APPENDIX III

TOPOGRAPHY, GEOLOGY AND SOIL MECHANICS

APPENDIX Ⅲ

TOPOGRAPHY, GEOLOGY AND SOIL MECHANICS

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. Topographic Survey

1-1. Bench Mark Value

The basic bench mark values in the Project area are shown in TableⅢ-1.

For future reference, permanent bench mark pillars of BWDB standard specifications were installed in 10 places at the proposed pump stations and along the main canals.

The heights and locations of these bench mark pillars are shown in TableⅢ-2.

1-2. Presentation of Survey Results

1) Longitudinal section of the canal alignments were plotted at a scale of 1/100 vertically and 1/5,000 horizontally.

2) Cross sections were plotted at a scale of 1/100 vertically and 1/1,000 horizontally.

3) Plane table survey results of the pump station and sampled areas were plotted at a scale of 1/2,000, respectively. Contours on the plane maps were presented as for intervals of 0.5 m height.

4) All levels were described in meters.

1-3. Error of Closure

The following error rates were adopted as allowable in the leveling work.

$$E = 20 \sqrt{S}$$

Where ; E : Error of closure (mm)
S : One-way distance of the measurement (km)

1-4. Bench Mark Pillar

Bench mark pillars which have been installed in this survey work were specified as per BWDB standards as shown in Fig. Ⅲ-1.

1-5. Work Quantity

The dimensions of the survey work are shown in the following table.

1) Canal Route Survey

Nageswari Main Canal	L = 37.3 km
Fulbari Main Canal	L = 28.6 km

2) Plane Table Survey

Pateswari Pumping Station		A = 45.0 ha
Tangonmari Pumping Station		A = 50.0 ha
Sampled Area :	Bhurungamari	A = 50.0 ha
	Bhurungamari (Deep Tube Well site)	A = 26.3 ha
	Fulbari	A = 50.0 ha
	Nageswari	A = 50.0 ha
	Nageswari (Deep Tube Well site)	A = 38.0 ha

3) River Cross-section Survey

Dudhkumar River	N = 31 Nos

4) B.M. Survey

Fly Level Survey	L =127.4 km
Concrete Pillar Setting	N = 10 Nos

Table III-1 Basic Bench Mark Value (1/3)

No.	B.M. of Value	Location	Remarks
1.	87.92feet	B.M. of value 87.92ft near the house of Md.Aziz Miah of village Madhabgram and which is situated by the Eastern side of R.D.R.S. Go-down, Kurigram.	WAPDA PILLAR No.77
2.	89.39feet	B.M. value of 89.39ft is kept on the top of pucca Tube Well pillar in the north side east corner and which is situated in the house of Sakmat Ali Member of Village Madhabgram.	Staff place on the top of Tube well in the north side east corner.
3.	94.77feet	B.M. value of 94.77ft is kept on the top of plinth floor slab in the Mosque of Pateswari Bazar.	Staff Place on the top of plinth floor in the south side near the middle pillar on Mosque.
4.	92.40feet	B.M. value of 92.40ft is kept on the top of abutment at Madhyakumar Bridge.	Staff place on the top of abutment in the south side east corner and its place in the adjacent of Railway of Bridge.
5.	97.26feet	B.M. value of 97.26ft is kept on the top of pucca well and which is situated in the compus of Police Station at Nageswari.	Staff place on the top of outer side North corner in the pucca well at Nageswari.
6.	95.9feet	B.M. value of 95.91ft is kept on the top of verandah plinth floor at Nageswari Inspection Bunbalow.	Staff place in the center of B.M. No.6 in the south side of verandah plinth floor at Nageswari Inspection Bungalow.
NAGESWARI TO DAMALGRAM (PHULKUMAR REGULATOR SITE			
7.	102.79feet	B.M. value of 102.79ft is kept on the top of verandah plinth floor in the Krishi Bank at Raygong.	Staff place on the top of verandah plinth floor in the north side west corner of Bank.
8.	108.43feet	B.M. value of 108.43ft is kept on the top of abutment at Raygog Bridge.	Staff place on the top of abutment in the south side east corner of Bridge.

Table Ⅲ-1 Basic Bench Mark Value (2/3)

No.	B.M. of Value	Location	Remarks
9.	97.44feet	B.M. value of 97.44ft is kept on the top of pucca Tube-well slab in 3" brick work at Damalgram (Phulkumar regulator site).	Staff place on the top of 3" brick work in the east side of Tube-well at Damalgram.
NAGESWARI TO BAHARAMPUR REGULATOR			
10.	93.10feet	B.M. value of 93.10ft is kept on the top of east side room floor level at Barubari Prymari School.	Staff place on the top of east side room floor at Barubari Prymari School.
11.	95.73feet	B.M. value of 95.73ft is kept on the top of pucca Tube-well pillar at Baharampur in the house of Kamaruddin Fakir and which is situated by the western side of Mosque (Baharampur regulator site).	Staff place on the top of Tube-well pillar in the North side West corner.
NAGESWARI TO SAGUNCHARA REGULATOR SITE(VIA:-FULBARI BRIDGE SITE)			
12.	94.21feet	B.M. value of 94.21ft is kept on the top of verandah plinth floor level at Newoashi Union Parishad in the vill. of Sukhati(South).	Staff place on the top of verandah plinth floor at Newoash Union Parishad.
13.	97.22feet	B.M. value of 97.22ft is kept on the top of pier in the Newoashi Bridge (Near Negoashi Bazar).	Staff place on the top pire in the south side west pillar at Bridge.
14.	98.32feet	B.M. value of 98.32ft is kept on the top of verandah plinth floor level of Science High School.	Staff place on the top of verandah plinth floor in the south side west corner of Science Laboratory.
15.	100.63feet	B.M. value of 100.63ft is kept on the top of railing of culvert at Chandrahana (Fulbari Bridge site) near the house of Anwar Ali Miah.	Staff place on the top of Railing of culvert in the East side North corner.
16.	99.57feet	B.M. value of 99.57ft is kept on the top of pucca well at Gogharkutti.	Staff place in the center of circle on the top of pucca well in B.M No.10 at Gogharkutti.

Table Ⅲ-1 Basic Bench Mark Value (3/3)

No.	B.M. of Value	Location	Remarks
17.	95.44feet	B.M. value of 95.44ft is kept on the top of R.C.C. pillar and which is situated in front of Kachu Mahammud' House in the village Goghar-kutti(Sagonchara Regulator site).	Staff place on the top of R.C.C. pillar.
18.	95.99feet	B.M. of value of 95.99ft is kept on the top of pucca Tube-well pillar and which is situated in front of Mosque in the village of Purba Dhaniram.	Staff place on the top of Tube-well pillar in the north side west corner.
DAMALGAM AT PHULKUMAR REGULATOR SITE			
19.	97.74feet	B.M. value of 97.74ft is kept on the floor near the front door of the Khalashi shed.	Staff placed on the floor of main room and just inside the front door of Khalashi shed.
BAHARAMPUR REGULATOR SITE			
20.	89.97feet	B.M. of value 89.97ft is kept near the Baharampur Regulator site.	Staff placed on the pucca pillar in the front side of the house of Ismail Hossain Fakir.

Table Ⅲ-2 List of Permanent Bench Mark

No.	B.M. of Number	B.M. of Value(m)	L o c a t i on	R e m a r ks
1.	NC-1	30.837	The B.M. pillar is embedded in the village of Kumar Andharijhar east of the house of Sekandar Alli.	All B.M. pillars are numbered with red paint.
2.	FC-2	32.179	The B.M. pillar is embedded at N/E corner of Purba Ramkhana High School.	Do
3.	FC-3	33.116	The B.M. pillar is embedded at East side of Ramkhana Tahshit Office.	Do
4.	FC-4	31.411	The B.M. pillar is embedded at N/W corner of the house of Abdul Aziz Mollah, village Paschim Anantapur.	Do
5.	FC-5	30.558	The B.M. pillar is embedded at N/E corner of Baniarhat Madrassa, south side of Nageswari-Fulbari road.	Do
6.	FC-6	31.218	The B.M. pillar is embedded infront of the Mosque at village Nandi Kuti.	Do
7.	NC-7	30.118	The B.M. pillar is embedded at S/E corner of the house of Abdul Haq Sarker, village Nilukhamar.	Do
8.	NC-8	28.658	The B.M. pillar is embedded infront of the Primary School at village Khamar Hasnabad.	Do
9.	NC-9	26.491	The B.M. pillar is embedded at West side of the house of Barkat Ali at village Shatibari.	Do
10.	NC-10	26.526	The B.M. pillar is embedded at South side of the Madrassa at village Panchgachhi.	Do

Note: - The value of B.M. pillars are carried out on the basis of the B.M. list supplied by BWDB Divn.-II, Kurigram.
- NC means Nageswari Canal and FC means Fulbari Canal.
- Reference Level Book No.703.

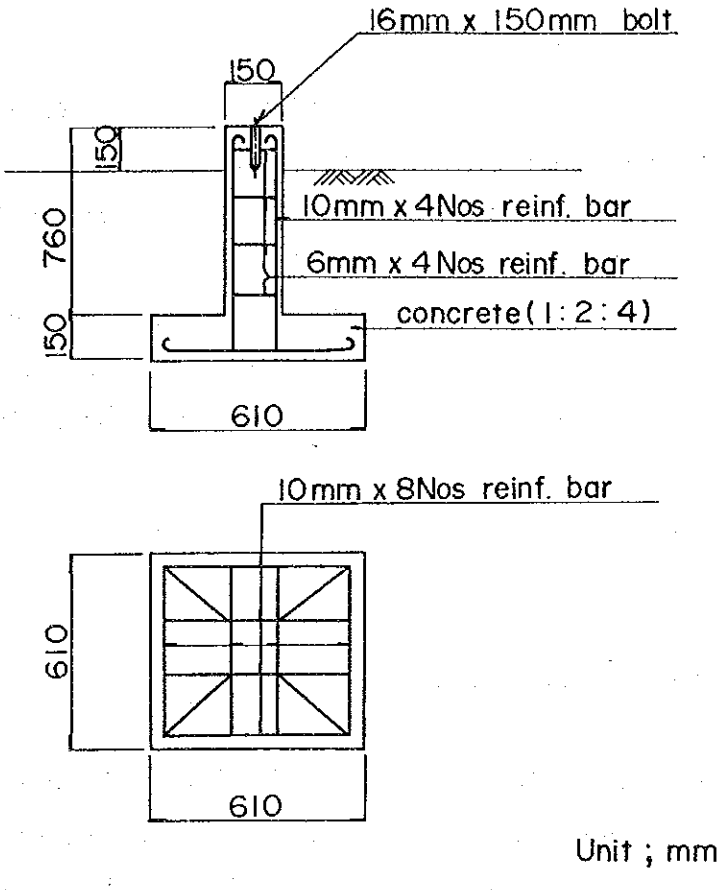


Fig. Ⅲ-1 Standard Bench Mark Pillar

2. Geology and Soil Mechanics

2-1. Exploratory Boring

(1) Bore Hole Drilling

Field work includes the drilling of one 28.5 m deep exploratory bore hole located at the main pumping plant area which is about 1,200 m south-west of the existing Railway Bridge along the Dudhkumar River Embankment.

The drilling percussion method with a 10.16 cm diametre casing pipe was used for the boring. The casing pipe was extended to about 20 m in depth and then bentonite - mud was used to protect the bore hole from caving in.

The location of the bore hole is shown on the attached location map. (see Fig. Ⅲ-2)

(2) Standard Penetration Test (SPT)

The SPT was performed at specified intervals of 1.0 m and 1.5 m by driving standard split spoon samplers at 3.5 cm intervals with a 63.9 kg hammer dropping freely from an average height of 76 cm. The number of blows required to drive the sampler for every 15.2 cm of penetration cace past the initial depth of 45.6 cm were used as the measure of standard penetration resistance - N per 30.5 cm.

(3) Disturbed Soil Samples

The disturbed soil cores in the spoon of the split tube sampler from SPT were collected and preserved in polyethelene bags for laboratory tests.

(4) Ground Water Table (G.W.T)

The G.W.T was measured and recorded from the existing ground level 24 hours after finishing the drilling work.

2-2. Laboratory Test

The following laboratory tests were performed on the disturbed soil samples collected from the bore holes. The tests were performed in accordance with ASTM/ AASHTO standard methods and the test results were evaluated as per the accepted code and practice of applied soil mechanics and foundation engineering.

Name of Test	Number of Tests Performed
- Moisture Content	7
- Mechanical Analysis by Sieve	10
- Mechanical Analysis by Sedimentation	10
- Wet and Dry Density	7
- Index Test (WI & Wp)	1
- Direct Shear Test	2
- Triaxial Shear Test (Qc)	5

These results were summarized as shown in Fig. Ⅲ-3, Ⅲ-4 and TableⅢ-3.

2-3. Soil Mechanical Analysis

(1) Mechanical Analysis Test

Effective Grain Size = D_{10} (mm)

Co-Efficient of Uniformity : $Cu = D_{60} / D_{10}$

Co-Efficient of Curvature : $Cz = \dfrac{(D_{30})^2}{D_{10} \cdot D_{60}}$

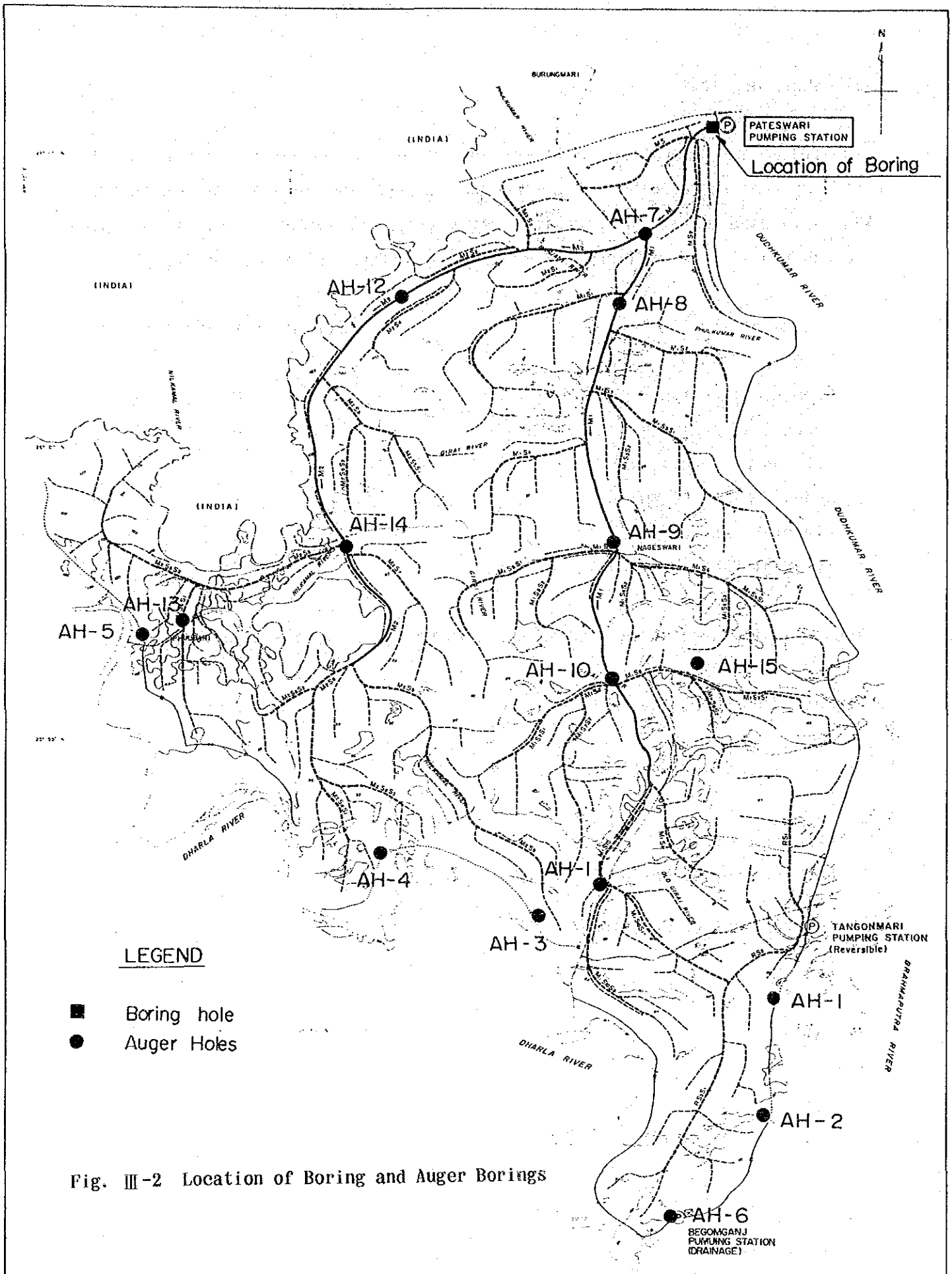
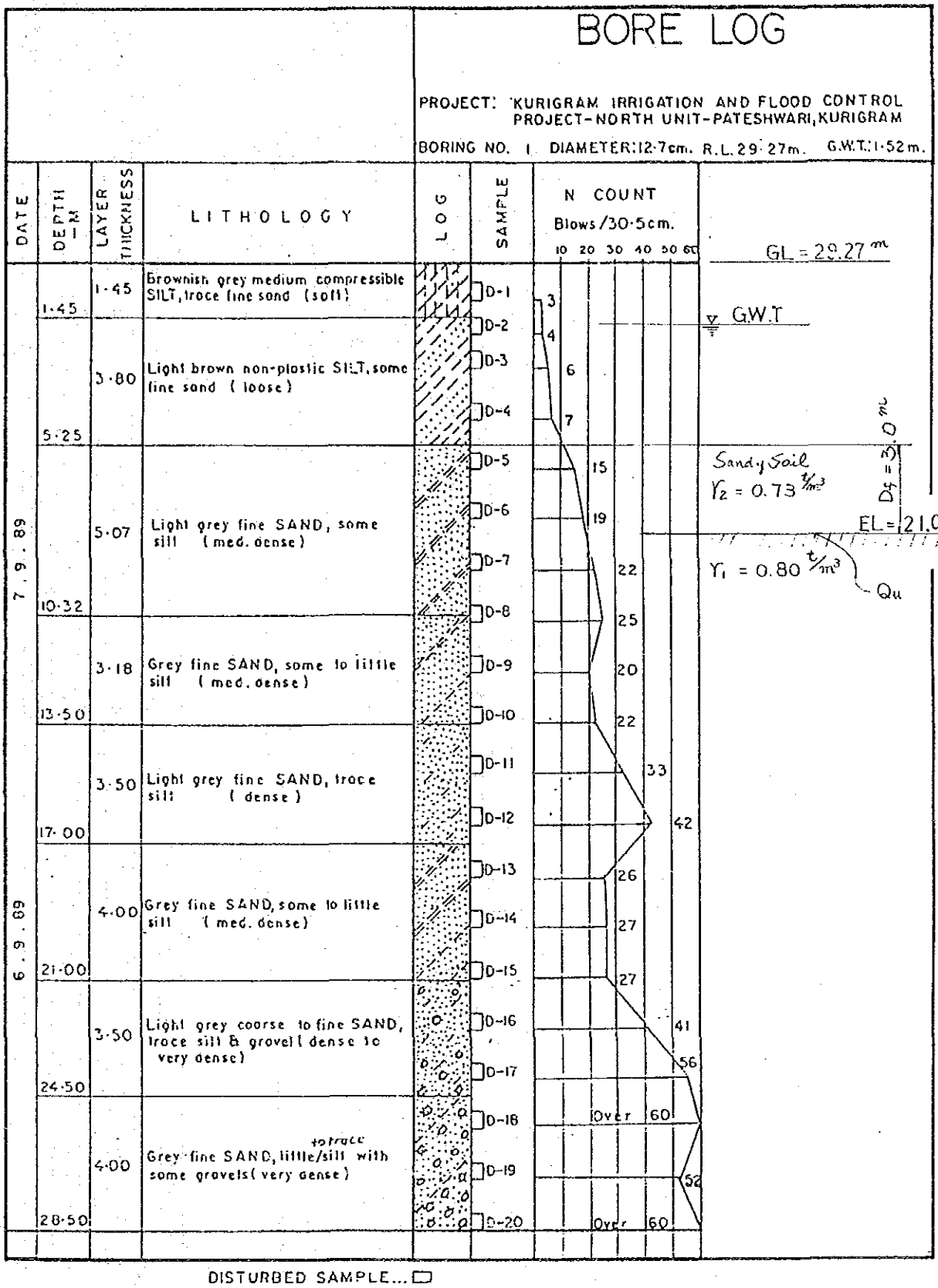


Fig. Ⅲ-2 Location of Boring and Auger Borings

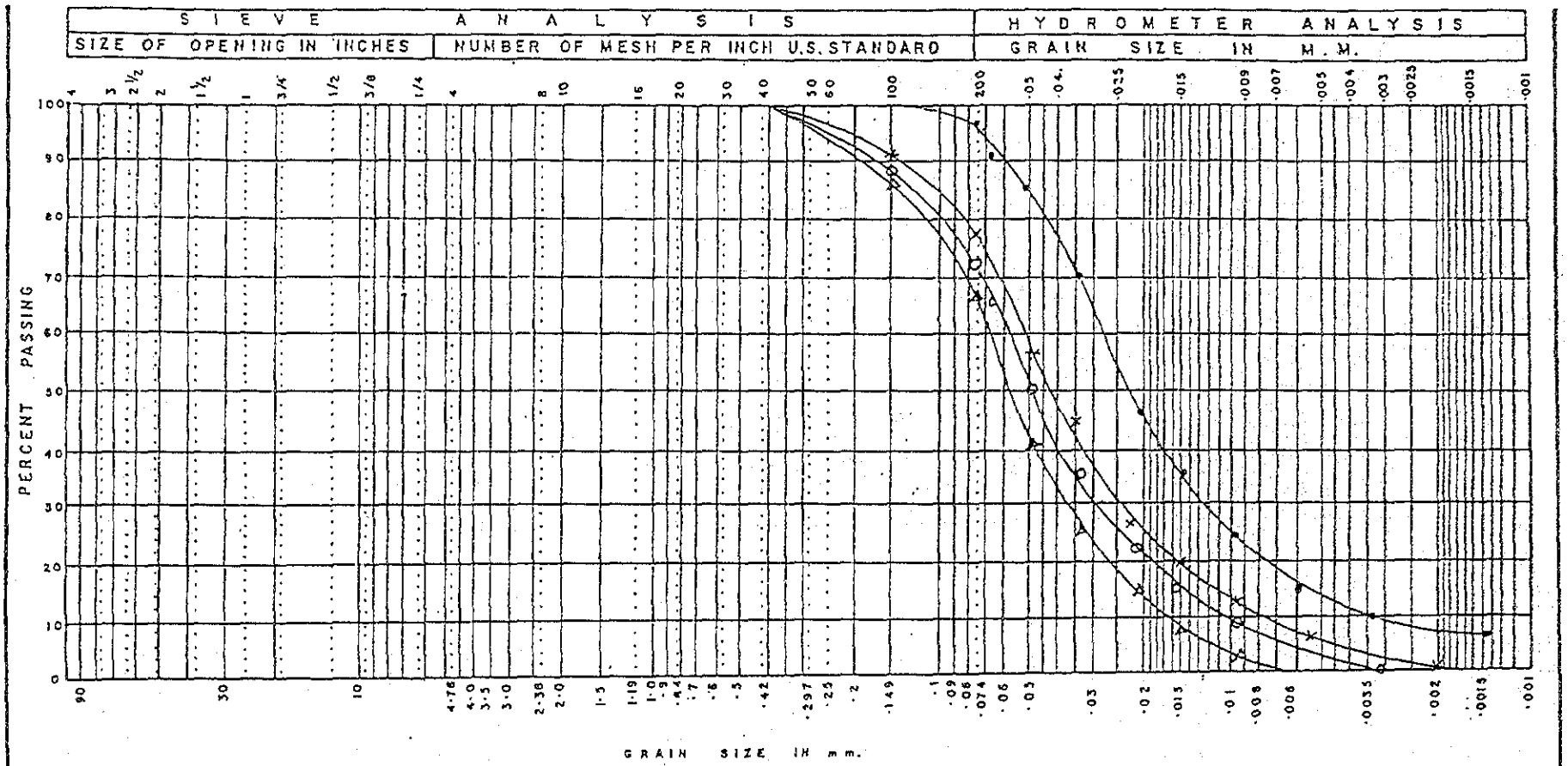
Fig. Ⅲ-3 Bore Log



DISTURBED SAMPLE... □

Fig. Ⅲ-4 Particle Size Gradation (1/5)

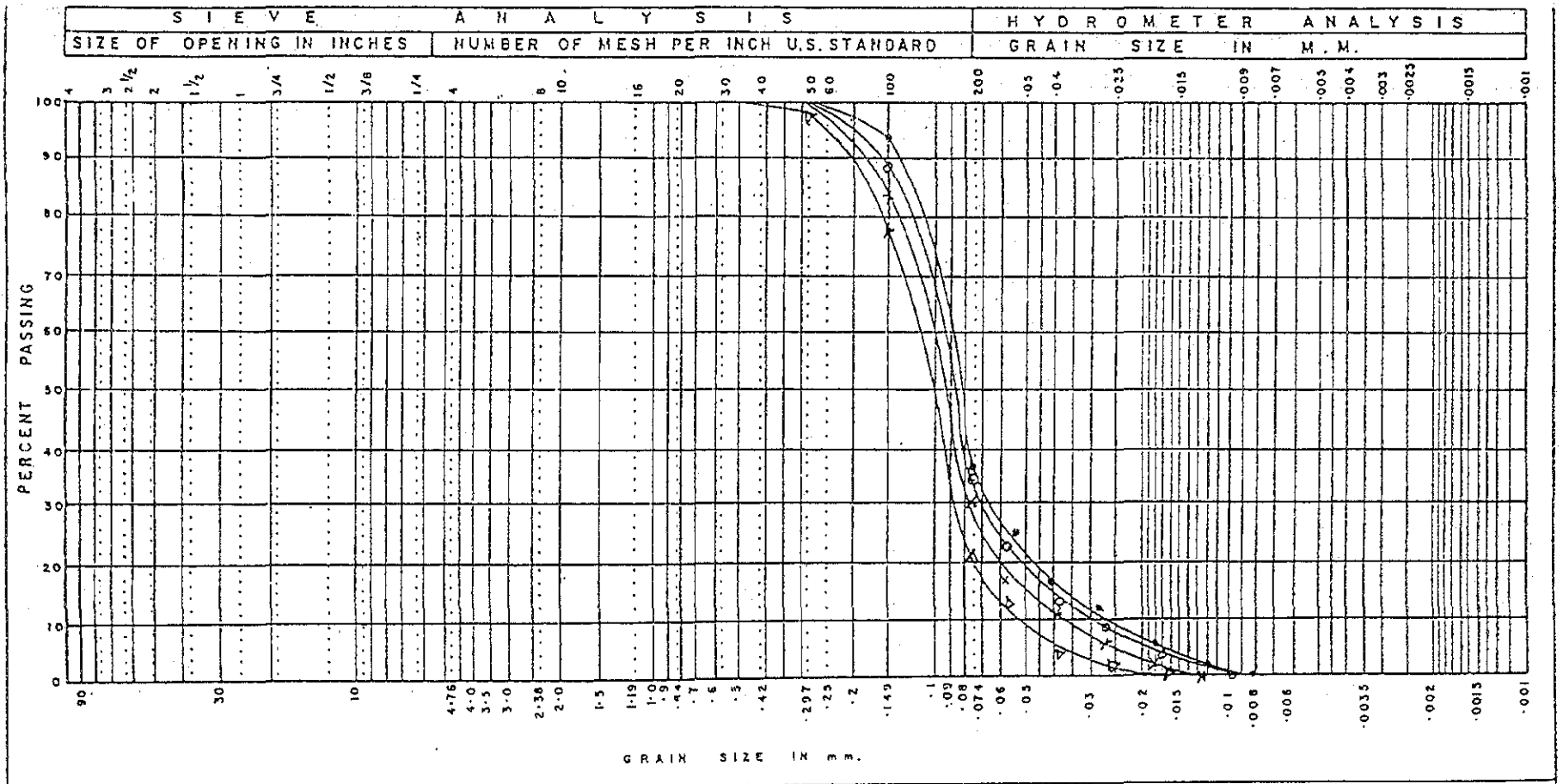
MATERIAL TESTING LABORATORY
PARTICLE SIZE GRADATION



LOCATION	BORING NO	SAMPLE NO	Depth—m From	To	SOIL CLASSIFICATION (UNIFIED SYSTEM)
Kurigram Irrigation and Flood	1	D-1	0.50	0.96	Medium compressible SILT, trace fine sand
Control Project - North Unit -		D-2	1.50	1.96	Non-plastic SILT, some fine sand
		D-3	2.50	2.96	Non-plastic SILT, some fine sand
		D-4	4.00	4.46	Non-plastic SILT, some fine sand

Fig. Ⅲ-4 Particle Size Gradation (2/5)

MATERIAL TESTING LABORATORY
PARTICLE SIZE GRADATION

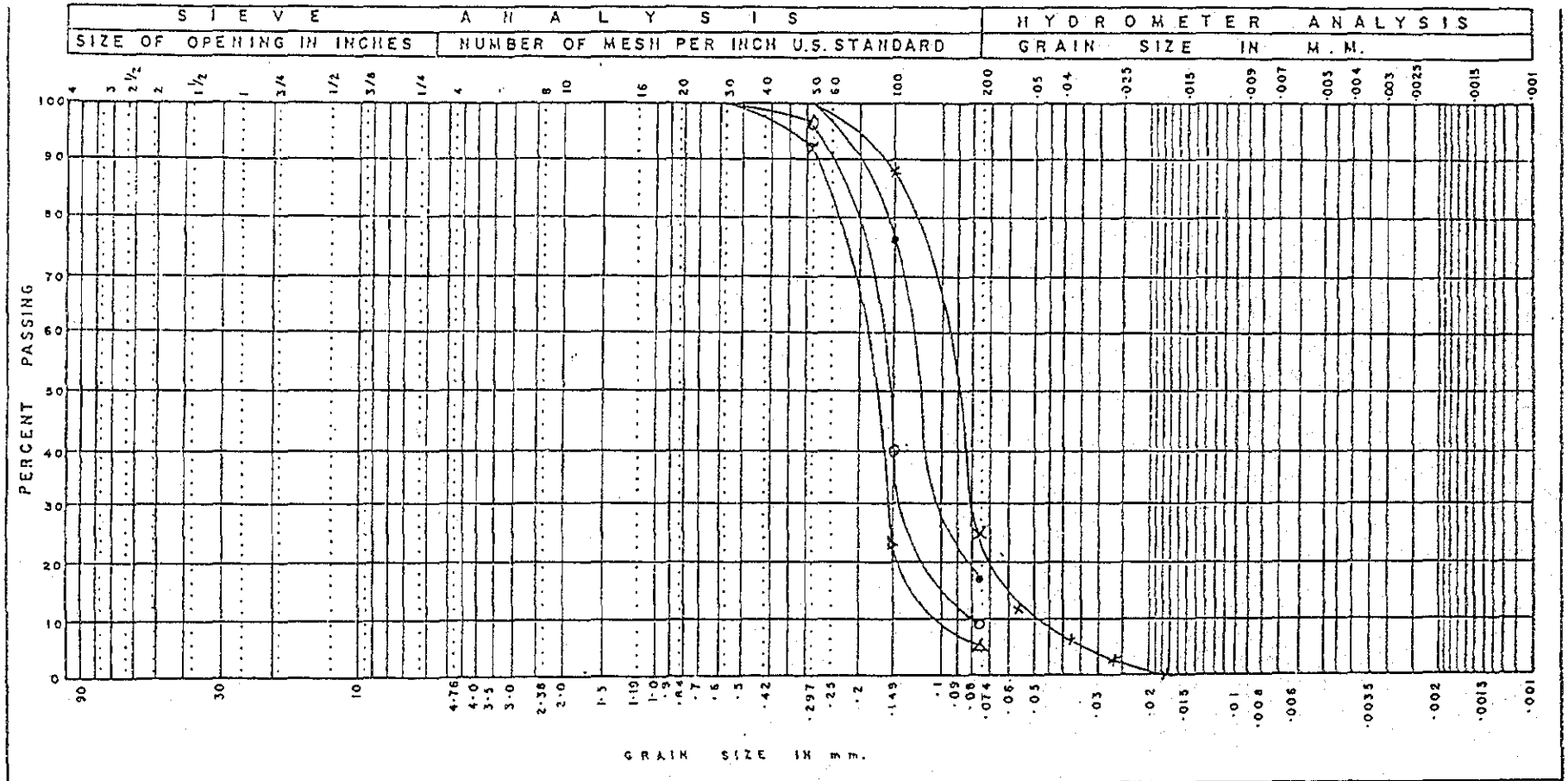


COBBLES	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES (SILT OR CLAY)

LOCATION	BORING NO	SAMPLE NO	Depth — m From	To	SOIL CLASSIFICATION (UNIFIED SYSTEM)	
Kurigram Irrigation and Flood	1	D-5	5.50	5.96	Fine SAND, some silt, trace mica	○—○—○
Control Project - North Unit -		D-6	7.00	7.46	Fine SAND, some silt, trace mica	×—×—×
		D-7	8.50	8.96	Fine SAND, some silt, trace mica	⊖—⊖—⊖
		D-8	10.00	10.46	Fine SAND, some silt, trace mica	△—△—△

Fig. Ⅲ-4 Particle Size Gradation (3/5)

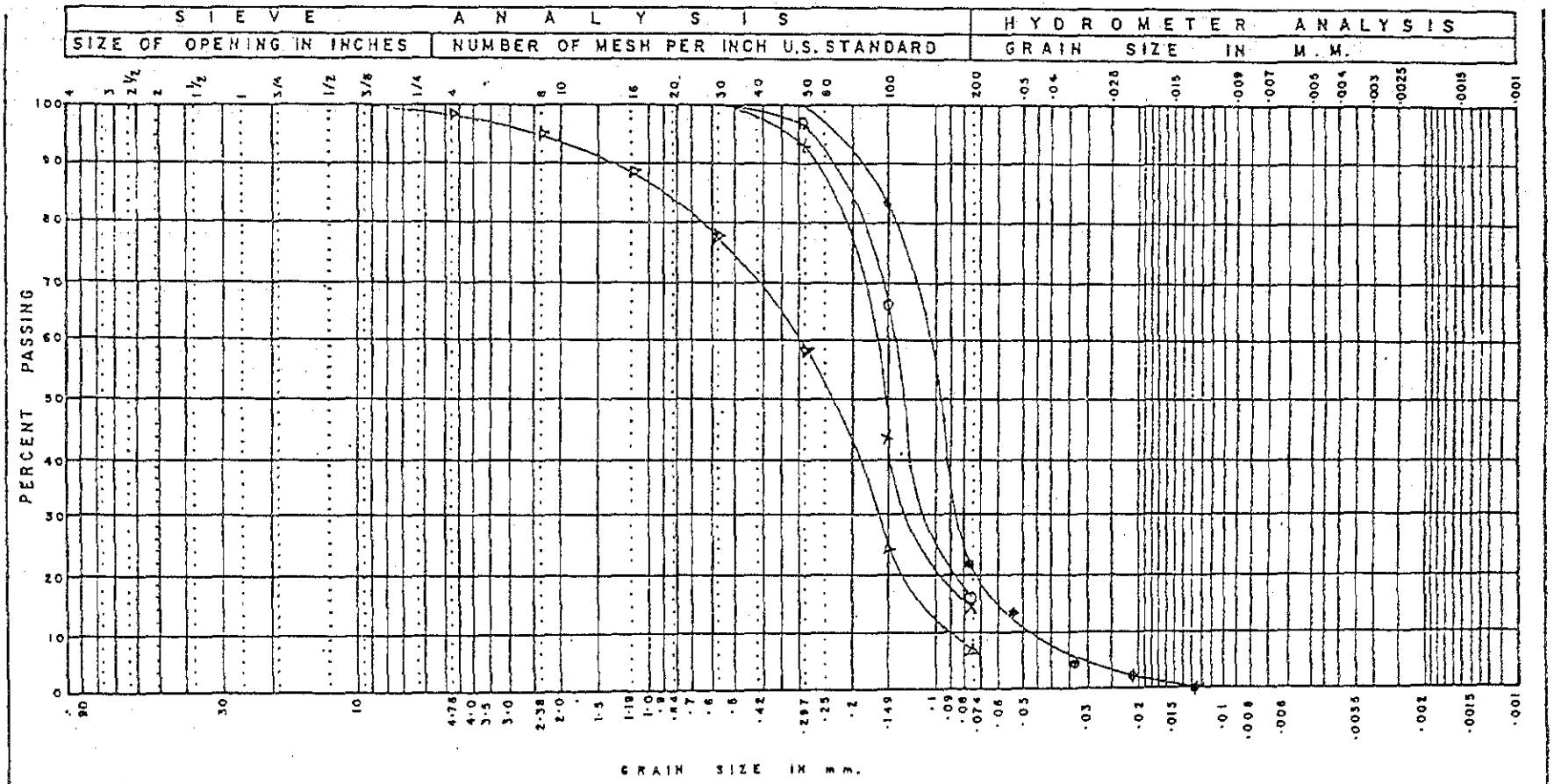
MATERIAL TESTING LABORATORY
PARTICLE SIZE GRADATION



LOCATION	BORING NO	SAMPLE NO	Depth—m From	To	SOIL CLASSIFICATION (UNIFIED SYSTEM)
Kurigram Irrigation and Flood	1	D-9	11.50	11.96	Fine SAND, little silt, trace mica
Control Project - North Unit -		D-10	13.00	13.46	Fine SAND, some silt, trace mica
		D-11	14.50	14.96	Fine SAND, trace silt, trace mica
		D-12	16.00	16.46	Fine SAND, trace silt, trace mica

Fig. Ⅲ-4 Particle Size Gradation (4/5)

MATERIAL TESTING LABORATORY
PARTICLE SIZE GRADATION

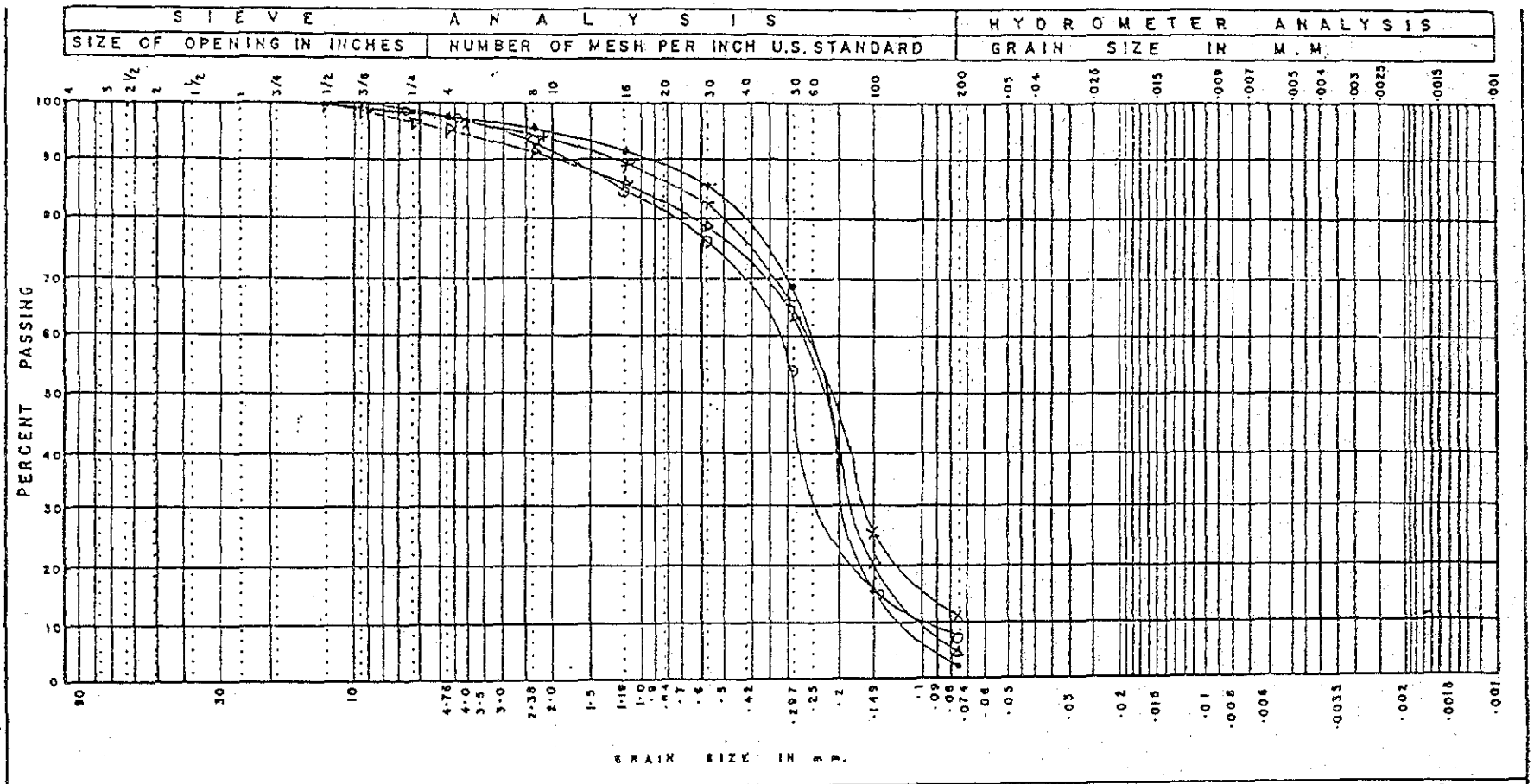


COBBLES	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES (SILT OR CLAY)

LOCATION	BORING NO	SAMPLE NO	Depth—m From	To	SOIL CLASSIFCATION (UNIFIED SYSTEM)	
Kurigram Irrigation and Flood	1	D-13	17.50	17.96	Fine SAND, some silt, trace mica	●—●—●
Control Project - Nort Unit -		D-14	19.0	19.46	Fine SAND, little silt, trace mica	×—×—×
		D-15	20.5	20.96	Fine SAND, little silt, trace mica	○—○—○
		D-16	22.0	22.46	Coarse through med. to fine SAND, trace silt	△—△—△

Fig. Ⅲ-4 Particle Size Gradation (5/5)

MATERIAL TESTING LABORATORY
PARTICLE SIZE GRADATION



LOCATION	BORING NO	SAMPLE NO	Depth—m From	To	SOIL CLASSIFICATION (UNIFIED SYSTEM)
Kurigram Irrigation and Flood	1	D-17	23.5	23.96	Medium to fine SAND, trace silt & gravel
Control Project - North Unit -		D-18	25.0	25.46	Fine SAND, little silt, some gravel
		D-19	26.5	26.96	Fine SAND, trace silt, some gravel
		D-20	28.0	28.46	Fine SAND, trace silt, some gravel

Table Ⅲ-3 Summary of Laboratory Test Results (1/3)

SUMMARY OF
LABORATORY TEST RESULTS Kurigram Irrigation & Flood Control Project

Borehole No.										
Sample No.		D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8	D-9
Depth- metre		0.50 to 0.96	1.50 to 1.96	2.50 to 2.96	4.00 to 4.46	5.50 to 5.96	7.00 to 7.46	8.50 to 8.96	10.00 to 10.46	11.50 to 11.96
Natural moisture content (%)				26.1				24.3		23.5
Specific gravity										
Atterberg limits	Liquid limit, W_L (%)	39								
	Plasticity index, Ip (%)	13								
Density	Wet (gm/cc)			1.734				1.926		1.944
	Dry (gm/cc)			1.375				1.550		1.574
Grain size analysis	Gravel (%)									
	Sand (%)	3	22	27	33	63	70	65	79	83
	Silt or Clay % (Fines)	97	78	73	67	37	30	35	21	17
Consolidation tests	Natural void ratio, e_o									
	Compression index, C_c									
Unconfined Compression tests	Strain at failure (%)									
	Stress undist. ( )									
	Stress remould ( )									
	Sensitivity									
Triaxial shear tests	ø (degree)			16				29.5		31
	C (kg/cm²)			0.07				0.10		0.06

Table Ⅲ-3 Summary of Laboratory Test Results (2/3)

SUMMARY OF
LABORATORY TEST RESULTS

Kurigram Irrigation & Flood Control Project

Borehole No.										
Sample No.		D-10	D-11	D-12	D-13	D-14	D-15	D-16	D-17	D-18
Depth- Metre		13.00 to 13.46	14.50 to 14.96	16.00 to 16.46	17.50 to 17.96	19.00 to 19.46	20.50 to 20.96	22.0 to 22.46	23.50 to 23.96	25.00 to 25.46
Natural moisture content (%)				20.3			21.3		19.4	
Specific gravity										
Alterberg limits	Liquid limit, W, (%)									
	Plasticity Index, Ip (%)									
Density	Wet (gm/cc)			1.919			1.910		1.914	
	Dry (gm/cc)			1.595			1.575		1.603	
Grain size analysis	Gravel (%)									
	Sand (%)	74	91	95	78	86	84	93	97	89
	Silt or Clay % (Fines)	26	9	5	22	14	16	7	3	11
Consolidation tests	Natural void ratio, e_o									
	Compression index, C_c									
Unconfined Compression tests	Strain at failure (%)									
	Stress undist. ( )									
	Stress remould( )									
	Sensitivity									
Triaxial shear tests	∅ (degree)			34			32.5			
	C (kg/cm2)			0			0.04			
Direct shear tests	∅ (degree)								33.5	
	C (kg/cm2)								0	

Table Ⅲ-3 Summary of Laboratory Test Results (3/3)

SUMMARY OF
LABORATORY TEST RESULTS

Hurigram Irrigation & Flood Control Project

Borehole No.										
Sample No.		D-19	D-20							
Depth- Metre		26.50 to 26.96	28.00 to 28.46							
Natural moisture content (%)			21.5							
Specific gravity										
Atterberg limits	Liquid limit, W_L (%)									
	Plasticity Index, Ip (%)									
Density	Wet (gm/cc)		1.931							
	Dry (gm/cc)		1.589							
Grain size analysis	Gravel (%)									
	Sand (%)	93	95							
	Silt or Clay % (Fines)	7	5							
Consolidation tests	Natural void ratio, e_o									
	Compression index, C_c									
Unconfined Compression tests	Strain at failure (%)									
	Stress undist. ( )									
	Stress remould( )									
	Sensitivity									
Triaxial shear tests	Ø (degree)									
	C (kg/cm^2)									
Direct shear tests	Ø (degree)		34							
	C (kg/cm^2)		0.02							

Sample No.	Depth - Meter From	To	D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	Cu	Cz
D - 1	0.5	0.96	0.0035	0.0125	0.0255	7.3	1.8
D - 2	1.5	1.96	0.008	0.0235	0.053	6.6	1.3
D - 3	2.5	2.96	0.010	0.0275	0.060	6.0	1.3
D - 4	4.0	4.46	0.017	0.0370	0.069	4.1	1.2
D - 5	5.5	5.96	0.027	0.068	0.089	3.3	1.9
D - 6	7.0	7.46	0.0375	0.078	0.100	2.7	1.6
D - 7	8.5	9.96	0.030	0.070	0.094	3.1	1.7
D - 8	10.0	10.46	0.052	0.089	0.1147	2.2	1.3
D - 10	13.0	13.46	0.050	0.080	0.095	1.9	1.3
D - 11	14.5	14.96	0.080	0.1441	0.1643	2.1	1.6
D - 12	16.0	16.46	0.1098	0.1592	0.1898	1.7	1.2
D - 13	17.5	17.96	0.0475	0.0875	0.1049	2.2	1.5
D - 16	22.0	22.46	0.0900	0.1643	0.297	3.3	1.0
D - 17	23.5	23.96	0.1245	0.200	0.250	2.0	1.3
D - 19	26.5	26.96	0.100	0.250	0.3278	3.3	1.9
D - 20	28.0	28.46	0.1049	0.1898	0.250	2.4	1.4

(2) Main Pump Station Foundation Analysis

a) Bearing Capacity of Soil

Formula used for computation :

$$Qu = 1/3 \cdot (\alpha \cdot C \cdot Nc + \beta \cdot \gamma_1 \cdot B \cdot Nr + \gamma_2 \cdot Df \cdot Ng)$$

where;

Qu :Allowable bearing capacity of soil (ton / m^2)

C :Ground cohesion below the foundation's load surface (ton / m^2)

γ_1:Unit weight of ground below the foundation's load surface (use submerged weight for soil below the water table) (ton / m^3)

γ_2:Average unit weight of ground above the foundation's load surface (use submerged weight for soil below the water table)

(ton / m^3)

α, β :Shape factor (refer to TableⅢ-4)

Nc,Nr,Ng :Bearing capacity factor (refer to Table Ⅲ-5 and Fig. Ⅲ-5)

Df :Depth of the deepest ground surface adjacent to the foundation's load surface (m)

B :Minimum width of the foundation's load surface (m)
In case of a circular shape, use diameter.

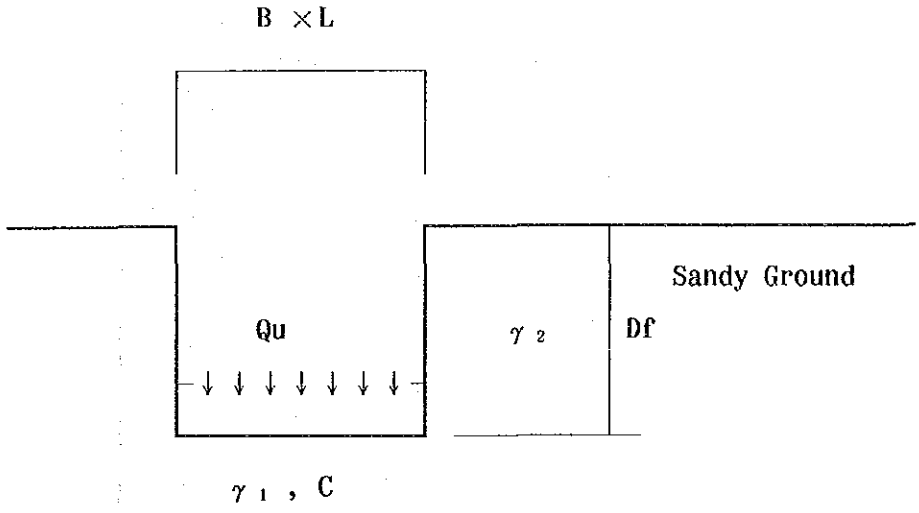


Table Ⅲ-4 Shape Factor

Shape of the Foundation Plate	Continuos	Square	Rectangle	Circular
α	1.0	1.3	1.0 + B/L	1.3
β	0.5	0.4	0.5 − B/L	0.3

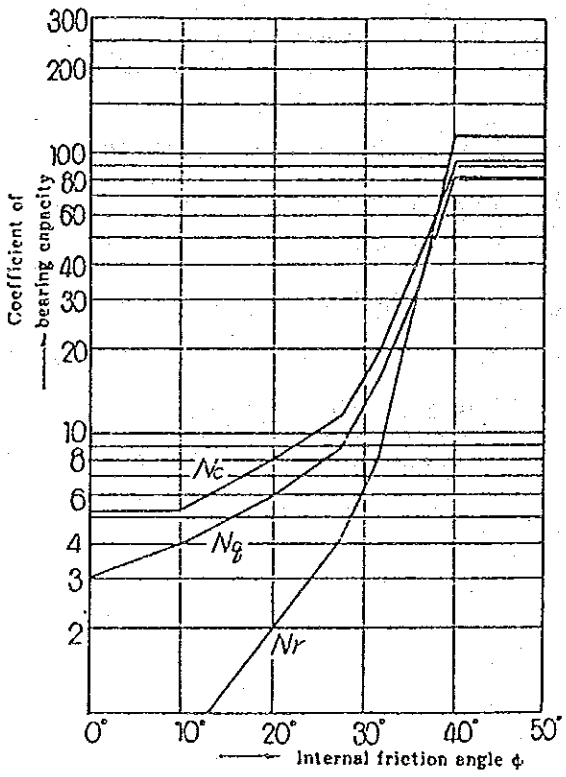
※ B : Length of the short side of the rectangle (m)
L : Length of the long side of the rectangle (m)

The value of cohesion C and the angle of internal friction should be determined by a direct shear test or by a triaxial compression test. However, as it is difficult to take undisturbed samples from sandy ground, the value of the angle of internal friction is assumed from the results of the standard penetration test, and cohesion is assumed as C = 0.

Table Ⅲ-5 Bearing Capacity Factor

ϕ	Nc	Nr	Ng
0°	5.3	0	3.0
5°	5.3	0	3.4
10°	5.3	0	3.9
15°	6.5	1.2	4.7
20°	7.9	2.0	5.9
25°	9.9	3.3	7.6
28°	11.4	4.4	9.1
32°	20.9	10.6	16.1
36°	42.2	30.5	33.6
over40°	95.7	114.0	83.2

Fig. Ⅲ-5 The Relationship between the Internal Friction Angle and the Bearing Capacity Coefficient



$Qu = 1/3\ (\alpha \cdot C \cdot Nc + \beta \cdot \gamma_1 \cdot B \cdot Nr + \gamma_2 \cdot Df \cdot Ng)$

where;

$\phi = (16 + 29.5) / 2 = 23°$

$C = 0$

$\alpha = 1.0 + 0.3 \cdot B/L = 1.2$

$\beta = 0.5 - 0.1 \cdot B/L = 0.4$

$\gamma_1 = 1.80 - ※ 1.00 = 0.80\ t/m^3$

$\gamma_2 = 1.73 - ※ 1.00 = 0.73\ t/m^3$

※ : unit weight of water.

Nc = 10 (refer to Fig -Ⅲ-5)

Nr = 3 (-do-)

Ng = 7 (-do-)

Df = 3 m

B = 26 m

$Qu = 13.42 \Rightarrow 13\ ton / m^2$

The bearing capacity of a foundation should be checked by using the plate bearing test during the construction period.

When the outline of the ground's condition is known and a soil investigation study is not carried out, the normal bearing capacity table shown in Table Ⅲ-6 can be referred to for the empirical estimation of the long term unit bearing capacity of that ground.

Table Ⅲ-6 Long-Term Allowable Bearing Capacity

Condition of the foundation plate	Long-term allowable bearing capacity (t/m^2)	Remarks	
		N value	Qu (t/m^2)
Bedrock	100	100 or more	
Cemented sand	50	50 or more	
Mudstone	30	30 or more	
Gravel , dense	60		
non-dense	30		
Sand, dense	30	30 - 50	
medium	20	30 - 40	
loose	10	10 - 20	
very loose	5	5 - 10	
	0	less than 5	
Clay, very hard	20	15 - 30	25 more
hard	10	8 - 30	10 - 25
medium	5	4 - 8	5 - 10
soft	2	2 - 4	2.5- 5
very soft	0	0 - 2	< 2.5

It is possible for a short-term allowable bearing capacity to be applied at double the value of a long-term one. (example : temporary work)

b) Pile Foundation

The following analysis shows the allowable bearing capacity of the foundation piles at the Pateswari main pump station.

The results from the allowable bearing capacity of assumptive concrete piles dia. 300 mm, 350 mm and 400 mm are as follows;

- dia. 300 mm ⇨ Ra = 30 ton (refer to Table Ⅲ-7)
- dia. 350 mm ⇨ Ra = 36 ton (- do -)
- dia. 400 mm ⇨ Ra = 44 ton (- do -)

Allowable bearing capacity (Ra);

$Ra = 1/n \cdot Ru$

$Ru = qd \cdot A + U \sum li \cdot fi$

where ;

Ra : Allowable bearing capacity (ton)

Ru : Ultimate bearing capacity of a pile (ton)

qd : Ultimate bearing strength at the top of the pile (t/m^2)

$qd = N\ (4 \cdot h/D + 10)$

A : Area of pile tip (m^2)

U : Circumference of a pile (m)

li : Length of skin friction (m)

fi : Skin friction strength (t/m^2)

n : Safety factor n = 3

Table Ⅲ-7 Computation of Allowable Bearing Capacity (Ra)

	φ 300	φ 350	φ 400	Remarks
Pile Length : L (m)	16.0	16.0	16.0	
A (m2)	0.071	0.096	0.126	
U (m2)	0.94	1.10	1.26	
N-value at pile to top:N	50	50	50	
Design N-value : N'	40	40	40	
Depth ratio : h/D	5.0	4.3	3.75	
qd/N'	30	27	25	
qd (t/m2)	1,200	1,080	1,000	
qd・A (t) ※ -1	85.2	103.7	126.0	
Σli・fi (t/m)	5.5	5.5	5.5	
U Σli・fi (t) ※ -2	5.2	6.1	6.9	
Ru =※ -1 + ※ -2	90.4	109.8	132.9	
Ra = 1/3・Ru (t)	30	36	44	

Fig. Ⅲ-6 Calculation Degree of Ultimate Bearing Capacity(qd) at the Pile

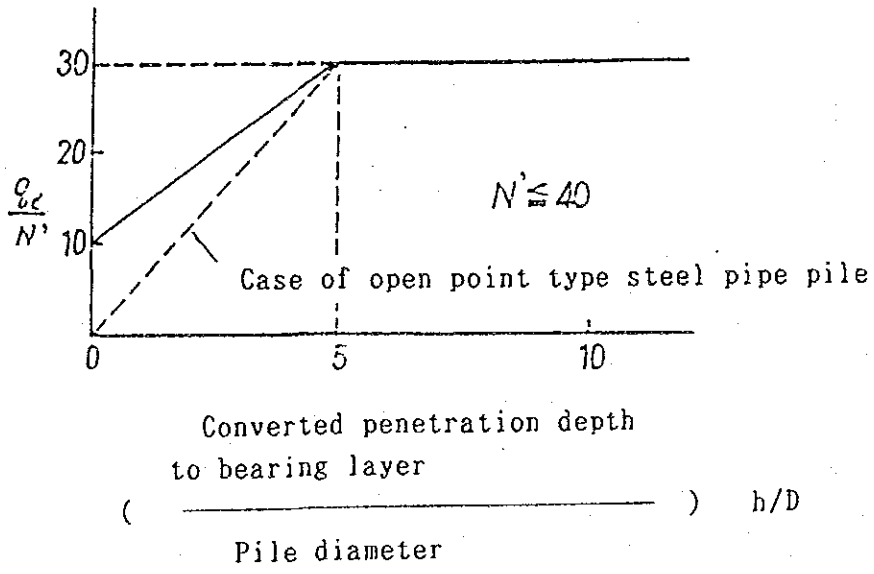


Fig. Ⅲ-6 is applicable in the case where the ground at the pile's tip is gravel, sand or clay type ground, but not in the case of rock, soft rock, etc. Also, the average N - value of 40 at the pile's tip is treated as its maximum limit.

2-4. Auger Boring

The scope of the work comprises the collection of soil samples, recording of ground water table, stratification of the soil's profile by auger boring and laboratory testing of soil samples.

The field work included the drilling of 15 auger holes 3 m to 5 m deep. Auger boring was performed with 4" dia augers down to a paximum depth of 5 meters below the existing ground level. In most of the holes ground water was met between 3 m and 4 m in depth when further boring was not possible due to the presence of water in the bore hole. (not available soil sampling)

The location of auger boring is shown on the attached location map.(see Fig. Ⅲ-2)

(1) Disturbed Soil Samples (D)

Disturbed soil samples were collected from the auger blades at one meter intervals and also at every change in strata. The samples were preserved in water polyethelene bags.

(2) Ground Water Table (G.W.T)

The G.W.T was measured and recorded from the existing ground level after the completion auger boring.

(3) Laboratory Test

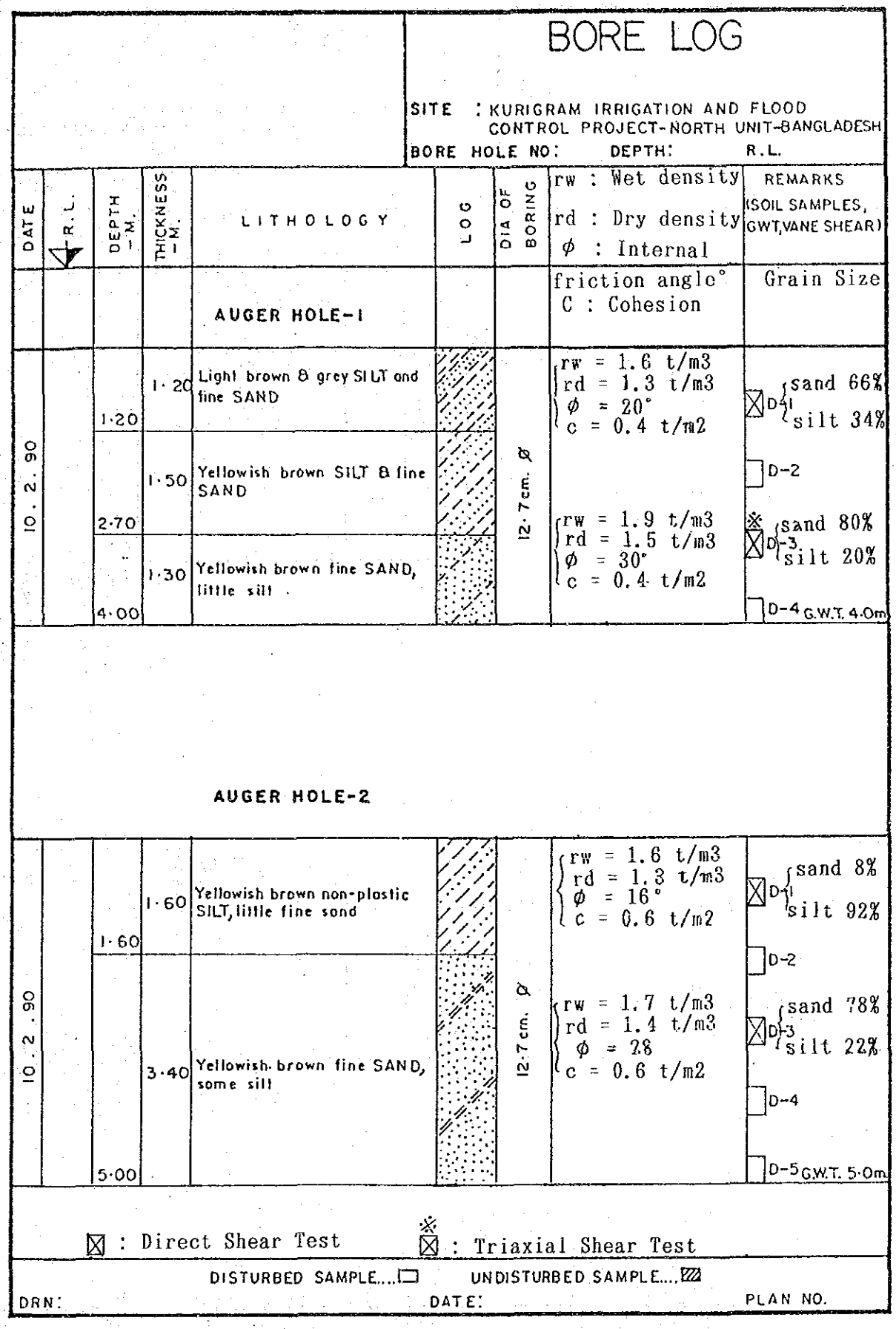
The following laboratory tests have been performed on the disturbed soil samples collected from the bore holes. The tests were performed in accordance

with ASTM/ AASHTO standard methods and the test results evaluated as per the accepted code and practice of applied soil mechanics and foundation engineering.

Type of Test	Number of Test Performed
Moisture Content	30
Mechanical Analysis by Sieve	9
Mechanical Analysis by Sedimentation	21
Wet and Dry Density	30
Index Test (Wl & Wp)	10
Direct Shear Test	26
Triaxial Shear Test (Qc)	4

These results were summarized as shown in Fig. Ⅲ-7, Ⅲ-8 and TableⅢ-8.

Fig. Ⅲ-7 Auger Bore Log (1/8)



BORE LOG

SITE : KURIGRAM IRRIGATION AND FLOOD CONTROL PROJECT-NORTH UNIT-BANGLADESH

BORE HOLE NO: DEPTH: R.L.

DATE	R.L.	DEPTH - M.	THICKNESS - M.	LITHOLOGY	LOG	DIA OF BORING	rw : Wet density rd : Dry density φ : Internal friction angle° C : Cohesion	REMARKS (SOIL SAMPLES, GWT, VANE SHEAR) Grain Size
				AUGER HOLE-1				
10.2.90		1.20	1.20	Light brown & grey SILT and fine SAND		12.7cm. φ	rw = 1.6 t/m3 rd = 1.3 t/m3 φ = 20° c = 0.4 t/m2	☒ D-1 sand 66% silt 34%
		2.70	1.50	Yellowish brown SILT & fine SAND				D-2
		4.00	1.30	Yellowish brown fine SAND, little silt			rw = 1.9 t/m3 rd = 1.5 t/m3 φ = 30° c = 0.4 t/m2	※☒ D-3 sand 80% silt 20% D-4 G.W.T. 4.0m
				AUGER HOLE-2				
10.2.90		1.60	1.60	Yellowish brown non-plastic SILT, little fine sand		12.7cm. φ	rw = 1.6 t/m3 rd = 1.3 t/m3 φ = 16° c = 0.6 t/m2	☒ D-1 sand 8% silt 92%
		5.00	3.40	Yellowish brown fine SAND, some silt			rw = 1.7 t/m3 rd = 1.4 t/m3 φ = 28 c = 0.6 t/m2	D-2 ※☒ D-3 sand 78% silt 22% D-4 D-5 G.W.T. 5.0m

☒ : Direct Shear Test ※☒ : Triaxial Shear Test

DISTURBED SAMPLE.... UNDISTURBED SAMPLE....

DRN: DATE: PLAN NO.

Fig. Ⅲ-7 Auger Bore Log (2/8)

BORE LOG

SITE : KURIGRAM IRRIGATION AND FLOOD CONTROL PROJECT - NORTH UNIT - BANGLADESH

DATE	R.L.	DEPTH - M.	THICKNESS - M.	LITHOLOGY	LOG	DIA OF BORING	rw : Wet density rd : Dry density ϕ : Internal friction angle° C : Cohesion	REMARKS (SOIL SAMPLES, GWT, VANE SHEAR) Grain Size
				AUGER HOLE-3				
14.2.90		0.45	0.45	Light brown medium compressible SILT, trace fine sand		12.7cm. ϕ	rw = 1.7 t/m3 rd = 1.4 t/m3 ϕ = 28 c = 0.3 t/m2	☒ D-1 W = 23.3% Wl = 38% Wp = 9% D-2 D-3 G.W.T. 3.0m. sand 39% silt 61%
		1.35	0.90	Light grey fine SAND, trace silt				
		3.00	1.65	Grey non-plastic SILT and fine SAND			rw = 1.6 t/m3 rd = 1.3 t/m3 ϕ = 19° c = 0.4 t/m2	W = 24.3% Wl = 35% Wp = 7%
				AUGER HOLE-4				
15.2.90		1.60	1.60	Light brown fine SAND & SILT		12.7cm. ϕ	rw = 1.7 t/m3 rd = 1.4 t/m3 ϕ = 28.5° c = 0.5 t/m2	☒ D-1 sand 61% silt 39% D-2
		2.95	1.35	Light brown & grey medium compressible SILT				
		3.00	0.05	Grey FINE SAND, little silt			rw = 1.7 t/m3 rd = 1.4 t/m3 ϕ = 29° c = 0.3 t/m2	☒ D-3 G.W.T. 3.0m. sand 80% silt 20%

W : Natural moisture content (%)
Wl : Luquid limit (%)
Wp : Plasticity index (%)
☒ : Direct Shear Test
※ ☒ : Triaxial Shear Test

DISTURBED SAMPLE.... □ UNDISTURBED SAMPLE.... ▨

DRN: DATE: PLAN NO.

Fig. Ⅲ-7 Auger Bore Log (3/8)

BORE LOG

SITE : KURIGRAM IRRIGATION AND FLOOD CONTROL PROJECT-NORTH UNIT-BANGLADESH

DATE	R.L.	DEPTH -M.	THICKNESS -M.	LITHOLOGY	LOG	DIA OF BORING		REMARKS (SOIL SAMPLES, GWT, VANE SHEAR)
				AUGER HOLE-5				
12.2.90		1.95	1.95	Light brown medium compressible SILT, trace sand		12.7cm. ø	rw = 1.6 t/m3 rd = 1.3 t/m3 ø = 9° c = 1.0 t/m2	D-1 sand 9%, silt 91% D-2 W = 25.2%, Wl = 36%, Wp = 8%
		3.0	1.05	Light brown fine SAND & SILT			rw = 1.8 t/m3 rd = 1.4 t/m3 ø = 27.5° c = 0.6 t/m2	D-3 sand 63%, silt 37%
		3.45	0.45	Light brown medium compressible SILT, trace sand				
		4.00	0.55	Grey fine SAND, some silt				D-4 G.W.T. 4.0m.
								※ W = 24.5%, Wl = 39%, Wp = 11%
				AUGER HOLE-6				
10.2.90		1.75	1.75	Light grey fine SAND, little silt		12.7 cm. ø	rw = 1.9 t/m3 rd = 1.6 t/m3 ø = 31.5 c = 0.4 t/m2	※ D-1 sand 88%, silt 12%
		3.00	1.25	Light brown fine SAND, some silt			rw = 1.7 t/m3 rd = 1.4 t/m3 ø = 28° c = 0.5 t/m2	D-2 D-3 G.W.T. 3.0m. sand 79%, silt 21%

DISTURBED SAMPLE....□ UNDISTURBED SAMPLE....▨

DRN: DATE: PLAN NO.

Fig. Ⅲ-7 Auger Bore Log (4/8)

BORE LOG

SITE : KURIGRAM IRRIGATION AND FLOOD CONTROL PROJECT- NORTH UNIT-BANGLADESH

DATE	R.L.	DEPTH - M.	THICKNESS - M.	LITHOLOGY	LOG	DIA OF BORING		REMARKS (SOIL SAMPLES, GWT, VANE SHEAR)
				AUGER HOLE-7				
13.2.90		2.95	2.95	Light brown fine SAND & SILT		12.7 cm. ø	rw = 1.7 t/m3 rd = 1.4 t/m3 ø = 21° c = 0.4 t/m2	D-1 sand 74% silt 26% D-2
		4.00	1.05	Grey medium compressible SILT, trace sand			rw = 1.6 t/m3 rd = 1.3 t/m3 ø = 8° c = 1.1 t/m2	D-3 sand 7% silt 93% D-4 G.W.T. 4.0m. W = 25.6% Wl = 41% Wp = 13%
				AUGER HOLE-8				
13.2.90		1.60	1.60	Light brown fine SAND & SILT		12.7 cm. ø	rw = 1.6 t/m3 rd = 1.3 t/m3 ø = 25° c = 0.6 t/m2	D-1 sand 54% silt 46% D-2
		2.20	0.60	Light brown SILT, some fine sand				
		4.00	1.80	Light brown fine SAND, little silt			rw = 1.7 t/m3 rd = 1.4 t/m3 ø = 29.5° c = 0.4 t/m2	D-3 sand 89% silt 11% D-4 G.W.T. 4.0m.

DISTURBED SAMPLE....□ UNDISTURBED SAMPLE....▨

DRN: DATE: PLAN NO.

Fig. Ⅲ-7 Auger Bore Log (5/8)

BORE LOG

SITE : KURIGRAM IRRIGATION AND FLOOD CONTROL PROJECT -NORTH UNIT- BANGLADESH

DATE	R.L.	DEPTH - M.	THICKNESS - M.	LITHOLOGY	LOG	DIA OF BORING		REMARKS (SOIL SAMPLES, GWT, VANE SHEAR)
				AUGER HOLE-9				
12.2.90			2·60	Light brown fine SAND, little silt		12·7 cm. ø	rw = 1.7 t/m3 rd = 1.4 t/m3 ø = 28° c = 0.4 t/m2	D-1 sand 86% silt 14% D-2
		2·60	0·90	Light brown fine SAND & SILT			rw = 1.7 t/m3 rd = 1.3 t/m3 ø = 20.5° c = 0.5 t/m2	D-3 sand 53% silt 47%
		3·50	0·50	Grey SILT, trace fine sand				D-4 G.W.T. 4.0m
		4.00						
				AUGER HOLE-10				
14.2.90		0 0·60	0·60	Light brown medium compressible SILT		12·7 cm. ø	rw = 1.6 t/m3 rd = 1.3 t/m3 ø = 24° c = 0.4 t/m2	D-1 sand 58% silt 42% D-2 W = 24.2% Wl = 3[illegible]% Wp = 1[illegible]%
		1·60	1·00	Light brown fine SAND & SILT				
			2·40	Light brown fine SAND, some silt			rw = 1.6 t/m3 rd = 1.3 t/m3 ø = 28.5° c = 0.5 t/m2	D-3 sand 75% silt 25%
		4.00						D-4 G.W.T. 4.0m.

DISTURBED SAMPLE.... □ UNDISTURBED SAMPLE.... ▨

DRN: DATE: PLAN NO.

Fig. Ⅲ-7 Auger Bore Log (6/8)

BORE LOG

SITE : KURIGRAM IRRIGATION AND FLOOD CONTROL PROJECT--NORTH UNIT-BANGLADESH

DATE	R.L.	DEPTH - M.	THICKNESS - M.	LITHOLOGY	LOG	DIA OF BORING		REMARKS (SOIL SAMPLES, GWT, VANE SHEAR)
				AUGER HOLE-11				
14.2.90		0.60	0.60	Light brown compressible SILT, trace sand		12.7cm. ø	rw = 1.8 t/m3 rd = 1.4 t/m3 ø = 28° c = 0.2 t/m2	D-1 sand 64%, silt 36% D-2 W = 23.2%, Wl = 3[illegible]%, Wp = 1[illegible]%
		2.60	2.00	Light brown fine SAND some silt			rw = 1.7 t/m3 rd = 1.4 t/m3 ø = 29.5° c = 0.3 t/m2	D-3 sand 61%, silt 39%
		4.00	1.40	Brown fine SAND & SILT				D-4 G.W.T. 4.0m.
				AUGER HOLE-12				
11.2.90		1.15	1.15	Light brown medium compressible SILT, little fine sand		12.7 cm. ø	rw = 1.6 t/m3 rd = 1.3 t/m3 ø = 15° c = 0.7 t/m2	D-1 sand 11%, silt 89% D-2 W = 26.1%, Wl = 3[illegible]%, Wp = 7[illegible]%
		4.00	2.85	Light brown fine SAND, some silt			rw = 1.9 t/m3 rd = 1.6 t/m3 ø = 29.5° c = 0.7 t/m2	D-3 sand 71%, silt 29%
								D-4 G.W.T. 4.0m.

DISTURBED SAMPLE.... ☐ UNDISTURBED SAMPLE.... ▨

DRN: DATE: PLAN NO.

Fig. Ⅲ-7 Auger Bore Log (7/8)

BORE LOG

SITE : KURIGRAM IRRIGATION AND FLOOD CONTROL PROJECT-NORTH UNIT-BANGLADESH

DATE	R.L.	DEPTH - M.	THICKNESS - M.	LITHOLOGY	LOG	DIA OF BORING		REMARKS (SOIL SAMPLES, GWT, VANE SHEAR)
				AUGER HOLE-13				
12.2.90		1.05	1.05	Light brown SILT & fine SAND		12.7 cm. ø	rw = 1.8 t/m3 rd = 1.4 t/m3 ø = 22° c = 1.1 t/m2	※ D-1 sand 54%, silt 46%
		3.00	1.95	Light brown fine SAND, some silt				D-2
							rw = 1.7 t/m3 rd = 1.4 t/m3 ø = 29.5° c = 0.2 t/m2	D-3 G.W.T. 3.0m. sand 48%, silt 52%
				AUGER HOLE-14				
11.2.90		1.40	1.40	Light brown fine SAND, trace silt		12.7 cm. ø	rw = 1.7 t/m3 rd = 1.4 t/m3 ø = 28 c = 0.7 t/m2	D-1 sand 90%, silt 10%
		2.10	0.60	Light brown & grey medium compressible SILT, trace fine sand				D-2
		3.20	1.10	Brownish grey medium plastic CLAY, trace sand			rw = 2.0 t/m3 rd = 1.4 t/m3 ø = 6° c = 1.1 t/m2	D-3 sand 7%, silt 93% D-4 W = 25.3%, Wl = 4?%, Wp = 2?%
		5.00	1.80	Light brown fine SAND, some silt				D-5 G.W.T. 5.0m.

DISTURBED SAMPLE....□ UNDISTURBED SAMPLE....▨

DRN: DATE: PLAN NO.

Fig. Ⅲ-7 Auger Bore Log (8/8)

BORE LOG

SITE : KURIGRAM IRRIGATION AND FLOOD CONTROL PROJECT-NORTH UNIT-BANGLADESH

DATE	R.L.	DEPTH -M.	THICKNESS -M.	LITHOLOGY	LOG	DIA OF BORING		REMARKS (SOIL SAMPLES, GWT, VANE SHEAR)
				AUGER HOLE-15				
14.2.90		0.55	0.55	Light grey medium compressible SILT, trace sand		12.7cm. ø	rw = 1.7 t/m3 rd = 1.4 t/m3 ø = 10° c = 1.0 t/m2	sand 7% D-1 silt 93%
		1.40	0.85	Light yellowish brown medium compressible SILT, trace sand				D-2 W = 24.2% Wl = 36% Wp = 8%
		3.0	1.60	Light brown fine SAND, trace silt			rw = 1.7 t/m3 rd = 1.4 t/m3 ø = 30° c = 0.2 t/m2	D-3 G.W.T. 3.0m. sand 92% silt 8%

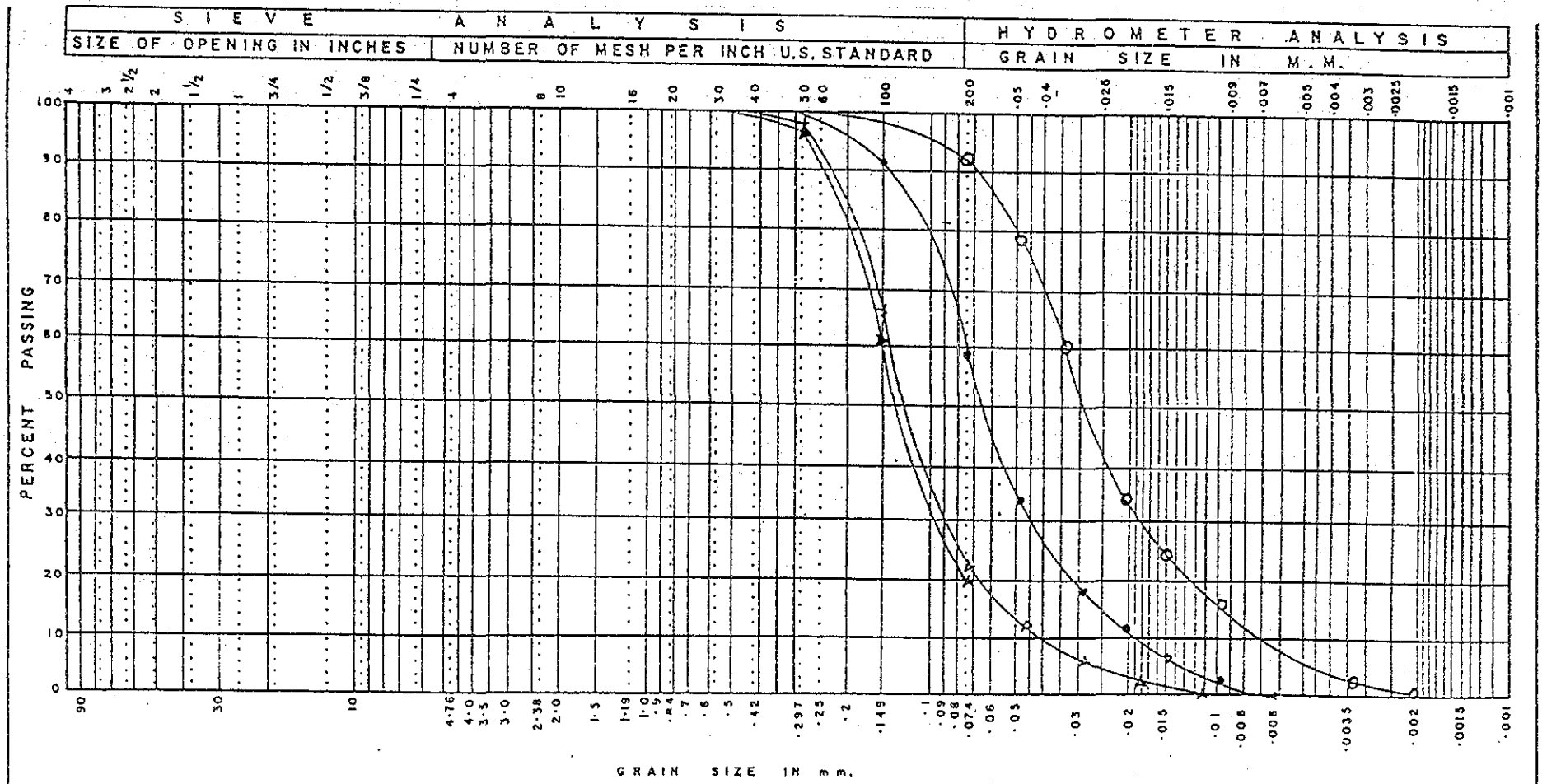
DISTURBED SAMPLE....□ UNDISTURBED SAMPLE....▨

DRN: DATE: PLAN NO.

MATERIAL TESTING LABORATORY

PARTICLE SIZE GRADATION

Fig. Ⅲ-8 Particle Size Gradation (Auger Boring) (1/8)

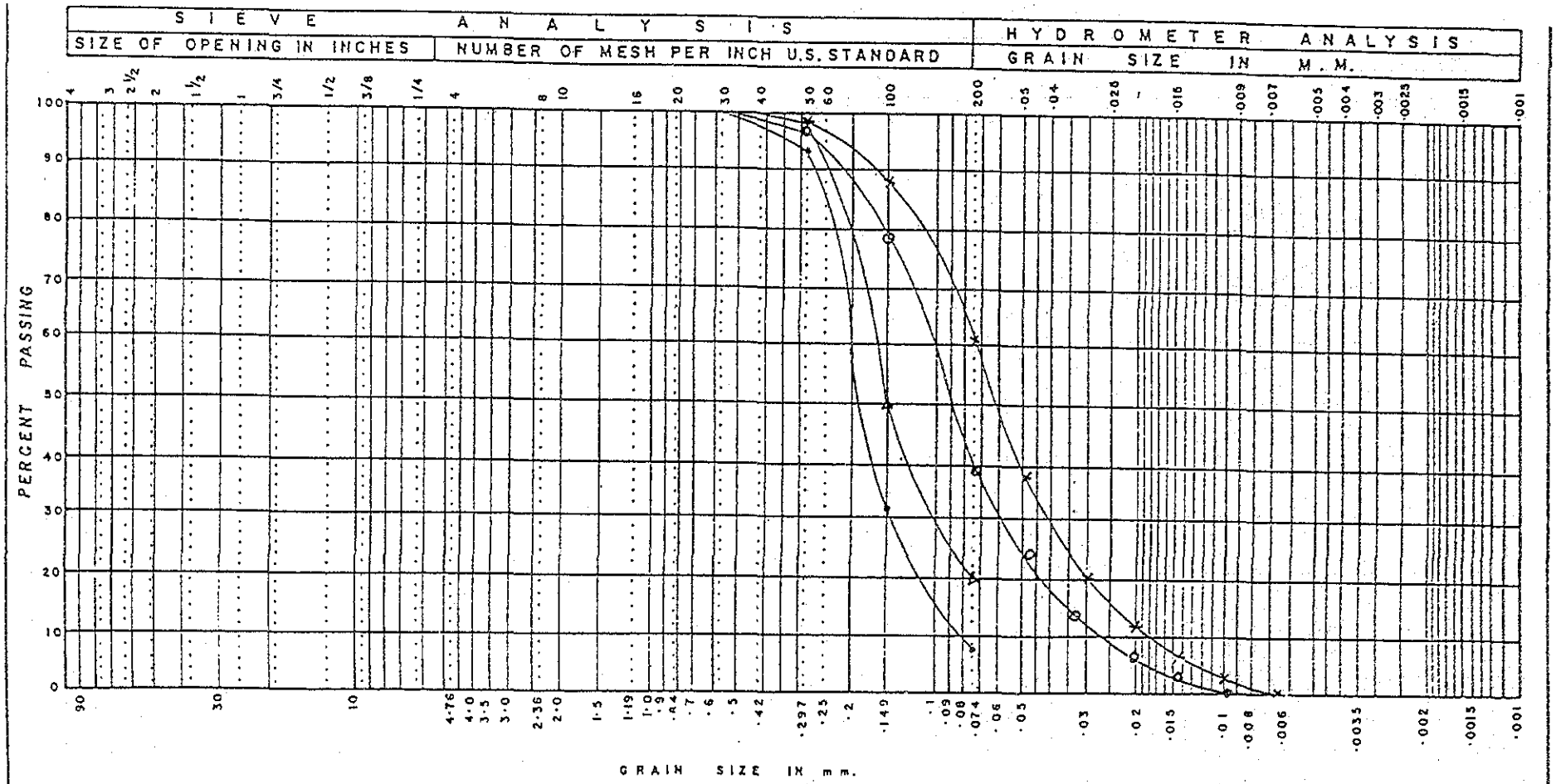


COBBLES	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES (SILT OR CLAY)

LOCATION	BORING NO	SAMPLE NO	Depth m From	To	SOIL CLASSIFICATION (UNIFIED SYSTEM)
Kurigram Flood Control & Irrigation	Auger - 1	D-1	1		SILT and fine SAND
Project		D-3	3		Fine SAND, little silt
	2	D-1	1		SILT, trace fine sand
		D-3	3		Fine SAND, some silt

MATERIAL TESTING LABORATORY
PARTICLE SIZE GRADATION

Fig. Ⅲ-8 Particle Size Gradation (Auger Boring) (2/8)

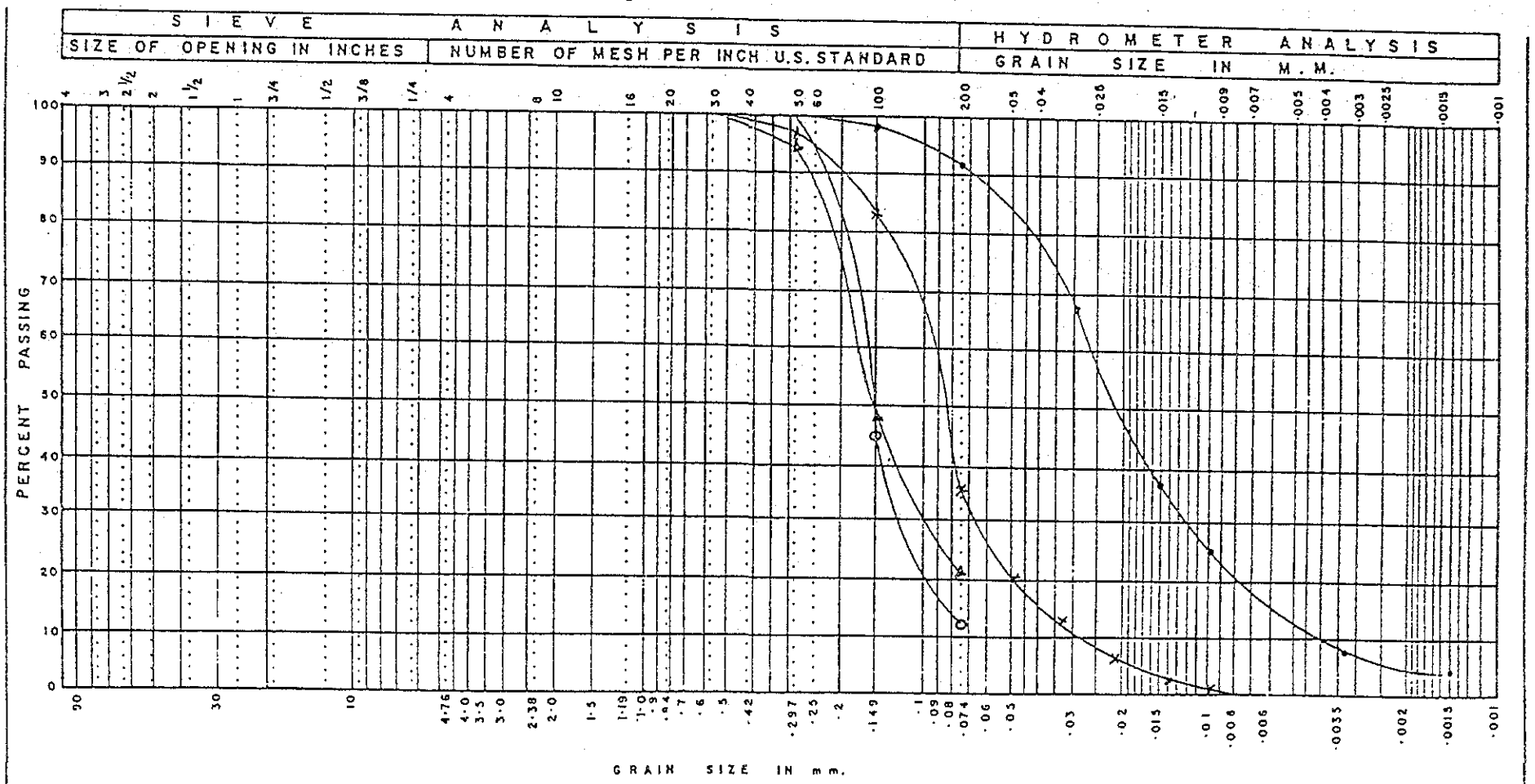


COBBLES	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES (SILT OR CLAY)

LOCATION	BORING NO	SAMPLE NO	Depth—m From	To	SOIL CLASSIFICATION (UNIFIED SYSTEM)	
Kurigram Flood Control & Irrigation	3	D-1	1		Fine SAND, trace silt	●—●—●
Project		D-3	3		SILT and fine SAND	×—×—×
	4	D-1	1		Fine SAND and SILT	○—○—○
		D-3	3		Fine SAND, little silt	△—△—△

MATERIAL TESTING LABORATORY
PARTICLE SIZE GRADATION

Fig. Ⅲ-8 Particle Size Gradation (Auger Boring) (3/8)

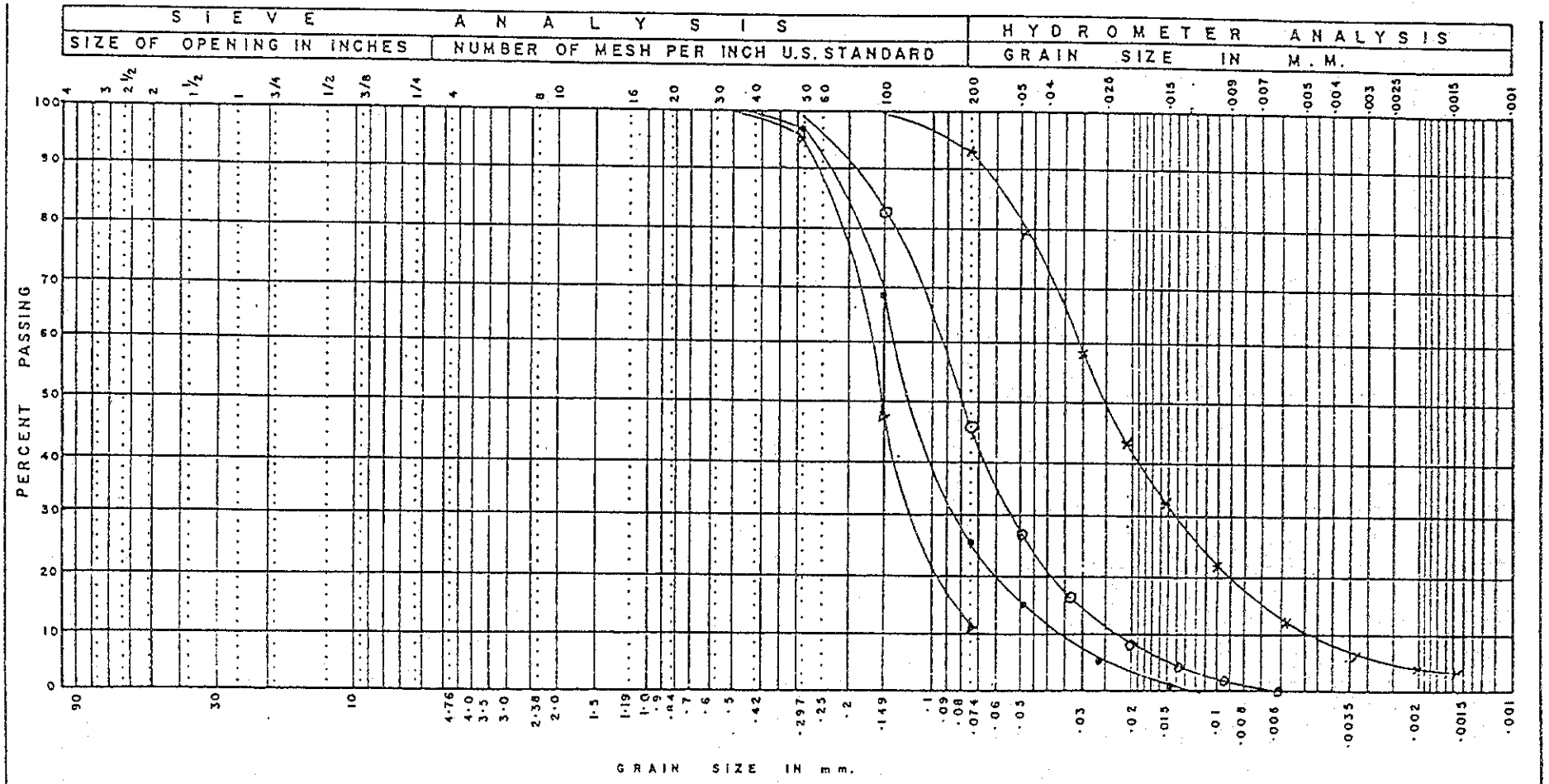


LOCATION	BORING NO	SAMPLE NO	Depth—m From	To	SOIL CLASSIFICATION (UNIFIED SYSTEM)
Kurigram Flood Control & Irrigation	5	D-1	1		Medium compressible SILT, trace sand
Project		D-3	3		Fine SAND and SILT
	6	D-1	1		Fine SAND, little silt
		D-3	3		Fine SAND, some silt

MATERIAL TESTING LABORATORY

PARTICLE SIZE GRADATION

Fig. Ⅲ-8 Particle Size Gradation (Auger Boring) (4/8)

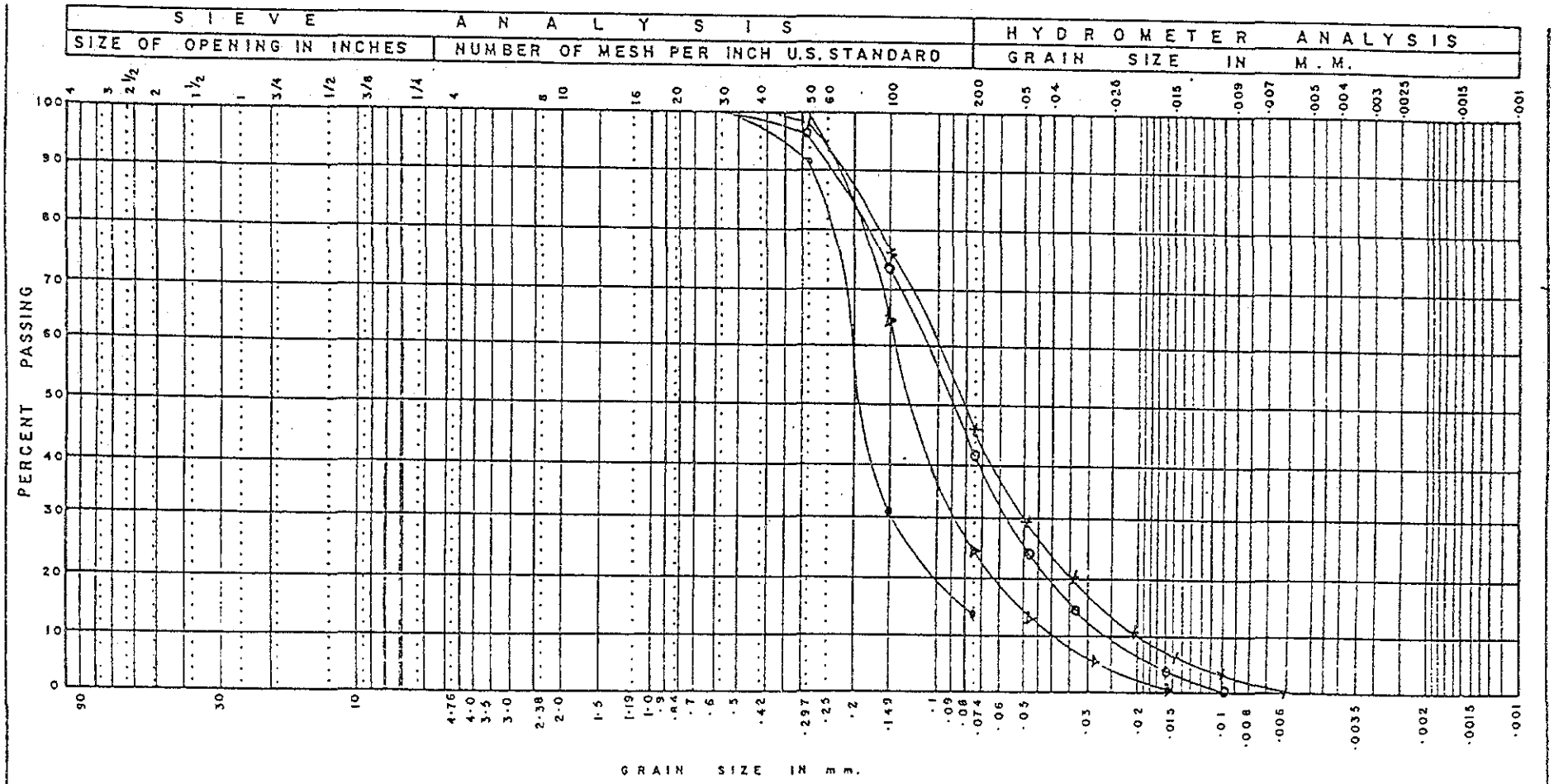


LOCATION	BORING NO	SAMPLE NO	Depth—m From	To	SOIL CLASSIFICATION (UNIFIED SYSTEM)
Kurigram Flood Control & Irrigation Project	7	D-1	1		Fine SAND, some silt
		D-3	3		Medium compressible SILT, trace sand
	8	D-1	1		Fine SAND and SILT
		D-3	3		Fine SAND, little silt

MATERIAL TESTING LABORATORY

PARTICLE SIZE GRADATION

Fig. Ⅲ-8 Particle Size Gradation (Auger Boring) (5/8)



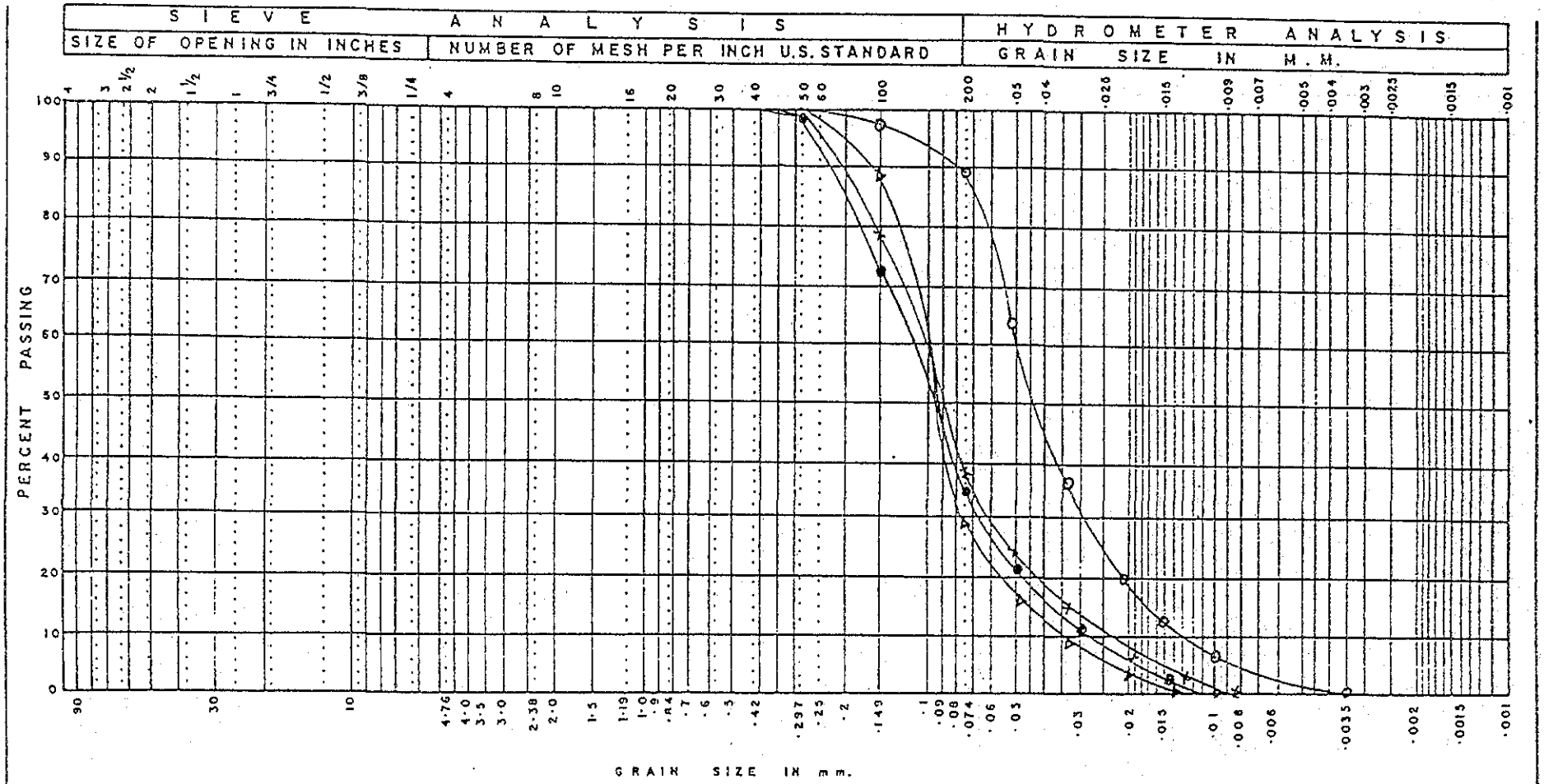
COBBLES	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES (SILT OR CLAY)

LOCATION	BORING NO	SAMPLE NO	Depth—m From	To	SOIL CLASSIFICATION (UNIFIED SYSTEM)
Kurigram Flood Control & Irrigation	9	D-1	1		Fine SAND, little silt
Project		D-3	3		Fine SAND and SILT
	10	D-1	1		Fine SAND and SILT
		D-3	3		Fine SAND, some silt

MATERIAL TESTING LABORATORY

PARTICLE SIZE GRADATION

Fig. Ⅲ-8 Particle Size Gradation (Auger Boring) (6/8)



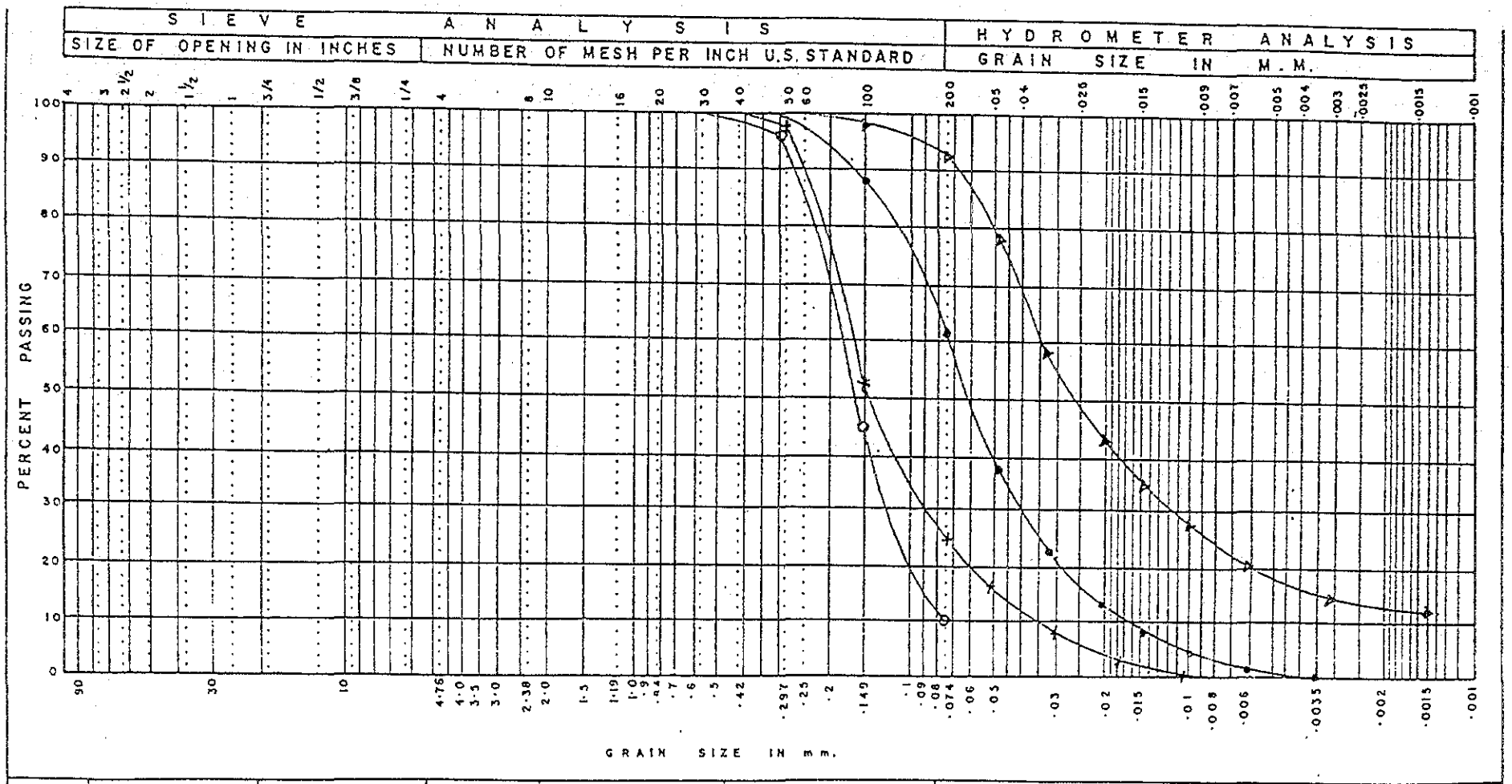
COBBLES	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES (SILT OR CLAY)

LOCATION	BORING NO	SAMPLE NO	Depth—m From	To	SOIL CLASSIFICATION (UNIFIED SYSTEM)
Kurigram Flood Control & Irrigation Project	11	D-1	1		Fine SAND, some silt
		D-3	3		Fine SAND and SILT
	12	D-1	1		Compressible SILT, little fine sand
		D-3	3		Fine SAND, some silt

MATERIAL TESTING LABORATORY

PARTICLE SIZE GRADATION

Fig. Ⅲ-8 Particle Size Gradation (Auger Boring) (7/8)

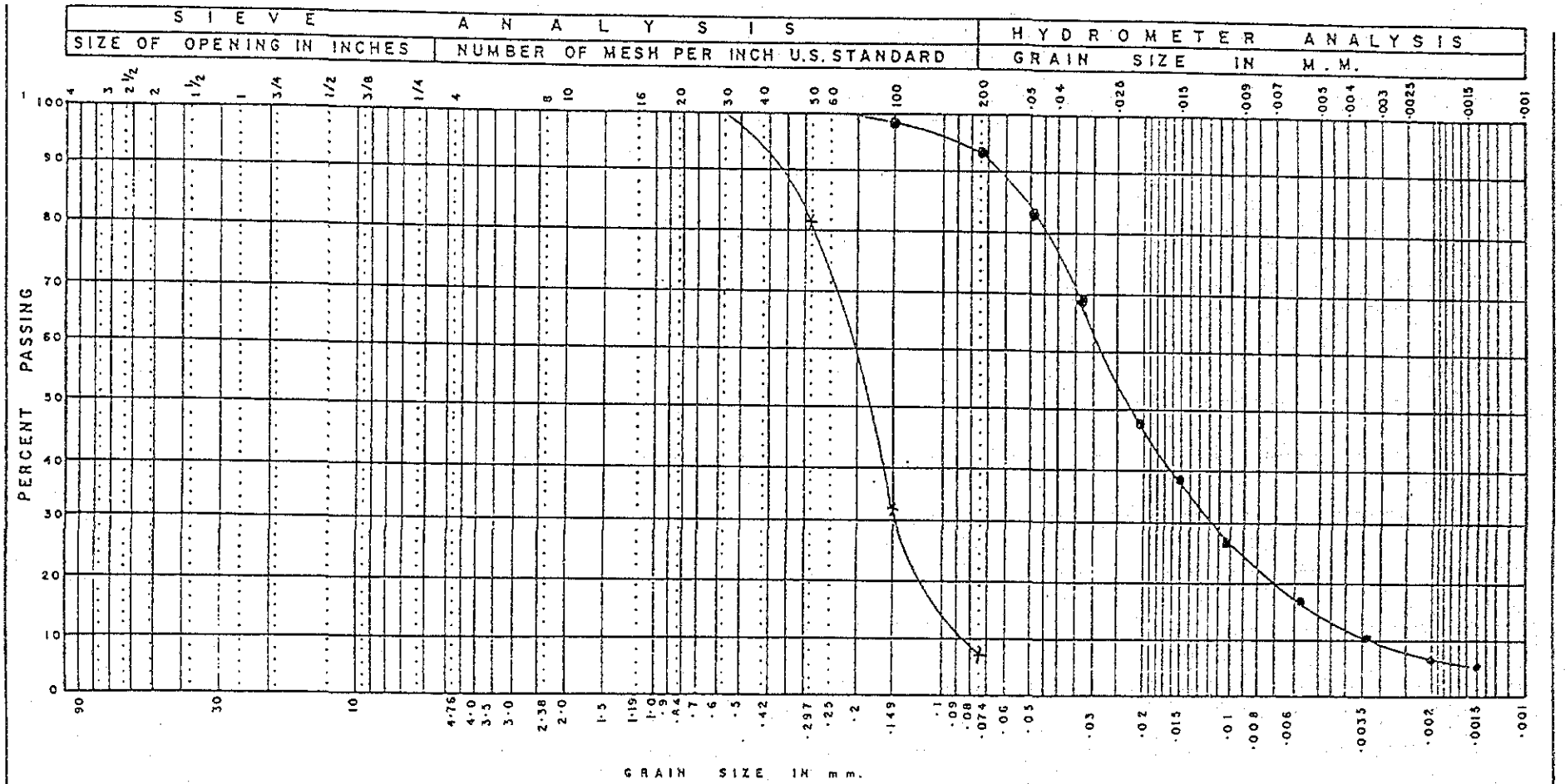


LOCATION	BORING NO	SAMPLE NO	Depth—m From	To	SOIL CLASSIFICATION (UNIFIED SYSTEM)
Kurigram Flood Control & Irrigation	13	D-1	1		Fine SAND and SILT
Project		D-3	3		Fine SAND, some silt
	14	D-1	1		Fine SAND, trace silt
		D-3	3		Medium plastic CLAY, trace sand

MATERIAL TESTING LABORATORY

PARTICLE SIZE GRADATION

Fig. Ⅲ-8 Particle Size Gradation (Auger Boring) (8/8)



LOCATION	BORING NO	SAMPLE NO	Depth — m From To	SOIL CLASSIFICATION (UNIFIED SYSTEM)	
Kurigram Flood Control & Irrigation	15	D-1	1	Compressible SILT, trace sand	—o—o—o—
Project		D-3	3	Fine SAND, trace silt	—×—×—×—

Table Ⅲ-8 Summary of Laboratory Test Results (Auger Boring) (1/4)

SUMMARY OF LABORATORY TEST RESULTS

Kurigram Irrigation & Flood Control Priject

Borehole No. (Auger Hole)		AH.-1		AH -2		AH -3		AH -4		
Sample No.		D-1	D-3	D-1	D-3	D-1	D-3	D-1	D-3	
Depth-Metre		1 m	3	1	3	1	3	1	3	
Natural moisture content (%)		25.2	24.20	24.35	22.65	23.25	24.31	23.81	16.30	
Specific gravity										
Atterberg limits	Liquid limit, W_L (%)					* 38	** 35			
	Plasticity Index, Ip (%)					9	7			
Density	Wet (gm/cc)	1.585	1.915	1.538	1.651	1.681	1.523	1.647	1.640	
	Dry (gm/cc)	1.266	1.542	1.237	1.346	1.364	1.225	1.330	1.410	
Grain size analysis	Gravel (%)									
	Sand (%)	66	80	8	78		39	61	80	
	Silt or Clay % (Fines)	34	20	92	22		61	39	20	
Consolidation tests	Natural void ratio, e_o									
	Compression index, C_c									
Unconfined Compression tests	Strain at failure (%)									
	Stress undist. ( )									
	Stress remould ( )									
	Sensitivity									
Triaxial shear tests	∅ (degree)		30							
	C (kg/cm^2)		0.035							
Direct Shear tests	∅ (degree)	20		16	28	28	19	28.5	29	
	C (kg/cm^2)	0.04		0.06	0.06	0.025	0.035	0.05	0.03	

* Upper Part of sample
* * Lower Part of sample

Table Ⅲ-8 Summary of Laboratory Test Results (Auger Boring) (2/4)

SUMMARY OF
LABORATORY TEST RESULTS

Kurigram Irrigation & Flood Control Priject

Borehole No. (Auger Hole)		AH -5		AH -6		AH -7		AH -8		
Sample No.		D-1	D-3	D-1	D-3	D-1	D-3	D-1	D-3	
Depth-Metre		1	3	1	3	1	3	1	3	
Natural moisture content (%)		25.15	24.45	22.1	24.08	23.63	25.55	23.18	15.15	
Specific gravity										
Atterberg limits	Liquid limit, W, (%)	36	39				41			
	Plasticity Index, Ip (%)	8	11				13			
Density	Wet (gm/cc)	1.524	1.720	1.901	1.647	1.613	1.520	1.539	1.614	
	Dry (gm/cc)	1.218	1.382	1.557	1.327	1.305	1.211	1.250	1.402	
Grain size analysis	Gravel (%)									
	Sand (%)	9	63	88	79	74	7	54	89	
	Silt or Clay % (Fines)	91	37	12	21	26	93	46	11	
Consolidation tests	Natural void ratio, e_o									
	Compression index, C_c									
Unconfined Compression tests	Strain at failure (%)									
	Stress undist. ( )									
	Stress remould( )									
	Sensitivity									
Trioxial shear tests	Ø (degree)			31.5						
	C (kg/cm^2)			0.04						
Direct Shear tests	Ø (degree)	9	27.5		28	21	8	25	29.5	
	C (kg/cm^2)	0.10	0.06		0.05	0.035	0.105	0.055	0.035	

Table Ⅲ-8 Summary of Laboratory Test Results (Auger Boring) (3/4)

SUMMARY OF LABORATORY TEST RESULTS

Kurigram Irrigation & Flood Control Project

Borehole No. (Auger Hole)		AH-9		AH-10		AH-11		AH-12		
Sample No.		D-1	D-3	D-1	D-3	D-1	D-3	D-1	D-3	
Depth-Metre		1	3	1	3	1	3	1	3	
Natural moisture content (%)		21.06	25.67	24.22	22.06	23.15	19.35	26.10	23.80	
Specific gravity										
Atterberg limits	Liquid limit, W_l (%)			* 39		* 35		* 33		
	Plasticity Index, Ip (%)			12		10		7		
Density	Wet (gm/cc)	1.692	1.611	1.589	1.588	1.728	1.638	1.546	1.921	
	Dry (gm/cc)	1.398	1.282	1.279	1.301	1.403	1.410	1.226	1.552	
Grain size analysis	Gravel (%)									
	Sand (%)	86	53	58	75	64	61	11	71	
	Silt or Clay % (Fines)	14	47	42	25	36	39	89	29	
Consolidation tests	Natural void ratio, e_o									
	Compression index, C_c									
Unconfined Compression tests	Strain at failure (%)									
	Stress undist. ( )									
	Stress remould ( )									
	Sensitivity									
Triaxial shear tests	Ø (degree)								29.5	
	C (kg/cm^2)								0.07	
Direct Shear tests	Ø (degree)	26	20.5	24	28.5	28	29.5	15		
	C (kg/cm^2)	0.030	0.045	0.035	0.050	0.02	0.03	0.070		

* Upper Part of sample

Table Ⅲ-8 Summary of Laboratory Test Results (Auger Boring) (4/4)

SUMMARY OF
LABORATORY TEST RESULTS

Kurigram Irrigation & Flood Control Project

Borehole No. (Auger Hole)		AH-13		AH-14		AH-15				
Sample No.		D-1	D-3	D-1	D-3	D-1	D-3			
Depth- Metre		1	3	1	3	1	3			
Natural moisture content (%)		25.2	19.36	15.15	25.26	24.21	16.25			
Specific gravity										
Atterberg limits	Liquid limit, W_L (%)				47	36				
	Plasticity index, Ip (%)				23	8				
Density	Wet (gm/cc)	1.782	1.673	1.624	1.960	1.687	1.676			
	Dry (gm/cc)	1.423	1.402	1.410	1.405	1.358	1.442			
Grain size analysis	Gravel (%)									
	Sand (%)	54	48	90	7	7	92			
	Silt or % (Fines) Clay	46	52	10	93	93	8			
Consolidation tests	Natural void ratio, e_o									
	Compression index, C_c									
Unconfined Compression tests	Strain at failure (%)									
	Stress undist.( )									
	Stress remould( )									
	Sensitivity									
Triaxial shear tests	Ø (degree)	22								
	C (kg/cm^2)	0.105								
Direct Shear tests	Ø (degree)		29.5	28	6	10	30			
	C (kg/cm^2)		0.02	0.07	0.105	0.10	0.015			

APPENDIX Ⅳ

SOCIO - ECONOMY

APPENDIX Ⅳ

SOCIO-ECONOMY

LIST OF TABLES

LIST OF FIGURES

Table Ⅳ-1 Selected Basic Indicators of the Country

	Items		Indicators	
1)	Total Area (source: Upazila Statistics 1985)	(ha)	14,399,880	
2)	Total Land Area (-do-)	(ha)	11,655,200	
3)	Population (1981 Population Census)	(persons)	87,119,965	(100.0)
	(1) in Urban Areas		13,227,625	(15.2)
	(2) in Rural Areas		73,892,340	(84.8)
4)	Households (-do-)	(No.)	15,075,887	(100.0)
	(1) in Urban Areas		2,198,654	(14.6)
	(2) Farm Household Holdings		12,877,233	(85.4)
5)	Cultivated Area (Upazila Statistics 1985) 1]	(ha)	9,117,000	
6)	Operated Area (1983-84 Agricultural Census) 2]	(ha)	9,316,147	(100.0)
	(1) Non Farm Household Holdings		138,173	(1.5)
	(2) Farm Household Holdings		9,177,974	(98.5)
7)	Net Cultivated Area (-do-)	(ha)	8,157,766	(100.0)
	(1) Non Farm Household Holdings		7,526	(0.1)
	(2) Farm Household Holdings		8,150,240	(99.9)
8)	Farm Households (1983-84 Agricultural Census)	(No.)	10,045,299	(100.0)
	(1) Small Scale Farmers		7,065,957	(70.4)
	(2) Medium Scale Farmers		2,483,210	(24.7)
	(3) Large Scale Farmers		496,132	(9.1)
9)	Non Farm Households (-do-)	(No.)	3,772,647	
10)	Landless Farmers (-do-)	(No.)	6,831,373	(100.0)
	(1) Landless I		1,198,056	(17.5)
	(2) Landless II		1,965,002	(28.8)
	(3) Landless III		3,668,315	(53.7)
11)	Working Population of 10 Years old and Above (1981 Population Census)	(persons)	23,617,000	(100.0)
	(1) Agriculture		14,472,000	(61.3)
	(2) Manufacturing		1,005,000	(4.3)
	(3) Business		2,622,000	(11.1)
	(4) Others		5,518,000	(23.3)
a)	Population Density	(persons/sq.km)	605	
b)	Population Growth Rate	(%)	2.8	
c)	Per Capita Availability of Land	(ha)	0.13	
d)	Per Household Number of Family	(persons)	5.7	
e)	Per Farm Household Operated Area	(ha)	0.91	
f)	Per Farm Household Net Cultivated Area	(ha)	0.81	
g)	Farm Household as % of total Households	(%)	72.3	
h)	Cultivated Area as % of Total Area	(%)	63.3	
i)	Net Cultivated Area as % of Total Land Area	(%)	70.0	
j)	Landless Farmers as % of total Households	(%)	49.4	

Note: 1) Cultivated area is the area actually cropped regardless of the number of crops grown plus the area under current follow.
2) Operated area is the area owned by the household plus the area rented from others minus the owned area given to others for operation. It also includes uncultivated land operated by the household including homestead area.

Table Ⅳ-2 Damage to major crops by excessive rainfall, May, 1988

(Area in acre)

Name of crops	Fully damaged areas	Partially damaged area			Total area damaged	Expected Yield/acre if there were no damages (Kg)	Total loss of production (M tons)
		Total affected areas	Extent of damage percentage	Estimated areas fully damaged			
1	2	3	4	5	6	7	8
Boro	5240	64792	29.20	18919	24159	1074	25947
Jute	561	2879	33.40	962	1523	692	1054
Aman	19080	74932	31.30	23454	42534	370	15737
Aus	32629	77721	37.40	29068	61697	434	26726
Total	57510	220324	-	72403	129913	-	69464

Source: 1) Agriculture Statistics Wing, B.B.S.
2) 1989 Statistical Yearbook of Bangladesh

Table Ⅳ-3 Damage of major crops due to excessive rainfall, and early floods during June & July, 1988

(Area in acre)

Name of crops	Fully damaged areas	Partially damaged area			Total areas damaged	Expected Yield/acre if there were no damages (Kg)	Total loss of production (M tons)
		Total affected areas	Extent of damage percentage	Estimated areas fully damaged			
1	2	3	4	5	6	7	8
Aus	357787	630838	30.61	193108	550895	434	239088
Aman	342159	411570	30.00	123471	465630	575	267741
Jute	17030	82973	28.26	23447	40477	555	22448
Seed-bed	12797	13151	31.23	4107	16904	-	-
Total	729773	1138532	-	344133	1073906	-	529277

Source: 1) Agriculture Statistics Wing, B.B.S.
2) 1989 Statistical Yearbook of Bangladesh

Table IV-4 Damage to major crops due to severe floods during August and September, 1988

(Aria in acre)

Name of crops	Fully damaged areas	Partially damaged area			Total areas damaged	Expected Yields/acres if there were no damages (Kg)	Total loss of production (M tons)
		Total affected areas	Extent of damage percentage	Estimated areas fully damaged			
1	2	3	4	5	6	7	8
Aus	91392	59822	45.31	27107	118499	426	50509
Aman	2871433	1857221	38.88	722042	3593475	573	2059820
Seed bed	31261	11904	41.31	4918	36179	-	-
Sugar cane	15238	59297	24.90	14767	30005	12504	375170
Jute	30995	41067	33.15	13614	44609	588	26240
Vegetables	16742	3290	44.10	1451	18193	3906	71062
Others	2451	1543	70.64	1090	3541	7193	25471
Total	3059512	2034144	-	784989	3844501	-	-

Source: 1) Agriculture Statistics Wing, B.B.S.
2) 1989 Statistical Yearbook of Bangladesh

Table IV-5 Damage of crops by cyclone/tidal bore in November, 1988

(Area in acre)

Name of crops	Fully damaged areas	Partially damaged area			Total areas damaged	Expected Yield/acre if there were no damage (Kg)	Total loss of production (M tons)
		Total affected areas	Extent of damage percentage	Estimated areas fully damaged			
1	2	3	4	5	6	7	8
Aman	50184	2218584	27.944	619960	670144	671	449421
Seed-bed	15593	43157	45.144	19483	35076	-	-
Wheat	14097	81228	30.93	25120	39217	719	28213
Pulses	26825	115283	40.10	50836	77661	419	32569
Vegetables	4360	24267	39.87	9675	14035	3033	42572
Others	58170	204199	35.39	72269	130439	1536	200388
Total	169229	2686718	29.68	797343	966572	-	753163

Note: Other crops include Pepper, Brinjal, Radish, Beans, Potato, Banana, Beetel leaves, Mustard, Cabbage, Tomato, Water Gourd, Groundnut, Onion, Garlic and Sugarcane.

Source: 1) Agriculture Statistics Wing, B.B.S.
2) 1989 Statistical Yearbook of Bangladesh

Table IV-6 (a) Selected Basic Indicators

	Upazila[1]	Total Area[2] (ha)	Total Land Area[3] (ha)	Administrative Units[5]			Population[6] (persons)
				Union	Mouza	Village	
Study Area	Bhurungamari	23700 (3556)[4]	21800	10 (3)	56 (10)	123 (9)	149454 (25871)
	Nageswari	41760 (22282)	29000	15 (11)	79 (45)	335 (286)	235338 (163278)
	Bulbari	15640 (14813)	14500	6 (6)	48 (46)	123 (121)	103577 (110298)
	Kurigram	25560 (8958)	17400	8 (5)	72 (20)	335 (67)	175945 (53228)
	Total	106660 (49609)	82700	39 (25)	255 (122)	916 (444)	664314 (352675)
Kurigram Zila	9 Upazila	217300	19710	72	585	-	1266425
Rangpur Region	5 Zilas 35 Upazilas	958560	90960	346	3714	-	6510050
Bangladesh	64 Zilas 460 Upazilas 32 thanas	14399880	11655200	4401	60315	-	87119965

Note: 1) Source - 1989 Statistical Yearbook of Bangladesh

2),3) Source - Upazila profile 1989 and Upazila Statistics Volume-one. This area is an Upazila wise area.
Total area includes reserve forest, river and land areas.

4) This figure is Union or Mouza wise which is supposed to be included in the project area according to the 1981 Population census.

5) Source - 1981 Population Census and 1989 statistical Yearbook of Bangladesh.

6) Source - 1981 Populaton Census. (Enumrated)

7),8),9) Source - the Bangladesh Census of Agriculture and Livestock 1983 - 84.

10) This rate is of the annual intercensus at growth rate during the 1974 - 81 Population Census.

11),12) Source - 1981 Population Census

13) (1) Source - The Bangladesh Census of Agriculture and Livestock 1983 - 84
(2) This figure is that of dividing the net cultivated area farm household holdings by the number of farm households.

Table Ⅳ-6 (b) Selected Basic Indicators (Continued)

	Upazila[1]	Net Cult. Area[7] (ha)	Households[8]			Net Irrigation Area[9] (ha)
			Total	Non Farm households	Farm households	
Study Areas	Bhurungamari	16686	25774	7931	17843	1874
	Nageswari	26737	39506	12425	27081	2272
	Bulbari	10956	18961	6075	12886	956
	Kurigram	13621	23738	7086	16652	860
	Total	68000	107979 (100.0)	33517 (31.0)	74462 (69.0)	5962
Kurigram Zila	9 Upazila	133872	222127 (100.0)	67727 (30.5)	154400 (69.5)	10655
Rangpur Region	5 Zilas 35 Upazilas	664735	1140525 (100.0)	341982 (30.0)	798543 (70.0)	131414
Bangladesh	64 Zilas 460 Upazilas 32 thanas	(thousand) 8157766	13817646 (100.0)	3772647 (27.3)	10045299 (72.2)	1620305

Table Ⅳ-6 (c) Selected Basic Indicators (Continued)

	Upazila	Population Growth Rate (1974-81) (%)10)	Population Density (Persons/ sq.km)	Net Cult. Area as % of Total Land Area (%)	Per Capita Availability of Land (ha)
Study Areas	Bhurungamari	2.4	633	76.6	0.15
	Nageswari	2.4	579	92.2	0.12
	Bulbari	2.1	662	75.6	0.14
	Kurigram	3.1	688	78.3	0.10
	Total	2.4	623	82.3	0.12
Kurigram Zila	9 Upazila	2.2	583	67.9	0.16
Rangpur Region	5 Zilas 35 Upazilas	2.6	677	73.1	0.14
Bangladesh	64 Zilas 460 Upazilas 32 thanas	2.8	605	70.0	0.13

Table Ⅳ-6 (d) Selected Basic Indicators (Continued)

	Upazila	Per Capita net Cult. Areas (ha)	% of Irrigated Areas to net Cult. Areas (ha)	Amount per Family per Household (in dwelling unit) (persons) 12)	Per Farm-household Net Cult. Areas (ha) 13)	Per Farm-household Operated Areas (ha) 14)
Study Areas	Bhurungamari	0.11	11.2	5.5	0.94	1.10
	Nageswari	0.11	8.5	5.7	0.99	1.26
	Bulbari	0.11	8.7	5.5	0.85	1.04
	Kurigram	0.08	6.3	5.8	0.82	1.12
	Total	0.10	8.8	5.6	0.91	1.17
Kurigram Zila	9 Upazila	0.11	8.0	5.6	0.87	1.10
Rangpur Region	5 Zilas 35 Upazilas	0.10	19.8	5.5	0.83	0.97
Bangladesh	64 Zilas 460 Upazilas 32 thanas	0.09	19.9	5.7	0.81	0.91

Table Ⅳ-7 Main Social Indicators of the Study Area

Items	Indicators	Note
Population	664,314 persons (1981)	
Population growth rate (average annual)	2.4% (1974 - 81)	3.0% (1961 - 74)
Population density	623 persons/sq. km. (1981)	Country -- 605 persons/sq.km. (1981)
Primary school enrolement rate	Both sexes 52.2% Males 70.3% Females 33.7% (1981)	Country --- Both sexes 57.2% Males 61.0%, Females 53.1% (1981)
Primary school attendance rate	Both sexes 15.9%, Males 18.2% Females 13.6% (1981)	Country --- Both sexes 21.8% Males 23.0%, Females 20.7% (1981)
Literacy rate (5 years old and above)	Both sexes 15.7%, Males 22.9% Females 8.2% (1981)	Country --- Both sexes 23.8% Males 31.0%, Females 16.0% (1981)
Hospital beds per 1,000 persons	0.16 beds/1,000 persons (1981)	Country --- 0.55 beds/1,000 persons (1981)
No. of hand water pumps for drinking water per 1,000 households	(1981) 41 No./1,000 households (1989) 64 No./1,000 households	Country --- 35 No./1,000 households (1981)
No. of villages with electricity per 1,000 villages	27 villages in the Kurigram upazila	Country --- (1981) 34 village/1,000 villages
Working population	193,832 persons (44% of all population aged 10 years old and above) (1981)	Country --- 23,617 thousand persons (44.5%)
Working population with main occupations	Both sexes Agriculture 77.8% Manufacture 0.9 Business 5.1 Others 16.2 (1981)	Country Both sexes Males Females Agriculture 61.3% 63.1% 28.0% Manufactures 4.3 4.2 5.1 Business 11.1 11.4 4.9 Others 23.3 21.3 62.0 (1981)
No. of households without homestead land	13% (of the total households)	Country ---9%
Structural patterns of dwelling units	Kutcha patlern -- 87.6% Semi-pucca -- 11.6% Pucca -- 0.8%	
Road length per sq. km.	2.18 km (Kutcha roads -- 2.10 km, pucca roads -- 0.08 km) (1981)	
No. of transportation means per 1,000 persons	Buses -- 0.08 No. per 1,000 persons Rickshaws -- 47 No. per 1,000 persons	
Sex ratio	104 (1981)	Country --- 106 (1981)
Dependency ratio	101 (1981)	Country --- 100 (1981)
No. of post offices per 1,000 households	0.36 No./1,000 households	
No. of bank branches per 1,000 households	0.22 No./1,000 households	

Source: Bangladesh pulation Census 1981, Bangladesh Census of Agriculture and Livestock 1983-84 and Upazila Profile (1989)

Table Ⅳ-8 Food Balance in the Kurigram Zila

1) Actual paddy production (1985/86 - 1987/88) (unit: ton)

Varieties \ Years		1985-86	1986-87	1987-88	Total	Average
Aus	H.Y.V.	13,147	20,500	21,972		
	Local	39,042	55,750	65,023		
	Sub-total	52,189	76,2580	86,995		
B-Aman		2,350	2,250	1,460		
T-Aman	H.Y.V.	46,391	54,405	51,946		
	Paisan	16,372	23,498	17,201		
	Local	84,852	83,396	96,582		
	Sub-total	147,585	161,299	165,729		
Boro	H.Y.V.	33,626	51,866	84,961		
	Local	9,795	11,412	12,198		
	Sub-total	43,421	63,278	97,159		
Total		245,545	606,077	351,343	899,965	299,988

Source: DAE, 'Kurigram Agriculture'

2) Actual wheat production (1985/86 - 1987/88) (unit: ton)

Years	1985-86	1986-87	1987-88	Total	Average
Production	39,471	41,740	34,264	115,475	38,492

Source: The Above source.

3) Procurement Quantities (unit: ton)

Kind \ Years	1985-86	1986-87	1987-88	Total	Average
Rice	5,184	3,753	5,854	14,791	4,930
Wheat	5,605	3,553	3,458	12,616	4,205
Total	10,789	7,306	9,312	27,407	9,135

Source: MOF, Kuringram District.

4) Off-take quantities (unit: ton)

Kind \ Years	1985-86	1986-87	1987-88	Total	Average
Rice	2,442	7,073	5,745	15,260	5,087
Wheat	21,360	34,298	40,837	96,495	32,165
Total	23,802	41,371	46,582	111,755	37,252

Source: The above source.

5) Actual Average Production of Foodgrains (rice and wheat) (1984/85-1987/88) (unit: ton)

Kind	Production	Note
Rice	200,992	Paddy Prod. 299,988t Milling rate x 0.67 = 200,992t
Wheat	36,567	Paddy Prod. 38,492t Milling rate x 0.95 = 36,567t
Total	237,559	

Source: The above table.

6) Net Production of Foodgrains (rice and wheat) (unit: ton)

Kind	Net Production	Note
Rice	196,108	Deduction for seed, waste etc. has been taken as 2.43% of the total production of rice
Wheat	35,456	Deduction for seed, waste etc. has been taken as 3.01% of the total production of wheat
Total	231,564	

Source: The above table.

7) Net Availability of Foodgrains (rice and wheat) (unit: ton)

Net Production of Foodgrains	Note			
259,681	Net Production	Procurement quan.	Off take quan.	
	231,564t	- 9,135t	+ 37,252t	= 259,681t

Source: The above table.
Note ; This figure was calculated on the assumption that all foodgrains produced in the Kurigram zila would be consumed inside the zila.

8) Population at Present (1988)

Production	Note
persons 1,496,000	This figure as of 1988 was estimated based on the population of 1981, assuming that the average annual population growth rate has been 2.4% as it was between 1974-81.

Source: Bangladesh Population Census 1981.

9) Per capita consumption of foodgrains

1) per annum (kg) 174 kg (259,681t / 1,496,000persons)

2) per day (g) 477 g (174kg/ 365days)

10) Intake of kcal per capita per day

1,673 kcal (477g x 3.5084kcal/g)

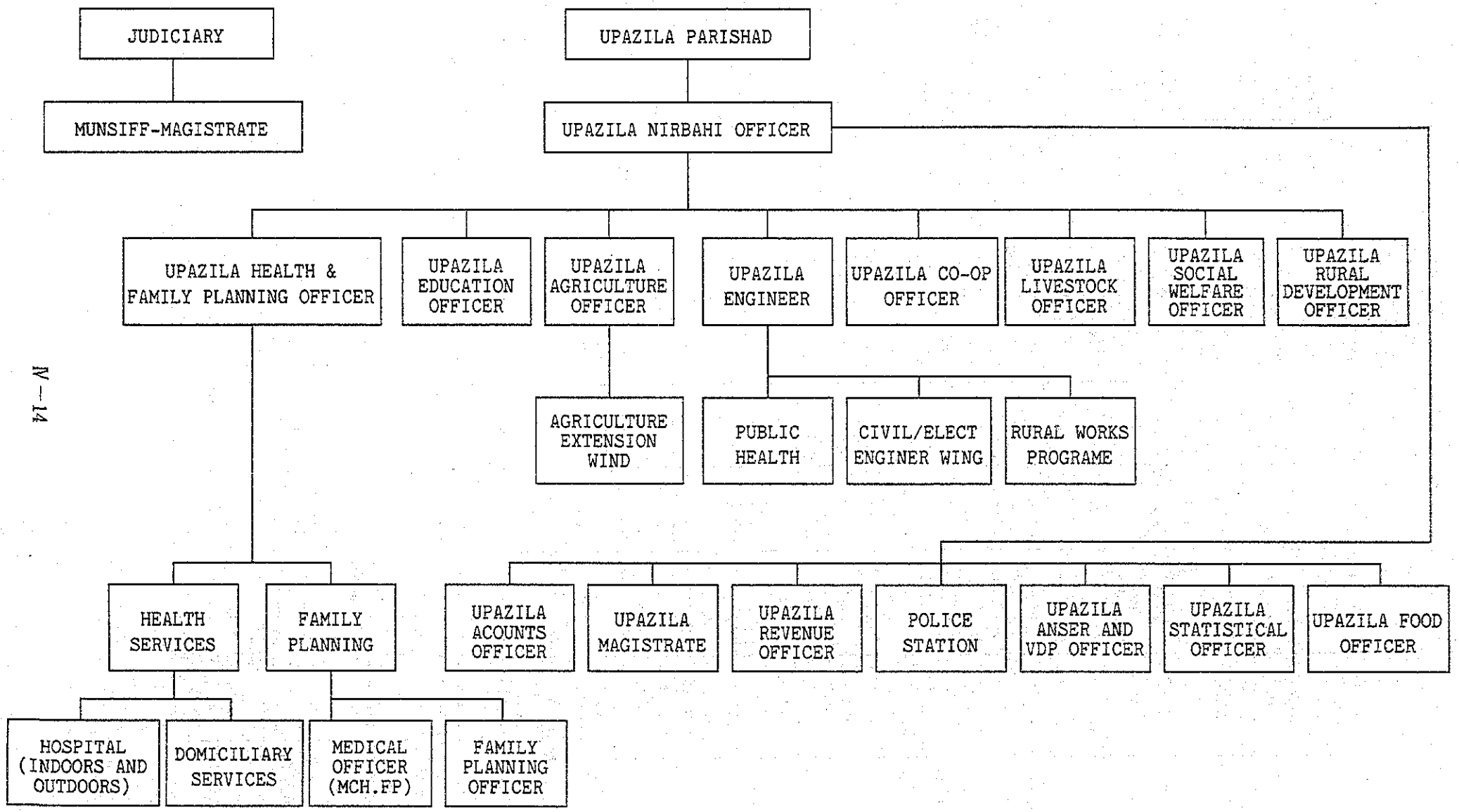
Table Ⅳ-9 Achievement Status of Foodgrains Procurement Programe

Year	Procure-ment	Food-grains	Bhurun-gamari	Nages-wari	Fulbari	Kurigram	Total (study area) (A)	Kurigram Zila (10 upa-zilas) (B)	A/B (%)
1986 \ 1987	Target (ton)	Rice	1,440	1,900	700	1,100	5,140	7,000	73.4
		Wheat	800	1,200	500	800	3,300	6,000	55.0
		Sub-total	2,240	3,100	1,200	1,900	8,440	13,000	64.9
	Actual (ton)	Rice	1,024	1,078	238	428	2,768	3,753	73.8
		Wheat	1,166	1,516	204	76	2,962	3,553	83.4
		Sub-total	2,190	2,594	442	504	5,730	7,306	78.4
	Achieve-ment ratio (%)	Rice	71.1	56.7	34.0	38.9	53.9	53.6	
		Wheat	145.8	126.3	40.8	9.5	89.8	59.2	
		Sub-total	97.8	83.7	36.8	26.5	67.9	56.2	
1987 \ 1988	Target (ton)	Rice	2,466	3,066	1,132	666	7,330	9,332	78.5
		Wheat	1,000	1,900	400	300	3,600	5,000	72.0
		Sub-total	3,466	4,966	1,532	966	10,930	14,332	76.3
	Actual (ton)	Rice	1,778	2,189	619	299	4,885	5,854	83.4
		Wheat	561	1,409	278	198	2,446	3,458	70.7
		Sub-total	2,339	3,598	897	497	7,331	9,312	78.7
	Achieve-ment (ratio (%)	Rice	72.1	71.4	54.7	44.9	66.6	62.7	
		Wheat	56.1	74.2	69.5	66.0	67.9	69.2	
		Sub-total	67.5	72.5	58.6	51.4	67.1	65.0	
1988 \ 1989	Target (ton)	Rice	2,600	3,216	861	567	7,244	8,632	83.9
		Wheat	1,000	1,900	500	400	3,800	6,000	63.3
		Sub-total	3,600	5,116	1,361	967	11,044	14,632	75.5
	Actual (ton)	Rice	357	19	4	58	438	526	83.3
		Wheat	124	115	-	-	239	255	93.7
		Sub-total	481	134	4	58	677	781	86.7
	Achieve-ment ratio (%)	Rice	13.7	0.6	0.5	10.2	6.0	6.1	
		Wheat	12.4	6.1	-	-	6.3	4.3	
		Sub-total	13.4	2.6	0.3	6.0	6.1	5.3	
Total	Target (ton)	Rice	6,506	8,182	2,693	2,333	19,714	24,964	79.0
		Wheat	2,800	5,000	1,400	1,500	10,700	17,000	62.9
		Sub-total	9,306	13,182	4,093	3,833	30,414	41,964	72.5
	Actual (ton)	Rice	3,159	3,286	861	785	8,091	10,133	79.8
		Wheat	1,851	3,040	482	274	5,647	7,266	77.7
		Sub-total	5,010	6,326	1,343	1,059	13,738	17,399	79.0
	Achieve-ment ratio (%)	Rice	48.6	40.2	32.0	33.6	41.0	40.6	
		Wheat	66.1	160.8	34.4	18.3	52.8	42.7	
		Sub-total	53.8	48.0	32.8	27.6	45.2	41.5	

Source: MOF, Kurigram District
Note: The achievement ratios of the procurement amounts of foodgrain in both the four upazilas and Kurigram zila have ranged between 1986/87 and 1987/88 as follows.

Year	Procurement		Bhurun-gamari	Nages-wari	Fulbari	Kurigram	Total (study area) (A)	Kurigram Zila (10 upa-zilas) (B)	A/B (%)
1986/87 - 1987/88	Target (ton)		5,706	8,066	2,732	2,866	19,370	29,332	66.0
	Actual (ton)		4,529	6,192	1,339	1,001	13,061	16,618	78.6
	Achieve-ment ratio (%)	Food-grains	79.4	76.8	49.0	34.9	67.4	60.8	
		Rice	71.7	65.8	46.8	41.6	61.4	58.8	
		Wheat	95.9	94.4	53.6	24.9	78.4	63.7	

Fig. Ⅳ-1 Organization of Upazila Administration



APPENDIX V

AGRICULTURE

APPENDIX V

AGRICULTURE

LIST OF TABLES

LIST OF FIGURES

Page

Table V-3-1-(1) Year-wise Crop Production Data by BBS (contd.)

Upazila : Nageswari

unit : ha. ton/ha.

Crop	Cropped Area in hectare						Yield in ton/ha.					
	84/85	85/86	86/87	87/88	88/89	aver.	84/85	85/86	86/87	87/88	88/89	aver.
B-Aus L	12649	12524	9696	9292	8848	10602	0.65	0.65	0.92	0.92	1.02	0.83
T-Aus HYV	596	404	404	1010	646	612	1.85	1.94	1.29	1.38	1.48	1.59
T-Aman L	14302	14504	13736	14140	12322	13801	1.57	1.57	1.48	1.48	1.48	1.51
T-AmanHYV	4186	4671	4752	4954	5358	4784	2.22	2.12	2.13	2.13	2.03	2.16
T-AmanPjm	1146	985	1066	1106	1011	1063	2.31	2.24	2.12	2.03	2.13	2.15
T-Aman L	505	404	404	283	283	376	1.02	1.11	1.11	1.11	1.01	1.07
Boro L	323	404	485	404	121	347	1.66	1.66	1.38	1.38	1.29	1.48
Boro HYV	1664	2654	3232	4128	4848	3305	2.68	2.68	2.58	2.49	2.49	2.58
Boro Pajam	-	32	40	38	20	26	-	2.40	2.58	2.40	2.31	2.42
Tral Paddy	35371	36582	33815	35355	33457	34916	-	-	-	-	-	-
Khrf Kaun	10	73	61	64	71	56	1.02	0.74	0.65	0.65	0.73	0.76
Rabi Kaun	8	4	16	16	10	11	0.92	0.92	0.74	0.74	0.54	0.77
Wheat	3944	2828	3434	3434	3272	3382	2.03	2.22	2.31	1.57	1.94	2.01
Jute Local	4864	6763	6383	4444	4444	5380	1.29	1.11	1.57	1.66	1.48	1.42
Jute HYV	1325	1539	1818	1495	1101	1456	1.57	1.48	1.66	1.85	1.85	1.68
Sugarcane	57	40	-	18	12	32	46.2	42.5	-	36.9	36.9	40.4
Khesari	21	16	30	32	34	27	0.92	0.83	0.83	0.74	0.83	0.83
Masur	71	61	81	81	71	73	0.83	0.65	0.74	0.74	0.74	0.74
Maskalai	40	30	28	30	30	32	0.65	0.74	0.83	0.83	0.83	0.78
Rab Chilli	21	24	22	22	26	23	0.83	0.74	0.74	0.74	0.74	0.76
Krf Chilli	10	10	10	12	12	11	0.55	0.65	0.65	0.65	0.65	0.63
Mustard L	129	444	386	351	404	343	0.74	0.74	0.74	0.65	0.65	0.70
Mustard H	-	-	18	18	12	16	-	-	0.74	0.74	0.74	0.74
Potato L	61	61	32	31	32	43	7.85	6.46	5.54	6.46	5.72	6.41
Potato HYV	59	61	80	91	81	74	10.2	9.20	8.30	8.90	8.90	8.90
Rabi G'nut	2	-	-	4	4	4	0.74	-	-	0.74	0.83	0.77
Khrf G'nut	-	-	-	4	4	4	-	-	-	0.92	1.11	1.02
Rabi Til	6	6	16	14	12	11	0.74	0.74	0.55	0.55	0.65	0.65
Khrf Til	14	12	8	8	8	10	0.64	0.64	0.64	0.55	0.55	0.61
Sweet Potao	121	121	101	20	20	77	10.2	8.30	8.30	9.20	7.40	8.70
Krf Vegtble	22	28	26	26	28	26	7.80	7.90	7.80	8.10	8.20	7.90
Rabi Vegtbl	14	12	16	16	18	15	8.80	7.80	7.80	8.40	8.90	8.30
Ttl Others	10799	12133	12156	10230	9706	11106	-	-	-	-	-	-
Grd Total	46170	48715	46381	45585	43163	46022	(total acreage : 29709.ha.c.i. =156%)					

source : the same as the precedent table note : same as above

Table V-3-1-(2) Year-wise Crop Production Data by BBS (contd.)

Upazila : Bhurungamari

unit : ha. ton/ha.

Crop	Cropped Area in hectare						Yield in ton/ha.					
	84/85	85/86	86/87	87/88	88/89	aver.	84/85	85/86	86/87	87/88	88/89	aver.
B-Aus L	8027	7474	5656	4969	4969	6219	0.65	0.74	0.65	0.83	0.92	0.76
T-Aus HYV	1159	1212	1002	1616	808	1159	1.85	1.94	1.29	1.38	1.48	1.59
T-Aman L	12726	12362	12201	15352	14382	13405	1.48	1.48	1.48	1.48	1.48	1.48
T-AmanHYV	3434	3555	3596	3596	5050	3846	2.31	2.17	2.22	2.03	1.85	2.11
T-AmanPjm	788	1212	1192	949	921	1012	2.31	2.22	2.22	2.03	2.03	2.16
T-Aman L	49	40	40	48	20	40	1.01	1.11	1.20	1.11	0.92	1.07
Boro L	141	133	101	105	20	100	1.66	1.66	1.38	1.48	1.29	1.49
Boro HYV	1414	2206	1822	2424	2828	2139	2.49	2.77	2.49	2.49	2.40	2.53
Boro Pajam	-	16	42	44	121	56	-	2.40	2.77	2.31	2.22	2.42
Tral Paddy	27738	28480	25652	29103	29119	27976	-	-	-	-	-	-
Khrf Kaun	12	16	30	30	30	26	1.02	0.74	0.65	0.65	0.74	0.76
Rabi Kaun	8	4	57	61	40	34	0.92	0.92	0.92	0.83	0.83	0.88
Wheat	1958	1366	1535	1535	1414	1562	1.94	2.03	2.22	1.57	1.85	1.92
Jute Local	1832	1907	2545	2020	2020	2065	1.38	1.11	1.38	1.66	1.57	1.42
Jute HYV	428	962	1091	1010	1212	941	1.57	1.38	1.66	1.85	1.85	1.66
Sugarcane	18	20	16	-	-	18	41.5	36.9	36.9	-	-	-
Khesari	89	81	65	67	51	70	0.92	0.74	0.83	0.92	0.92	0.87
Masur	44	40	40	36	40	40	0.65	0.65	0.65	0.74	0.74	0.68
Maskalai	59	61	61	32	20	46	0.74	0.74	0.83	0.92	0.83	0.81
Rab Chilli	101	101	162	174	152	138	0.92	0.83	0.83	0.83	0.74	0.83
Krf Chilli	18	10	10	6	6	10	0.65	0.65	0.65	0.65	0.65	0.65
Mustard L	182	162	137	91	81	130	0.74	0.74	0.65	0.65	0.74	0.70
Mustard H	-	-	4	4	52	12	-	-	0.74	0.74	0.74	0.74
Potato L	97	84	61	61	81	77	7.40	6.50	5.50	6.40	5.90	6.30
Potato HYV	162	141	141	158	129	146	9.70	9.20	8.30	8.90	7.80	8.80
Rabi G'nut	4	12	8	6	4	7	0.74	0.83	0.92	0.74	0.83	0.81
Khrf G'nut	2	2	8	8	8	5	1.11	1.11	1.11	0.92	1.38	1.13
Rabi Til	6	6	8	8	6	7	0.74	0.74	0.55	0.55	0.65	0.65
Khrf Til	7	6	4	4	4	5	0.65	0.55	0.65	0.65	0.74	0.65
Sweet Potao	72	61	51	46	44	55	10.6	9.70	8.30	9.20	8.30	9.20
Krf Vegtble	27	18	16	16	18	19	8.0	8.3	7.80	7.80	7.80	7.90
Rabi Vegtbl	12	10	10	10	12	11	8.3	7.8	7.40	8.40	8.90	8.20
Ttl Others	5138	5080	6060	5383	5424	5424	-	-	-	-	-	-
Grd Total	32876	33560	31712	34486	34543	33400	(total acreage : 16972.ha. c.i. =199%)					

source : the same as the precedent table note : same as above

Table V-3-1-(3) Year-wise Crop Production Data by BBS (contd.)

Upazila : Fulbari

unit : ha. ton/ha.

Crop	Cropped Area in hectare						Yield in ton/ha.					
	84/85	85/86	86/87	87/88	88/89	aver.	84/85	85/86	86/87	87/88	88/89	aver.
B-Aus L	9373	9290	6060	5656	5232	7122	0.74	0.65	0.83	0.83	0.92	0.79
T-Aus HYV	396	202	248	606	404	371	1.85	1.94	1.29	1.38	1.57	1.61
T-Aman L	11231	12160	12130	12524	12516	12112	1.57	1.57	1.48	1.38	1.38	1.48
T-AmanHYV	1283	1252	889	786	343	911	2.31	2.26	2.22	2.03	1.85	2.13
T-AmanPjm	408	388	384	384	333	379	2.31	2.22	2.22	2.12	2.03	2.18
T-Aman L	61	485	404	323	121	356	1.11	1.20	1.20	1.20	0.92	1.13
Boro L	162	174	234	253	40	173	1.66	1.66	1.57	1.66	1.48	1.61
Boro HYV	485	747	1238	2020	2828	1464	2.77	2.77	2.58	2.49	2.31	2.58
Boro Pajam	-	20	20	22	61	31	-	2.22	2.49	2.31	2.22	2.31
Tral Paddy	23399	24718	21607	22574	21878	22919	-	-	-	-	-	-
Khrf Kaun	12	16	16	18	18	16	0.92	0.74	0.55	0.65	0.74	0.72
Rabi Kaun	8	4	28	28	20	19	0.99	0.92	0.74	0.74	0.54	0.79
Wheat	739	505	889	889	897	784	2.03	2.03	2.12	1.57	1.38	1.92
Jute Local	1947	2105	2161	1761	1761	1947	1.20	1.02	1.48	1.57	1.38	1.33
Jute HYV	582	1061	764	345	1073	765	1.29	1.29	1.57	1.75	1.75	1.53
Sugarcane	51	16	12	34	36	30	41.5	36.9	36.9	36.9	36.9	37.8
Khesari	18	20	20	22	24	21	0.92	0.83	0.83	0.92	0.92	0.88
Masur	14	20	20	24	24	21	0.65	0.65	0.65	0.74	0.74	0.68
Maskalai	30	28	36	40	40	28	0.65	0.74	0.74	0.92	0.83	0.78
Rab Chilli	101	101	178	186	152	143	0.83	0.74	0.74	0.74	0.74	0.76
Krf Chilli	4	6	6	4	4	5	0.55	0.55	0.65	0.65	0.55	0.59
Mustard L	293	230	198	186	152	143	0.83	0.74	0.74	0.74	0.74	0.77
Mustard H	-	-	4	4	52	20	-	-	0.74	0.83	0.74	0.77
Potato L	77	57	57	40	61	58	7.40	6.5	6.0	6.4	5.9	6.4
Potato HYV	53	53	83	113	101	60	9.20	8.3	7.8	8.9	7.8	8.4
Rabi G'nut	-	4	-	(4)	(4)	4(4)	-	0.8	-	(1.11)	(1.20)	.8(1)
Khrf G'nut	10	8	10	12	8	10	0.74	0.74	0.55	0.55	0.65	0.65
Rabi Til	4	4	-	-	-	4	0.65	0.55	-	-	-	0.60
Khrf Til	40	40	10	10	10	22	9.2	9.2	8.3	9.2	6.9	8.6
Sweet Potao	26	16	19	18	22	20	8.0	8.1	7.8	7.8	7.8	7.9
Krf Vegtble	10	10	12	12	14	12	8.3	7.8	7.4	8.4	8.9	8.2
Rabi Vegtbl	91	12	10	14	16	29	1.04	0.92	0.92	0.92	0.92	0.95
Ttl Others	4101	4316	4523	3788	4458	4250	-	-	-	-	-	-
Grd Total	27500	29034	26140	26362	26366	27169	(total acreage : 125369.ha.c.i. =219%)					

source and note : the same as the precedent tables.

Table V-3-1-(4) Year-wise Crop Production Data by BBS (contd.)

Upazila : Kurigram Sadar

unit : ha. ton/ha.

Crop	Cropped Area in hectare						Yield in ton/ha.					
	84/85	85/86	86/87	87/88	88/89	aver.	84/85	85/86	86/87	87/88	88/89	aver.
B-Aus L	9567	8827	6464	5709	5656	7245	0.65	0.74	0.83	0.92	0.92	0.81
T-Aus HYV	990	1111	808	1010	606	905	1.75	1.85	1.38	1.38	1.48	1.57
T-Aman L	9723	9797	9979	10100	9736	9867	1.57	1.48	1.38	1.48	1.38	1.46
T-AmanHYV	2274	2283	2101	2626	2828	2422	2.31	2.12	2.12	2.03	1.85	2.10
T-AmanPjm	592	586	513	364	40	419	2.31	2.22	2.22	2.12	1.94	2.16
T-Aman L	61	40	40	40	40	44	1.02	1.11	1.11	1.11	0.92	1.05
Boro L	91	121	129	129	81	110	1.66	1.66	1.38	1.38	1.29	1.48
Boro HYV	679	1309	2040	3596	4040	2333	2.49	2.86	2.68	2.58	2.40	2.60
Boro Pajam	-	12	14	14	40	20	-	2.22	2.40	2.40	2.31	2.33
Tral Paddy	23977	24086	22088	23588	23067	23365	-	-	-	-	-	-
Khrf Kaun	12	61	40	44	40	40	1.02	0.65	0.55	0.65	0.74	0.72
Rabi Kaun	4	2	-	-	-	3	0.92	0.92	-	-	-	0.92
Wheat	1069	319	1323	1323	1131	1033	1.94	2.03	2.22	1.57	1.94	1.94
Jute Local	2396	2608	3293	2505	2505	2661	1.38	1.11	1.48	1.66	1.38	1.40
Jute HYV	481	889	1010	828	929	827	1.48	1.38	1.75	1.85	1.85	1.66
Sugarcane	73	77	-	6	2	39	45.0	44.8	41.5	32.3	34.6	38.3
Khesari	87	71	81	71	67	75	0.83	0.83	0.92	0.92	0.92	0.89
Masur	24	30	32	30	32	30	0.65	0.65	0.65	0.74	0.74	0.68
Maskalai	22	20	30	24	26	25	0.74	0.74	0.74	0.74	0.83	0.76
Rab Chilli	79	77	71	121	103	90	0.74	0.74	0.74	0.74	0.74	0.74
Krf Chilli	14	10	10	22	20	15	0.55	0.65	0.65	0.65	0.65	0.63
Mustard L	424	222	113	93	89	188	0.65	0.74	0.74	0.65	0.65	0.68
Mustard H	-	-	8	20	8	12	-	-	0.74	0.74	0.74	0.74
Potato L	61	48	32	133	129	81	7.85	6.46	5.55	6.37	5.72	6.39
Potato HYV	91	71	81	94	80	83	9.69	9.23	4.62	8.86	7.85	8.05
Rabi G'nut	3	2	2	28	28	13	0.83	0.83	0.92	0.74	0.83	0.83
Khrf G'nut	4	4	4	-	4	4	1.11	1.11	0.92	-	1.20	1.08
Rabi Til	8	8	4	8	6	7	0.65	0.65	0.55	0.55	0.65	0.61
Khrf Til	4	4	-	-	-	4	0.74	0.65	0.65	0.74	0.65	0.68
Sweet Potao	61	51	40	26	24	40	9.69	9.23	8.31	6.92	6.92	8.21
Krf Vegtble	19	22	24	30	24	24	7.8	7.9	7.8	8.1	8.2	8.0
Rabi Vegtbl	12	12	30	20	18	16	8.3	7.8	7.8	8.4	8.9	8.2
Ttl Others	4948	4608	6218	5426	5265	5310	-	-	-	-	-	-
Grd Total	28925	28694	28306	29014	28322	28675	(total acreage : 18269.ha.c.i. =159%)					

source and note : the same as the precedent tables.

Table V-3-2 Year-wise Crop Production Data by BBS
Total of 4 related Upazilas

unit : ha. ton/ha.

Crop	Cropped Area in hectare						Yield in ton/ha.					
	84/85	85/86	86/87	87/88	88/89	aver.	84/85	85/86	86/87	87/88	88/89	aver.
B-Aus L	70387	67185	46783	43612	42622	54236	0.69	0.71	0.89	0.88	0.96	0.83
T-Aus HYV	5684	4919	4680	8052	4735	5614	1.86	1.93	1.47	1.44	1.49	1.64
T-Aman L	96564	97816	96455	98576	89462	95593	1.53	1.51	1.43	1.41	1.47	1.47
T-AmanHYV	15753	15635	16160	15400	16055	15801	2.27	2.13	2.17	2.12	1.92	2.12
T-AmanPjm	3929	4097	3927	3206	2709	3574	2.28	2.19	2.19	2.07	2.02	2.15
T-Aman L	5086	4355	4000	2497	2222	3632	1.06	1.15	1.19	1.18	1.03	1.12
Boro L	1331	1644	2242	2361	703	1656	1.66	1.63	1.46	1.51	1.29	1.26
Boro HYV	7603	9425	15176	21844	26260	16062	2.57	2.72	2.57	2.52	2.41	2.46
Boro Pajam	0	56	354	402	889	425	-	2.34	2.56	2.33	2.19	2.36
Tral Paddy	205427	205132	189737	195950	185657	196593	-	-	-	-	-	-
Khrf Kaun	111	412	329	372	382	321	0.99	0.71	0.64	0.65	0.74	0.75
Rabi Kaun	93	44	111	123	97	94	0.97	0.92	0.79	0.88	0.54	0.82
Wheat	17622	12076	20059	20733	18806	17859	1.98	2.12	2.22	1.61	1.89	1.96
Jute Local	21260	21499	27080	18285	18245	21274	1.30	1.06	1.48	1.62	1.43	1.37
Jute HYV	5710	7573	8355	7179	7272	7220	1.49	1.31	1.66	1.80	1.80	1.61
Sugarcane	2131	1780	945	582	551	1198	41.6	37.9	36.9	35.0	35.1	37.3
Khesari	1390	1071	913	790	683	969	0.90	0.81	0.85	0.88	0.90	0.87
Masur	277	253	271	315	331	289	0.72	0.65	0.67	0.74	0.74	0.70
Maskalai	584	614	507	402	457	513	0.67	0.74	0.78	0.85	0.83	0.78
Rab Chilli	547	537	600	616	545	569	0.84	0.76	0.76	0.76	0.74	0.77
Krf Chilli	89	85	73	67	79	79	0.58	0.62	0.65	0.65	0.62	0.62
Mustard L	3903	3602	2969	3226	2355	3211	0.78	0.74	0.65	0.72	0.69	0.72
Mustard H	-	-	113	160	69	114	-	-	0.76	0.80	0.69	0.75
Potato L	444	412	382	592	609	488	5.70	5.76	6.04	5.91	5.91	5.86
Potato HYV	747	692	679	907	784	762	7.97	7.96	8.18	8.12	7.85	8.16
Rabi G'nut	26	63	618	313	271	258	0.79	0.80	1.02	0.81	0.84	0.85
Khrf G'nut	10	10	18	28	28	19	1.11	1.05	1.03	0.99	1.23	1.08
Rabi Til	83	75	87	99	85	86	0.67	0.69	0.52	0.56	0.59	0.61
Khrf Til	69	55	48	46	57	55	0.68	0.56	0.61	0.61	0.61	0.61
Sweet Potao	869	786	492	386	388	584	10.0	9.0	8.6	8.2	7.4	8.64
Krf Vegtble	226	263	242	234	278	249	7.96	8.06	7.68	7.88	7.86	7.89
Rabi Vegtbl	275	288	234	258	186	248	8.32	7.78	7.68	8.43	8.88	8.72
Ttl Others	56466	52200	65126	55713	52558	56459	-	-	-	-	-	-
Grd Total	261893	257332	254863	251663	238215	253052	(156% of total acreage incl. chaar)					

source : BBS Rangpur, note : data for tobacco not available

Table V-3-3 Trends of Cropping (1985~1989) unit : Ha. or ton/Ha./year

Crop	Cropping Area (Ha./year)					Yield Trends (ton/Ha./year)				
	Nages	Bhuru	Fulba	K.Sdr	PArea	Nages	Bhuru	Fulba	K.Sdr	Area
B-Aus Local	- 292	- 618	-404	-138	-317	-.123	-.075	+.007	-.143	- .03
T-Aus HYV	- 318	- 34	+ 75	-176	-166	-.067	-.183	-	+.262	+ 04
B-AmanLocal	-	- 21	0	-	- 1	+.084	-.050	-.003	-.206	-1.07
T-AmanLocal	-1362	+1016	+291	- 67	-516	-	-	+.018	+.101	+ .02
T-Amsn HYV	- 387	- 260	+ 5	+142	-177	-.068	-.357	-.019	-.188	- .09
T-AmanPajam	- 174	- 189	+ 34	+ 97	- 70	+.032	+.068	+1.308	+.060	+ .36
Boro Local	- 26	+ 95	+ 7	+164	+ 25	-.131	-.032	+.109	-.006	- .03
Boro HYV	+ 536	+ 266	+ 70	+369	+361	-.098	+.169	+.054	-.936	- .17
Wheat HYV	- 84	- 23	-	- 19	- 45	-.126	+.294	-	-.001	- .04
W.rainfed	- 184	- 264	+ 47	- 61	-105	-	-	-	-	-
Jute Local	- 321	- 339	+ 62	-270	- 49	-.090	-.090	-.207	-.066	- .11
Jute HYV	- 127	- 36	+295	-168	- 14	+.106	+.007	-	-.101	- .01
PotatoLocal	- 47	- 0	+ 5	+ 24	- 17	-.018	-.018	-.011	-.021	- .01
Potato HYV	- 29	- 3	+ 9	+ 76	+ 2	-.015	+.418	+.033	-.238	- .01
Mustard	- 34	- 116	+ 4	+ 5	- 22	+.033	-.006	+.008	-.060	- .01
Kaun	- 15	- 4	+ 2	-	0	-.012	-.173	-	-.008	- .01
Chilli	-	+ 1	+ 3	+ 3	0	-	-	+.007	-.223	- .03
Pulses	- 7	+ 10	-	-	- 2	+.037	-.006	-	-	0
Sweet Potato	- 31	+ 0	+ 1	+ 13	- 12	-	-	-.058	-1.670	- .31
Vegetables	- 91	- 0	+ 4	+ 32	- 36	-	- 1.970	-.691	-3.247	- .90

note : Most trends show declining or negative values due mainly to two consecticve years of large scale floods This table is based on the data supplied from agricultural extension offices.

Table V-3-4-(1)Estimated Year-wise Crop Production Within the Project Area
(only inside the currently established enbankment) unit : ha. ton/ha.

Crop	Year	Nageswari		Bhurungamari		Pulbari		kurigram Sadar	
		Area	Yield	Area	Yield	Area	Yield	Area	Yield
B-Aus L	84/85	5222	0.80	918	1.10	6819	0.63	4278	0.78
	85/86	5848	1.10	794	0.98	5667	0.75	4332	0.76
	86/87	4926	0.79	605	0.81	5486	0.73	3173	0.97
	87/88	3552	0.77	572	0.85	4735	0.84	2670	1.09
	88/89	5738	0.46	206	0.69	3109	0.64	2599	1.08
	aver.	5057	0.79	619	0.85	5153	0.73	3410	0.90
T-Aus L	84/85	447	1.85	-	-	-	-	-	-
	85/86	456	2.37	11	1.13	-	-	-	-
	86/87	452	2.17	11	1.83	-	-	-	-
	87/88	448	2.17	10	1.32	-	-	-	-
	88/89	106	1.99	5	0.94	-	-	-	-
	aver.	382	2.14	9	1.33	-	-	-	-
TAusHYV	84/85	1179	1.75	98	2.54	151	1.13	464	1.47
	85/86	1222	1.96	148	2.46	198	0.94	615	1.30
	86/87	1210	2.14	122	2.35	184	0.86	434	1.22
	87/88	1291	2.48	130	2.21	533	0.78	507	1.21
	88/89	930	1.59	26	2.37	483	0.86	652	1.33
	aver.	1166	2.01	105	2.37	310	0.86	534	1.31
B-AmanL	84/85	286	2.11	16	1.84	126	0.35	84	0.79
	85/86	289	1.81	16	1.86	129	0.31	18	0.75
	86/87	257	2.01	18	1.87	173	0.39	18	1.03
	87/88	265	2.00	64	1.90	160	0.40	18	1.07
	88/89	249	-nil	5	1.86	172	0.10	22	0.79
	aver.	269	1.61	24	1.88	152	0.30	32	0.88
T-Aman L	84/85	7309	1.04	1408	1.78	6454	1.37	3230	1.66
	85/86	5546	1.41	1610	1.75	7696	1.56	3245	2.08
	86/87	7179	1.92	1582	1.66	7017	1.73	3348	1.24
	87/88	7454	1.77	1793	1.45	8937	1.51	3053	1.45
	88/89	3926	0.75	520	1.42	4958	0.54	3385	0.83
	aver.	6283	1.44	1383	1.64	7012	1.41	3252	1.45
T-Aman P	84/85	2452	2.02	840	2.53	-	-	216	2.09
	85/86	2802	1.97	854	2.52	-	-	198	2.48
	86/87	1374	2.09	752	2.52	207	2.57	158	2.00
	87/88	925	1.79	661	2.32	218	2.05	242	1.93
	88/89	937	1.99	151	2.33	222	1.40	291	2.00
	aver.	1698	1.99	652	2.48	216	1.99	221	2.08
T-Aman H	84/85	3060	1.98	429	3.22	314	1.53	1260	2.51
	85/86	3466	2.15	579	2.43	352	1.53	1270	2.65
	86/87	3750	2.50	704	2.44	336	2.17	1111	2.12
	87/88	3499	3.00	601	2.42	324	2.53	1546	2.47
	88/89	4307	2.73	121	1.91	500	1.90	1545	1.76
	aver.	3616	2.50	487	2.54	365	1.91	1346	2.29

continuing to the following pages

Table V-3-4-(2)Estimated Year-wise Crop Production Within the Project Area (contd.)

Crop	Year	Nageswari		Bhurungamari		Fulbari		Kurigram Sadar	
		Area	Yield	Area	Yield	Area	Yield	Area	Yield
Boro HYV	84/85	1789	3.40	484	2.64	752	2.82	768	2.77
	85/86	2276	3.12	524	2.90	738	3.19	1149	2.78
	86/87	2475	3.25	534	3.13	967	3.29	1704	2.60
	87/88	3487	2.85	589	3.10	1251	2.78	2130	2.51
	88/89	4083	2.27	254	2.65	-	-	2472	2.49
	aver.	2822	2.87	477	2.92	927	3.01	1645	2.59
Aus/Aman	84/85	996	1.69	225	1.91	78	1.72	101	1.43
Mixed Pl.	85/86	947	1.74	212	1.77	-	-	-	-
or BoroL	86/87	917	1.76	258	1.90	-	-	-	-
	87/88	1085	1.68	240	1.88	-	-	-	-
	88/89	1006	1.39	39	1.47	-	-	-	-
	aver.	990	1.65	195	1.85	78	1.72	101	1.43
Jute L	84/85	983	1.66	365	1.53	401	0.66	1200	1.05
	85/86	1045	1.28	153	1.30	327	0.65	1389	1.72
	86/87	928	1.32	95	1.54	234	0.80	1958	1.41
	87/88	870	1.29	85	1.56	125	1.05	1452	1.70
	88/89	825	1.65	26	1.11	91	0	1454	1.31
	aver.	930	1.44	145	1.46	236	0.67	1491	1.45
Jute HYV	84/85	820	1.75	212	1.64	815	1.34	419	0.97
	85/86	961	1.39	91	1.60	719	1.68	332	2.12
	86/87	949	1.57	137	1.59	639	1.62	423	1.46
	87/88	1120	1.74	111	1.75	548	1.46	362	1.53
	88/89	720	1.98	38	1.46	359	0.82	483	1.52
	aver.	914	1.68	118	1.63	616	1.22	404	1.50
Mustard	84/85	321	0.83	78	0.80	141	0.86	67	0.55
	85/86	257	1.03	65	0.96	139	1.02	68	0.52
	86/87	354	0.80	76	0.73	138	1.01	84	0.54
	87/88	408	0.93	63	0.92	140	0.91	71	0.59
	88/89	370	0.92	54	0.70	133	0.52	76	0.53
	aver.	342	0.89	67	0.82	138	0.87	73	0.55
Kaun and	84/85	417	0.56	80	0.92	740	0.52	45	0.68
other	85/86	397	0.77	78	0.92	678	0.55	48	0.68
Millets	86/87	570	0.77	99	0.91	539	0.72	44	0.68
	87/88	563	0.82	74	0.61	577	0.52	53	0.58
	88/89	487	0.79	29	0.55	623	0.31	46	0.54
	aver.	487	0.75	72	0.82	631	0.52	47	0.64
Wheat L	84/85	815	1.14	294	1.47	81	0.71	-	-
	85/86	745	1.25	266	1.70	49	0.65	-	-
	86/87	821	1.35	237	1.72	21	0.64	-	-
	87/88	1030	1.37	204	0.72	-	-	-	-
	88/89	723	1.61	23	1.28	-	-	-	-
	aver.	827	1.35	205	1.43	50	0.68	-	-

continuing to the following pages

Table V-3-4-(3)Estimated Yea-rwise Crop Production Within the Project Area (contd.)

Crop	Year	Nageswari		Bhurungamari		Fulbari		kurigram Sadar	
		Area	Yield	Area	Yield	Area	Yield	Area	Yield
WheatHYV	84/85	858	1.94	200	2.01	426	1.57	697	1.63
	85/86	979	1.81	222	1.96	387	1.58	711	1.49
	86/87	1005	2.21	218	2.09	339	1.77	789	1.59
	87/88	1094	2.37	259	1.70	321	1.77	758	1.70
	88/89	1006	1.94	46	1.85	272	0.95	821	0.93
	aver.	988	2.07	189	1.93	349	1.56	755	1.46
SweetPto	84/85	188	6.24	9	11.44	21	4.85	15	7.38
	85/86	208	6.82	11	9.63	17	5.93	18	7.50
	86/87	232	8.20	12	8.84	13	5.68	19	7.48
	87/88	228	9.74	6	6.05	10	4.76	18	7.49
	88/89	9	13.03	3	10.53	4	3.47	17	7.48
	aver.	173	7.90	8	9.50	13	5.20	17	7.47
Potato	84/85	256	10.19	36	7.77	108	6.27	79	7.08
	85/86	333	9.46	33	8.97	105	6.34	95	8.22
	86/87	386	9.15	31	8.73	97	7.67	111	7.03
	87/88	437	9.95	34	8.56	108	7.77	111	8.17
	88/89	400	7.50	34	11.72	64	9.20	124	7.77
	aver.	362	9.64	34	9.35	96	7.32	108	7.65
Vegeta-	84/85	26	8.2	17	8.1	36	8.0	17	8.0
bles	85/86	40	7.9	12	8.0	26	8.0	19	7.9
	86/87	36	7.8	12	7.7	31	7.7	24	7.8
	87/88	42	8.3	11	8.1	30	8.1	28	8.2
	88/89	36	8.7	13	8.4	36	8.3	23	8.4
	aver.	36	8.2	13	8.1	32	8.0	22	8.1
Pulses	84/85	134	0.92	-	-	62	0.71	-	-
	85/86	107	0.83	-	-	72	0.74	-	-
	86/87	139	0.92	-	-	76	0.74	-	-
	87/88	151	0.89	-	-	90	0.90	-	-
	88/89	143	0.88	-	-	74	0.83	-	-
	aver.	135	0.89	-	-	75	0.79	-	-

Source : estimated from BBS union-wise data collected from upazila S.O.
Note : data for chilli, sugarcane, til, groundnut, tobacco etc. are not perfectly available, and finally omitted. Vegetables and Pulses include both rabi and kharif crops. Virtually, almost all potatoes and HYV wheat are irrigated. As the project area was located inside the existing embankment, only unions inside it were referred to.

Table V-3-5 Yield and Average Cropped Area per Farm in the Project Area from the results of Farm Interview Survey

Unit : ha. ton/ha.

Crop	Nageswari		Bhurangamari		Fulbari		Kurigram Sader		Project Area	
	Area/Farm	Yield	Area/Farm	Yield	Area/Farm	Yield	Area/Farm	Yield	Area/Farm	Yield
Aus Local	0.23	0.875	0.17	0.580	0.38	0.930	0.32	1.050	0.28	0.859
HYV	0.19	0.678	0.08	3.240	0.16	1.826	0.12	2.885	0.14	2.160
Aman B	0.07	0.187	-	-	-	-	0.00	0.461	0.04	0.324
T-Local	0.30	1.295	0.35	1.481	0.31	1.530	0.21	0.877	0.29	1.296
T-HYV	0.15	2.860	0.16	2.407	0.26	2.582	0.08	1.693	0.16	2.386
Boro Local	0.02	0.639	0.04	1.620	0.01	1.134	0.00	1.616	0.02	1.252
HYV	0.12	2.324	0.16	2.391	0.11	2.623	0.01	3.702	0.10	2.760
Wheat	0.10	2.051	0.15	1.389	0.02	1.234	0.05	1.682	0.08	1.589
Jute	0.15	1.352	0.16	1.302	0.19	1.178	0.11	1.520	0.15	1.338
Potato	0.02	4.397	0.11	4.474	0.02	5.323	0.01	2.828	0.04	4.256
Mustard	0.05	1.104	0.04	0.463	0.14	0.463	0.00	0.462	0.06	0.623
Chilli	0.02	2.631	0.00	0.810	-	-	0.00	2.631	0.00	2.024
Kaun	0.08	0.909	0.09	1.736	0.11	0.727	0.05	1.477	0.08	1.212
Pulses	0.05	0.914	0.03	0.463	0.01	-	0.00	0.810	0.02	0.729
Cheena	0.01	0.983	-	-	-	-	-	0.980	0.00	0.982
Sweet Potato	0.00	3.240	-	-	-	-	0.01	1.154	0.00	2.197
Vegetables	-	-	0.01	-	0.01	5.323	0.00	7.386	0.01	6.354
Sugarcane	-	-	-	-	0.06	3.372	-	-	0.01	3.372
Summer crop	1.17	-	1.00	-	1.44	-	0.81	-	1.15	-
Winter Crop	0.39	-	0.54	-	0.35	-	0.16	-	0.33	-

Source : Farm interview survey, by the Team.

Table V-3-6-(1) Use of Input from Interview Survey (1)

unit : kg/ha

Input Name		Seed					Urea				
Upazila		Nag.	Bhr.	Ful.	K.S.	P.Area	Nag.	Bhr.	Ful.	K.S.	P.Area
Aus	Local	68.3	46.2	67.4	69.2	68.3	84.5	84.2	95.0	90.1	89.5
	HYV	75.2	75.7	73.9	73.9	74.9	184.9	247.5	179.4	201.9	189.9
B-Aman		-	-	-	-	-	-	-	-	-	-
T-Aman	Local	66.1	47.5	67.4	64.4	66.5	81.7	129.2	97.4	85.7	91.0
	HYV	69.2	65.4	70.2	67.4	69.2	169.1	185.6	125.2	94.1	148.5
Boro	Local	69.1	75.7	71.1	35.1	64.6	153.5	173.3	74.2	-	148.5
	HYV	70.2	75.7	80.3	75.7	75.7	207.9	189.7	136.1	148.5	193.1
Wheat		95.1	101.7	101.6	104.3	99.7	136.1	136.1	113.9	107.2	131.3
Jute		25.9	34.8	21.2	18.5	22.7	88.2	95.5	131.5	67.2	85.1
Potato		4,136	11,080	5,909	5,263	4,986	146.3	140.2	148.5	-	145.4
Mustard		10.2	7.4	19.4	33.2	15.7	104.0	74.3	66.0	99.0	92.8
Chilly		14.8	13.8	-	-	13.8	99.0	49.5	-	-	86.6
Kaun(Fox Millet)		16.6	13.8	16.6	16.6	16.6	91.9	61.9	66.6	90.7	82.0
Chena(Ind.Millet)		27.7	-	-	16.6	20.3	-	-	-	74.3	74.3
Pulses		29.5	20.3	-	7.4	19.4	168.3	-	-	-	168.3
Vegetables		7.4	-	-	-	7.4	185.6	-	-	-	183.7
Sugar Cane		-	-	97.9	-	100.6	-	-	123.8	-	123.8
Doincha(Sesban)		-	-	-	-	-	-	-	-	-	-

Input Name		Triple Super Phospate					Muriata of Potash				
Upazila		Nag.	Bhr.	Ful.	K.S.	P.Area	Nag.	Bhr.	Ful.	K.S.	P.Area
Aus	Local	96.2	-	173.3	41.2	74.3	61.9	-	74.3	46.0	53.6
	HYV	120.4	140.2	95.2	94.1	115.1	47.3	74.3	52.2	39.6	60.0
B-Aman		-	-	-	-	-	-	-	-	-	-
T-Aman	Local	99.0	90.7	74.3	74.3	89.1	53.0	24.8	49.5	99.0	38.9
	HYV	94.6	74.3	123.8	49.5	90.7	40.0	57.7	49.5	24.8	43.0
Boro	Local	74.2	123.8	-	-	74.3	24.8	24.8	-	-	24.8
	HYV	140.2	173.3	57.7	-	118.8	74.3	74.3	57.7	-	69.3
Wheat		144.0	123.8	-	49.5	119.6	74.3	74.3	-	49.5	70.1
Jute		109.6	173.3	123.8	44.6	108.9	44.6	107.2	49.5	24.8	55.2
Potato		247.5	-	99.0	74.3	195.2	107.2	-	24.8	-	74.3
Mustard		284.6	173.3	-	-	188.1	123.8	74.3	24.8	24.8	86.6
Chilly		214.5	123.8	-	-	178.2	173.3	49.5	-	-	123.8
Kaun(Fox Millet)		181.5	-	-	-	181.5	99.0	-	-	-	99.0
Chena(Ind.Millet)		-	-	-	-	-	-	-	-	-	-
Pulses		173.3	-	-	-	173.3	-	-	-	-	-
Vegetables		228.9	-	-	-	228.9	74.3	-	-	-	74.3
Sugar Cane		-	-	-	-	-	-	-	-	-	-
Doincha(Sesban)		74.3	-	-	-	74.3	24.8	-	-	-	24.8

Table V-3-6-(2) Use of Input from Interview Survey (2)

unit : as per specified

Input Name		Manure (ton/ha)					Pesticide (in Tada/ha)				
Upazila		Nag.	Bhr.	Ful.	K.S.	P.Area	Nag.	Bhr.	Ful.	K.S.	P.Area
Aus	Local	1.74	1.94	1.82	3.29	2.15	371.6	279.7	247.5	287.3	327.7
	HYV	1.75	5.02	2.01	3.93	2.78	357.0	325.5	288.6	378.2	349.0
B-Aman		-	-	-	-	-					
T-Aman	Local		1.64	2.53	2.64	2.21	270.6	278.0	185.6	309.4	268.5
	HYV	2.04	2.68	1.87	1.15	2.03	350.5	310.2	319.3	-	342.5
Boro	Local	1.20	1.20	-	-	1.20	-	-	-	-	-
	HYV	2.93	1.94	4.08	1.20	3.05	438.6	495.0	258.2	-	399.7
Wheat		2.22	1.57	1.20	2.22	2.20	243.0	495.0	-	287.1	273.5
Jute		2.08	2.31	3.97	2.12	2.27	341.6	-	-	32.2	149.5
Potato		1.83	2.31	1.20	2.31	1.89	403.4	-	-	-	403.4
Mustard		4.28	3.42	1.38	1.94	2.04	-	-	-	-	-
Chilly		1.64	1.20	-	-	1.57	155.9	-	-	-	155.9
Kaun(Fox Millet)		1.44	1.20	2.14	1.20	1.72	215.3	-	-	-	215.3
Chena(Ind.Millet)		1.20	-	-	-	1.20	-	-	-	-	-
Pulses		1.64	-	-	-	1.64	155.9	-	-	-	155.9
Vegetables		1.20	-	-	-	1.20	32.2	-	-	-	32.2
Sugar Cane		-	-	5.77	-	5.77	-	-	-	-	-
Doincha(Sesban)		-	-	-	-	-	-	-	-	-	-

Input Name		Labour (hrs/ha/year)					Draught Power (hrs/ha/year)				
Upazila		Nag.	Bhr.	Ful.	K.S.	P.Area	Nag.	Bhr.	Ful.	K.S.	P.Area
Aus	Local	218.4	287.1	228.8	217.2	222.9	80.7	91.9	80.2	75.2	80.2
	HYV	243.1	198.0	228.9	269.9	246.1	81.7	74.3	73.6	81.2	80.4
B-Aman		203.0	-	-	74.3	181.5	-	-	-	-	-
T-Aman	Local	175.3	168.3	179.9	160.3	172.0	67.4	79.2	72.0	66.8	74.3
	HYV	203.3	185.6	181.0	203.7	195.7	65.5	68.1	70.1	61.9	66.3
Boro	Local	179.4	173.3	173.3	210.1	181.5	64.4	61.9	78.4	37.1	65.2
	HYV	218.2	185.6	198.0	222.8	207.7	71.2	68.1	66.8	74.3	69.7
Wheat		183.8	167.1	165.0	175.6	179.7	67.7	68.1	66.8	71.9	70.8
Jute		214.9	272.2	221.5	222.0	227.1	78.1	68.1	70.4	73.4	74.7
Potato		172.4	210.4	160.9	282.2	185.1	96.9	71.8	91.6	91.6	92.3
Mustard		104.5	74.3	123.8	90.7	230.2	64.0	61.9	59.1	61.9	61.9
Chilly		178.2	-	-	-	178.2	76.3	86.6	-	-	80.8
Kaun(Fox Millet)		172.3	173.3	155.8	195.5	172.4	74.3	66.0	71.2	78.4	74.9
Chena(Ind.Millet)		148.5	173.3	-	214.5	176.3	43.3	86.6	-	61.9	53.5
Pulses		116.1	74.3	24.8	49.5	107.6	46.6	61.9	-	12.4	45.4
Vegetables		206.2	-	222.8	156.7	198.0	57.4	-	61.9	28.9	60.0
Sugar Cane		272.3*	-	420.8	-	300.5	-	-	74.3	-	74.3
Doincha(Sesban)		74.3	-	-	-	74.3	-	-	-	-	-

* sweet potato

Table V-3-7 Crop Damage from Interview Results

unit : %

Upazila		Nageswari		Bhrungamari		Fulbari		Kuringram sadar		Project Area	
Cause of Damage		F	D	F	D	F	D	F	D	F	D
Aus Local	F.N.	1	38	0	93	9	15	9	43	4	40
	Q'ty	100	85	0	67	88	64	88	64	87	75
Aus HYV	F.N.	1	17	0	7	9	15	3	16	3	16
	Q'ty	29	47	0	28	95	61	71	52	49	49
B-Aman Local	F.N.	1	0	0	0	2	0	8	0	3	0
	Q'ty	62	0	0	0	43	0	59	0	54	0
T-Aman HYV	F.N.	35	0	42	1	52	0	47	0	41	0
	Q'ty	65	0	66	100	58	0	62	0	63	0
T-Aman HYV	F.N.	21	0	27	0	27	0	10	0	20	0
	Q'ty	48	0	73	0	56	0	84	0	61	0
Boro Local	F.N.	1	2	0	2	3	3	0	2	1	2
	Q'ty	100	83	0	43	60	100	0	52	60	75
Boro HYV	F.N.	2	6	2	22	0	16	1	3	2	8
	Q'ty	30	48	33	43	0	29	54	66	32	49
Jute	F.N.	5	13	13	22	3	23	8	15	6	16
	Q'ty	89	58	63	56	64	50	65	5	77	43
Wheat	F.N.	1	26	0	31	0	2	0	16	0	20
	Q'ty	50	45	0	50	0	60	0	41	0	47
Kaun	F.N.	0	9	0	11	1	13	0	5	0	9
	Q'ty	100	62	0	66	60	74	0	64	0	65
Mustard	F.N.	0	3	0	0	1	6	0	1	0	3
	Q'ty	0	68	0	0	100	83	0	33	0	56
Potato	F.N.	0	4	0	4	0	2	0	0	0	3
	Q'ty	0	62	0	20	0	17	0	0	0	35
Pulses	F.N.	1	4	-	-	-	-	-	-	1	35
	Q'ty	58	52	-	-	-	-	-	-	29	26
Chilly	F.N.	0	2	-	-	-	-	-	-	0	1
	Q'ty	0	67	-	-	-	-	-	-	0	34
Sweet Potato	F.N.	0	0	-	-	-	-	-	-	0	0
	Q'ty	60	0	-	-	-	-	-	-	30	0
Sugar Cane	F.N.	-	-	-	-	-	-	2	0	-	0
	Q'ty	-	-	-	-	-	-	71	0	-	11

Note : 0 includes figures less than 0.4%
Flood damages includes those from heavy rains
F.N. : Farm Number
Q'ty : Quantities
F : Flood
D : Drought

Table V-3-8-(1) Pest-Damaged Area and Pesticide Use in Kurigram District

unit : ha

Year	Aman-Paddy	Potato	Mustard	Wheat	Winter Veget.	Boro-Paddy	Sugar Cane	Aus-Paddy	Jute	Summer Veget.
Pest Attacked Area										
1984/85	2262	29	21	8	300	1296	105	1625	46	483
1985/86	2098	23	25	13	273	1250	88	1508	45	449
1986/87	1718	27	21	13	296	1323	85	1544	48	414
1987/88	4283	21	15	11	197	186	-	-	-	-
Chemical Sprayed Area										
1984/85	2262	29	21	8	300	1296	105	1625	46	483
1985/86	2098	23	25	13	273	1250	88	1508	83*	449
1986/87	1718	27	21	13	296	1323	85	1544	48	410
1987/88	4283	21	15	11	197	186	-	-	-	-
% of Attacked Area in Average										
1984-87	2.6	1.0	2.9	0.2	17.8	3.4	26.8	2.0	0.3	69.1

Source : Kuringram Farmers
Note * Pesticides are usually costly, so they used to be applied after pests are discovered. But in this case some preventive spray must have been performed. Rate of pest-attack is still low except vegetables (especially summer) and continuous sugarcane crop.

Table V-3-8-(2) Informed Major Flood Damage by Upazila

unit : ha. ton 1000taka

Upazila	Year	Crop	Affected Area(ha)	Lost Qtty.	Value Lost	Rate of Loss in ton/ha	Rate of Loss % to Std
Nageswari	88/89	T-Aman	6773	14633	120000	2.16	90%
	88/89	Jute	199	329	2668	1.65	100%
	88/89	T-A-Pajam	1123	2430	20000	-	-
Bhurungamari	88/89	T-Aman	1164	1721	8304	1.48	60%
	88/89	Jute	12	-	71	-	60%
Fulbari	88/89	T-Aman	283	848	4571	3.00	100%
	88/89	All Crop	2980	-	-	-	-
Kurigram S.	88/89	T-Aman	4884	7820	2740	1.60	80%
	88/89	Jute	1515	950	225	0.62	40%

An Example of Damage Estimation by BBS in Kurigram Sadar in 1988/89

Crop	Affected wholly damaged	Area in ha. Partly-damaged area	extent(%)	Partly-damaged area(ha)	Total Damaged Acreage	Std. Yield ton/ha.	Total Crop Dama'd	Rate of Loss	Estimated Loss
Jute	808	1616	50	808	1616*	1.67	2699	60	1619
Aus-L	808	3232	50	1616	2424	1.30	3151	60	1891
BoroL	-	323	25	81	81	2.78	225	25	56
BoroHYV	-	2626	25	960	960	3.70	3552	25	888
Kaun	81	162	50	81	162	1.11	180	60	108

Saurce : BBS Officers Unpublished Data. Estmated Loss in metric tons.
Note * This figure was finally appraised as 1515 as is seen above.

Table V-3-8-(3) Cropped Area Flooded by 1988/89 Flood

(rate of Submergence 25.5%)

unit : ha.

Name of Union	Total Area	Flooded A.	Name of Union	Total Area	Flooded A.
Nageswari Upazila			Bhurungamari Upazila		
Bhittorbond	1382	574	Andharijhar	4529	972
Kaligonj	1719	384	Joimonilhat	3150	354
Hasnabad	1596	265	Bongoshonahat	2889	346
Newasi	1818	504	Proj. Area Total	10568	1672 (16%)
Khamkahana	2160	143	Furbari Upazila		
Nageswari	2635	627	Nowdanga	2061	680
Raigonj	1626	372	Fulbari	1888	85
Bhamondanga	1557	582	Shimulbari	1541	693
Khedar	2242	651	Kashipur	2190	105
Shontshpur	2482	579	Bhangamor	2137	216
Proj. Area Total	19217	4681 (23%)	Borobhita	2614	1620
Kurigram Sadar Upazila			Proj. Area Total	12431	3409 (27%)
Paachighachi	1971	808	Grand Total	49397	12617 (25.5%)
Bhogdanga	2831	808	Outside the Project Area		
Goghadaha	2379	1239	Nageswari 5unions	9274	2694 (29%)
Proj. Area Total	7181	2855 (39%)	Bhurun'ri 2unions	9129	1638 (18%)
			KurigramS 2unions	4047	3038 (75%)

Source : unpablished upazila data,

Note : area south to the Dharla embankmant such as a part of Fulbari and 4 other unions of Kurigram S. omitted.

Table V-3-9(1)Estimation of Current Livestock Herds

Upazilas	Upazilas Total		Kurigram S.		Nageswari		Bhrungamari		Fulbari	
No of L.S.U.	Adult	Young	Adult	Young	Adult	Young	Adult	Young	Adult	Young
Cattle Head	105,267	68,339	13,361	17,763	43,173	18,502	33,101	9,580	15,632	22,494
L.S.U. equiv	105,267	34,170	13,361	8,882	43,173	9,251	33,101	4,790	15,632	11,247
Buffaloe H.	5,354	1,563	949	348	3,426	605	689	200	290	410
L.S.U. equiv	5,354	781	949	174	3,426	302	689	100	290	205
Goat H.	43,470	43,375	12,921	7,543	17,496	25,975	6,510	5,214	6,543	4,643
L.S.U. equiv	4,347	2,169	1,292	377	1,750	1,299	651	261	654	232
Sheep H.	8,918	8,365	1,760	1,030	3,391	5,087	2,444	871	1,323	1,377
L.S.U. equiv	891	418	176	51	339	254	244	44	132	69
Total H.	-	-	-	-	-	-	-	-	-	-
L.S.U. equiv	115,859	37,538	15,778	9,484	48,688	11,106	34,685	5,195	16,708	11,753
Land Area(ha)	50,305		10,194		20,231		7,449		12,431	
Total L.S.U	153,397		25,262		59,794		39,535		28,481	
L.S.U./ha	3.1		2.5		3.0		5.3		2.3	

Note : Land area also includes a part out of project area.
Actual carrying capacity will be lower than the calculated figures because of sales/slaughter.
L.S.U. : Livestock Unit (Wt=500Kg)

Table V-3-9-(2)Livestock Holding Patterns by Agricultural Census 83/84

Upazila Name	Numbers of Livestock ……1000 heads…… Nag.	Blu.	Ful.	K.S.	Percntage of Holders Nag.	Blu.	Ful.	K.S.	Average Head/Farm
				Bovine Animal (Cattle and Buffaloes)					
All Holdings	80.4	58.3	36.9	47.6	54.2	60.0	51.4	51.5	2.8 - 3.2
Non Farm Hold'	2.3	1.8	1.0	1.5	14.6	17.1	9.6	10.3	-
Small Holders	23.0	18.8	12.1	15.1	59.2	66.9	57.5	54.8	1.4 - 1.7
Medium Holders	35.8	26.1	16.4	21.3	95.1	97.6	96.4	93.3	4.1 - 4.6
Large Holders	19.3	11.1	7.4	9.8	97.3	99.6	99.2	98.0	7.7 - 8.7
				Number of Holding with Goasts/Sheep					
	…… 1000 holdings ……				% of total farm holdings				
All Holdings	22.8	14.2	11.8	13.8	57.8	55.2	62.0	58.1	
Non Farm Hold'	0.6	2.3	2.7	2.7	49.8	38.1	44.2	37.8	
Small Holders	9.5	6.2	5.5	6.4	59.7	57.3	65.3	60.6	
MediumHolders	6.4	4.0	2.8	3.7	73.8	70.2	78.4	76.6	
Large Holders	2.0	1.0	0.7	1.0	79.4	76.0	83.5	82.6	
				Poultry (Chiken and Duck/Geese)					
All Holdings	190.	112.9	82.	115.3	76.6	73.4	69.9	75.6	4.3 - 4.9
Non Farm Hold'	30.8	17.7	11.2	15.9	60.6	57.3	51.3	57.4	3.6 - 4.1
Small Holders	68.7	43.5	32.6	46.9	79.7	76.3	74.2	79.2	3.9 - 4.4
MediumHolders	63.8	38.7	28.0	37.6	89.0	86.7	86.5	90.0	6.9 - 7.7
Large Holders	27.6	13.3	10.5	14.9	93.2	89.2	90.5	93.8	9.9 - 12.8

Source : Agricultural Census 1983/84

Note : Numbers of goats not available

Table V-3-10 Estimated Feed Dependency of Draught Animals etc. on Grainstraw

unit : item-wise given

Item/Upazila	Nageswari	Bhrungamari	Pulbari	Kurigram Sadar	Project Area
Bullock (head)	61675	22532	38126	31124	153457
Buffalo (head)	4031	484	700	1297	6512
Unit head *	66714	23137	39001	32745	161597
	(below : in tons)				
Produced Paddy	49738	8006	10971	21187	89902
Equiv.Paddystraw	56700	9167	12911	24534	103312
Produced Wheat	3169	677	259	1099	5204
Equiv.Wheatstraw	3486	745	285	1209	5725
Available P.straw	48195	7792	10974	20854	87815
Available W.straw	3137	671	257	1088	5153
Avail.Pstraw/head	0.722	0.337	0.281	0.637	0.543
Avail.Wstraw/head	0.047	0.027	0.007	0.033	0.035
Total Straw/h./yr.	0.769	0.364	0.288	0.670	0.578
	(below : in per cent)				
T.D.N.Dependency on Grainstraw	84.3	39.9	31.6	73.4	63.3
Estimated Grass Intake to/head/yr.	3.2	12.4	13.9	5.4	7.5
Estimated Rawgrass Intake kg./head/day	8.8	34.0	38.3	14.8	20.7

Source : estimated from the data by upazila profile statistics 1988/89

Note : * estimated under an assumption that average weight of draught animal be 300 kg. including calves and that of buffaloes 375 kg. One unit head = 1 adult bullock = 0.8 adult buffalo. TDN requirement is averagely estimated as 4.5 kg./day/adulthead only for maintenance metabolism.

Table V-3-11 Fish Resources In Kurigram District

unit : itemwise specified

Item	Unit	Number	Item	Unit	Number	
Professional Fishermen	men	7252	Production of Fries	thousand nos	550	
% of Fishermen/Population	%	0.05	Shortage of Fries	- do -	3400	
Fishermen per Village	men	8.6	Annual Fish Catch	metric-ton	4170	
Fishing Cooperatives	nos.	44	Annal Fish Demand	- do -	12286	
Number of Rivers	nos.	10	Annal Fish Shortage	ton	8116	
Water Area of Rivers	ha.	3399	Fries Required	thousand nos.	3950	
Number of Beels(lakes)	nos.	251	Comprehensive Fishery Devlpment Scheme			
Water Area of Beels	ha.	1264	Participating Upazilas	nos.	3	
Canals and Ponds	nos.	86	Total Number of Ponds	nos.	15	
Water Area of Canal/Pond	ha.	218	Water Surface of Ponds	ha.	3.2	
Private Dighis(Ponds)			Total Cost Invested	taka	86984	
fallow ponds	nos.	1249	Name of NGO		R.D.R.S.	R.I.P
d.o. their water-area	ha.	193	Particpated Group	nos.	41	56
cultivated ponds	nos.	2331	Total Farmers	men	749	1247
d.o. water area	ha.	429	Total Fishponds	nos.	45	10
Grand Total of Ponds	nos.	3666		ha.	13	27
d.o. water surface	ha.	840	Planned Fry Production	nos.	54800	n.a.
% of Water Surface	%	3.9	Planned Fish Production	kg.	3251	n.a.
Per Capita Area of W.S.	ha.	0.004	Planned Fish Sale 1000	taka	64	155

Souce : personal information from Upazila F.O.s

Table V-4-1 Yield Estimation from Improvement Factors

unit : ton/ha. coefficients

Crop	Current yield A	Techno-renova' B	Damage Preve' C	W.O.Y. estim' D =ABC	Varie' impro' E	Techn' impro' F	Flood prev' G	Drought P H	Complex F I=EFGH	W.P.Y. proje' J=AI	WPY/WOY J/D
B-AusL	0.83	1.00	1.00	0.83	1.15	1.30	1.19	1.32	2.35	1.95	2.3
T-AusH	1.64	1.15	1.13	2.13	1.15	1.15	1.13	1.14	1.70	2.79	1.3
BAmanL	1.15	1.00	1.05	1.21	-	-	-	-	-	-	-
TAmanL	1.47	1.00	1.05	1.57	1.15	1.40	1.15	1.00	1.85	2.72	1.7
TAmanP	2.15	1.10	1.05	2.48	-	-	-	-	-	-	-
TAmanH	2.12	1.15	1.13	2.75	1.15	1.40	1.13	1.00	1.82	3.86	1.4
Boro L	1.26	1.00	1.05	1.32	-	-	-	-	-	-	-
Boro H	2.56	1.15	1.05	3.09	1.15	1.20	1.05	1.19	1.72	4.41	1.4
Jute L	1.37	1.00	1.05	1.44	-	-	-	-	-	-	-
Jute H	1.61	1.00	1.05	1.69	1.00	1.10	1.17	1.24	1.60	2.57	1.5
Mustad	0.75	1.15	1.00	0.86	1.15	1.10	1.08	1.31	1.79	1.34	1.6
Kaun	0.79	1.00	1.00	0.79	-	-	-	-	-	-	-
WheatL	1.64	1.00	1.00	1.64	-	-	-	-	-	-	-
WheatH	1.96	1.15	1.00	2.25	1.15	1.20	1.00	1.26	1.74	3.41	1.5
Potato	8.89	1.15	1.00	10.22	1.15	1.20	1.19	1.34	2.20	18.92	2.1
Sptato	7.75	1.00	1.00	7.75	-	-	-	-	-	-	-
Pulses	0.86	1.05	1.00	0.90	1.15	1.10	1.00	1.25	1.58	1.36	1.5

Source : based on the BBS statistics used, results of farm interview survey

note : the results obtained here gives only an indicator for checking W.P.Y.

WOP : without-projectyields, WPY : with-project yields

Table V-4-2 Long-Term Yield Trends of Selected Crops in Bangladesh

unit : annual growth rate in %

Crop	Trends for 1974 - 82	Trends for 1978 - 88 *	Yield ratio of Local vars/ HYVs
Total Paddy	1.7	1.4	2.07
Aus Varieties	2.3	-	1.87
Amanv Arieties	2.1	-	Transplanted 1.58
	-	-	Broadcasted 2.26
Boro Varieties	1.0	-	1.84
Potatoes	0.7	0.9	1.62
Wheat	12.6	0.4	2.28
Pulses	-1.9	+1.0	-
Jute	2.6	1.7	1.22
Oilseeds	1.2	1.1	-
Kaun	-	0.7	-
Sugarcane	0.8	-	-

Note : * estimated from FAO prodution yearbooks. An overall five year trend was estimated by adopting rhe average of two major crops i.e. paddy and jute : 0.5 (p+j)* 5 = 9.3% mean of yield ratio 0.5 (yp+yj) = 1.65, 9.3*1.65 = 15%

Source : Bangladesh Agriculture by Mustaq Ahmed, FAO yearbooks

Table V-4-3 List of High Yielding/Improved Varieties

Crop	Name of HYV and Improved Local Varieties		Remarks
	Existing	Future Promising	
T-Aman	BR-4, BR-5, BR-10, BR-11, BR-22, BR-23 Latisail, Nigesail, Rajsail, Binasail		* photo-sensitive improved var's
T-Aus	BR-1, BR-2, BR-3, BR-6, BR-8, BR-9, BR-14, BR-16, BR-20	BR-21	short duration
Boro	BR-1, BR-2, BR-3, BR-7, BR-9, BR-12, BR-14, BR-15, BR-16, Hobigonj*	Iratom-24, BAU-63 (Barsha), BR-18&19	* improved var's
Wheat	Kanchan, Sonalika, Ananda, Akbar Balaka, Agrahaioni*	Bolkot**, Kufri-lalima	** leaf-rust resi- * late-sowing var.
Potatoes	Cardinal, Multa, Kufri-Shunduri Albina, Chunri	Diamond, Serrana, Patroniez	
Jute	O-4, O-9897*, D-154, CVL-1, CVP-3	CVE-3, Choitori	* late sowing var.
Musterd	Tori-7*, Shonaly, Shonpad, Shazal SS-75, Rai-5, TS-72 Shombol	Kalyania, Daulat**	* improved var's ** drought torelant
Mungbean	Mubarik, Faridpur-1	Eshordy-16	
Khesari	Kalaroa*, 630	Selection-3968	* improved var.
Kaun	Bogla-1, Sibnagar, Lokashamipur	Proso-millet	
Maize	Bornali	Shuvra, Khai-bhutta	
Tomato	Roma VF,	Mamik, Ratan	

Table V-4-4 Land Type Distribution under W.P. and W.O.P.*

unit : ha.

land Type / Project	F_0		F_1		F_2		Total	
	W.P.	W.O.P.	W.P.	W.O.P.	W.P.	W.O.P.	W.P.	W.O.P.
Nageswari	12910	11100	2800	5660	0	100	15710	16860
Bhurungamari	1790	1770	200	310	0	0	1990	2080
Fulbari	7300	7210	290	600	0	100	7590	7910
Kurigram Sadar	700	420	5510	5630	1300	2200	7510	8250
Peoject Area	22700	20500	8800	12200	1300	2400	32800	35100

Source : estimated from crop, soil, elevation and flood damage maps. and scheduled canal/drainige lines. Changes in land type acreages reflect drainage improvement in case of increase in Fo or decrease in other land types in one hand, and acquisition of land for canal/drainage construction on the other. *: With/Without Project

Table V-4-5-(1) Input Requirement (With-Project)

unit : ha. kg.or l./ha. ton/project

Crop	Area	Seed		Urea		T.S.P.		M.P.		Gypsum		ZincSulfate	
		rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.
B-Aus local	3075	100	308	100	308	20	62	20	62	-	-	-	-
T-Aus HYV	12450	25	311	150	1867	30	374	30	374	-	-	4	50
T-Aman HYV	10475	30	314	190	1990	120	1257	30	314	-	-	4	42
T-Aman Local	1975	40	79	110	217	40	79	-	-	-	-	-	-
LateT-AmanII	4800	16	77	140	672	100	480	30	144	-	-	4	19
Boro HYV	7100	25	178	210	1491	140	994	40	284	-	-	4	28
Wheat HYV	7875	125	984	130	1024	120	945	75	591	90	709	4	32
Jute HYV	7875	12	95	130	1024	30	236	60	473	-	-	4	32
Potato HYV	1425	1500	2138	100	143	230	328	300	428	260	371	4	-
Mustard HYV	7650	10	77	70	536	160	1224	50	382	130	995	4	31
Khesari Pulse	7100	30	213	-	-	30	213	20	142	-	-	4	28
Mungbean	5675	20	114	45	255	40	227	20	114	-	-	4	23
S.Vegetables	875	0.3	0.3	170	149	90	79	220	193	100	88	5	4
W.Vegetables	225	0.4	0.1	250	56	150	34	190	43	50	11	5	1
Foddermaize	1525	50	76	100	153	60	92	60	92	90	137	4	6
Dhoincha(GM)	1975	40	79	-	-	30	59	-	-	-	-	-	-

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Table V-4-5(2) Input Requirement (With-Project) (contd.)

unit : kg. or l./ha. * manday 1000 mandy ** hr. 1000hr.

Crop	Manure		Pesticides		Pesticides		Labour*		Draught**		Implement	
	rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.
B-Aus l	5t.	15375	ma1.0	3	-	-	130	400	250	769	2.5	7764
T-Aus H	5t.	62250	b 0.5	6	d 0.5	6	125	1556	280	3486	2.5	31125
T-AmanH	-	-	d 0.5	5	bd1.0	10	150	1571	270	2828	2.5	26188
T-AmanL	5t.	9875	ma1.0	2	-	-	140	277	280	553	2.5	4938
LateT-A	-	-	ma1.0	5	-	-	120	576	260	1248	2.5	12000
BoroHYV	-	-	d 0.5	4	bd0.5	4	200	1420	280	1988	2.5	17750
Wheat H	4t.	31500	s 1.7	13	d 0.5	4	150	1181	280	2205	2.5	19688
JutelHYV	4t.	31500	d 0.5	4	ma0.8	6	250	1969	400	3150	2.5	19688
PotatoH	8t.	11400	s 1.7	2	dz6.0	4	200	285	400	570	2.5	3563
Mustard	6t.	45900	s 1.7	13	-	-	50	383	375	2869	2.5	19125
Khesari	8t.	56800	s 1.7	12	-	-	80	568	60	426	2.5	17750
Mugbean	6t.	34050	ma0.8	5	-	-	125	709	240	1362	2.5	14188
S.Veget	5t.	4375	ma1.0	1	d 1.0	1	360	315	150	131	2.5	2188
W.Veget	5t.	1125	ma1.0	0	-	-	360	68	150	34	2.5	563
FodderC	2t.	3150	-	-	-	-	50	79	60	95	2.5	3938
Doincha	-	-	-	-	-	-	20	40	20	40	2.5	4938

Note : ma:marathion, bd:biddrin, b:basudin, d:dimecron, dz:diazinon, s:sevin
qtty.:quantity/project, manure rate expressed in ton/ha Source:calcilated

Table V-4-5(3) Input Requirement (Without-Project)

unit : ha. kg. or l./ha. ton/project

Crop	Area	Seed		Urea		T.S.P.		M.P.		Gypsum		ZincSulgate	
		rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.
B-Aus l	13242	70	927	25	331	10	132	0	0	0	0	0	0
T-Aus H	2756	20	55	110	303	80	220	40	110	30	83	5	14
B-AmanL	453	100	45	30	14	10	5	0	0	0	0	0	0
T-AmanL	14474	35	507	100	1447	60	868	40	579	20	289	5	72
T-AmanP	3066	35	107	170	521	100	307	50	153	40	123	5	15
T-AmanH	7879	30	236	150	1182	100	787	50	394	30	236	5	39
BoroHYV	5745	30	172	170	977	120	689	50	287	30	172	5	29
Boro L	1872	30	56	60	112	30	56	0	0	0	0	0	0
AusAman	1296	40	52	80	104	60	78	40	52	20	26	5	6
Jute L	2795	10	28	50	140	8	22	12	34	20	56	0	0
JuteHYV	1962	7	14	60	118	10	20	12	24	30	59	0	0
Mustard	601	8	5	60	36	40	24	30	18	50	30	0	0
Kaun	1175	7	8	60	71	40	47	0	0	0	0	0	0
Wheat L	1140	150	171	60	69	40	46	12	14	30	34	0	0
WheatHY	2158	150	324	85	183	50	108	25	54	50	108	2.5	5
SPotato	200	900	180	20	4	8	2	50	10	0	0	0	0
PotatoH	660	1500	990	250	165	180	119	50	165	0	0	0	0
S. Veget	200	0.3	0	320	64	220	44	230	46	50	10	5	1
W. Veget	300	0.8	1	375	113	225	68	225	58	50	15	5	2
PAULSES	250	30	8	0	0	20	5	0	0	0	0	0	0

(continued)

Table V-4-5(4) Input Requirement (Without-Project) (contd.)

unit : kg. or l./ha. * manday 1000 mandy ** hr. 1000hr.pair

Crop	Manure		Pesticides		Pesticides		Labour*		Bullock**		Implement	
	rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.	rate	qtty.
B-Aus I	0	0	0	0	0	0	120	1589	66	874	2.0	16484
T-Aus II	1.0	2756	b6.0	2	dm0.7	0	144	397	72	198	2.5	6890
B-AmanL	0	0	0	0	0	0	140	63	72	33	2.0	906
T-AmanL	1.0	14474	b6.0	87	dm0.7	10	100	1447	100	1447	2.5	36185
T-AmanP	4.0	12264	d1.0	3	dz1.0	3	150	460	100	307	2.5	7665
T-AmanH	1.5	11819	b6.0	47	dm0.7	6	150	1182	84	662	2.5	19678
BoroHYV	1.5	8618	b6.0	34	dm0.7	3	156	896	90	517	2.5	14363
Boro L	1.0	1872	0	0	0	0	162	303	123	230	2.5	4680
AusAman	1.5	1947	0	0	0	0	140	181	72	93	2.5	3240
Jute L	5.0	13975	0	0	0	0	200	559	48	134	2.0	5590
JuteHYV	6.0	11772	0	0	dm0.5	1	225	441	60	118	2.0	3924
Mustard	1.5	902	b1.0	2	0	0	115	69	72	43	2.0	1202
Kaun	1.0	1175	0	0	0	0	96	113	48	56	2.0	2350
Wheat L	2.0	2280	0	0	0	0	100	114	48	55	2.0	2280
WheatHY	1.5	3237	0	0	dz0.5	1	110	237	60	129	2.0	4316
SPotato	1.0	200	0	0	0	0	100	20	40	8	2.0	1320
Potato	6.0	3960	b6.0	4	dz1.0	1	128	84	300	198	2.5	1650
S.Veget	5.0	1000	ma1.0	0	dm1.0	0	160	32	80	16	2.0	400
W.Vege	6.0	1800	ma1.0	1	0	0	50	75	170	51	2.5	750
PAULSES	5.0	1250	0	0	0	0	80	20	40	10	2.0	500

Note : ma:marathion, bd:biddrin, b:basudin, d:dimecron, dz:diazinon, s:sevin
Z.S. :zinc sulphate, qrry:quantity/project, manure rate in ton/ha.

Table V-4-6 Farmgate Prices of Agricultural Inputs in Kurigram

unit : kg. or l. take/kg. or l.

Item	Qty.	U.Price	Item	Qty.	U.Price	Item	Qty.	U.Price
Fertilizers			Seed(contd.)			Chemicals(contd.)		
urea	kg.	4.85	tomato import'	kg.	1170.0	basudin10granulkg.		81.0
Nitrogen	Nkg.	11.20	cauliflower	kg.	1125.0	diazinon 60-EC l.		138.6
T.S.P.	kg.	5.00	radish import'	kg.	350.0	sumithion 20-EC l.		1100.0
Phosphate	P205kg.	10.70	okra	kg.	16.0	furadan 3granulkg.		72.5
M.P.	kg.	4.00	watermelon	kg.	75.0	Feeds		
Potash	K20kg.	7.10	cucumber	kg.	10.5	rice bran ton		357.5
ZincSulphate	kg.	17.25	red-chilly	kg.	75.0	mustard oilcake t		6500.0
Sulphor	Skg.	42.20	doincha	kg.	15.0	Livestock		
Zinc	Znkg.	6.70	Seedling			buffaloes adultpair		5-8000
Gypsum	kg.	1.40	boro paddy	100bundle	31.3	bullocks adultpair		2-5000
Cowdung	ton	150.00	tomato	100nos	2.0	goat(male) head		400
Seed			brinjal	100nos	2.0	goat(female) head		300
paddy HYV.	kg.	6.3- 8.5	cauliflower	100nos	5.0	cow(yearling) head		500
paddy local	kg.	6.0-11.0	cabbage	100nos	5.0	cull bullock head		1500
jute HYV.	kg.	16.0-60.0	Agrochemicals			chicken bird		25-40
jute local	kg.	12.0-28.0	dimecron	l.	600-650	duck bird		25-30
wheat HYV.	kg.	7.3- 8.5	bidrin	l.	670-800	Husking charge ton		214.5
mastard L.	kg.	10.7	malathion	l.	200	FlourMilcharge ton		536.2
mastard HYV.	kg.	20.0	dithane-M-45	kg.	300	Husker-Engine set		34600
khesari	kg.	10.0	heptachlor 40WP	kg.	181-345	RiceDehulMill set		49600
mungbean	kg.	17.0-28.0	sevin 85-SP		495	IrrigateWater ha.		1875-2475
potato	kg.	9.0	dipterex 80-SP	kg.	356	d.o.uplandcropha.		675-960
maize	kg.	10.0	gramoxon	l.	195	shallowtubepumpset		3500
kaun	kg.	7.0	dieldrin 20-EC	kg.	420	shal'tubeengineset		13900

source : observed in the area during Aug.1989-Mar. 1990 by study team

Table V-4-7-(1)Monthly Crop Labour Requirement (With-Project)

unit : manday/ha. manyear/area

Crop	jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
B-Aus Local		20	30	5	5	30	35	5					130
T-Aus HYV			15	45	5	5	45	10					125
T-Aman HYV						10	50	10	5	5	60	10	150
T-Aman Local	10							25	50	5	5	45	140
LatAman HYV								15	50	5	5	45	120
Boro HYV	25	70	10	10	15	60	10						200
Wheat HYV	5	5	65	5							50	20	150
Jute HYV		25	60	10	10	45	70	20	10				250
Potato HYV	60	10							10	50	60	10	200
Mustard HYV	5	20	5								5	15	50
Khesari	5	5	40								20	10	80
Mungbean							15	35	10	10	45	10	125
S.Vegetble							50	90	40	140	40		360
W.Vegetabl	120	20								20	60	80	300
Foddercrop	20	5									5	20	50
Dhoincha			10	5	5								20
C.P.Fo-Fo	10	31	53	29	9	34	71	27	20	6	61	30	381
C.P.F1-Fo	35	51	42	20	11	45	63	41	19	51	66	21	465
C.P.F1-F1	13	36	53	10	9	35	29	12	15	1	20	22	255
C.P.F2-F1	52	43	49	9	9	41	37	8	5	17	42	28	340
C.P.F2-F2	39	46	23	9	10	39	14	1	3	12	22	15	233

Area Labour Requirement (million manday/1000man-year) Fo-Fo 7.32/29.3 Fo-F1 1.63/6.5 F1-F1 2.01/8.1
F2-F1 0.31/1.2 F2-F2 0.30/1.2 AreaTotal 11.57/4.63
Source : estimated from farm interview survey and BARI data

Table V-4-7-(2)Monthly Crop Labour Requirement (Without-Project)

unit : manday/ha. manyear/area

Crop	jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
B-Aus Local		20	30	5	5	25	30	5					120
T-Aus HYV		5	20	49	5	5	48	12					144
B-Aman Local					10	50	10	5	5	40	20		140
T-Aman Local							10	25	25	5	5	30	100
T-AmanPajam						10	40	30	5	5	50		150
T-Aman HYV						10	40	20	5	5	60	10	150
Boro HYV	20	40	28	5	18	45							156
Boro Local	40	35	5	27	45							10	162
Aus-AmanMix	10	30	20	5	5	30	5	30	5				140
Jute Local		15	60	5	5	30	50	20	15				200
Jute HYV		15	60	5	5	35	60	20	15	10			225
Mustard	5	20	35*	30*	* : including processing						5	15	115
Kaun	10	23	10	5	33	10						5	96
Wheat Local	5	5	35								40	10	100
Wheat HYV	5	5	40								40	20	110
Sweet Potato	5	5	5	5	40					5	20	15	100
Potato HYV	24	24								25	50	5	128
Summer Veget							20	40	15	60	25		160
Winter Veget	100	20								20	50	60	250
Pulses	5	30	5								10	30	80
WeigthedMean	4	23	32	4	7	30	37	23	16	5	27	23	231

Area Labour Requirement = 8.11million manday = 32.4thousand manyear

Source : estimated from the results of farm interview survey

Table V-4-8 With-project Livestock Herd Projection
Within The Project Area unit : head

Upazila	Bul-lock	Cows	Oxen	Hei-fers	Buff-aloes	Total Draught	Year-lings	Cal-ves	Goats	Sheep
Estimated Number of Heads in 1987 from Upazila Livestock Data										
Nageswari	44221	13906	114	9271	2098	69610	7457	10430	24746	523
Bhur'mari	2340	9945	585	1170	234	14724	585	585	234	351
Fulbari	14629	11653	3645	4363	1077	35367	4840	4840	24424	218
KurigramS	4349	6745	914	2104	354	14466	1316	847	19597	1637
Toral Pro	65539	42249	5258	16908	3763	133717	14198	16702	69001	2729
Projected Number of Heads from TDN/DCP Estimated in the Foregoing Table										
Nageswari	49900	15700	200	10400	2200	78400	8100	9000	40160	850
Bhur'mari	2600	11200	600	1300	300	16000	700	800	380	570
Fulbari	16500	13100	4100	4900	1200	39800	5200	5600	39640	350
KurigramS	4900	7600	1000	2400	500	16400	1600	1800	361800	2660
Toral Pro	73900	47600	5900	19000	4200	150600	15600	17200	111980	4430

Source : Kurigram Farmers, Upazila BBS data for 1987, Foregoing Table

Table V-4-9 Available By-Products for Feeds in the Project Area

unit : ton

Crop	Mainprod.	Straw	Bran	Oilcake	Grass	Main Prod.	Straw	Bran	Oilcake
B-Aus L	6150	6765	246	-	-	10991	12090	440	-
T-Aus H	37350	35482	1064	-	-	5870	5577	889	-
B-AmanL	-	-	-	-	-	548	603	18	-
T-AmanL	5530	6083	243	-	-	22724	24996	1000	-
T-AmanP	-	-	-	-	-	7604	7604	304	-
T-AmanH	41900	39805	1194	-	-	21667	20584	650	-
LTAmanH	14400	14400	432	-	-	-	-	-	-
BoroHYV	31950	30352	911	-	-	17752	16864	586	-
Boro L	-	-	-	-	-	2471	2347	94	-
AusAman	-	-	-	-	-	2294	2523	92	-
Mustard	9945	-	6962	-	-	517	-	-	362
Wheat H	27562	44099	4793	-	-	4851	7762	728	-
Wheat L	-	-	-	-	-	1870	2992	281	-
FodderC	137250	-	-	-	137250	-	-	-	-
GreenMn	59250	-	-	-	59250	-	-	-	-
TotalFd	-	176986	8451	6962	137250	-	103942	5082	362
Feedable Qty.	-	141589	5916	5569	140363	-	83154	3557	290
Equiv. TDN	-	30172	2660	3598	25581	-	14824	1597	535
Equiv. DCP	-	1629	890	1773	4070	-	994	535	92

Note : Increment expected from the project ; TDN equiv. 45055t. DCP equiv. 6741t
Source : calculated from prodution data for with- and without-project

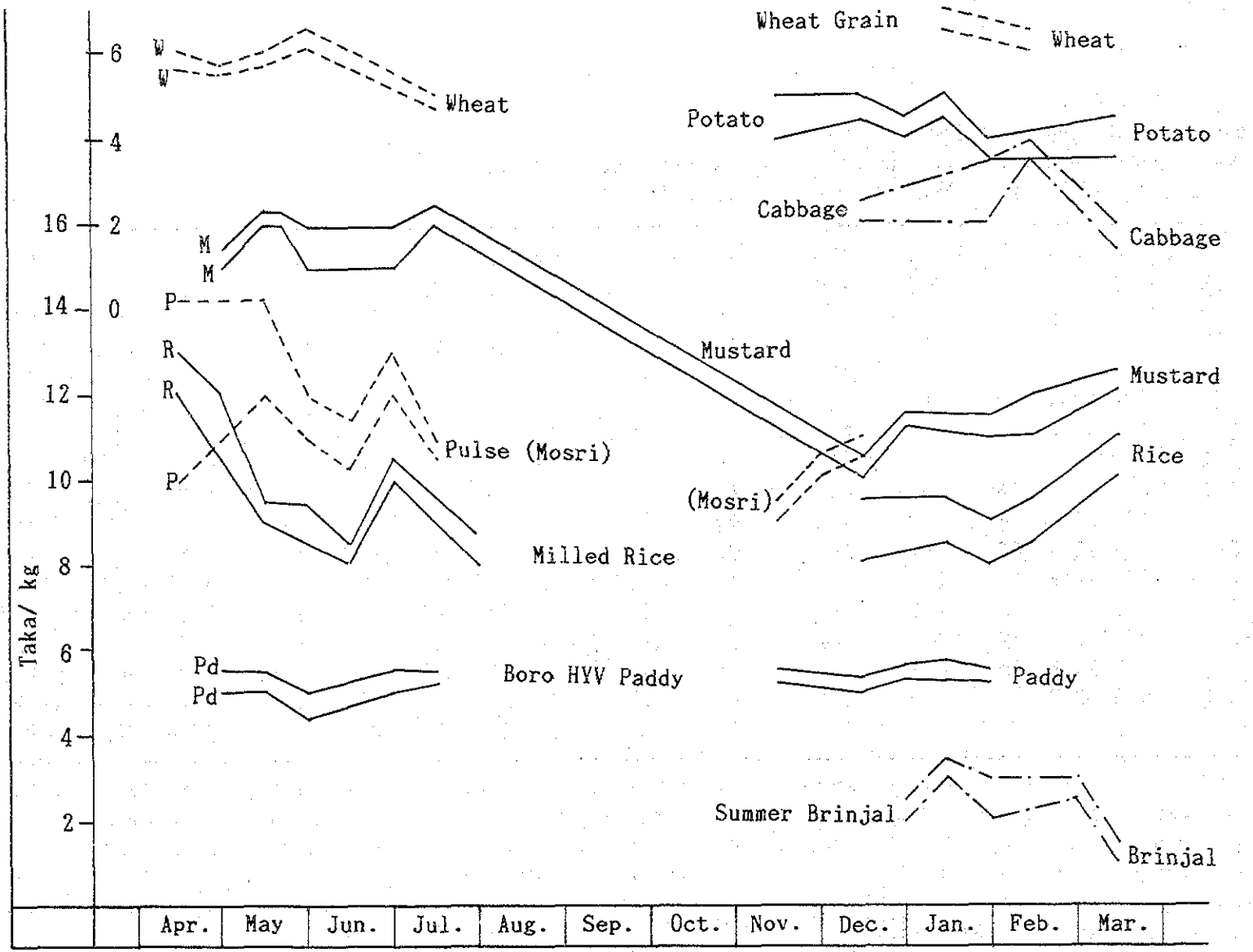
Table V-4-10 A Standard Guide-Manual for Crop Production

unit : kg./ha. day/ha. ton/ha.

crop var. unit:	cropping - sowing or transplant (month)	season growth period (days)	input use per ha. seed -----	urea kg./ha.	TSP	MP	cowdung (gypsum) -----ton/ha.	draught works pairday	labour works manday	irrigation cost/crop Taka/ha.	plant protection chemicals kg(l)/ha.	target yield under Std. conditions ton/ha.
B-Aus Local	lMar-mApr	110-115	96	27	5	0	0.5	44	146	-	ma or di 3.0	1.0-1.5
T-AmanLocal	Jul- Aug	145-150	37	27	5	0	0	44	150	-	ba & di 5.0	1.7-2.5
T-AmanImpro	eJul-lJul	120-130	37	59	27	0	0	43	136	2500	fu & bi 5.0	2.1-3.1
T-Aman HYV	Jul- Aug	145-150	37	185	74	70	(0.06)0	49	208	2500	bi & di10.0	3.7-5.0
Boro Local	lNov-mDec	145-150	37	27	12	12	0	42	169	2500	-	1.5-2.5
Boro HYV	mDec-lJan	145-150	37	138	74	70	(0.06)0	54	228	6000	bi & di 3.0	4.6-5.5
Jute HYV	lMar-mApr	120-140	6	100	25	45	0	48	220	-	da & bi 5.0	1.9-2.5
Wheat HYV	mNov-mDec	103-117	138	230	161	70	0	44	131	1500	ma & da 4.0	3.2-4.2
MustardImpro	lOct-mNov	90-110	11	22	57	15	1.2	37	97	-	ma 3.0	1.2-1.3
KhesariLocal	Oct- Nov	90-105	37	76	120	46	0	30	46	-	da 3.0	1.4-1.5
Mungbeanloc.	Sep- Oct	75- 80	27	76	120	46	0	30	46	-	ma or da 3.0	1.2-1.3
Potato HYV	lOct-lNov	85- 95	1173	49	37	27	1.5	51	126	2500	se or da 9.0	10 -15
Maize HYV	lSep-mOct	80- 95	10	222	110	50	(0.13)0	36	120	-	-	0.9-3.0
Sweet Potato	mSep-eOct	100-115	345	140	100	150	0	40	130	-	-	4.0-6.0
Onion(spice)	lNov-eJan	140-170	271	30	0	20	1.5	40	175	-	-	4.1-5.1
R.Vegetables	Oct- Nov	90-100	0.5	57	25	12	1.5	53	345	4000	se 5.0	20 -30
K.Vegetables	Jun- Jul	100-110	1	230	173	40	0	56	360	-	ma & bi 2.0	15 -25

note: jute yield; pure fibre basis, season,e; early,m; mid,l; late, chemical, ma; malathion, di; dimecron bi; bidrin, fu; furadan, ba; basudin, da; diazinon, se; sevin. sources: BAE crop diary, Kurigram - Farmers, BRRI crop manual

Fig.V-3-1 Recorded Village-Market Price Fluctuation at Nageswari



Source : Unpublished Data from Upazila and District Marketing Officers