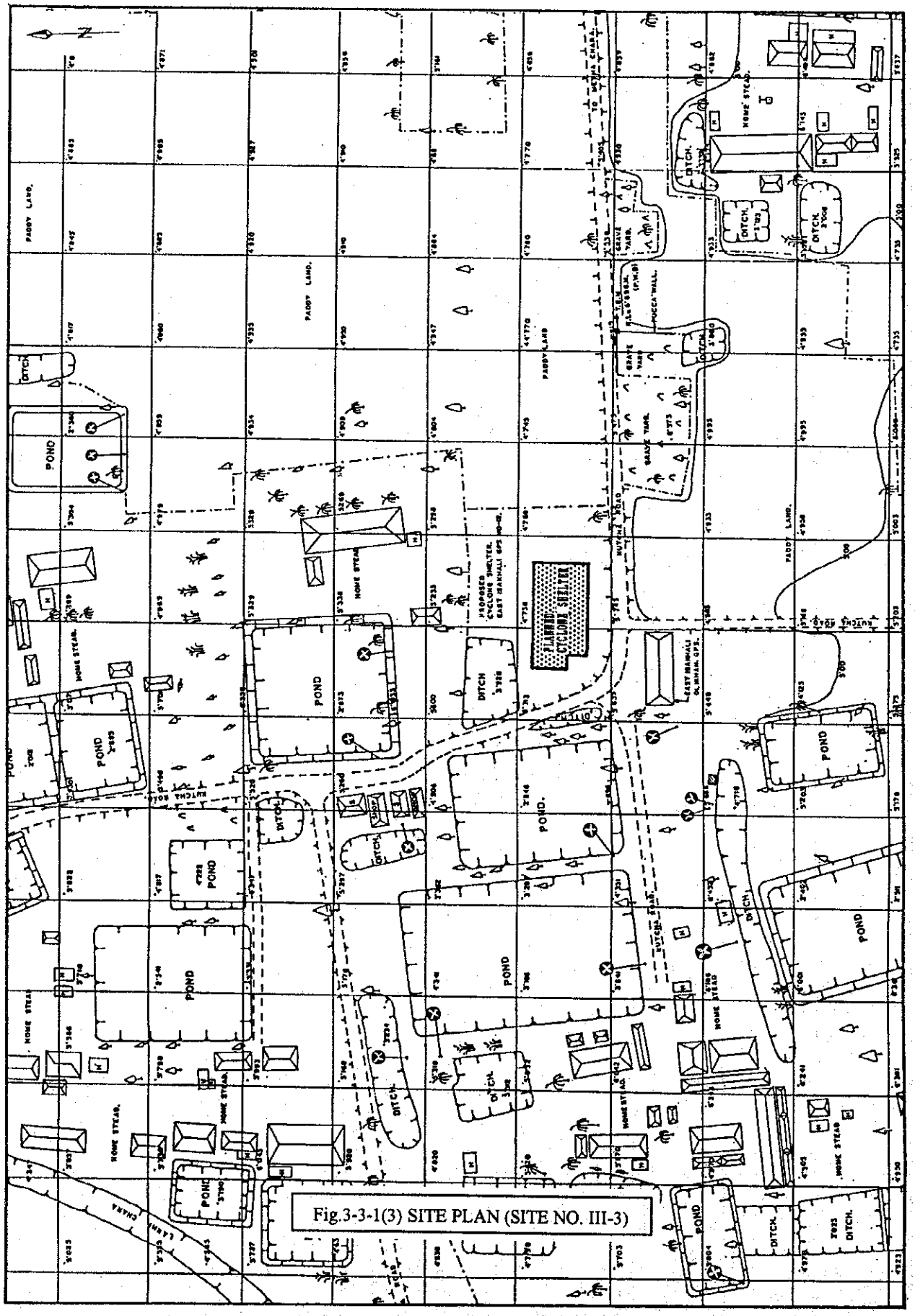


Fig.3-3-1(3) SITE PLAN (SITE NO. III-3)

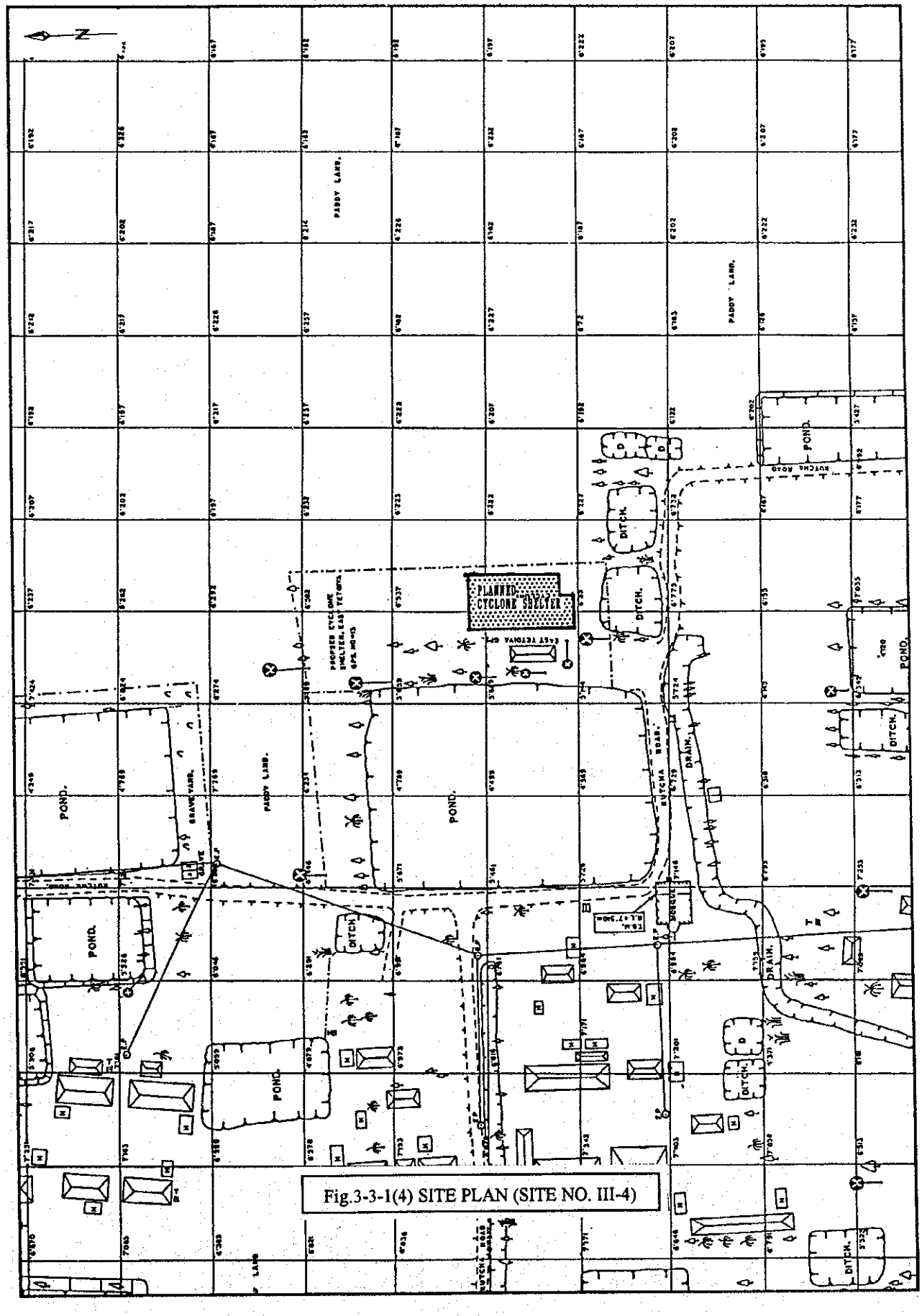


Fig.3-3-1(4) SITE PLAN (SITE NO. III-4)

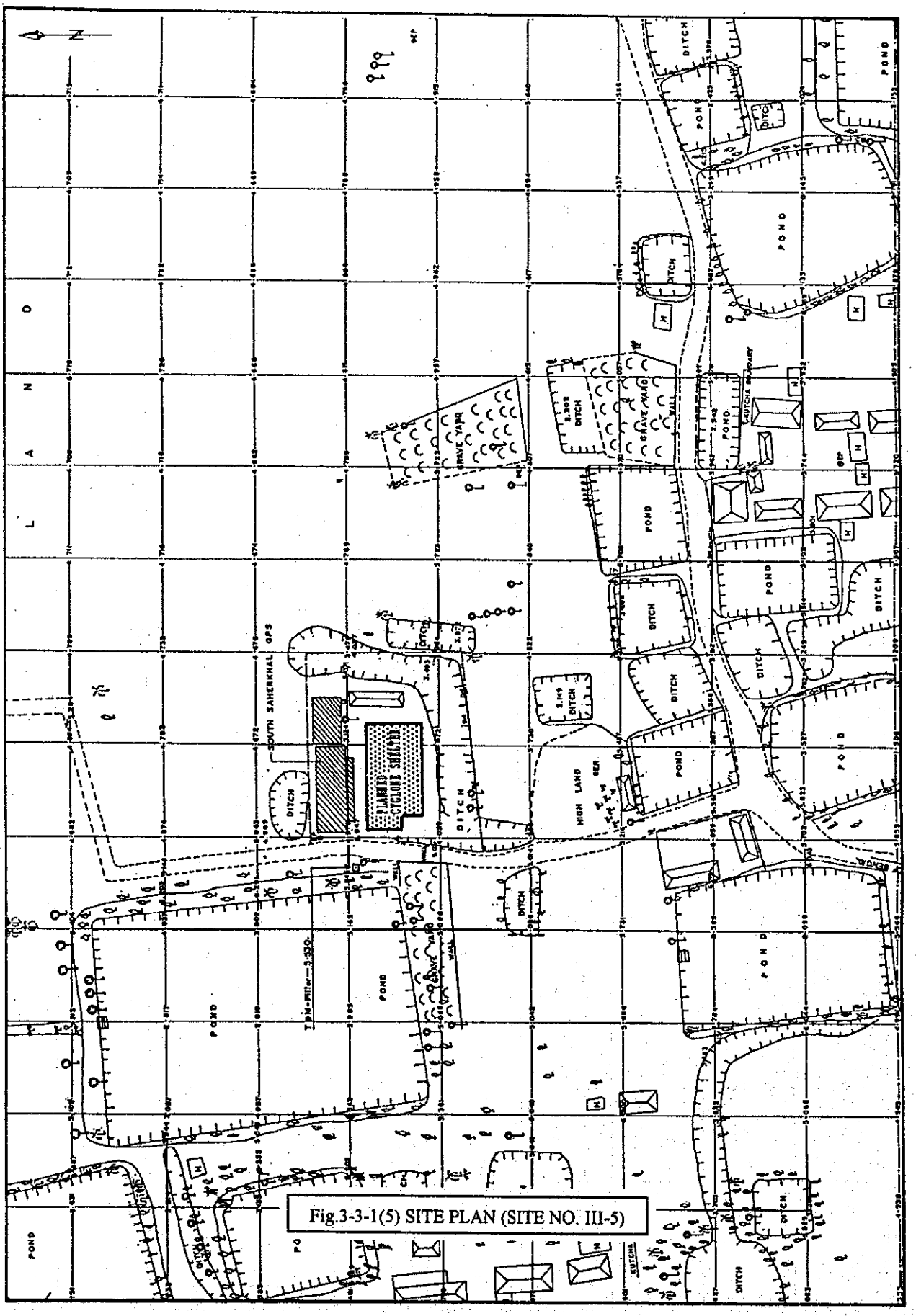
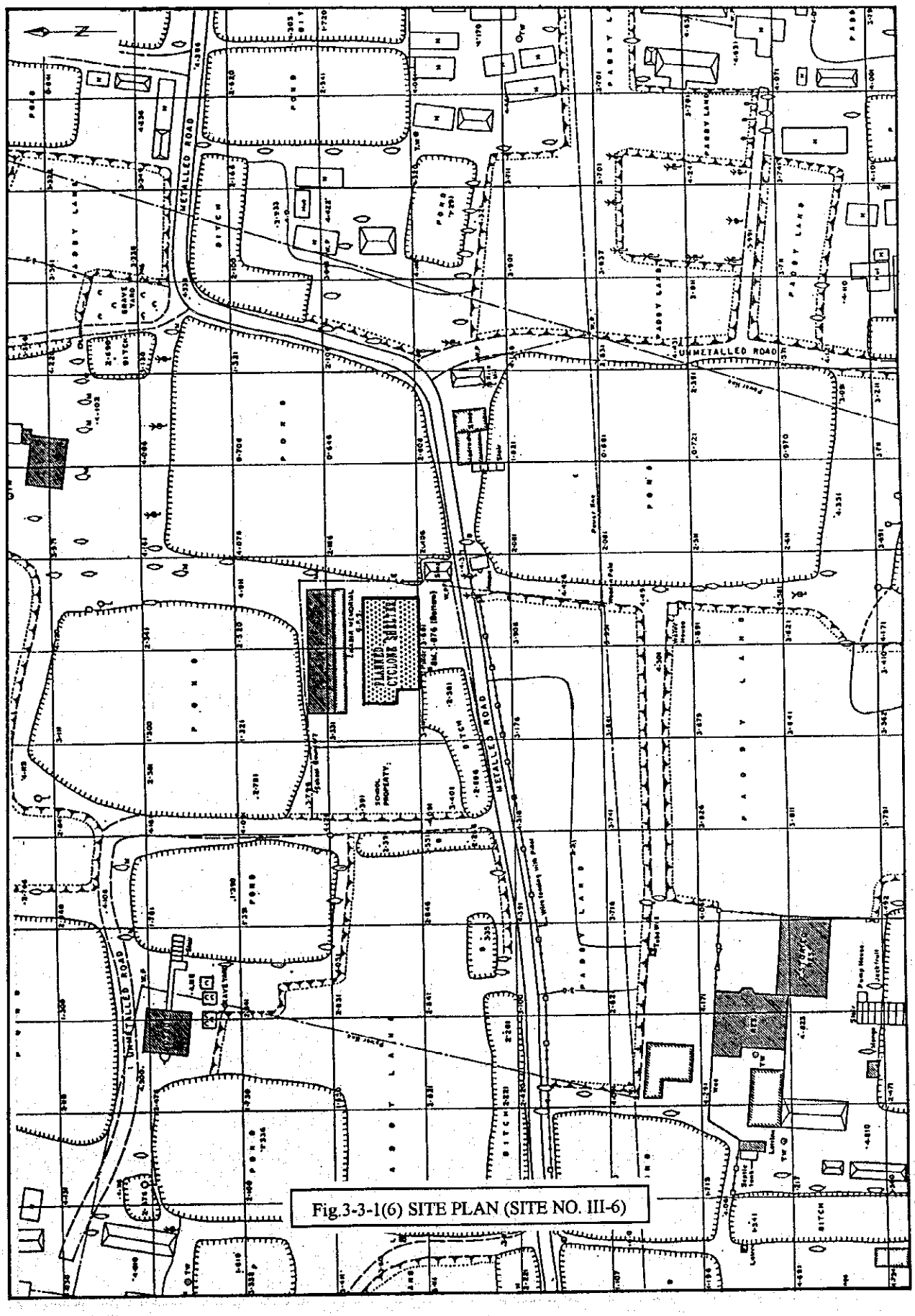


Fig.3-3-1(5) SITE PLAN (SITE NO. III-5)



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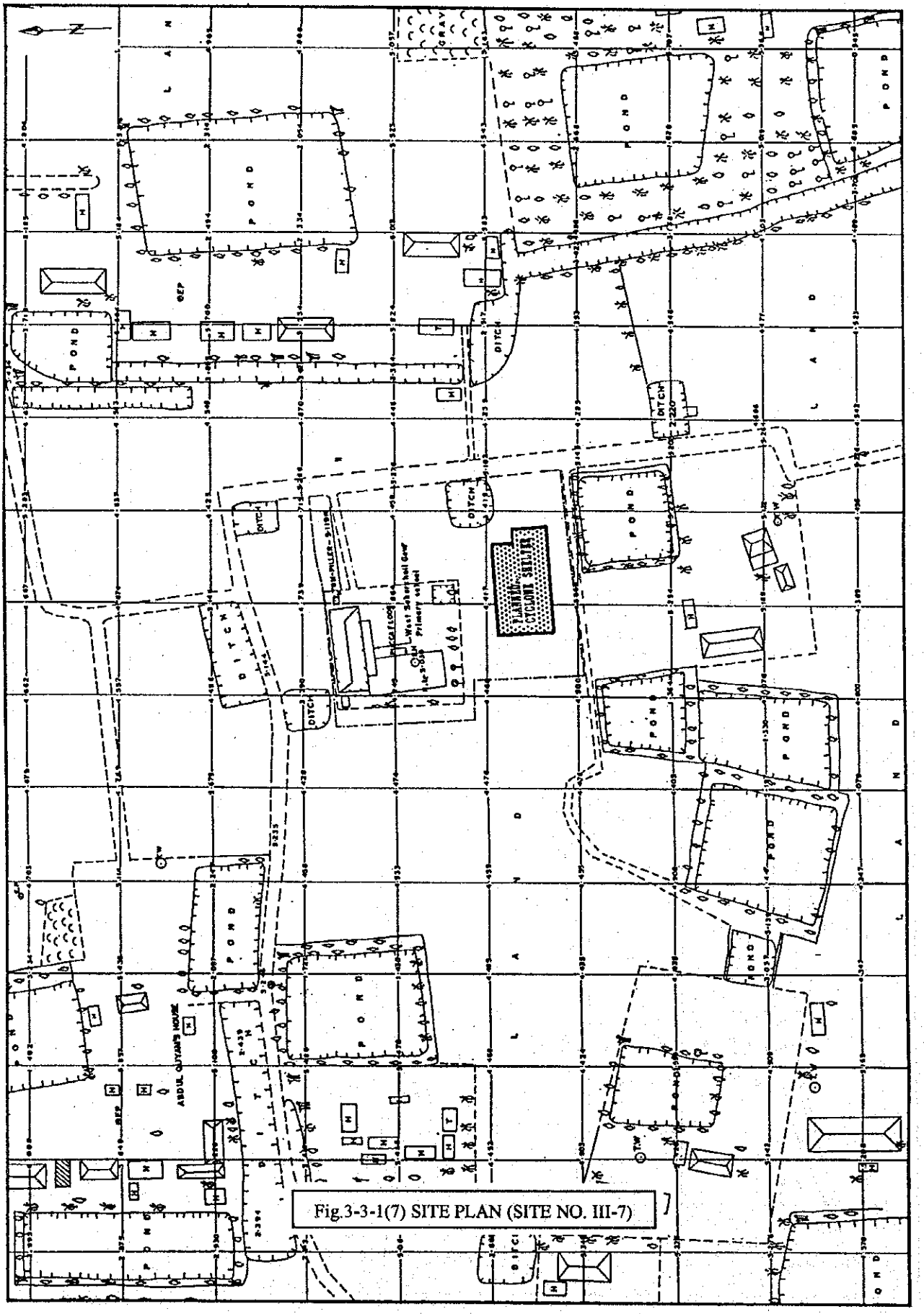

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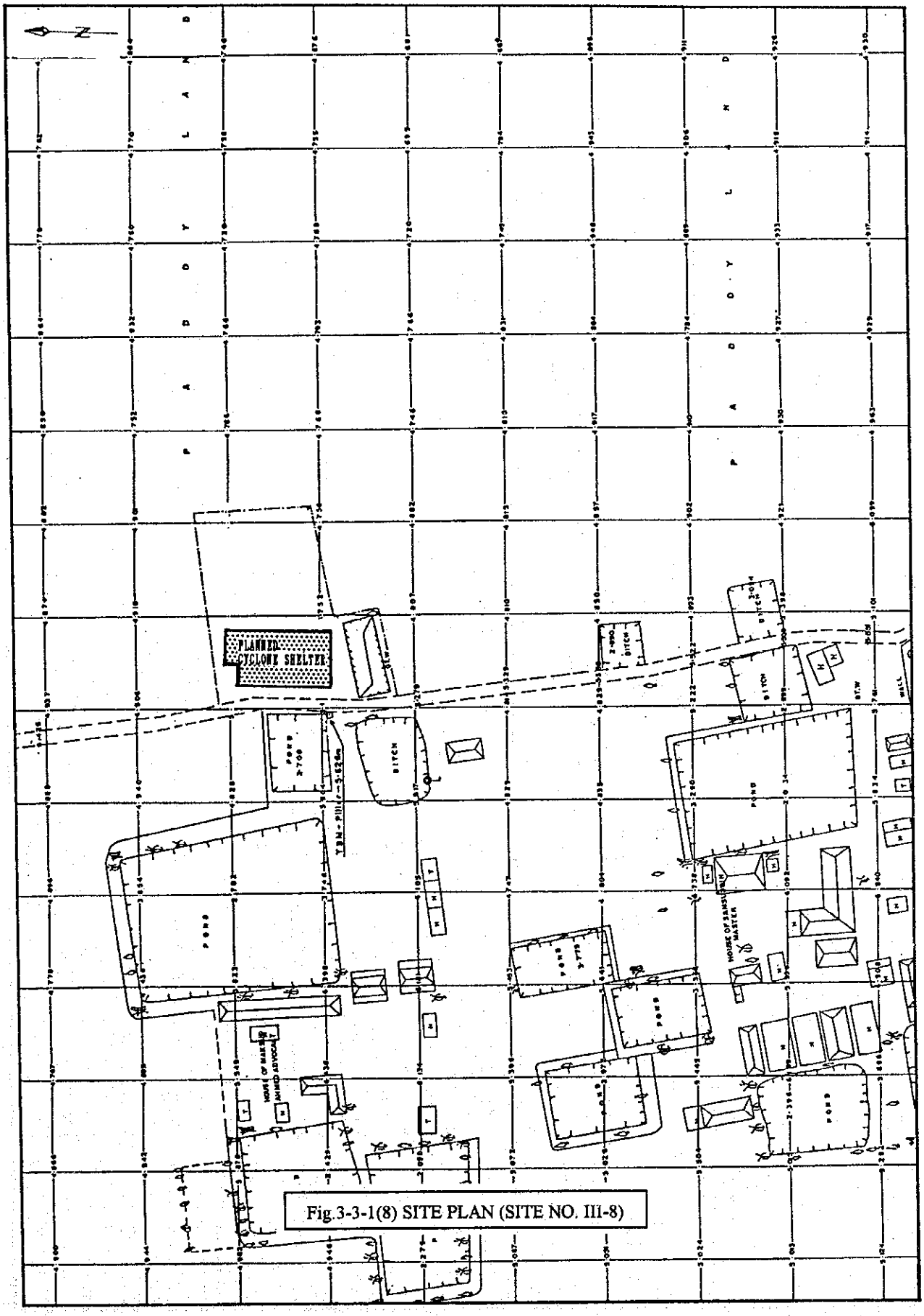
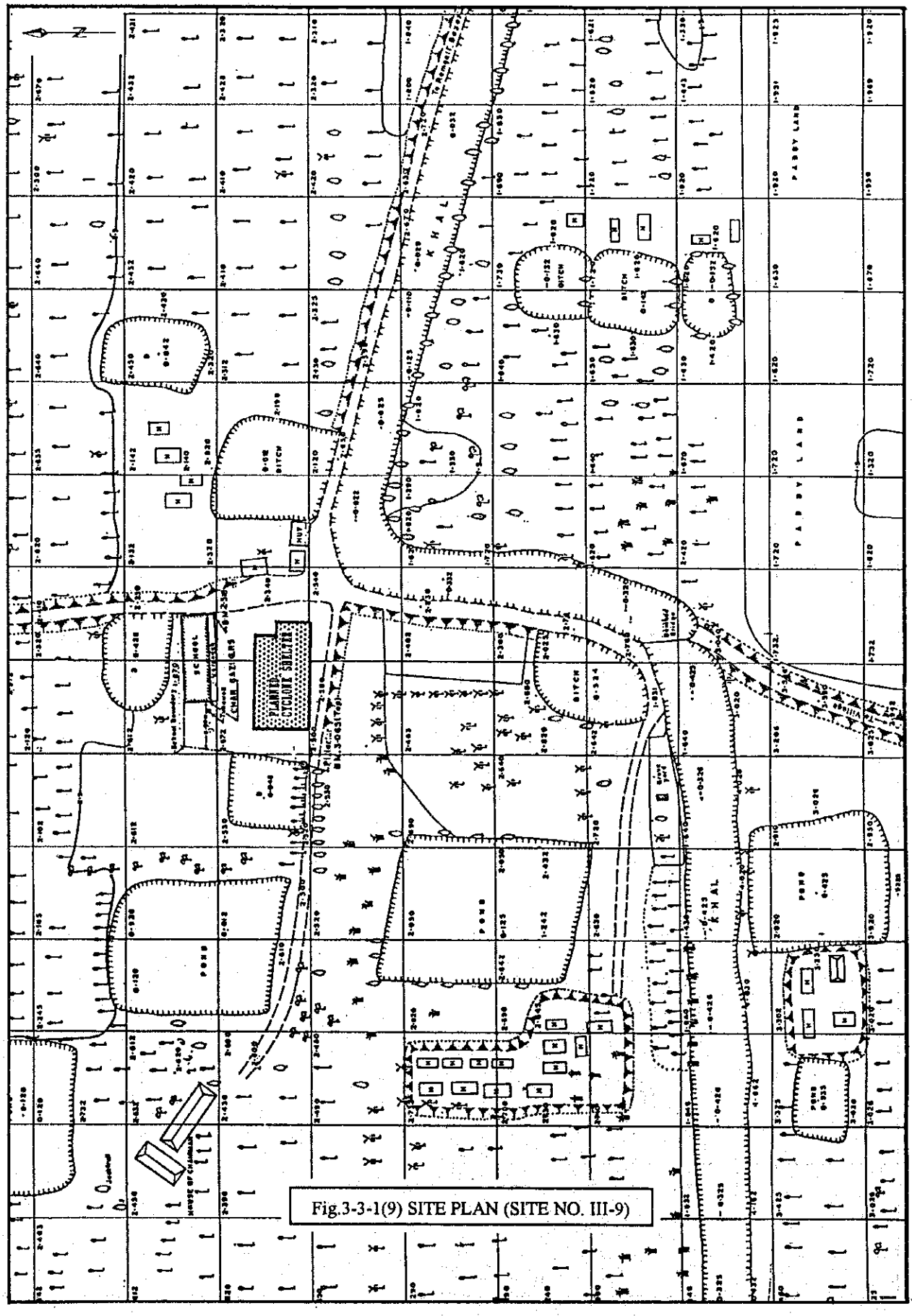


Fig.3-3-1(8) SITE PLAN (SITE NO. III-8)



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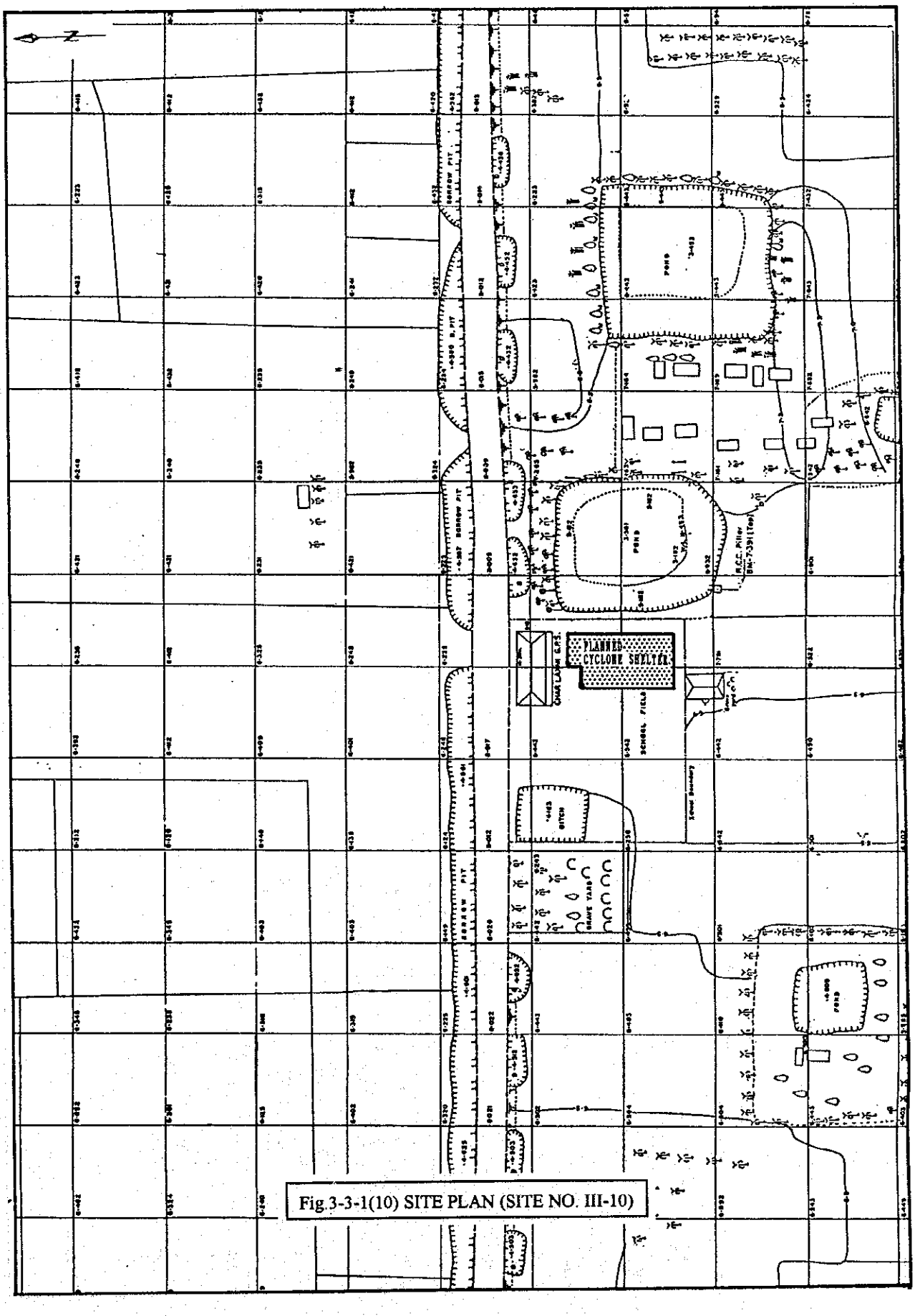


Fig.3-3-1(10) SITE PLAN (SITE NO. III-10)

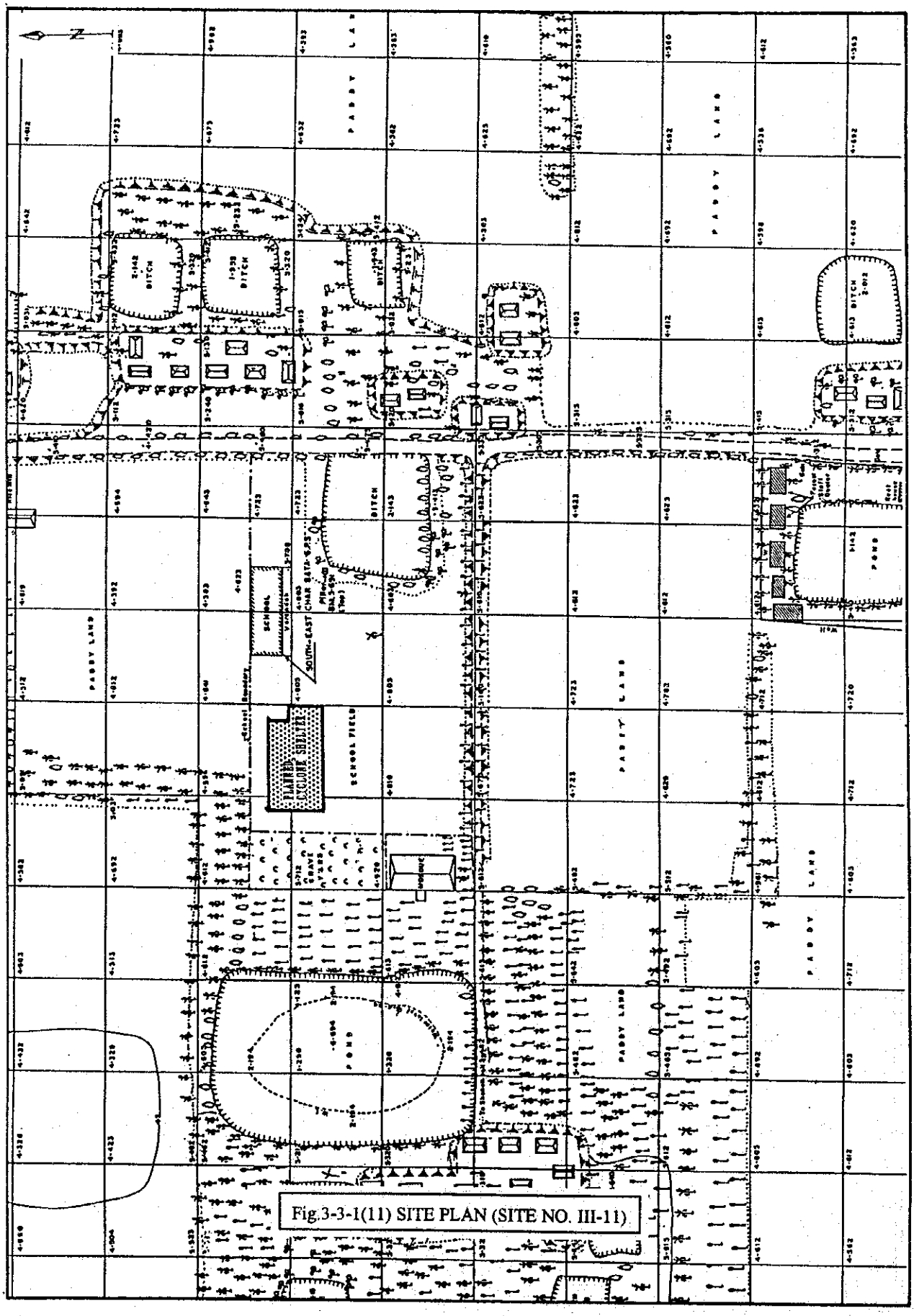


Fig.3-3-1(11) SITE PLAN (SITE NO. III-11)

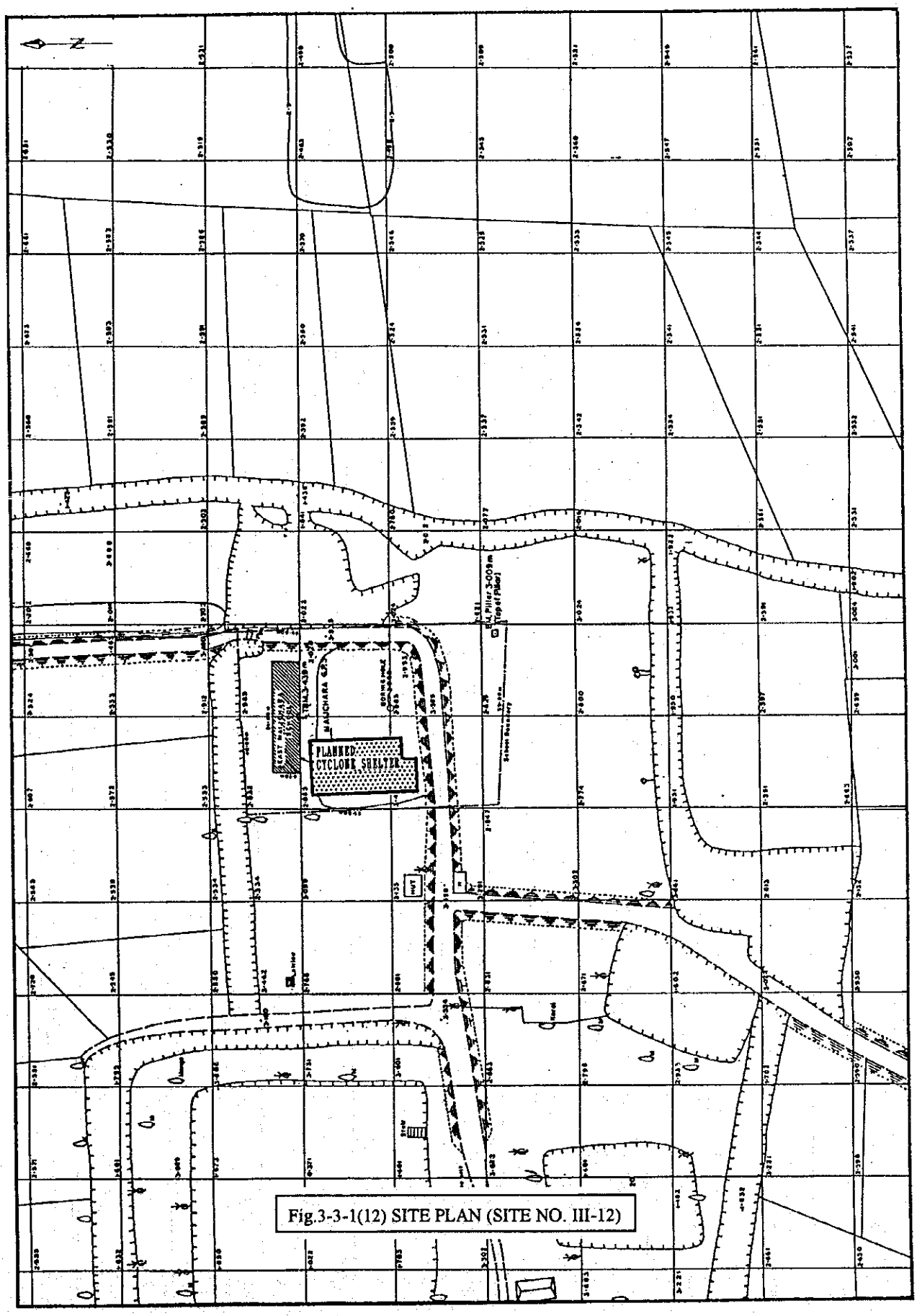
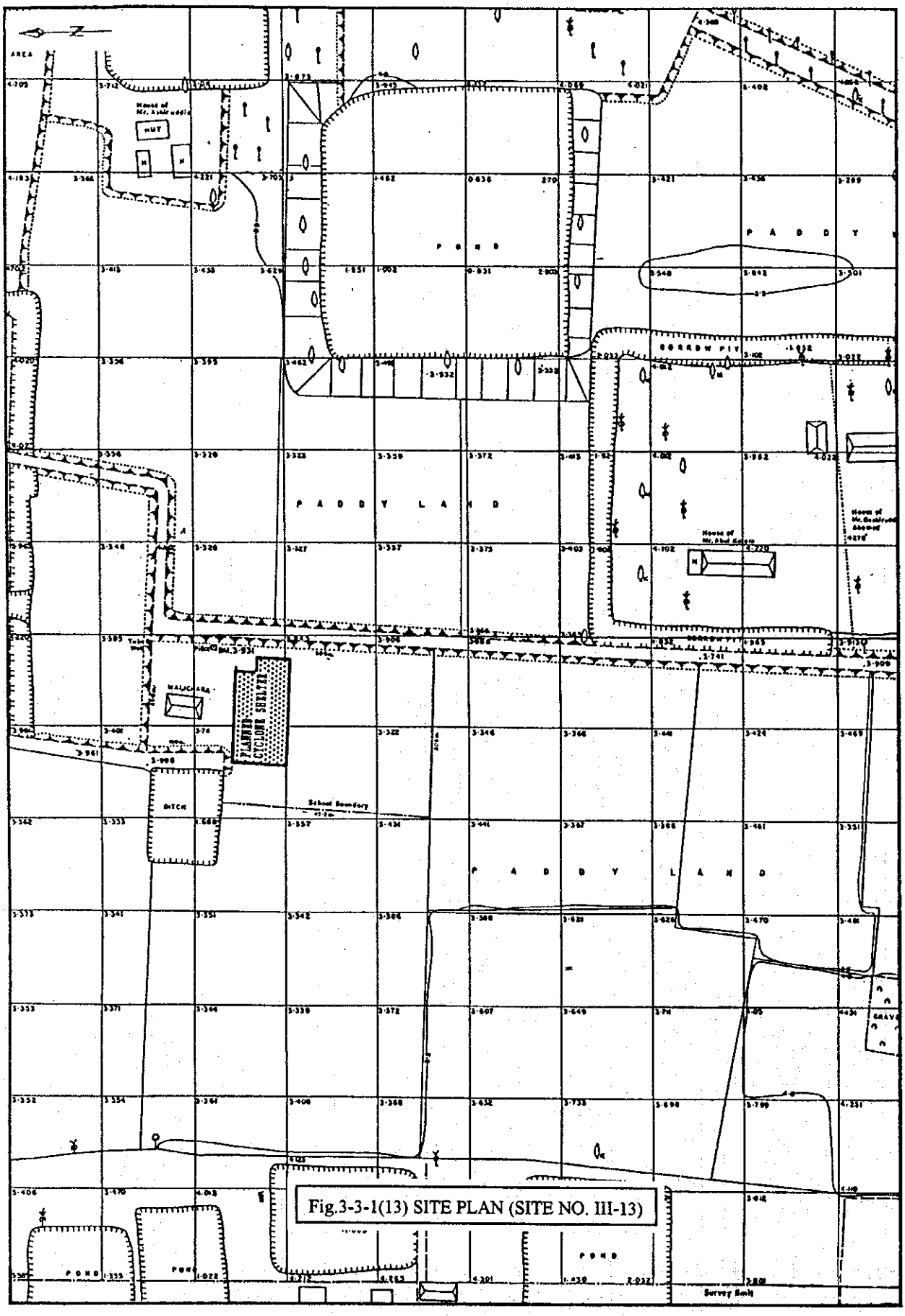


Fig.3-3-1(12) SITE PLAN (SITE NO. III-12)



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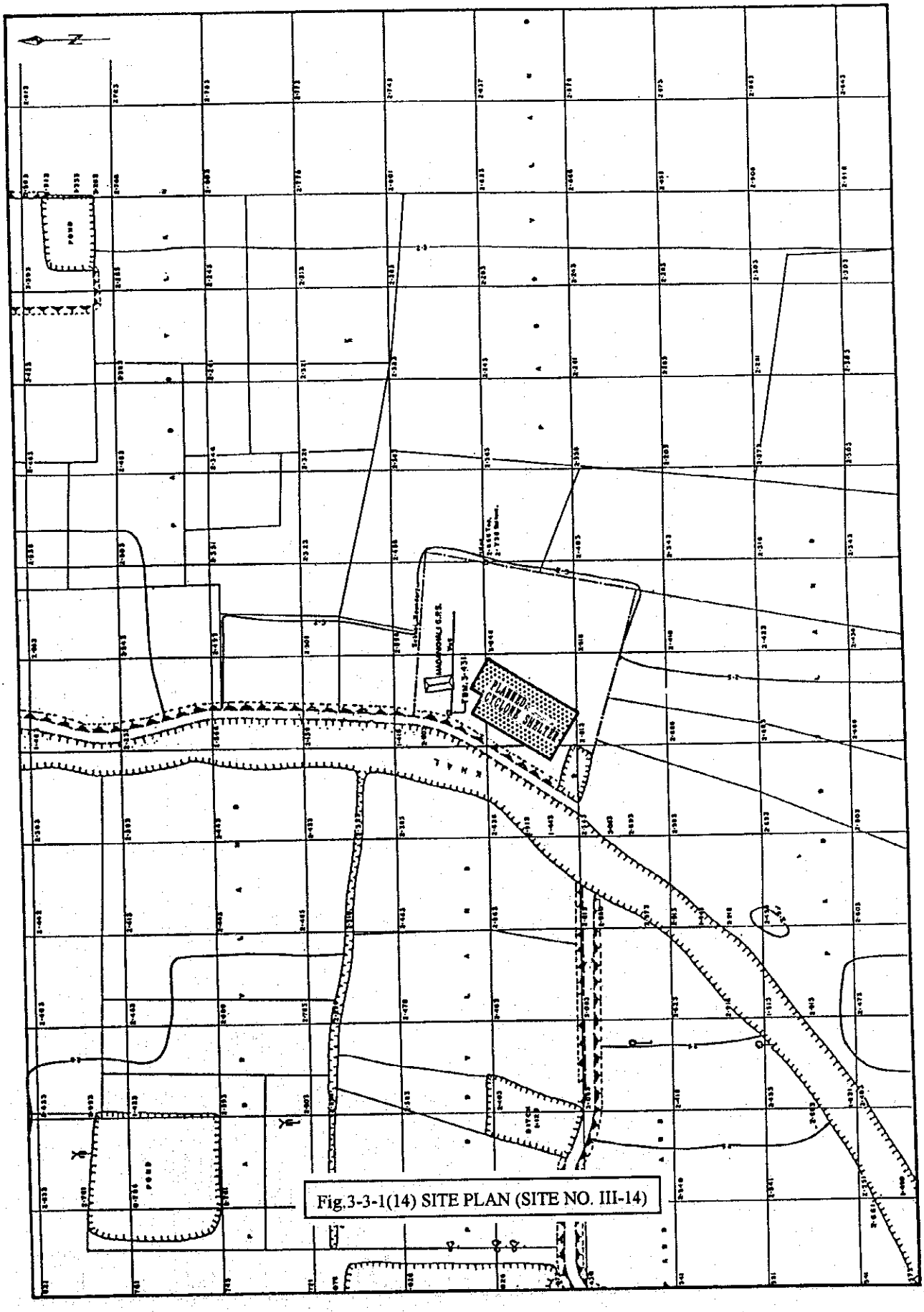


Fig.3-3-1(14) SITE PLAN (SITE NO. III-14)

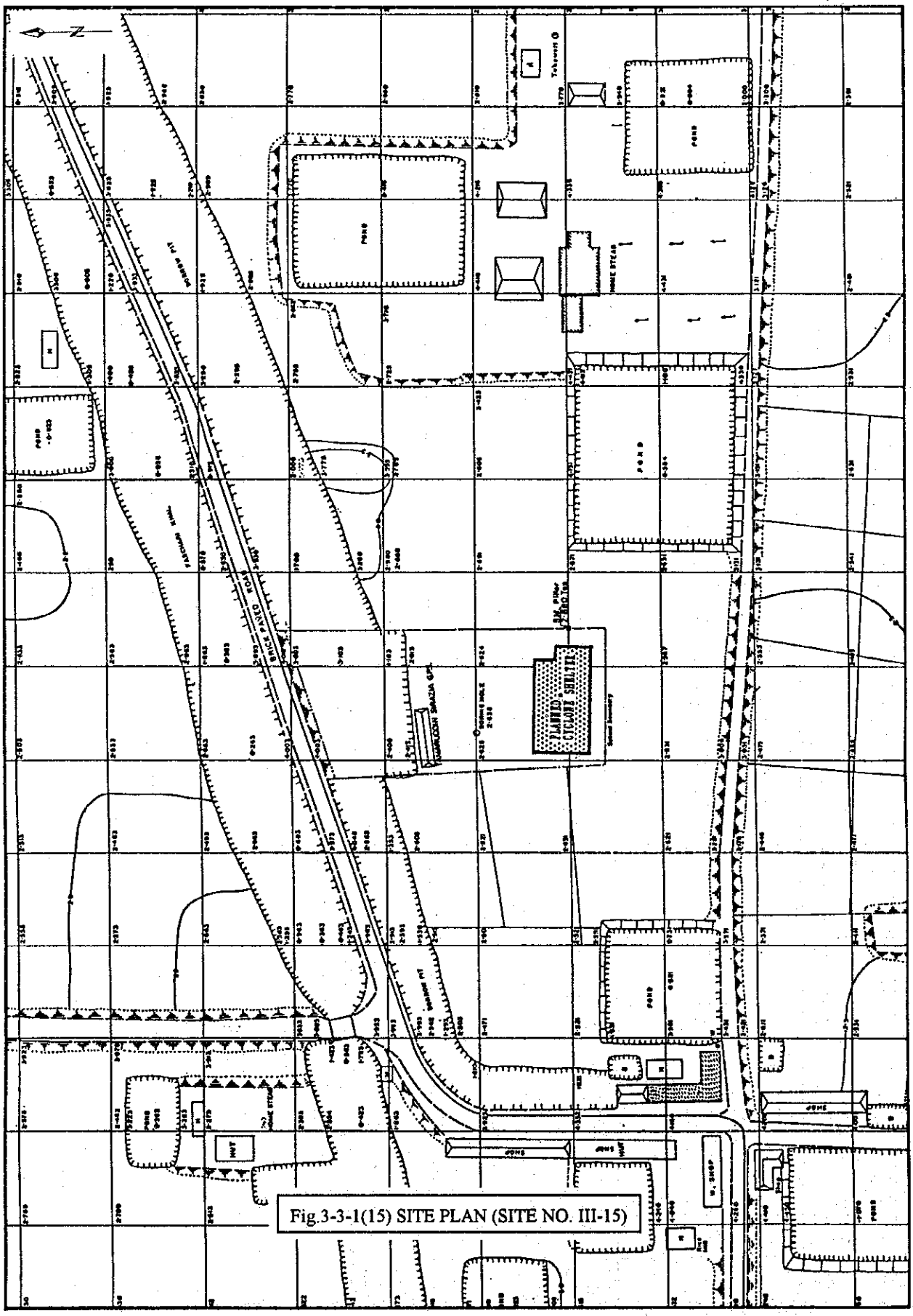


Fig.3-3-1(15) SITE PLAN (SITE NO. III-15)

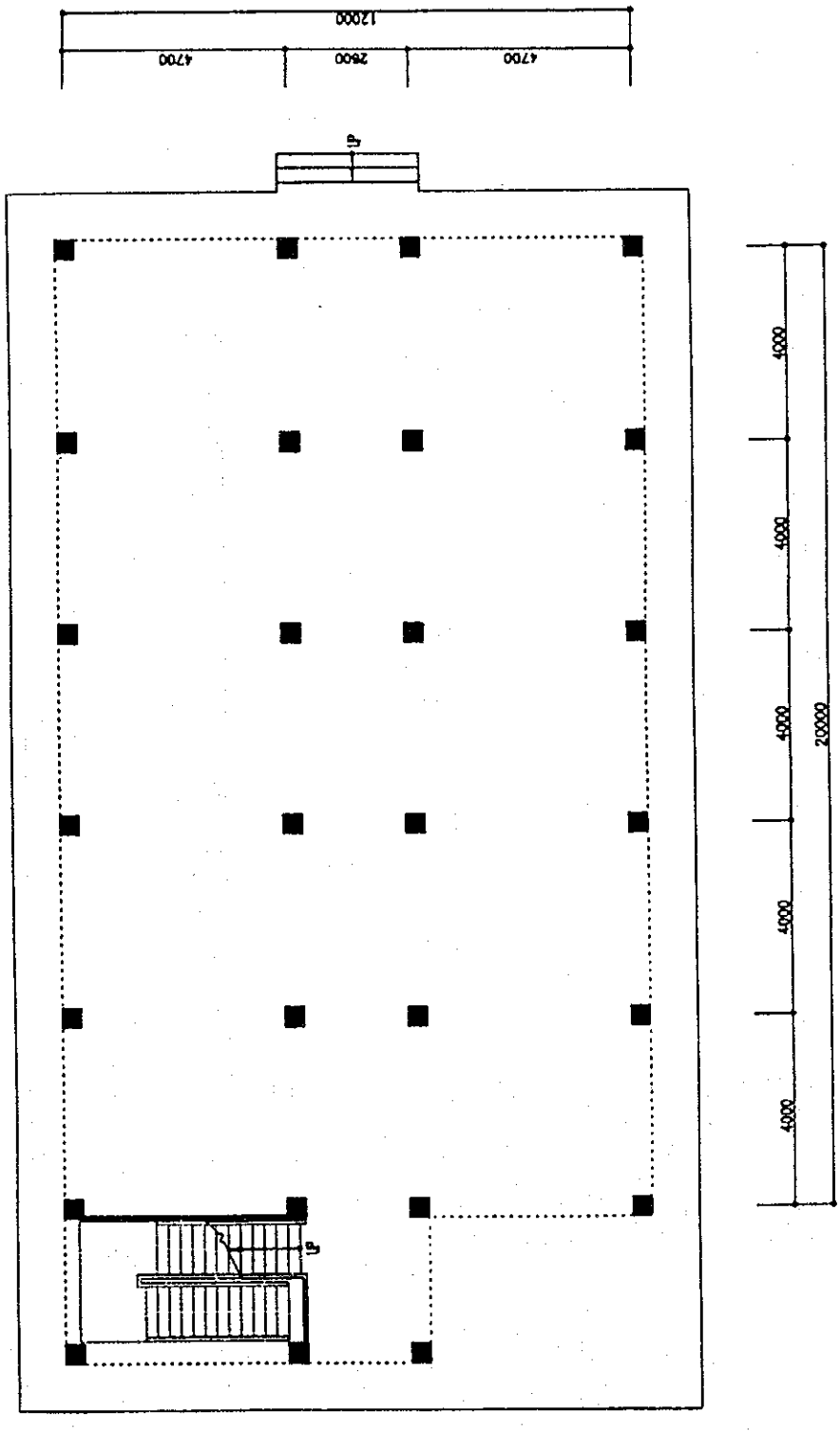


Fig.3-3-2(1) GROUND FLOOR PLAN

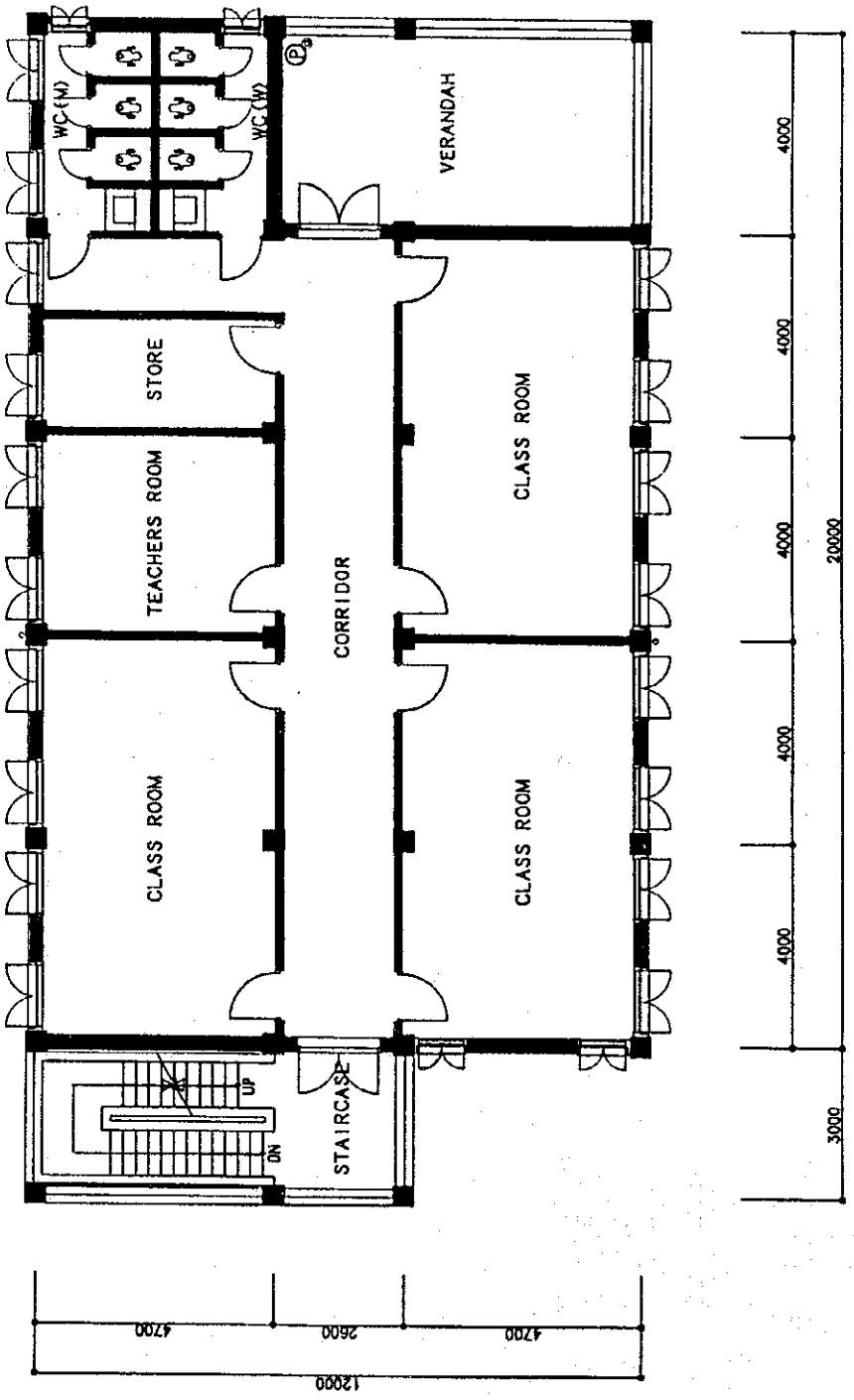


Fig.3-3-2(2) FIRST FLOOR PLAN

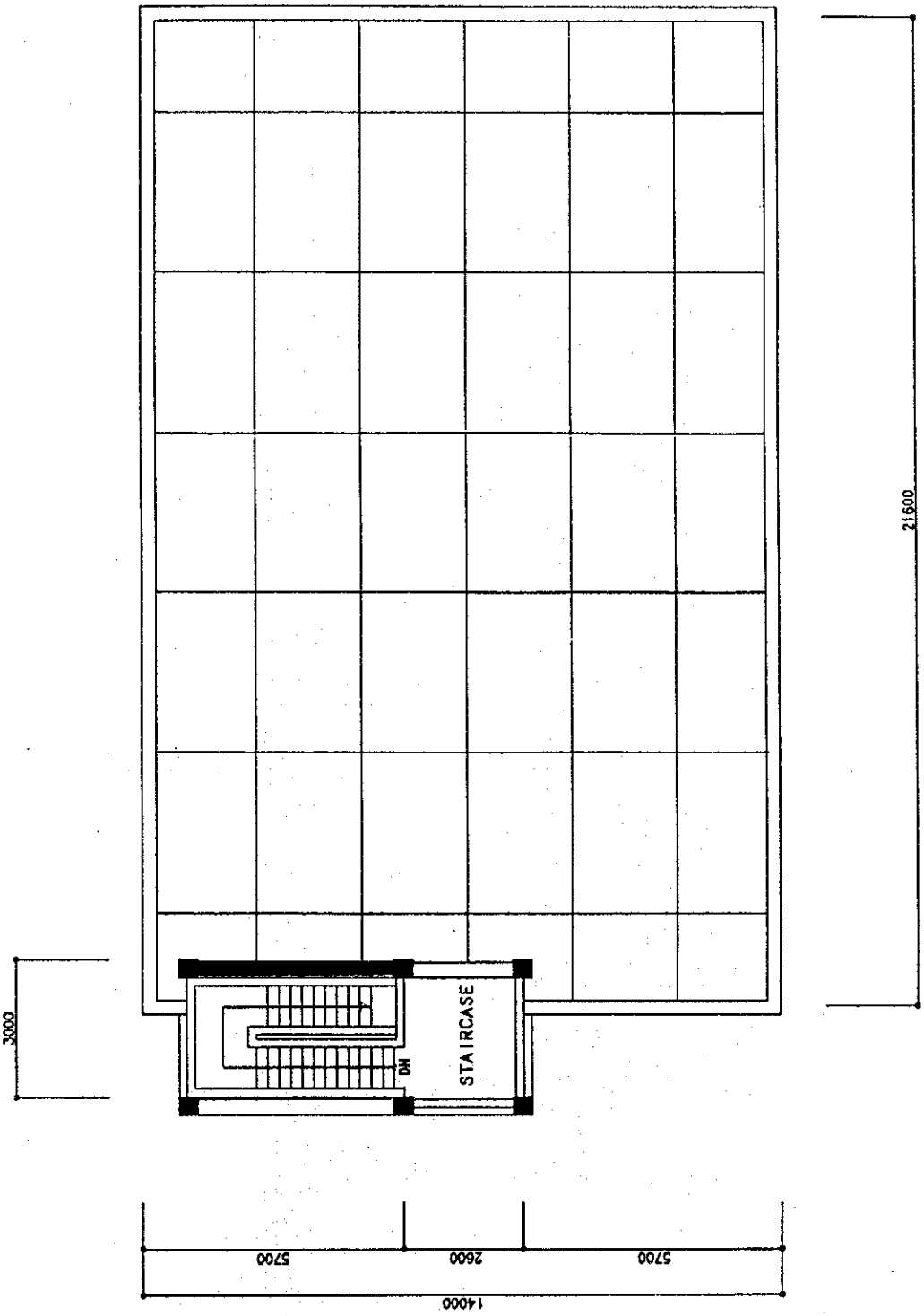


Fig.3-3-2(3) ROOF FLOOR PLAN

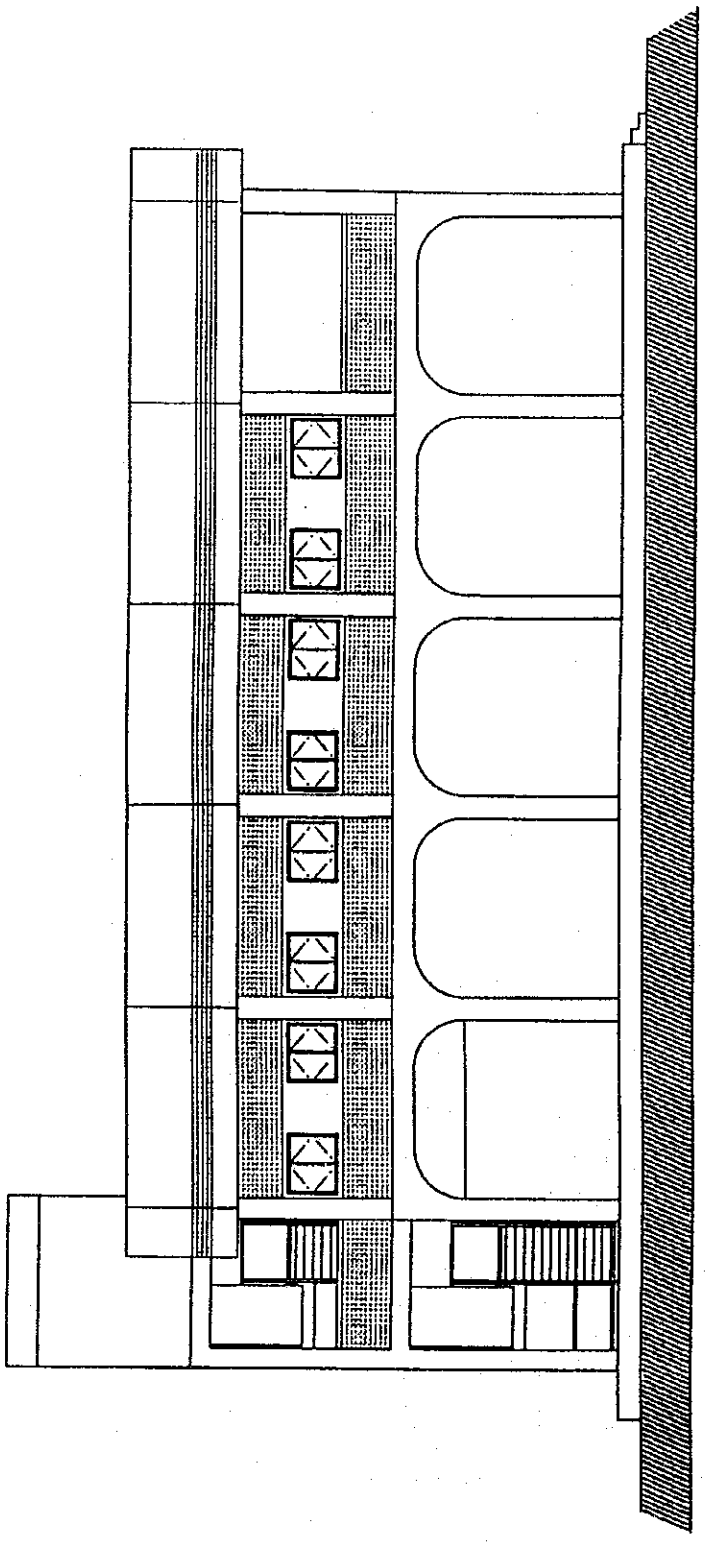


Fig.3-3-2(4) ELEVATION

SITE NO.	H
Ⅲ－1	3.5
Ⅲ－2	3.5
Ⅲ－3	3.5
Ⅲ－4	3.5
Ⅲ－5	3.5
Ⅲ－6	3.5
Ⅲ－7	3.5
Ⅲ－8	3.5
Ⅲ－9	5.0
Ⅲ－10	3.5
Ⅲ－11	5.0
Ⅲ－12	5.0
Ⅲ－13	5.0
Ⅲ－14	5.0
Ⅲ－15	5.0

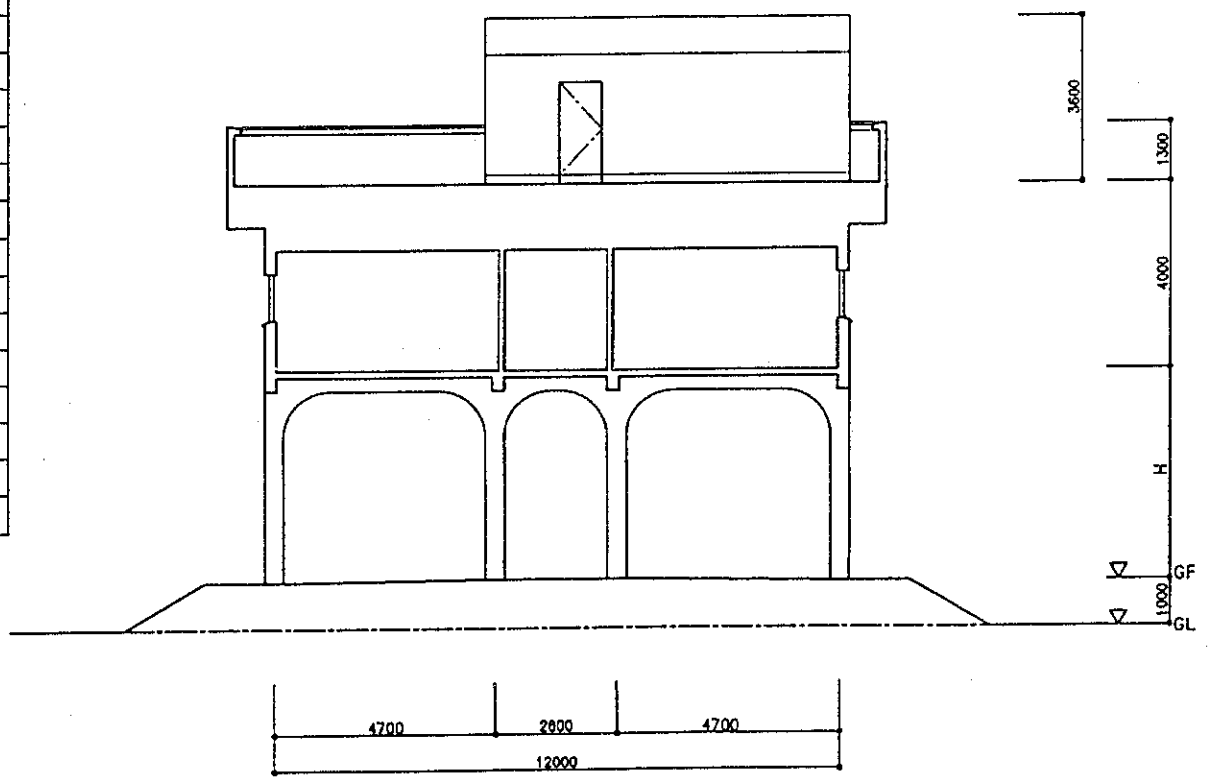


Fig.3-3-2(5) SECTION

CHAPTER 4

IMPLEMENTATION PLAN

CHAPTER 4 IMPLEMENTATION PLAN

4-1 Implementation Plan

4-1-1 Implementation Concept

(1) Project Implementation System

The responsible ministry for the Project (III) is the MLGRD & C and the implementation agency is the LGED of the MLGRD & C. Therefore, the local counterparts for the Detailed Design Study are the staff members of the LGED who will also be responsible for implementation of the construction work representing the Bangladesh side. The contracts with the consultant and contractor for the Project (III) will also be made by the LGED.

Following the signing of the E/N relating to grant aid for the Project (III), the LGED will conclude a consultancy contract with a Japanese consultant. The Japanese consultant will be assigned the preparation of the detailed design (preparation of detailed design documents and drawings and supervision of the tender procedure on behalf of the Government of Bangladesh) and supervision of the construction work. The actual construction work will be conducted by a Japanese contractor, selected by the LGED in accordance with the tender procedure supervised by the consultant.

4-1-2 Implementation Conditions

Basic construction materials, such as cement, sand, gravel and reinforcing bars, etc. will be procured locally and local workers will be employed for construction purposes. Consequently, a local contractor will be appointed as the sub-contractor in view of his detailed knowledge of the conditions of the local construction industry. The local sub-contractor should have experience of similar work so that the assigned work under appropriate supervision and with advice provided by the Japanese contractor is properly conducted.

Earth work must be avoided during the rainy season in Bangladesh, i.e. from June to October. Careful planning of the staging of the construction work during the dry season, i.e. commencement of earth work at the beginning of the dry season and finishing work at the end of the dry season, is extremely important as these types of

work are dependent upon weather conditions. In addition, special attention must be paid to the religious holiday of Ramadam (celebrated by Muslims in Bangladesh) in terms of planning and construction scheduling due to the drastic reduction of the work productivity by those Muslims who may be employed as construction workers.

4-1-3 Scope of Works

All the work related to the Project will be conducted by either the Japanese side or the Bangladesh side in accordance with the following division of work.

Japanese Side

1) Construction of 15 cyclone shelter-cum-primary school buildings
2) Provision of school furniture
3) Provision of hand-operated water pumps
4) Construction of boreholes (GL -300/-400 m)
5) Construction of septic tanks with soak wells
6) Provision of consultancy services

Bangladesh Side

1) Provision of construction sites and land preparation prior to the commencement of construction work (including the removal of the existing abandoned school building at Site No. III-5).
2) Construction of killas

4-1-4 Consultant Supervision

Following the signing of the E/N, the consultant which has secured the consultancy contract will prepare the detailed design and tender documents, conduct the tender process on behalf of the Government of Bangladesh and supervise the work to be conducted by the contractor who submits the successful bid.

(1) Preparation of Detailed Design and Tender Documents

The detailed design documents will be prepared by the consultant based on the survey maps prepared for the Basic Design, the boring survey results for the Basic Design and the findings of further field surveys for the Detailed Design.

The consultant will also prepare the tender documents for approval by the Government of Bangladesh.

(2) Tender

The consultant will carry out the tender announcement, acceptance of tender applications, explanatory meeting on the tender process, distribution of tender documents, acceptance of bids and evaluation of bids on behalf of the Government of Bangladesh. The consultant will be an advisor for negotiations between the Government of Bangladesh and the successful bidder in view of the conclusion of the construction contract.

(3) Work Supervision

Following the conclusion of the construction contract, the work supervision stage will commence. The consultant will check and approve the documents presented by the contractor. At the actual construction sites, the consultant on behalf of the Government of Bangladesh will supervise the contractor (including sub-contractors) on all aspects of the construction work, including the transportation of materials and equipment, process control, quality control (including the quality tests carried out by the contractor at an authorized laboratory in Bangladesh) and materials control.

(4) Personnel Plan

The experts to be assigned at the detailed design stage will be the Project Manager who will be responsible for overall project implementation and engineers specialising in architectural design, structural design, estimation and tender document preparation, etc., all of whom will be controlled by the Project Manager. For on-site management and supervision, the Architectural Designer (A) will be dispatched to Bangladesh as a full-time supervisor under the control of the Project Manager and the Architectural Designer (B) will also be dispatched at a spot supervisor.

4-1-5 Procurement Plan

In principle, the materials and equipment required for the implementation of the Project (III) will be procured locally. Those materials and equipment which are unavailable in Bangladesh, the quality of which is unacceptable, the stable supply of which is not guaranteed or the cost of which is prohibitive will be procured in Japan in order to ensure reliability and cost-competitiveness.

(1) Main Materials and Equipment to be Procured in Bangladesh

1) Construction Materials

- reinforcing bars
- cement
- aggregate
- bricks
- water-resistant paint
- concrete forms

2) Facilities

- sanitary facilities
- hand pumps for boreholes

3) School Furniture

- desks
- chairs
- blackboards

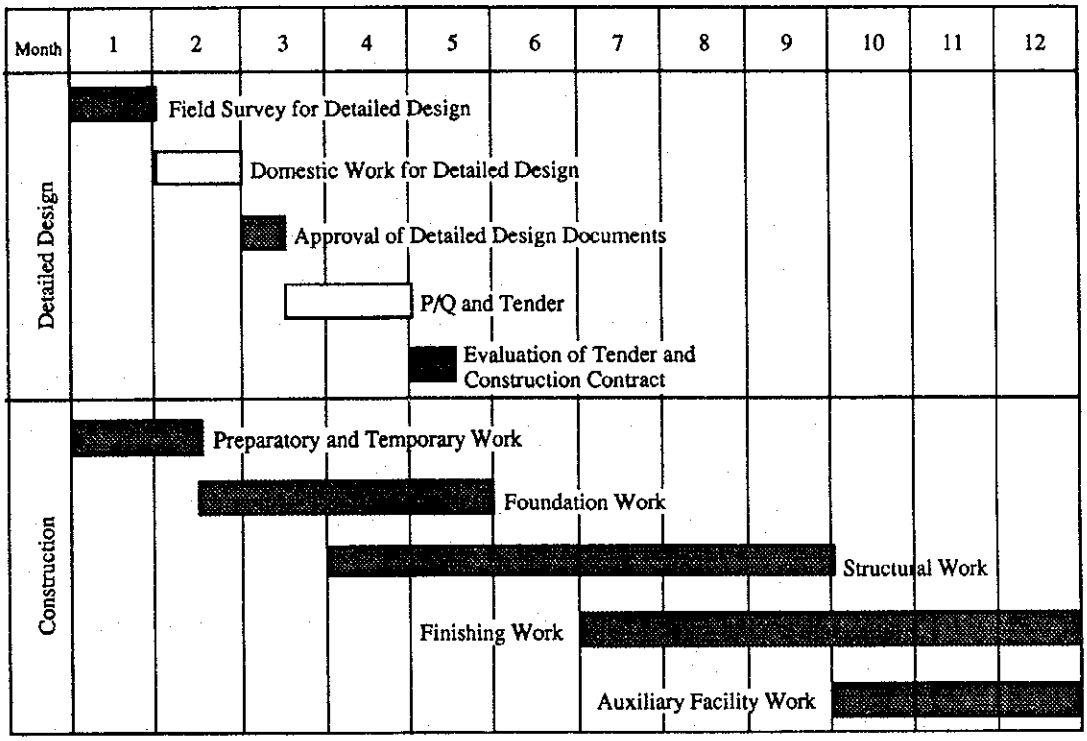
(2) Labour

All types of workers and skills required for the implementation of the Project (III) are available in Bangladesh and, therefore, all necessary labour will be recruited locally.

4-1-6 Implementation Schedule

The adoption of the following project implementation schedule after the signing of the E/N by both governments is desirable. Following the signing of the E/N, the Government of Bangladesh (LGED) will then immediately conclude the consultancy agreement to proceed with the detailed design. A period of 2.0 months will be required to complete the detailed design, including field survey, which will be immediately followed by the tender procedure to select the contractor. This tender procedure will be conducted by the consultant on behalf of the LGED and the contract will be made through negotiations between by the LGED and successful tenderer. The construction period for the Project (III) will, in principle, be 12 months.

Table 4-1-1 Project Implementation Schedule



4-1-7 Obligations of Recipient Country

Following necessary measures should be taken by the Government of Bangladesh, if the grant aid by the Government of Japan is extended to the Project (III).

1) To secure the site for the Project (III);
2) To clear and level the Project Sites prior to commencement of construction, if necessary;
3) To construct proper access roads for constructing the planned shelters, if necessary;
4) To remove the existing abandoned school building prior to the construction of planned shelter in the Site No. III-5;
5) To bear commissions to the Japanese foreign exchange bank for its banking services, namely the advising commission of the "Authorization to Pay" and payment commission;

6) To ensure necessary payment of taxes and to take necessary procedures for customs clearance of the materials and equipment for the Project (III) at the port of disembarkation promptly;

7) In order to exempt Japanese juridical and physical national engaged in the Project (III) from custom duties, internal taxes and fiscal levies which may be imposed in Bangladesh with respect to the supply of the products and services under the verified contracts, the cost of such duties, internal taxes and other fiscal levies to be imposed under the Bangladesh Regulations shall be borne by the relevant Bangladesh Ministry/agency concerned with the Project (III) for which budget provision shall be made by them;

8) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Bangladesh and stay therein for the performance of their work;

9) To provide necessary permissions, licenses and other authorizations for carrying out the Project (III), if necessary;

10) To maintain and use properly and effectively the facilities constructed and the equipment provided under the Project (III); and

11) To bear all the expenses, other than those to be borne by the grant aid within the scope of the Project (III).

4-2 Project Cost Estimation

4-2-1 Project Cost Estimation

In the case of the implementation for the Project (III) with grant aid provided by the Government of Japan, the Government of Bangladesh will be required to meet the following costs for the successful completion of the Project (III).

(1) Bank Commission	: TK	1,235,800	(approximately 2.8 million yen)
(2) Killa Construction Cost	: TK	22,510,000	(approximately 51.5 million yen)
(3) Removal of Existing Ababdoned School Building at Site No. III-5	: TK	97,200	(approximately 0.2 million yen)
Total	: TK	23,843,000	(approximately 54.5 million yen)

4-3 Operation and Maintenance Costs

(1) Operation Plan

As the planned cyclone shelters will normally be used as government primary school buildings after construction, the PMED will be responsible for their operation and maintenance. However, the actual operation will be conducted by the DPE, a subordinate organization of the PMED.

The operation system is structured to ensure the smooth running of the primary schools which will be directly controlled by the ATEOs. Overall responsibility will be assumed by the Director General of the PMED, assisted by the Deputy Director, PEO and TEO at the Division, District and Thana levels respectively. The ATEOs at the bottom of the organizational structure are answerable to the TEOs. The actual management of each primary school will be conducted by the teaching staff led by the head master under the control of the ATEO. There are 65 teachers working at primary schools at 15 Project Sites. As indicated in 3-2-3 (2), the number of teacher staff at these schools is 76, including the planned increase by 3 each at Site Nos. III-12 and III-15 and 2 at site No. III-14.

(2) Maintenance Plan

In order to maintain the school buildings in good condition over a long period of time, regular maintenance after initial completion is essential in addition to strict material control and quality control during construction work. The practice of conducting repairs after deterioration is manifest only shortens the building life although repairs must be conducted. During the Study, some of the existing shelters were found to be highly deteriorated, presumably because of the lack of maintenance work over a long period of time. If the situation is not improved, the expected life of these shelters will be further shortened and they may soon not be able to be used as shelters. This reality indicates the inadequate maintenance budget due to the difficult financial situation at both the central government and local government levels. In view of this, it is essential that the planned cyclone shelters will be constructed using construction methods and materials requiring minimum maintenance. While the planned cyclone shelters will be managed by the PMED in view of their normal use as primary school buildings, it should prove more practical for the PMED to assign the responsibility for the buildings to the LGED. The direct maintenance responsibility will fall on the District Offices of the LGED and the engineer of the LGED Thana Offices.

Required Maintenance Work

The required maintenance work and its frequency for the planned cyclone shelters are as follows.

- Repainting of exterior walls : every 10 years
- Repainting of interior walls : every 10 years
- Repair of peeling mortar from columns, beams and walls : when necessary
- Inspection of borehole and pump : every month
- Repair of desks and chairs : when necessary

(3) Operation and maintenance Costs

The operation and maintenance costs for the planed 15 shelters will consist of the personnel cost, stationary cost and maintenance service cost as listed below. Here, the maintenance (repair) cost is given as the average annual cost although repair work is not evenly conducted every year as described in (2) above.

1) Personnel cost				
(teachers' salaries)	:	TK	1,441,800	(approx. ¥3,302,000)/year
2) Stationary cost				
(chalk and roll books, etc.)	:	TK	32,400	(approx. ¥74,000)/year
3) Maintenance cost				
- Exterior wall repainting	:	TK	126,000	(approx. ¥289,000)/year
- Interior wall repainting	:	TK	401,480	(approx. ¥920,000)/year
- Mortar repair	:	TK	11,720	(approx. ¥27,000)/year
Total		TK	2,013,500	(approx. ¥4,612,000)/year

CHAPTER 5

PROJECT EVALUATION AND RECOMMENDATION

CHAPTER 5 PROJECT EVALUATION AND RECOMMENDATION

5-1 Project Effects

The Government of Bangladesh has introduced the Master Plan to construct 2,500 new cyclone shelters as an emergency measure to protect those people of Bangladesh living in the coastal HRA from storm surge caused by cyclones and has requested the assistance of donor countries, international aid organizations and NGOs, etc. for the Master Plan. The construction of many shelters is currently in progress by Japan and other donor countries as well as aid organizations. The Project (III) is considered a significant international cooperation project, playing an important role in the completion of the Master Plan.

According to the Master Plan, some 3,400 cyclone shelters will be required by the year 2002 to protect the inhabitants of the HRA and approximately 1,300 shelters have so far been constructed or finalized for construction. In regard to the construction of 2,500 shelters called for by the Master Plan, some 2,100 shelters still must be constructed in the coming years. For the 4 Thanas in the Project area, 428 shelters still require construction, including the 15 shelters to be constructed under the Project (III).

The Project is essential from the viewpoint of saving human lives and demands its urgent implementation as a natural disaster prevention measure. The completion of these 15 shelters will have the far-reaching effect of providing safe shelter for some 24,000 people living in the HRA at the time of an emergency due to storm surge, in turn caused by a cyclone. They will also contribute to the promotion of education as the shelters will normally be used as safe and pleasant primary school buildings for some 4,500 pupils. Moreover, the promotion of local employment through the recruitment of labour for the Project (III) and the new sense of security due to the construction of the shelters will facilitate the settlement of people in the shelter areas. The improved access to areas in the vicinity of the Project Sites due to the construction of access roads will also considerably contribute to local development and upgrading of the living standard.

From an international point of view, the Project (III) perfectly matches the objectives of the IDNDR and Japan almost appears to have an obligation to actively implement the Project (III) as part of the international community's assistance for the Master Plan.

5-2 Recommendation

The implementation of the Project (III) will have the many positive effects described in 5-1. In addition, the Project (III) will contribute to revitalizing local areas as it will make the coastal area a safe place to live, protecting the lives of inhabitants. The Project (III) will also provide safe and pleasant places of education for many pupils as the shelters will normally be used as primary school buildings. In view of these positive consequences of the Project (III), the Project (III)'s implementation as a grant aid project of the Government of Japan is deemed highly viable.

The Project (III) aims at constructing 15 new cyclone shelters and is the successor of the Project (I) (10 shelters) and the Project (II) (15 shelters) to complete the 40 shelters originally requested by the Government of Bangladesh. Given the objectives and conclusions of the Project (III) which prove the viability and necessity of such a project, further studies are desirable with a view to the construction of more cyclone shelters in the future.

Several measures have already been suggested to ensure the smooth and effective implementation of the Project (III) and the implementation of these measures as outlined below by the Bangladesh side is a precondition for the Project (III).

(1) Removal of Existing Abandoned School Building

A existing abandoned school building is still standing on Site No. III-5 and its removal is essential in view of its obstructing the construction work.

(2) Construction of Killas

The construction of a killa together with the new shelter is essential to protect the assets and livestock of those people who are evacuated to the shelter. The Government of Bangladesh is required to construct a killa of which the scale corresponds to the capacity of each shelter.

(3) Establishment of Operation and Maintenance System

As the new cyclone shelters will normally be used as primary school buildings, the jurisdiction over them will be transferred from the LGED to the PMED. Accordingly, the PMED will be required to consolidate the existing operation and maintenance system during the construction period as a move to firmly establish a system which is capable of handling the new facilities. In regard to the operation

and maintenance cost, while it has been reported that the PMED is capable of the necessary budgetary appropriation, it will be essential to make the necessary arrangements to secure such budgetary appropriation.

(4) Increase of Teachers

As the construction of cyclone shelters under the Project (III) also means the replacement of existing primary school buildings, the number of existing teachers will be inadequate at some sites vis-a-vis the calculated maximum number of classrooms for existing pupils. It will be necessary to increase the number of teachers by 3 at Site Nos. III-12 and III-15 and by 2 at Site No. III-14.

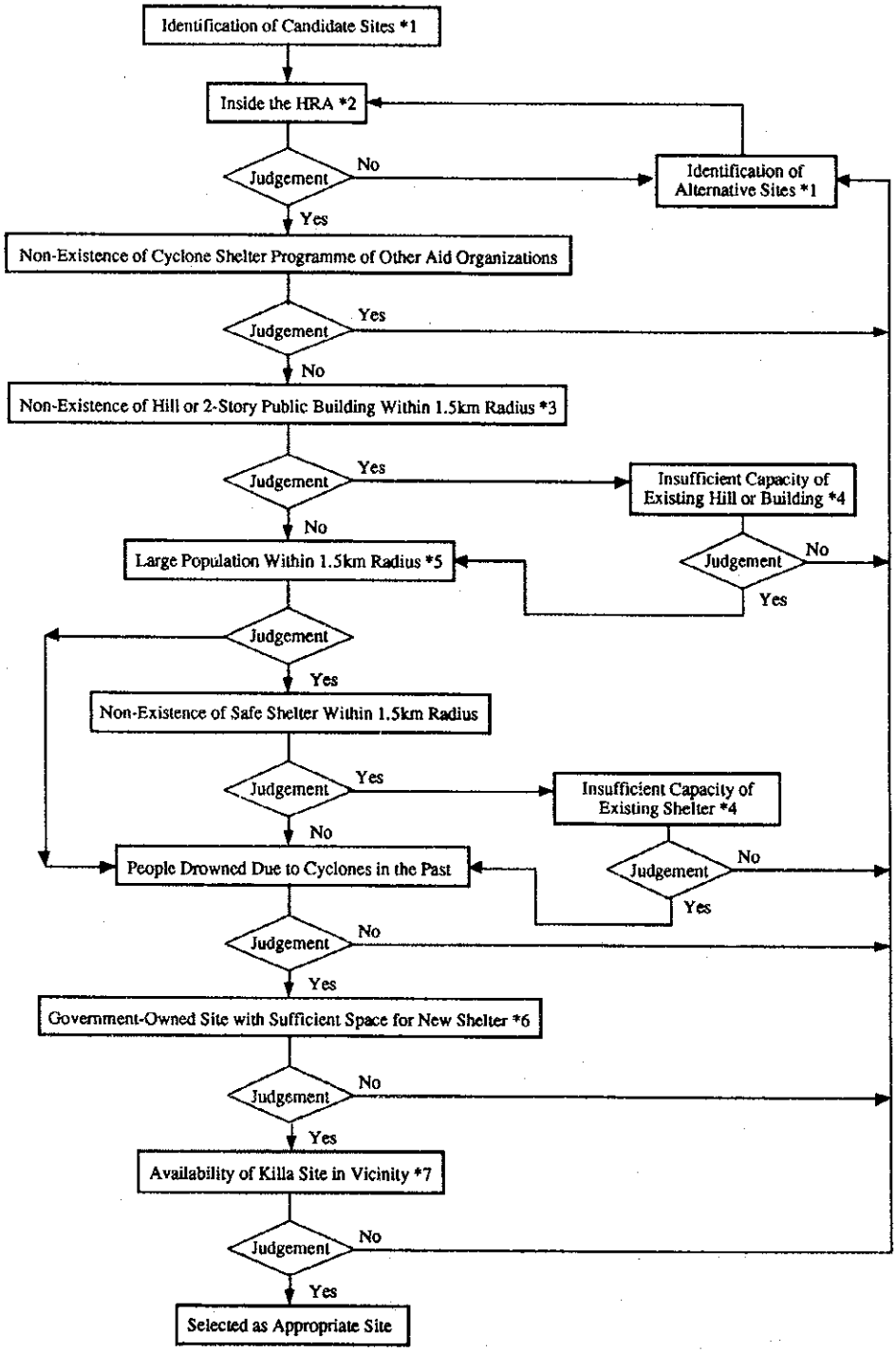
(5) Proceeding with Necessary Procedures

The Government of Bangladesh must pay special attention to the smooth proceeding of the necessary procedures involving related ministries and agencies in view of the Project's implementation in accordance with the schedule within the framework of Japan's grant aid system. The PCP relating to the Project (III) was revised last year by the Government of Bangladesh and the authorization for such revision has already been granted by the ECNEC, ensuring the necessary funding in the government budget.

(6) Site Selection Process

The list of candidate sites proposed by the Government of Bangladesh for the Project (III), in fact, includes unsuitable sites for the Japanese grant aid in that they are located outside the HRA, that a new multipurpose cyclone shelter is under construction next to an existing primary school building by another aid organization, or that the sites and/or buildings are actually owned by non-government primary schools, of which the property is not controlled by the Government of Bangladesh. The implementation of the Basic Design Study under these circumstances means a longer survey time is required to check the very basis of the original selection criteria, possible delaying the actual implementation of the Project. The Bangladesh side is strongly advised to carefully check the conditions of the candidate sites to avoid a time-consuming survey at the basic design stage. Fig. 5-2-1 shows the proposed flow for the selection of candidate sites in the future based on the findings of the latest basic design survey.

Fig. 5-2-1 Flow Chart for Selection of Appropriate Sites



Notes *1 The candidates are government primary schools which have been damaged by cyclones in the past or which are likely to be damaged.
*2 The candidate sites should be inside the HRA as defined by the Master Plan for the Multi-Purpose Cyclone Shelter Programme of the UNDP.
*3 The height must be sufficient to provide safe evacuation in the case of a likely cyclonic surge.
*4 An accommodation capacity of some 1,700 people is the general yardstick for the planned cyclone shelter size.
*5 The general yardstick is some 4,000 inhabitants within a 1.5km radius of the site.
*6 The Project envisages a maximum of 3 to 5 classrooms, requiring a minimum land size of 35m × 20m.
*7 Given the killa's envisaged functions, the killa site must be within close view of the cyclone shelter (maximum distance: 0.3km).