TW. 1

γd max. = 1.334 g/Cm³
Wopt = 32.70 %

Dry Density (t/m³)

Moisture Content (%)

TW. 2

γd max. = 1.267 g/Cm³
Wopt = 36.43 %

Dry Density (t/m³)

Moisture Content (%)

TW. 3

γd max. = 1.282 g/Cm³
Wopt = 35.60 %

Dry Density (t/m³)

Moisture Content (%)

TW. 4

γd max. = 1.312 g/Cm³
Wopt = 33.20 %

Dry Density (t/m³)

Moisture Content (%)

Fig. A 4.4   MOISTURE - DRY DENSITY RELATIONSHIP OF
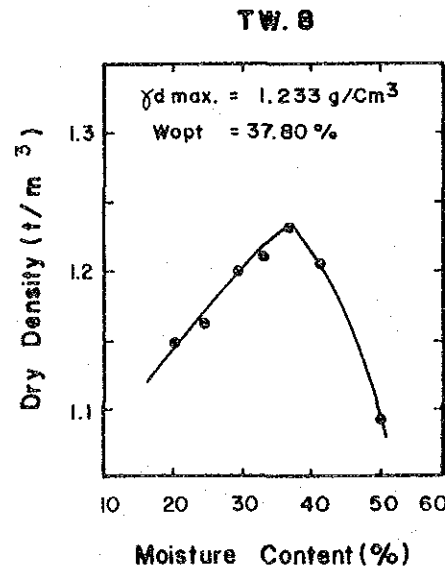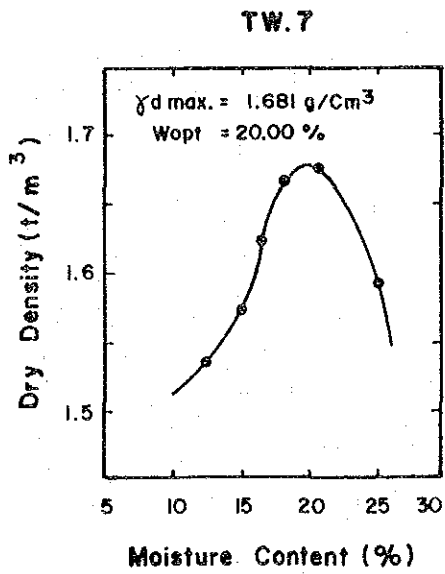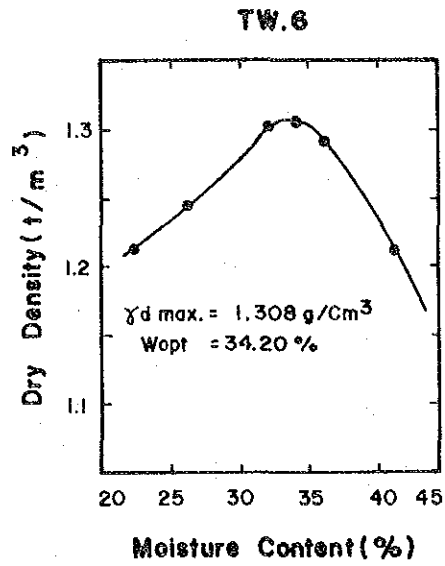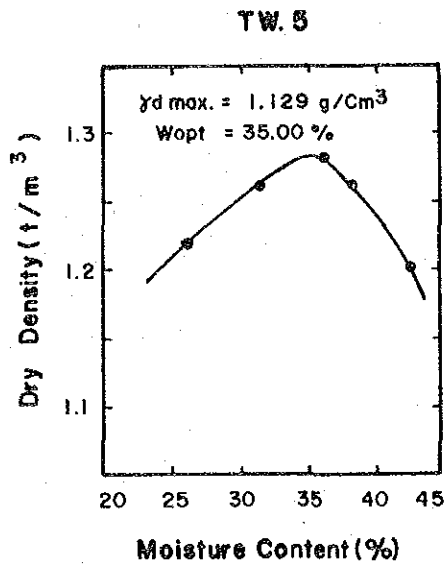EARTH MATERIAL SAMPLED FROM WIDAS
LOWER REACH   (1/3)

Fig. A4.4   MOISTURE – DRY DENSITY RELATIONSHIP
OF EARTH MATERIAL SAMPLED FROM
WIDAS LOWER REACH (2 / 3)

TW.9

γd max. = 1.318 g/Cm³
Wopt = 34.80 %

Dry Density (t/m³)

Moisture Content(%)

TW.10

γd max. = 1.220 g/Cm³
Wopt = 37.10 %

Dry Density (t/m³)

Moisture Content (%)

TW.11

γd max. = 1.244 g/Cm³
Wopt = 36.90 %

Dry Density (t/m³)

Moisture Content(%)

TW.12

γd max. = 1.206 g/Cm³
Wopt = 40.05 %

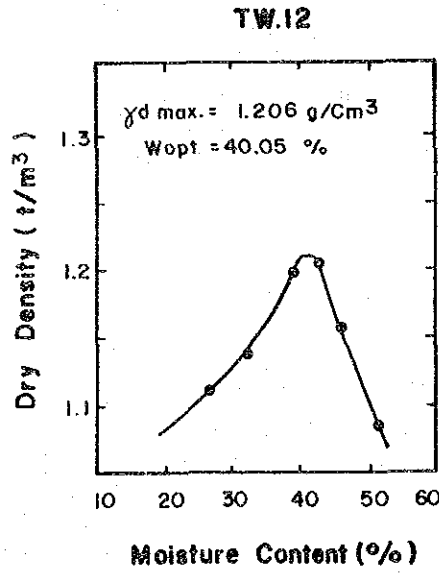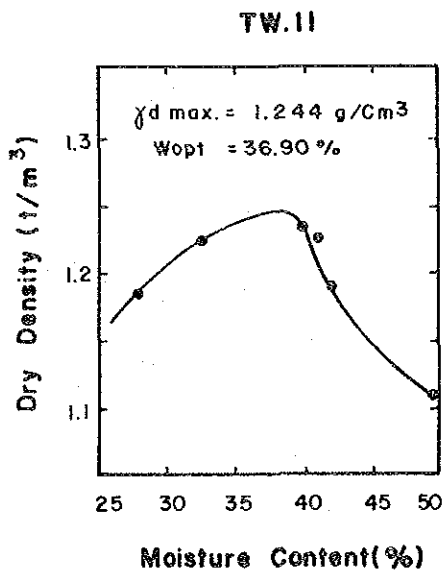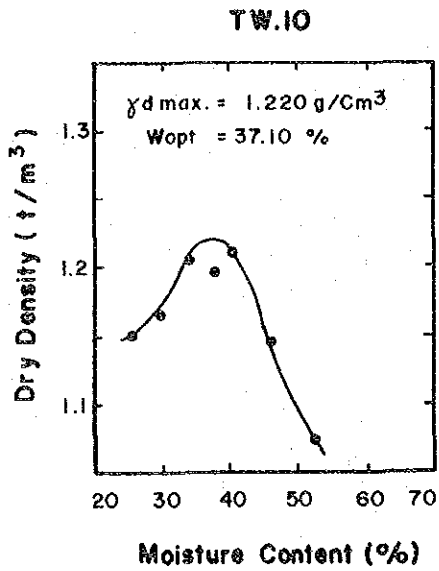Dry Density (t/m³)

Moisture Content (%)

Fig. A4.4   MOISTURE - DRY DENSITY RELATIONSHIP
OF EARTH MATERIAL SAMPLED FROM
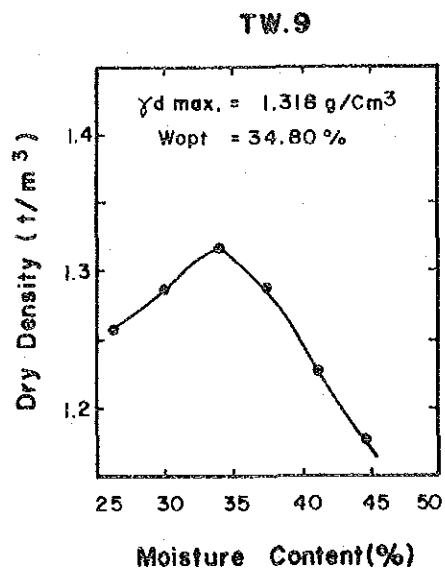WIDAS LOWER REACH (3/3)

TW. 1

C = 0.15 Kg/Cm^2
ϕ = 25°

Shear Stress (Kg/Cm^2)

Effective Normal Stress (Kg /Cm^2)

TW. 4

C = 0,25 Kg/Cm^2
$\emptyset$ = 16°

Shear Stress (Kg/Cm^2)

Effective Normal Stress (Kg/Cm^2)

TW. 5

C = 0.40 Kg/Cm^2
$\emptyset$ = 5°

Shear Stress (Kg/Cm^2)

Effective Normal Stress (Kg/Cm^2)

Fig. A4.5   TRIAXIAL COMPRESSION TEST
RESULTS ($\overline{C}\ \overline{U}$) SAMPLED FROM
WIDAS LOWER REACH (1/2)

TW.6

$C = 0.5$ Kg/Cm^2
$\emptyset = 13°$

Shear Stress(Kg/Cm^2)

Effective Normal Stress (Kg/Cm^2)

TW.7

$C = 0.2$ Kg/Cm^2
$\emptyset = 30°$

Shear Stress(Kg/Cm^2)

Effective Normal Stress (Kg/Cm^2)

TW.9

$C = 0.35$ Kg/Cm^2
$\emptyset = 9°$

Shear Stress(Kg/Cm^2)

Effective Normal Stress (Kg/Cm^2)
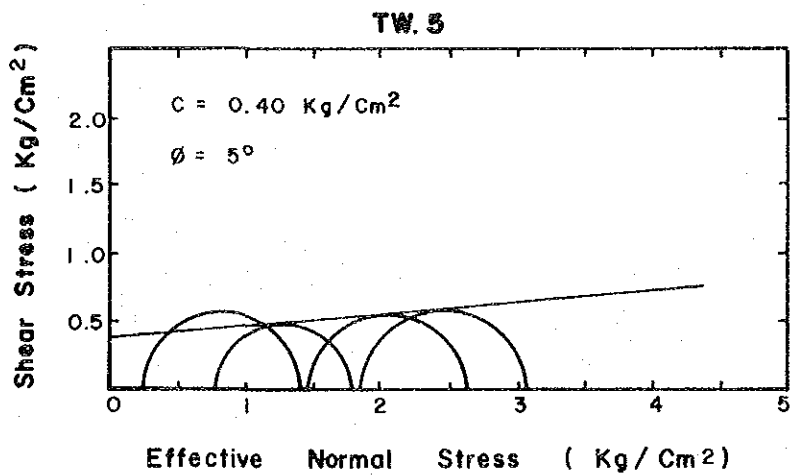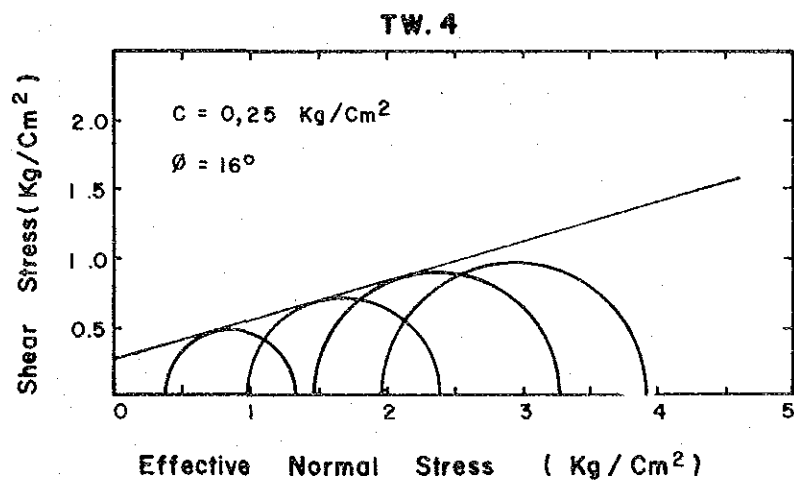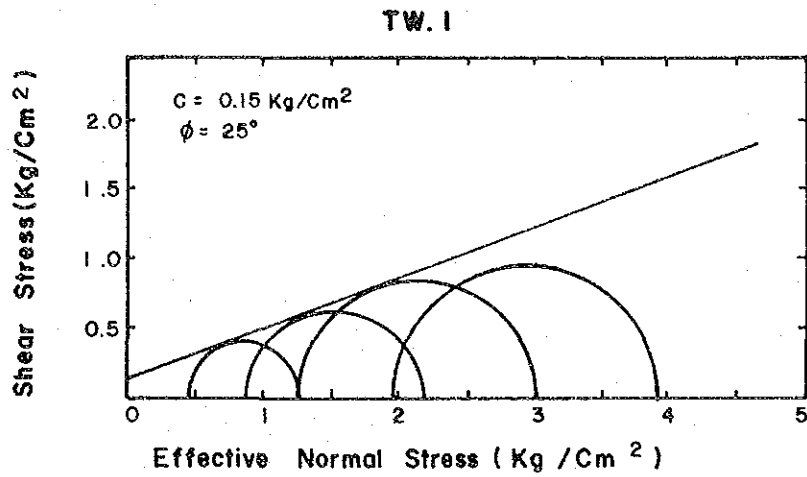
Fig. A4.5   TRIAXIAL COMPRESSION   TEST
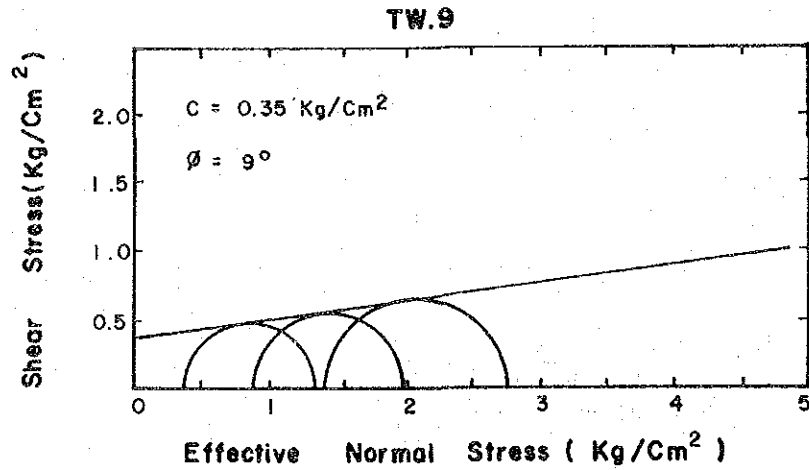RESULTS ($\overline{CU}$) SAMPLED   FROM
WIDAS LOWER REACH (2/2)

TW. 1

Void Ratio

Consolidation Pressure (Kg / Cm²)

TW. 4

Void Ratio

Consolidation Pressure (Kg / Cm²)

Fig. A4.6   VOID RATIO - CONSOLIDATION PRESSURE
RELATIONSHIP OF EARTH MATERIAL
SAMPLED FROM WIDAS LOWER REACH (1/3)

TW. 5

TW. 6

Fig. A 4.6   VOID RATIO - CONSOLIDATION PRESSURE
RELATIONSHIP OF EARTH MATERIAL
SAMPLED FROM WIDAS LOWER REACH (2/3)

TW. 7

TW. 9

Fig. A 4.6   VOID RATIO - CONSOLIDATION PRESSURE
RELATIONSHIP OF EARTH MATERIAL
SAMPLED FROM WIDAS LOWER REACH (3/3)

ANNEX - 4

FLOOD CONTROL

ANNEX - 4

FLOOD CONTROL

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES
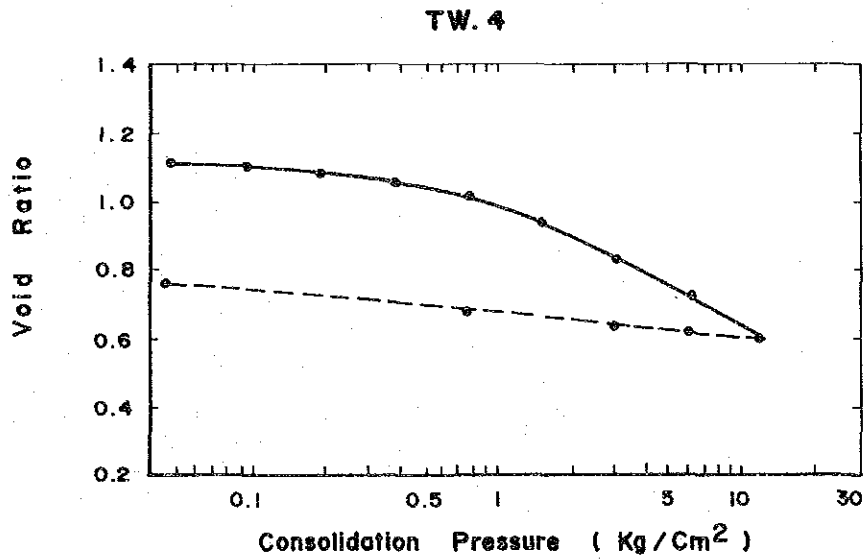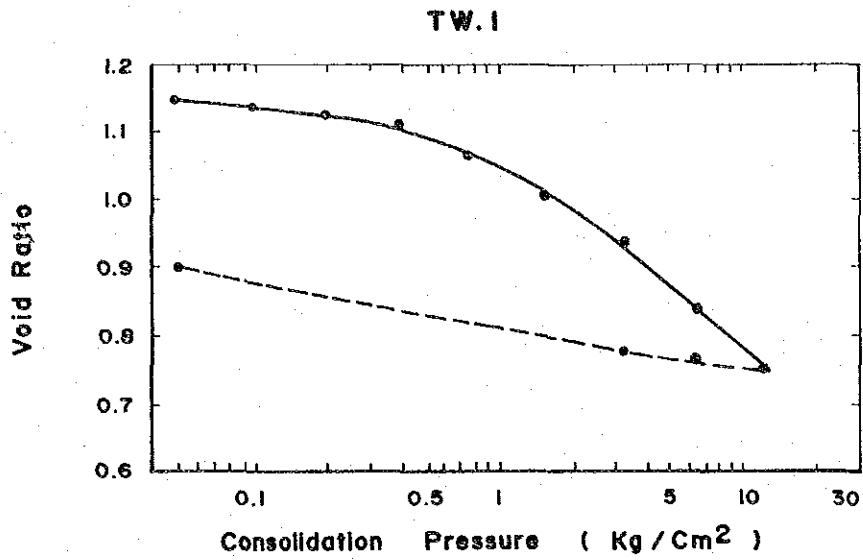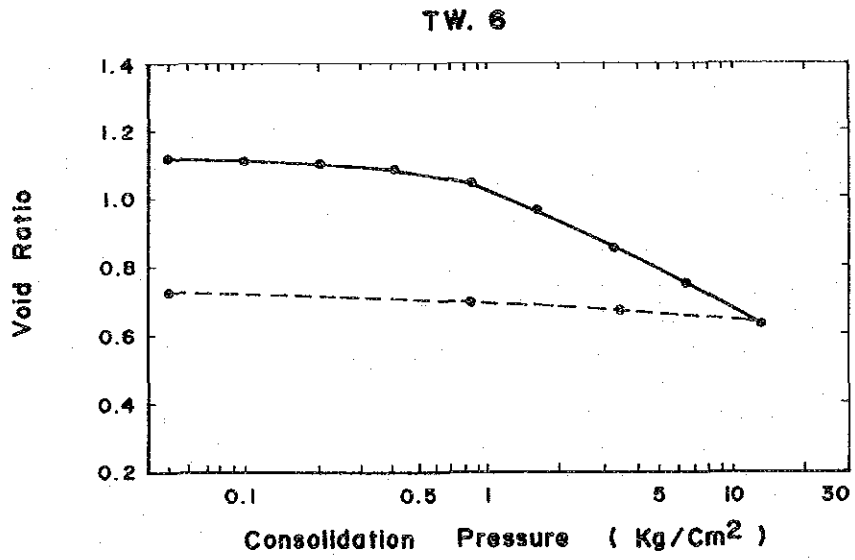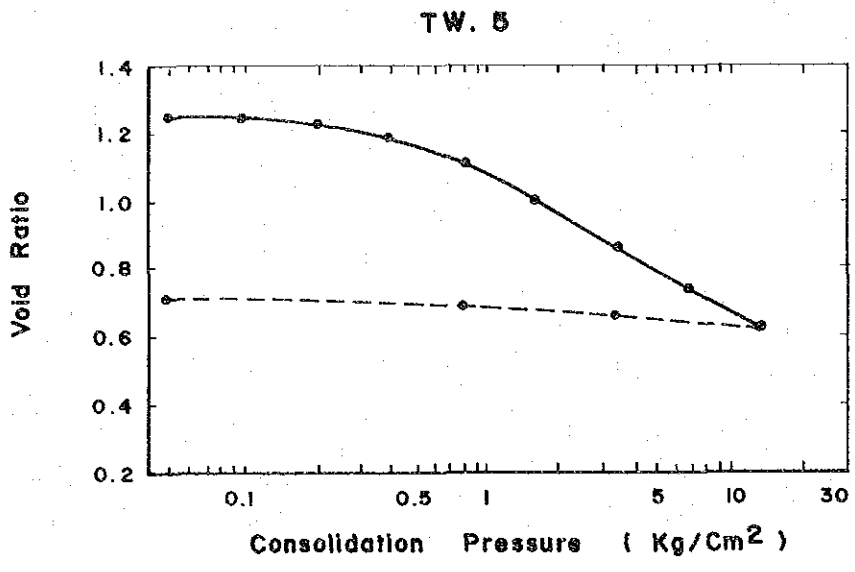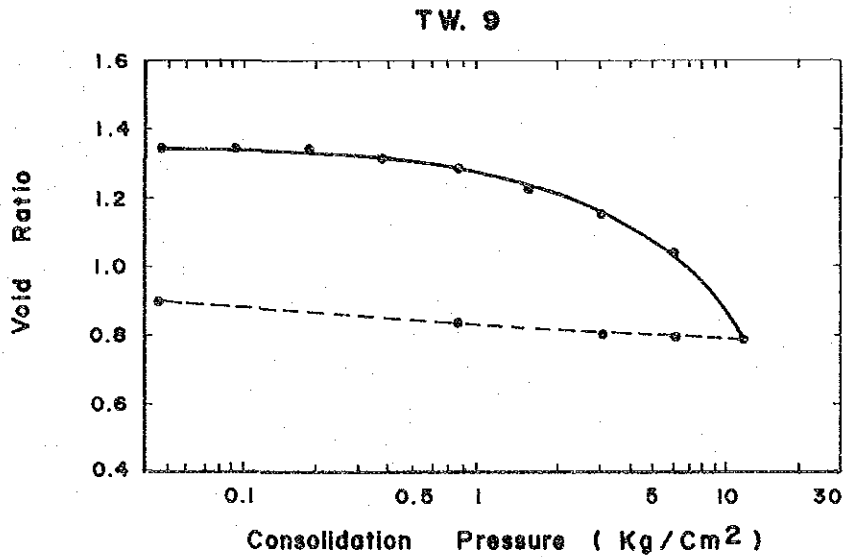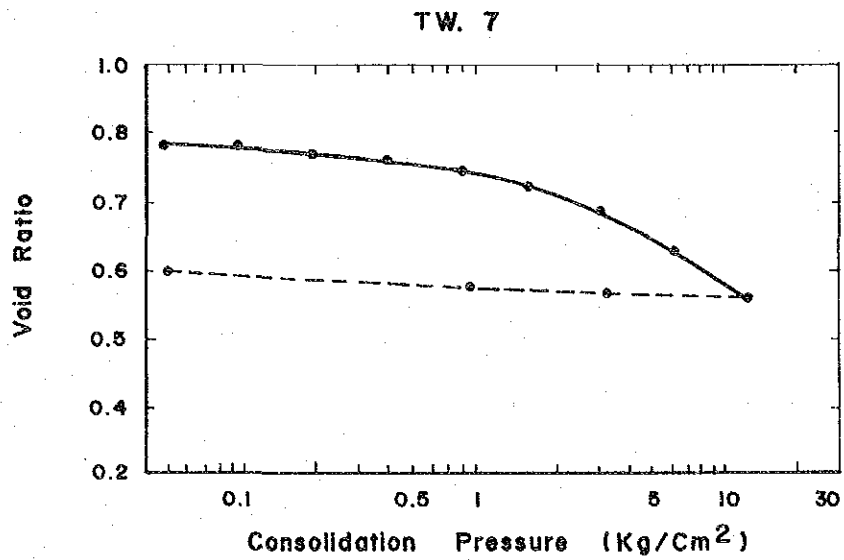
Supplement data and calculation results on flood control plan are presented in this ANNEX-4.

This ANNEX-4 contains the following items;

- Present Conditions of Rivers and Related River Structures
- Comparative Study on Alternative Flood Control Plan
- Hydraulic Study on Retarding Basin
- Proposed River Channel Improvement
- Proposed Related River Structures

4.1 Present Conditions of Rivers and Related River Structures

1. Characteristics of existing river channel

Based on the river cross-sections surveyed by BRBDEO, major features of the existing channels are listed in Table 4.1.1 and shown on Fig. 4.1.1 for major 4 rivers. The cross-sections surveyed are given in the Topographic Survey Report on the Widas Flood Control and Drainage Project (Part II), Feb. 1985.

2. Retarding basin

Topographic maps of the Widas, Ulo and Kedungsoko retarding basins are shown in Fig. 4.1.2 with the elevation contours of 1 m interval.

Cropping patterns in the three retarding basins are presented on Fig. 4.1.3. Hamlet (village) and house in the above basins are listed up in Table 4.1.2.

3. Observation records of groundwater level, water level in retarding basin and observed annual peak discharge at Lengkong.

Groundwater level and water level in the Widas basin have been observed since Dec. 1984. The locations of the observation are shown on Fig. 4.1.4. The observation records of groundwater level of the wells are shown on Fig. 4.1.5. The water level records are shown on Fig. 4.1.6. Annual peak discharge observed at Lengkong in Widas are shown on Fig. 4.1.7.

For reference, ten-days rainfall observed at Bulakmojo (near Nganjuk) and at Mrican is given on Table 4.1.3 for the last 10 years.

4. Related river structures

The locations and those major dimensions of the related river structures are listed in Table 4.1.4 for river structures except bridge and Table 4.1.5 for bridge. Fig. 4.1.8 shows sketch of irrigation head works.

Table 4.1.1 CHARACTERISTICS OF EXISTING RIVER CHANNEL (1/5)

Widas river

Sect. No.	Distance (m) Single	Distance (m) Accum.	Riverbed Elevation (SHVP, m)	Ground Elevation (SHP,m) Left	Ground Elevation (SHP,m) Right	Dike Elevation (SHP,m) Left	Dike Elevation (SHP,m) Right	River Width (m) Low wc	River Width (m) Dike to Dike	Channel Depth (m)	Low wc Area (m²)	Bankful Capacity (m³/sec)
W 0.0	0	0	32.9	36.8	37.2			57		4.1	184	192
0.3	303	303	32.0	36.8	36.6			46		5.1	170	180
0.7	405	708	31.9	36.6	36.9			37		5.3	127	191
1.1	415	1,123	32.6	36.0	35.9			38		3.6	79	179
1.5	407	1,530	32.3	36.8	36.8			38		4.7	142	165
1.9	411	1,941	32.7	37.1	37.3			40		4.5	158	174
2.7	848	2,789	33.0	37.0	37.1			56		4.7	163	181
3.5	836	3,625	30.7	37.2	37.4			32		6.8	149	163
4.3	840	4,465	32.2	37.5	37.7	38.1		52		5.4	153	166
5.1	803	5,268	34.1	37.8	37.6			34		3.9	104	165
5.5	412	5,680	33.3	37.6	37.6			31		5.0	112	178
5.9	419	6,099	34.2	38.0	38.2	38.9		30		3.8	90	134
6.3	421	6,520	33.8	38.0	38.0			39		4.7	128	161
6.7	481	7,001	34.5	38.1	37.4	38.7	38.8	37	40	3.5	103	130
7.1	399	7,400	33.4	38.5	39.0	39.0		45		5.2	133	178
7.5	482	7,882	33.4	38.5	36.0	39.4	39.2	28	599	5.4	107	162
7.9	431	8,313	34.6	38.8	39.0	39.8		44		4.4	123	155
8.3	415	8,728	32.8	38.2	38.4	38.8	40.0	37	287	6.1	159	159
8.7	438	9,166	34.1	38.4	38.2	40.0	39.7	41	416	4.4	152	169
9.1	466	9,632	35.0	39.0	38.7	40.0	40.0	38	656	4.2	127	155
9.5	506	10,138	33.5	39.0	39.3	-	-	42		6.0	149	158
10.3	811	10,949	35.7	39.5	38.6	40.2	40.7	44	462	4.2	165	175
10.7	489	11,438	33.7	39.7	39.2	40.7	40.7	55	418	6.6	223	188
11.1	454	11,892	33.8	39.4	40.1	41.3		38		6.2	171	166
11.5	442	12,334	34.8	40.2	40.2	41.4		36		5.2	131	170
11.9	309	12,643	35.7	39.5	39.7	41.3	41.5	40	310	4.3	146	157
12.3	433	13,076	35.5	39.5	39.4	41.6	41.5	36	432	4.7	121	170
12.7	427	13,503	35.8	39.5	39.7	41.4	41.7	30	-	4.3	99	163
13.5	837	14,340	36.2	40.0	39.5	-	-	38	-	4.2	150	151
13.9	377	14,717	35.8	40.0	40.0		41.6	43		4.9	121	158
14.3	432	15,149	36.5	40.0	39.5	-	41.7	55		4.0	167	129
15.1	882	16,031	36.9	40.8	40.6		41.9	50		4.1	160	161
15.5	392	16,423	34.8	40.5	40.8		41.8	36		6.2	170	171
16.3	867	17,290	37.2	40.5	40.9		42.0	40		3.9	124	139
16.7	389	17,679	37.0	40.7	40.5			38		4.5	122	160
17.5	930	18,609	33.4	41.5	40.0			40		8.3	162	155
18.7	1,023	19,632	37.1	41.2	41.4			40		4.9	135	163
19.1	393	20,025	37.2	41.4	41.0		42.3	32		4.8	111	164
19.5	438	20,463	36.9	41.5	40.5		42.6	30		5.3	110	160
19.9	373	20,836	37.7	41.0	41.6		42.7	36		4.4	119	151
20.3	191	21,027	37.7	42.0	41.5		42.8	36		5.3	146	201
20.7	599	21,626	37.8	41.5	41.5		43.0	40		4.7	138	163
21.1	424	22,050	38.0	42.0	42.0		42.9	36		4.3	122	143
21.5	400	22,450	38.4	42.0	41.4		43.0	26		4.5	86	164
21.9	422	22,872	38.6	42.0	41.8		42.9	47		4.0	159	127
22.3	400	23,272	38.6	42.5	42.0		43.3	52		4.2	138	150
22.7	350	23,622	38.4	42.5	42.3		42.8	44		4.5	138	139
23.1	375	23,997	38.1	43.0	42.8		44.0	47		4.9	144	146

Table 4.1.1   CHARACTERISTICS OF EXISTING RIVER CHANNEL (2/5)

Widas river

Sect. No.	Distance (m) Single	Distance (m) Accum.	Riverbed Elevation (SHVP, m)	Ground Elevation (SHVP,m) Left	Ground Elevation (SHVP,m) Right	Dike Elevation (SHVP,m) Left	Dike Elevation (SHVP,m) Right	River Width (m) Low wc	River Width (m) Dike to Dike	Channel Depth (m)	Low wc Area (m²)	Bankful Capacity (m³/sec)
W 23.5	350	24,347	38.2	43.0	42.2		43.8	38		4.8	137	155
23.9	450	24,797	36.9	42.6	42.5	43.1	44.2	35	232	5.7	144	123
24.3	550	25,347	38.2	43.0	42.6	43.7	44.2	42	254	5.2	150	152
25.1	500	25,847	39.7	43.3	43.2	44.3	44.5	30	130	4.8	87	165
25.5	550	26,397	38.8	43.5	43.3	44.7	45.2	34	142	5.2	139	166
25.9	300	26,697	39.2	43.9	43.0	44.5	44.6	38	130	4.9	135	161
26.1	250	26,947	38.9	44.5	43.2	44.9	44.7	46	152	4.9	187	149
26.6	500	27,447	39.2	44.0	44.0			32		4.8	96	85
27.1	500	27,947	39.8	44.0	44.4			33		4.7	107	93
27.6	500	28,447	40.4	44.5	44.6			30		4.3	85	100
28.1	500	28,947	40.6	44.6	44.8	45.2		27		4.4	99	104
28.6	500	29,447	39.8	44.7	45.1	45.2		32		5.2	113	107
29.1	500	29,947	40.7	45.0	45.1	45.3		32		4.3	103	113
29.6	500	30,447	41.2	45.0	45.5	45.7		37		4.2	108	111
30.1	500	30,947	41.1	45.8	45.8			43		4.7	104	125
30.6	500	31,447	41.5	46.0	46.4			40		4.1	131	129
31.1	500	31,947	42.1	46.2	46.1			44		4.2	109	134
31.6	500	32,447	42.2	47.0	46.3			60		4.2	118	141
32.1	500	32,947	42.2	46.8	46.9			41		4.3	115	148
32.6	500	33,447	42.3	47.0	47.0			44		4.3	137	147
33.1	500	33,947	42.9	47.0	47.4			51		3.8	123	138
33.6	500	34,447	43.2	47.5	47.2			49		3.7	110	128
34.1	500	34,947	43.2	47.2	47.5			48		4.1	111	135
34.6	500	35,447	43.7	48.0	48.1			71		4.0	144	172
35.1	500	35,947	43.3	48.5	48.0			50		4.7	108	166
35.6	500	36,447	43.3	48.7	48.5			54		5.0	110	195
36.1	500	36,947	43.8	48.8	48.9			40		5.0	100	180
36.6	500	37,447	43.9	49.5	49.5			45		5.3	118	218
37.1	500	37,947	43.5	50.3	50.1			64		6.5	139	225
37.6	500	38,447	43.6	50.6	50.4			60		6.7	111	250
38.1	500	38,947	44.7	51.0	51.0			70		6.2	178	277
38.6	500	39,447	44.7	51.3	51.1		51.9	50		6.2	124	298
39.1	500	39,947	45.3	51.8	51.8			50		6.2	146	298
39.6	500	40,447	46.0	52.6	52.8			65		6.5	162	350
40.1	500	40,947	46.2	53.0	53.0			72		6.8	166	350
40.6	500	41,447	46.7	53.8	53.8			50		7.3	178	410
41.1	500	41,947	47.1	54.3	54.8			75		7.0	209	300
41.6	500	42,447	47.5	55.8	55.4			100		7.3	244	500
42.1	500	42,947	48.3	56.7	56.6			100		7.2	231	530
42.6	500	43,447	49.0	57.8	57.6			100		8.5	248	600
43.1	500	43,947	49.6	57.9	57.6			110		6.8	246	500
43.6	500	44,447	48.6	58.3	58.3			130		8.4	290	550
44.1	500	44,947	51.1	57.0	58.5		59.1	100		5.2	154	358
44.6	500	45,447	52.0	59.3	58.6			100		6.6	252	550
45.1	500	45,947	52.7	59.1	59.1			106		6.1	243	510
45.6	500	46,447	52.9	60.5	60.0			100		7.2	216	600
46.1	500	46,947	54.4	60.5	59.9			61		5.6	162	440

Table 4.1.1 CHARACTERISTICS OF EXISTING RIVER CHANNEL (3/5)

Widas river

Sect. No.	Distance (m) Single	Distance (m) Accum.	Riverbed Elevation (SHVP, m)	Ground Elevation (SMP,m) Left	Ground Elevation (SMP,m) Right	Dike Elevation (SMP,m) Left	Dike Elevation (SMP,m) Right	River Width (m) Low wc	River Width (m) Dike to Dike	Channel Depth (m)	Low wc Area (m²)	Bankful Capacity (m³/sec)
46.6	500	47,447	54.5	61.4	61.2			128		6.6	157	480
47.1	500	47,947	54.8	61.5	61.9			60		6.7	210	356
47.6	500	48,447	57.5	62.5	62.5			65		4.9	160	510
48.1	500	48,947	58.8	64.0	64.0			75		5.2	197	600
48.6	500	49,447	58.5	64.7	63.8			88		5.6	157	341
49.1	500	49,947	59.1	65.7	64.8			46		5.6	139	450
49.6	500	50,447	59.4	65.1	66.7			80		5.6	145	350
50.1	500	50,947	59.8	66.4	66.8			70		6.8	225	460
50.6	500	51,447	59.9	63.6	69.0			55		7.0	311	700

Kedungsoko river

Sect. No.	Distance (m) Single	Distance (m) Accum.	Riverbed Elevation (SHVP, m)	Ground Elevation (SMP,m) Left	Ground Elevation (SMP,m) Right	Dike Elevation (SMP,m) Left	Dike Elevation (SMP,m) Right	River Width (m) Low wc	River Width (m) Dike to Dike	Channel Depth (m)	Low wc Area (m²)	Bankful Capacity (m³/sec)
K 0.0 (W 26.1)	0	0	38.9				44.7					
0.5	500	500	39.2	43.2	43.0		45.3	32		3.8	99	201
1.0	500	1,000	40.0	43.7	42.2		45.2	42		3.5	74	157
1.5	500	1,500	39.9	43.8	43.8		-	34		4.0	102	165
2.0	500	2,000	39.9	43.9	43.7		45.1	30		4.0	88	127
2.5	500	2,500	40.4	43.8	43.7		45.0	30		3.7	64	117
3.0	500	3,000	40.1	43.6	43.7	44.6	45.1	30	50	3.7	78	79
3.5	500	3,500	40.6	44.2	44.1	45.1	45.2	30	60	3.5	70	77
4.0	500	4,000	40.5	44.3	44.3	45.7	44.9	28	100	4.0	76	114
4.5	500	4,500	41.1	44.7	44.9			30	97	3.8	88	108
5.0	500	5,000	41.8	44.5	44.5	45.6	45.9	34	98	3.3	81	120
5.25	250	5,250	42.0	-	-	45.5	45.9	31	97	3.2	70	107
5.5	250	5,500	42.1	44.6	44.5	45.4	45.9	27	95	3.1	60	94
6.0	500	6,000	42.4	44.3	44.2	45.6	45.9	23	98	3.1	56	87
6.5	500	6,500	42.8	44.8	44.8	45.8	46.0	28	100	2.9	60	84
7.0	500	7,000	43.0	44.9	45.0	46.3	46.8	26	98	2.8	50	76
7.5	500	7,500	43.3	44.9	45.2	46.0	46.8	27	93	2.4	41	50
8.0	500	8,000	43.4	45.4	45.6	47.1	47.2	32	96	2.9	65	79
8.5	500	8,500	43.7	45.8	45.5	47.4	47.8	28	97	2.8	40	68
9.0	500	9,000	44.2	46.3	46.8	48.1	47.7	31	96	2.6	56	55
9.5	500	9,500	44.3	46.0	46.0	48.1	48.1	28	98	2.4	50	50
10.0	500	10,000	44.2	46.6	46.8	49.1	48.9	65	98	2.8	96	71

Table 4.1.1   CHARACTERISTICS OF EXISTING RIVER CHANNEL (4/5)

Ulo river

Sect. No.	Distance (m) Single	Distance (m) Accum.	Riverbed Elevation (SHVP, m)	Ground Elevation (SHVP,m) Left	Ground Elevation (SHVP,m) Right	Dike Elevation (SHVP,m) Left	Dike Elevation (SHVP,m) Right	River Width (m) Low wc	River Width (m) Dike to Dike	Channel Depth (m)	Low wc Area (m²)	Bankful Capacity (m³/sec)
U 0.0 (K 1.5)	0	0	39.6	43.6	43.7			23		4.0	49	53
0.5	500	500	40.2	43.8	43.9			16		3.7	45	57
1.0	500	1,000	40.8	43.9	43.9			22		3.2	38	49
1.5	500	1,500	40.9	44.0	44.1	44.4	44.4	17	17	3.2	32	40
2.0	500	2,00	41.4	44.5	44.5			26		3.5	45	43
2.5	500	2,500	41.1	44.5	44.5	44.9		17		2.4	32	43
3.0	500	3,000	42.1	44.9	44.7	45.6	45.2	27	27	2.8	32	49
3.5	500	3,500	42.3	45.2	45.0	45.5	45.9	17	17	2.7	31	38
4.0	500	4,000	42.6	45.1	45.6	45.9	46.0	12	12	2.7	34	31
4.5	500	4,500	42.6	45.9	45.3	46.2	46.2	15	15	3.2	30	35
5.0	500	5,000	41.8	45.9	45.6	46.6	46.6	12	12	3.7	26	30
5.5	500	5,500	42.6	46.0	45.9	46.9	46.8	12	12	3.5	26	32
6.0	500	6,000	44.0	46.0	45.9	47.2	47.0	10	10	2.2	12	24
6.5	500	6,500	44.1	46.4	46.7	47.7	47.7	13	13	2.4	14	17
7.0	500	7,000	44.3	46.7	46.9	47.9	47.9	13	13	2.3	24	16
7.5	500	7,500	44.9	47.8	46.8	48.2	48.7	27	27	3.0	29	35
8.0	500	8,000	44.8	47.5	47.3	48.2	48.6	12	12	2.7	25	22
8.5	500	8,500	44.8	48.1	48.0	48.4	48.6	24	24	3.1	28	36
9.0	500	9,000	45.5	48.3	48.2	–	48.8	19		3.8	30	31
9.5	500	9,500	45.2	48.8	48.9	–	–	29		3.5	50	36
10.0	500	10,000	45.9	49.0	49.3			49		3.0	52	41
10.5	500	10,500	46.5	49.8	49.4		50.4	22		3.3	33	56
11.0	500	11,000	48.6	49.9	49.9		50.6	18		1.5	23	41
11.5	500	11,500	47.2	51.0	50.5		50.9	16		3.5	32	42
12.0	500	12,000	47.6	51.7	51.0		51.5	15		3.8	35	63
12.5	500	12,500	48.7	52.0	51.5		52.5	20		3.2	40	70
13.0	500	13,000	48.9	52.3	52.2		52.8	13		3.5	27	60
13.5	500	13,500	49.2	52.8	52.5		54.2	22		3.6	56	60
14.0	500	14,000	49.3	53.9	53.2		54.3	30		4.5	52	114
14.5	500	14,500	50.1	53.7	52.9		54.7	18		3.2	45	73
15.0	500	15,000	50.5	53.7	52.8		55.0	20		3.3	46	70
15.5	500	15,500	50.7	54.3	53.5		55.5	19		3.3	40	36
16.0	500	16,000	51.2	54.4	54.1		55.3	16		3.1	45	63
16.5	500	16,500	51.3	54.0	53.9	54.6	55.9	16	30	2.7	37	59
17.0	500	17,000	51.8	55.1	55.5	55.6	56.7	20	29	3.3	54	69
17.5	500	17,500	52.3	56.3	56.0	57.2	57.0	20	29	3.8	57	131
18.0	500	18,000	52.4	56.8	57.0	58.1	58.1	19	31	4.5	61	138
18.5	500	18,500	53.5	58.2	57.8		58.9	20		4.5	57	159
19.0	500	19,000	54.85	58.50	59.0							
19.5	500	19,500	56.25	61.0	61.0							
20.0	500	20,000	57.0	62.40	62.80							
20.5	500	20,500	58.75	64.0	64.0							
21.0	500	21,000	62.10	65.0	65.0							
21.5	500	21,500	62.50	66.0	66.0							
22.0	500	22,000	63.0	67.0	67.0							
22.5	500	22,500	64.0	69.0	68.0							

Note : Channel dimension upstream from sect 19.0 is based on the topo maps with 1/2,500 in scale.

Table 4.1.1   CHARACTERISTICS OF EXISTING RIVER CHANNEL (5/5)

Ulo river

Sect. No.	Distance (km) Single	Accum.	Riverbed Elevation (SHVP, m)	Ground Elevation (SHP,m) Left	Right	Dike Elevation (SHP,m) Left	Right	River Width (m) Low wc	Dike to Dike	Channel Depth (m)	Low wc Area (m²)	Bankful Capacity (m³/sec)
23.0	500	23,000	65.40	69.0	69.00							
23.5	500	23,500	66.90	70.0	70.0			94			246	
24.0	500	24,000	70.70	74.60	72.60							
24.5	500	24,500	76.0	80.0	80.0							
25.0	500	25,000	83.500	88.0	88.0							
25.5	500	25,500	89.0	92.0	92.0			66			271	
26.0	500	26,000	96.50	103.0	104.0							
26.5	500	26,500	107.70	110.0	111.0							
27.0	500	27,000	116.50	120.0	121.0							
27.5	500	27,500	128.0	130.0	135.0							
28.0	500	28,000	136.80	144.0	144.0							
28.0+ 100	100			140	144	144.7						

Note : Channel dimension upstream from sect 19.0 is based on the topo maps with 1/2,500 in scale

Kuncir river

Sect. No.	Distance (m) Single	Accum.	Riverbed Elevation (SHVP, m)	Ground Elevation (SHP,m) Left	Right	Dike Elevation (SHP,m) Left	Right	River Width (m) Low wc	Dike to Dike	Channel Depth (m)	Low wc Area (m²)	Bankful Capacity (m³/sec)
Kc 0.0 (K 5.25)	0	0	41.9	45.0	45.0			19		3.1	47	50
0.5	500	500	42.6	45.3	45.4			10		3.0	21	49
1.0	500	1,000	43.2	45.1	45.7			13		2.4	18	17
1.5	500	1,500	43.9	45.0	45.5	46.2	46.1	12	12	1.4	11	13
2.0	500	2,000	44.6	45.5	45.5	46.7	46.6	15	15	1.5	7	8
2.5	500	2,500	44.1	45.8	46.2	47.1	47.3	12	12	1.9	6	8
3.0	500	3,000	44.8	46.0	46.5	47.5	47.6	12	12	1.6	14	8
3.5	500	3,500	44.9	46.7	46.5	47.9	48.0	13	13	2.0	11	11
4.0	500	4,000	45.4	47.0	47.0	48.4	48.4	12	12	1.6	11	9
4.5	500	4,500	45.1	47.7	47.7	48.8	48.4	10	10	2.8	15	13
5.0	500	5,000	46.5	48.1	48.0	49.2	48.8	10	10	1.7	13	15
5.5	500	5,500	45.9	48.3	48.2	49.3	49.3	13	13	2.3	21	15
6.0	500	6,000	46.2	49.3	48.9	50.1	49.7	12	12	3.0	20	25
6.5	500	6,500	45.5	50.0	49.5	50.7	50.2	30	30	4.6		
7.0	500	7,000	47.4	50.2	50.0			13		2.5	66	43
7.5	500	7,500	47.9	50.7	50.5	51.5	50.9	16	16	2.7	25	50
8.0	500	8,000	47.9	51.0	51.4	51.6		20		3.2	22	34
8.5	500	8,500	48.8	52.2	51.5		52.4	20		3.3	42	49
9.0	500	9,000	48.8	52.4	51.9		52.7	45		3.3	46	41
9.5	300	9,300	49.5	52.8	52.5	53.1	53.4	16	16	3.2	37	64
10.0	500	10,000	50.7	53.8	54.0	54.5		19		3.3	40	101
10.5	500	10,500	51.8	56.0	56.0			25		4.7	100	216
11.0	500	11,000	52.1	56.0	55.8			32		3.9	48	126
11.5	500	11,500	52.0	56.8	57.0	57.2		20		4.7	55	137
12.0	500	12,000	53.4	58.0	58.0			27		4.5	68	148
12.5	500	12,500	55.0	59.8	59.7			20		4.6	63	270
13.0	500	13,000	56.4	62.2	62.0			27		5.8	114	320
13.5	500	13,500	57.7	63.3	63.0			40		5.9	128	360
14.0	500	14,000	58.6	65.2	64.7			23		6.4	80	310
14.5	500	14,500	60.2	66.6	66.1	66.8	66.3	36	62	5.9	129	260
16.5	2,000	16,500	68.1	76.5	78.9			65			157	
18.5	2,000	18,500	101.4	108.0	108.5			28			127	
20.5	2,000	20,500	140.2	145.2	145.3			42			160	

Table 4.1.2   HAMLET AND HOUSE IN THE NATURAL RETARDING BASIN

HAMLET AND HOUSE IN THE WIDAS
RETARDING BASIN (1/3)
(below 38.6 m SHVP)

Name of hamlet	No. of houses
Dk. Tambak	
Ds. Jatikalen	219
Kec. Jatikalen	
Dk. Kedung tunggak	
Ds. Jatikalen	107
Kec. Jatikalen	
Dk. Balowono	
Ds. Jatikalen	93
Kec. Jatikalen	
Dk. Ngrengket	
Ds. Ngrengket	213
Kec. Jatikalen	
T o t a l	632 nos

HAMLET AND HOUSE IN THE
ULO RETARDING BASIN (2/3)

(below 44.9 m SHVP)

Name of hamlet	No. of houses
Dk. Kedungsoko	
Ds. Kedungsoko	122
Kec. Sukomoro	
Dk. Gempol Cablek	
Ds. Kedungsoko	108
Kec. Sukomoro	
Dk. Turi	
Ds. Nglundo	55
Kec. Sukomoro	
Dk. Nglundo	
Ds. Nglundo	230
Kec. Sukomoro	
Dk. Jopatran	
Ds. Nglundo	106
Kec. Sukomoro	
Dk. Bale Turi	
Ds. Nglundo	34
Kec. Sukomoro	
Dk. Gebang	
Ds. Kedunggulun	48
Kec. Gondang	
Dk. Jasuman	
Ds. Kedunggulun	248
Kec. Gondang	
Dk. Paldaplang	
Ds. Kedunggulun	133
Kec. Gondang	
Dk. Bringin	
Ds. Kedunggulun	144
Kec. Gondang	
T o t a l	1228 nos

HAMLET AND HOUSE IN THE
KEDUNGSOKO RETARDING BASIN (3/3)
(below 45.0 m SHVP)

Name of hamlet	No. of houses
Dk. Miren	
Ds. Sidoarjo	283
Kec. Tanjung Anom	
Dk. Tanjungrejo	
Ds. Ngadirejo	4
Kec. Tanjung Anom	
Dk. Jaruman	
Ds. Ngadirejo	152
Kec. Tanjung Anom	
Dk. Nglegok	
Ds. Sumengko	42
Kec. Sukomoro	
Dk. Sekar Putih	
Ds. Sonobekel	17
Kec.Tanjung Anom	
Dk. Mukuh	
Ds. Sidoarjo	53
Kec. Tanjung Anom	
Dk. Ngadirejo	
Ds. Ngadirejo	193
Kec. Tanjung Anom	
Dk. Wonoasri	
Ds. Ngadirejo	203
Kec. Tanjung Anom	
Dk. Gempolan	
Ds. Semengko	15
Kec. Sukomoro	
Dk. Blimbing	
Ds. Banjar Anyar	245
Kec. Tanjung Anom	
Dk. Sumber Ungu	
Ds. Banjar Anyar	205
Kec. Tanjung Anom	
Dk. Sumber Agung	
Ds. Banjar Anyar	386
Kec. Tanjung Anom	
Dk. Sumberejo	
Ds. Banjar Anyar	107
Kec. Tanjung Anom	
Dk. Sumberwaru	
Ds. Banjar Anyar	180
Kec. Tanjung Anom	
Dk. Kedung Bengkah	
Ds. Kedungsoko	63
Kec. Sukomoro	
Dk. Bulak Sogo	
Ds. Nglundo	26
Kec. Sukomoro	
Dk. Bulak Jeruk	
Ds. Blitaran	160
Kec. Sukomoro	
Dk. Sembung	
Ds. Blitaran	108
Kec. Sukomoro	
Dk. Bungur	
Ds. Bungur	73
Kec. Sukomoro	
T o t a l	2515 nos

Table 4.1.3   TEN – DAYS RAINFALL AT BULAKMOJO
(1973 to 1983) (1/2)

Month	Each Ten Days	Year										
		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Jan.	F	72.5	92.1	118.7	113	114.9	110.5	114.5	88	66	96	140.5
	M	60.3	55.8	157.5	61.3	73.2	92.2	104.5	156	48	40.9	52.0
	L	108.4	86.1	59.3	10.7	153.2	123.3	46.7	75.6	151	67	143.0
Feb.	F	188.2	109.2	131.1	20.9	106.9	85.7	31.4	25.7	35.6	(-)	10.0
	M	213.6	27.2	51.3	32.7	56.6	192.7	9	72.4	320.9	(-)	103.0
	L	108.1	95.1	92	130.0	20.3	47.6	112.1	179.5	13.8	(-)	123.0
Mar.	F	79.8	105.6	76	191.3	53.8	131.5	22	34	(-)	169.0	42
	M	68.3	47.9	59.9	36.0	57.7	71.5	95	94.5	(-)	123.5	137
	L	70.8	57.8	133.1	121.0	128.9	40	105	60	(-)	60.0	112.8
Apr.	F	40.9	77.8	136.0	56.0	90.1	25.5	119.5	67.4	(-)	35.5	83.5
	M	72.9	145.6	137.2	22.5	4.9	11.0	147	106.7	(-)	28.0	64
	L	92.6	14.5	94.5	15.0	17.8	0	29.5	49.1	(-)	161.0	7
May	F	22.9	63.2	-	4.0	0	6.0	120	0	115.5	-	69.4
	M	15.5	75.8	-	0	0	83.0	9	0	1.6	-	93.7
	L	10.4	-	-	0	7.0	26.0	39	0	-	-	105.3
June	F	-	2.2	-	0	57.5	49.0	108.5	-	-	0	-
	M	-	-	-	0	9.9	19.0	0	-	43.4	0	-
	L	-	22.3	-	0	48.1	32.2	0	-	33.5	0	-
July	F	0	-	-	0	-	66.7	0	0	4.5	0	-
	M	61.9	-	13.9	0	-	4.5	0	0	31	0	-
	L	10.4	31.6	-	0	-	0	0	18.5	-	0	-
Aug.	F	0	61.1	-	0	-	0	0	11	-	0	-
	M	0	-	-	0	-	0	0	0	-	0	-
	L	0	7.3	-	0	-	0	0	0	24.1	0	-
Sep.	F	0	5.7	29.5	0	-	11.5	0	0	0	-	-
	M	47.0	77.6	17.8	0	-	0	0	0	3.0	-	-
	L	55.4	-	-	0	-	0	0	-	55.5	-	-
Oct.	F	-	76.3	99	0	-	11.3	0	0	82.0	0	-
	M	-	4.9	47	2.9	-	0	0	1.0	6.0	0	55
	L	20.4	62.8	131.0	11.4	-	0	0	11.0	-	0	27
Nov.	F	0	No data	33.4	77.8	-	55.5	0	48	62.0	0	74
	M	0	No data	71.1	0	-	42.0	34.5	40.5	84.5	15.1	145.5
	L	0	No data	87.5	149.9	99.5	39.0	3.5	233	77.5	0	103.5
Dec.	F	-	256.2	124.8	37.1	153.9	133.5	75.5	162.5	80.5	91.5	46.1
	M	-	91.4	46.6	32.1	30.4	85.0	105.5	74	40.9	87.3	-
	L	-	38.8	79.5	53.8	342.7	445.4	133	173.2	76.6	68	204.7

Note : (-); No available data

4.8

Table 4.1.3

TEN – DAY RAINFALL AT MRICAN
(1973 to 1983) (2/2)

Month	Each Ten Days	Year										
		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Jan.	F	No data	184.3	118.4	183.3	107.3	131	245	134.7	6	(-)	243
	M	"	61.1	72.3	119.3	142.0	112	239	188	87	(-)	76
	L	"	93.6	53.5	42.5	63.2	88	103	174	48	(-)	39
Feb.	F	"	53.2	89.0	26.5	16.7	50.5	136.5	157.2	102	124	90.0
	M	"	84.9	79.0	110.5	34.5	80.5	27	252.1	51	114	188
	L	"	148.3	74.0	169.0	69.1	41.5	78	58.1	88	164	98
Mar.	F	"	150.5	71.9	201.0	123.8	48.1	98.1	0	93.3	(-)	101
	M	"	50.3	113.4	106.2	49.2	20.2	159.3	54.9	18.7	(-)	144
	L	"	103.1	158.9	97.9	105.7	155.1	51.1	105	62.4	(-)	111
Apr.	F	"	58.8	23.5	9.8	34.9	64.8	147	103	39.0	-	49
	M	"	34.9	103.7	2.1	4.0	37.3	192	177	76	55	102
	L	"	4	49.3	21.6	109.3	68.2	31	121	132	12	168
May	F	"	154.9	85.6	17.7	0	79.5	112	2.0	16	-	65
	M	"	37.2	69.6	0	0	155	38	0	12	-	109
	L	"	-	15.9	0	49	13	97	16.0	-	-	101
June	F	"	-	-	0	10.5	38	49	-	-	-	-
	M	"	3	-	0	3	9	0	-	22	-	2
	L	"	23	31.2	0	9	103	0	-	27	-	-
July	F	-	-	-	0	0	104	0	0	15	-	-
	M	6	-	0.4	0	-	12	0	0	28	-	-
	L	-	47	-	0	-	14	0	60	-	-	-
Aug.	F	24	-	-	0	-	10	0	34	-	-	-
	M	-	0.8	0.3	0	-	59	0	2	1	-	-
	L	4	4.3	-	0	-	0	0	0	17	-	-
Sep.	F	2	37	18.1	0	-	38	0	0	4	-	-
	M	35.3	45	55.7	0	-	15	0	-	-	-	-
	L	49	-	1.4	24	-	0	0	1	38	-	-
Oct.	F	-	59	83.1	0	-	64	0	0	4	-	-
	M	17	-	11.3	59	-	4	0	5	18	-	25
	L	2	22	342.7	97.4	3	48	8.8	2	11	-	39
Nov.	F	-	1	19.0	0	-	45	3.4	0	15	-	4
	M	-	230	32.3	3.7	11.3	34	68.9	27	19	26	31
	L	-	64	108.5	192.1	10.0	10	47.3	50	133	3	90
Dec.	F	-	96	80	36.4	106.9	103	68	11	189	69	27
	M	-	31	205	1.8	37.7	88	63.5	18	94	98	15
	L	-	38	69.5	0.5	121.2	204	128.3	24.5	48	44	264

Note : (-) ; No available data

Table: 4.1.4   EXISTING RIVER STRUCTURE IN WIDAS BASIN (1/2)

River name : K. WIDAS

Location	Kind of Structure	Structure name	Located in			Purpose	Total Width	Width of movable part		Width of fixed part	Bed sill of Structure	Height		Remarks
			Left	Center	Right			Total width	Span			Movable part	Fixed part	
51.45 km	Dam (Ngudikan)			0		Irrigation	45.1 m	5.1 m (2.1 m)	1 m	40 m	–	2.5	2.5	
	Syphon	–		0		Irrigation	1.25	1.25	1	–	–	–	–	
	Sluice	–			0	Irrigation	3.5	1.75	2	–	–	–	–	

River name : K. KEDUNGSOKO

Location	Kind of Structure	Structure name	Located in			Purpose	Total Width	Width of movable part		Width of fixed part	Bed sill of Structure	Height		Remarks
			Left	Center	Right			Total width	Span			Movable part	Fixed part	
1.00 km	Sluice	–			0	Drainage	–	–	–	–	–	–	–	Ø 0.4 m x1
1.25	"	–			0	"	1.5	1.5	1	–	–	2.3	–	
3.30	"	–			0	"	0.3	0.3	1	–	–	0.5	–	
5.25	"	–			0	"	1.2	1.2	1	–	–	1.5	–	
6.50	"	–	0			"	–	–	–	–	–	–		Ø 0.8 m x1
10.15	Dam (Malangsari)			0		Irrigation	36.6	36.6	3.7x1 4.5x1 9.5x3 (3.2+15+7.5 +7.6+7.7)			4		
	Sluice		0			"	1.8	1.8	1	–	–			

River name : K. ULO

Location	Kind of Structure	Structure name	Located in			Purpose	Total Width	Width of movable part		Width of fixed part	Bed sill of Structure	Height		Remarks
			Left	Center	Right			Total width	Span			Movable part	Fixed part	
8.8 km	Syphon (Dorogeneng)			0		Irrigation	–	–	–	–	–	–	–	Canal B 3m x H1.5 m
10.8	Weir (Bulakmojo)			0		"	23.2 m	3.2 m (1.9 m)	1	20 m	–	3	3	
	Sluice	–			0	"	1.0	1.0	1	–	–	–	–	
14.0	Sluice (Dangdet dam)	0					1.5	1.5	1	–	–	1.0	–	
16.75	Sluice	–	0			"	0.5	0.5	1	–	–	0.8	–	
20.7	Dam (Tiripan)			0		"	10.05	10.05	5.025x2 (4.0m+4.1m)	–	–	2.2	–	
	Sluice	–	0			"	0.6	0.6	1	–	–	–	–	
	Sluice	–			0	"	1.2	1.2	(0.6x2)	–	–	–	–	
	Sluice	–			0	"	6.9	6.9	2.3 x 3 (1.6mx3)	–	–	–	–	
28.1	Kuncir diversion weir					(Same K. Kuncir)								

4.10

Table : 4.1.4   EXISTING RIVER STRUCTURE IN WIDAS BASIN (2/2)

River name : K. KUNCIR

Location	Kind of Structure	Structure name	Left	Center	Right	Purpose	Total Width	Width of movable part		Width of fixed part	Bed sill of Structure	Height		Remarks
								Total width	Span			Movable part	Fixed part	
1.9^{km}	Sluice	--	0			Drainage	0.5^m	0.5^m	1	–	–	1.0	–	
2.2	"	–	0			"	0.5	0.5	1	–	–	0.8	–	
"	"	–			0	"	0.5	0.5	1	–	–	0.8		
3.65	"	–	0			"	0.3	0.3	1	–	–	0.3		
4.55	"	–			0	"	–	–	–	–	–	–	–	Ø 0.3^{m}x1
6.5	Dam (Kapas)			0		"	18	18	6m x 3 (5m x 3)	–	–	4	–	
	Sluice	–	0			"	1.0	1.0	1	–	–	2		
	Sluice	–			0	"	1.0	1.0	1	–	–	2		
8.65	Syphon	–		0		"	–	–	–	–	–	–	–	Ø 2.0^{m}x2
9.65	Dam (Tanjung) (Kramat)			0		Irrigation	9.5	9.5	4.75mx2 (4.0mx2)	–	–	2.6	–	
	Sluice				0	"	0.7	0.7	1	–	–	–	–	
10.95	"				0	"	2.5	2.5	1	–	–	2	–	
17.58	Dam (Kedunggerit)			0		"	18.3	3.5 (2.0m)	1	.15	–	6	6	
	Sluice (Syphone)		0			"	1.3	1.3	1	–	–	–	–	
	Sluice				0	"	1.3	1.3	1	–	–	–	–	
20.5	Diversion weir			0		Flood Diversion	33.0	33.0	8,25x4 (7.5x4)	–	–	–	–	
20.55	Diversion weir		0			"	14.4	14.4	4.8x3 (4.0mx3)	–	–	–	–	

Table 4.1.5 PRESENT CONDITION OF EXISTING BRIDGE IN THE WIDAS BASIN (1/4)

River name : K. Widas

No of Inventory Survey	Location	Administrative office	Classification	Type of Super Structure	Type of Sub Structure	Bridge length L (m)	Nos. of Span	Span length l (m)	$\frac{B}{b}$ (m)	h_1 (m)	h_2 (m)
1	3.90 + 100		Footpath	Bamboo	Wooden	20.0	-	-	-	-	-
(Lengkong) 2	11.50 + 130		Road	RC-slab PC-Preten	Inverted -T Type Pile bent	65.0	7	7.5 14.0	$\frac{4.6}{9.5}\frac{1.0}{0.56}$	6.7	5.8
(Karangsemi) 3	24.7 + 150		do	Steel Truss	bent Inverted T-Type	63.0	4	24.0	4.5	7.6	6.1
4	32.1 + 200		do	SRC -T Beam	Inverted T-Type	47.00	4	12.0	$\frac{4.0}{0.6}$	9.0	8.5
5	34.6 + 350		do	Shape Steel	Steel Frame	40.30	5	8.0	2.0	5.25	5.0
6	37.1 + 120		Footpath	Steel suspension	do	31.8	4	11.50	2.25	8.1	7.6
7	38.6 + 250		Road	RC-T Beam	Inverted -T-Type	38.8	4	9.00	$\frac{3.9}{0.9}$	8.6	8.4
8	43.1 + 300		Road	RC-slab	Rigid	50.25	6	10.00	$\frac{4.3}{0.65}$	10.0	9.2
9	48.1 + 200		Light Railway	Steel truss	Gravity	46.7	3	28.70	2.75	7.5	7.0
10	48.6 + 200		Road	do	Gravity Pile bent	47.0	2	23.75	2.70	6.3	5.5

River name : K Kedungsoko

No of Inventory Survey	Location	Administrative office	Classification	Type of Super Structure	Type of Sub Structure	Bridge length L (m)	Nos. of Span	Span length l (m)	$\frac{B}{b}$ (m)	h_1 (m)	h_2 (m)
1	3.5 + 200	Binamarga	Road	Shape Steel	Inverted T-type Steel frame	50.8	5	11.6	$\frac{8.5}{0.75}$		
2	3.5 + 220		Railway	Steel girder	Inverted T-Type	82.0	8	12.2	1.06		
3	7.0 + 250		Footpath (Road)	Wooden	Wooden	41.0	8	10.0	1.3		
4	8.0 + 100		Footpath	Bamboo	--	40.0	-	-	-	-	-
5	10.0 + 150					40.8					
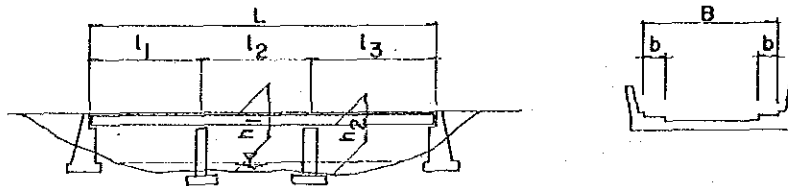
L : Bridge length
l : Span length (most longest)
B : Effective width include in sidewalk
b : Width of sidewalk
h_1 : Height to surface from river bed
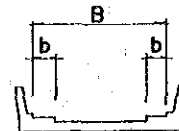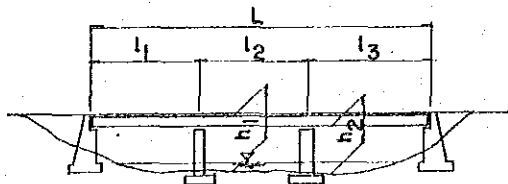h_2 : Height to girder bottom from river bed

Table 4.1.5   PRESENT CONDITION OF EXISTING BRIDGE IN THE WIDAS BASIN (2/4)

River name : K Ulo (No. 1)

No of Inventory Survey	Location	Administra- tive office	Classifi - cation	Type of Super Structure	Type of Sub Structure	Bridge length L(m)	Nos. of Span	Span length l(m)	B/b (m)	h₁ (m)	h₂ (m)
1	1.5 + 200		Road	Wooden	Wooden	15.5	3	5.3	2.35	4.75	4.60
2	5.5 + 350		Road	do	do	16.6	4	4.7	2.0	3.85	3.6
3	6.5 + 330		Road	RC-slab	Gravity	21.8	2	10.9	4.0	4.10	3.4
4	10.0 + 70		Road	Shape Steel	Inverted T-Type	15.3	2	7.65	3.9	4.55	4.35
5	11.5 + 00		Road	RC-T Beam	Inverted T-Type	24.6	2	11.5	6.2	5.0	4.6
6	13.0 + 200		Road	do	Inverted T-type	25.2	2	11.8	8.35 / 1.0	4.55	3.45
7	13.5 + 300		Road	Wooden	do	22.0	2	11.0	2.5	5.0	4.5
8	14.0 + 250	Binamarga	Road	RC-slab	do	46.0	4	11.0	1.3 / 0.7	4.9	4.2
9	14.5 + 250	PJKA	Railway	Steel Beam	do	51.60	3	17.40	1.067	5.9	4.3
10	16.0 + 300		Road	RC-T Beam	do	25.0	2	12.50	8.8 / 0.81	5.35	4.7
11	18.0 + 300		Road	do	Pile bent	27.8	2	13.90	8.9 / 1.1	6.8	6.1
12	18.5 + 50		Road	Shape Steel	Inverted T-Type	12.2	1	12.2	3.3	6.0	5.6
13	19.5 + 250		Footpath (Road)	Bamboo	Wooden	20.4	3	7.0	1.5	-	5.55
14	20.5 + 200		Road	Arch	Gravity	36.0	3	5(7)	2.5		
15	21.0 + 200		Road	RC-T Beam	Inverted T-Type	15.2	2	7.6	3.4	4.8	4.4
16	22.5 + 110		Footpath	Wooden	Gravity Wooden	9.4	2	4.7	1.8	7.25	7.0
17	24.0 + 440		Road	Shape Steel	Inverted T-Type	15.4	2	7.7	3.0	6.25	6.0
18	24.0 + 280		Aqueduct	Arch	Gravity	21.2	2	10.6	1.5	-	-
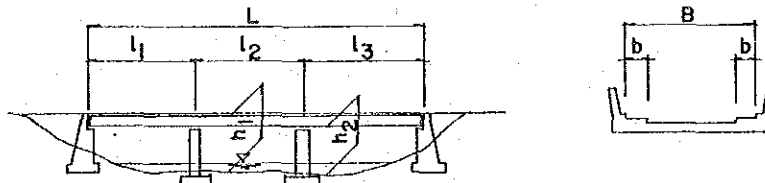
L : Bridge length
l : Span length (most longest)
B : Effective width include in sidewalk
b : Width of sidewalk
h₁ : Height to surface from river bed
h₂ : Height to girder bottom from river bed

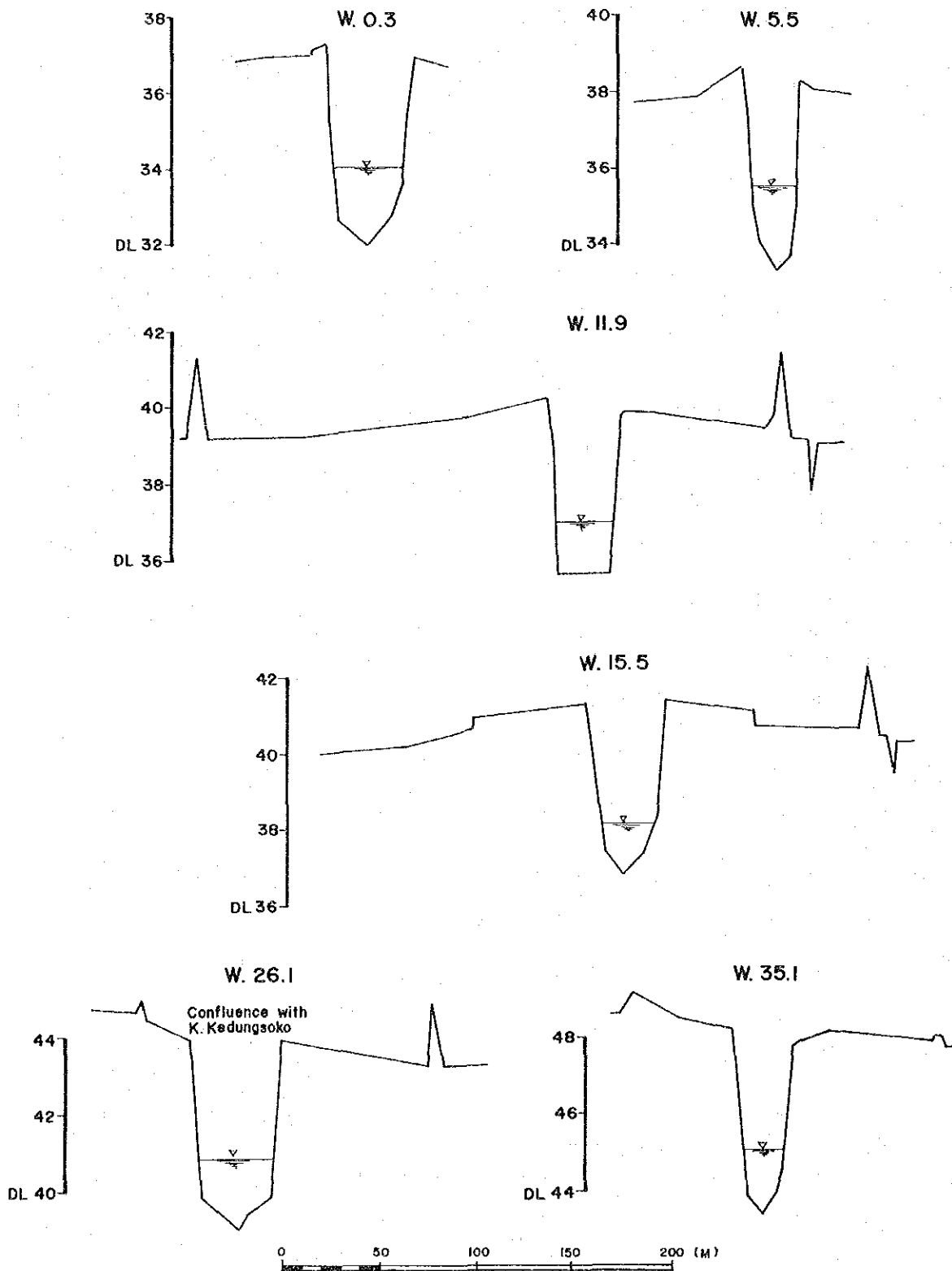## Table 4.1.5 PRESENT CONDITION OF EXISTING BRIDGE IN THE WIDAS BASIN (3/4)

River name : K Ulo (no. 2)

No of Inventory Survey	Location	Administrative office	Classification	Type of Super Structure	Type of Sub Structure	Bridge length L(m)	Nos. of Span	Span length l(m)	B/b (m)	h_1 (m)	h_2 (m)
19	24.5 + 300		Footpath	Shape Steel	Gravity	11.1	1	11.1	2.0/-	-	7.7
20	25.0 + 300		Road	Wooden	Inverted T-Type	22.6	3	7.5	2.5/-	6.5	-
21	25.5 + 430		Footpath (Road)	Wooden	do	14.1	2	7.0	2.0/-	-	7.4
22	26.0 + 400		Road	Shape Steel	Inverted T-Type	28.1	3	9.5	2.0/-	-	6.0
23	27.0 + 300		Footpath	Bamboo	Wooden	31.4	4	7.85	1.0/-	-	-

River name : K KUNCIR (No. 1)

No of Inventory Survey	Location	Administrative office	Classification	Type of Super Structure	Type of Sub Structure	Bridge length L(m)	Nos. of Span	Span length l(m)	B/b (m)	h_1 (m)	h_2 (m)
1	0 + 50		Footpath	Bamboo	-	10.0	1	10.0	-	-	-
2	0.5 + 70		do	do	-	10.0	1	10.0	-	-	-
3	1.0 - 50		Road	Wooden	Gravity	5.5	1	5.5	3.2/-	2.7	-
4	1.5 + 0		do	do	do	6.8	1	6.8	2.5/-	2.8	-
5	1.5 + 350		Footpath	Bamboo	Bamboo	10.0	1	10.0	-	-	-
6	2.0 + 200		Footpath (Road)	do	Wooden	10.0	1	10.0	1.5/-	-	-
7	2.5 + 120		do	do	Gravity	14.2	2	7.1	1.5/0	-	-
8	4.0 + 250		Road	RC-T Beam	do	14.4	1	14.0	4.8/-	4.3	3.0
9	5.5 + 0		do	Wooden	do	11.2	3	3.8	3.1/-	3.65	-
10	7.5 + 220		Footpath	Bamboo	Wooden	10.0	1	10.0	-	-	-
11	8.0 + 150		Road	Steel Truss	Gravity	20.25	1	20.25	2.6/-	-	3.7
12	8.0 + 450		do	Shape Steel	Gravity & Rigid frame	13.85	2	6.90	3.65/-	4.25	3.7
13	9.5 + 150		Road	RC-T Beam	Gravity Pile bent	19.00	2	9.5	8.2/1.0	4.8	4.4
14	10.0 + 400		Aqueduct	Steel Box	do	10.00	1	10.00	0.6/-	-	-
15	10.5 + 0		Road	H-beam	do	20.5	2	12.3	10.5/1.25	5.3	4.6
16	10.5 + 350		do	Wooden	Steel frame	25.5	3	13.7	2.6/-	-	4.7
17	12.0 + 120		Footpath	Bamboo	Steel frame Gravity	26.0	3	8.5	1.5/-	-	-
18	12.5 + 50		Road	Steel	Gravity	22.0	4	7.6	2.0/-	5.9	5.4

L : Bridge length

l : Span length (most longest)

B : Effective width include in sidewalk

b : Width of sidewalk

h_1 : Height to surface from river bed

h_2 : Height to girder bottom from river bed

Table 4.4.5 PRESENT CONDITION OF EXISTING BRIDGE IN THE WIDAS BASIN (4/4)

River name : K Kuncir (No. 2)

No of Inventory Survey	Location	Administrative office	Classification	Type of Super Structure	Type of Sub Structure	Bridge length L (m)	Nos. of Span	Span length l (m)	B/b (m)	h₁ (m)	h₂ (m)
19	13.0 + 80		Road	RC-slab	Inverted T-Type Pile bent	22.0	2	10.5	6.2	7.4	6.9
20	14.5 + 0		Road	Shape Steel	Inverted T-Type	17.8	2	8.9	3.5	7.25	6.7
21	16.5 + 180		Road	do	Gravity	10.0	1	10.0	2.5	7.90	7.60
22	17.0 + 250		Road	do	Inverted T-Type	14.5	2	7.25	2.5	6.2	5.9
23	17.0 + 400		Road	RC- T Beam	Inverted T-Type	21.0	2	10.25	6.2	5.50	4.70
24	18.5 + 150		Road	Shape Steel	Gravity	28.0	3	9.5	2.0	7.00	6.80
25	20.5 + 0		Road	Shape Steel	Gravity	40.0	4	8.0	3.6		

L : Bridge length
l : Span length (most longest)
B : Effective width include in sidewalk
b : Width of sidewalk
h₁ : Height to surface from river bed
h₂ : Height to girder bottom from river bed

4.15

Fig. 4.1.1   TYPICAL CROSS-SECTIONS OF THE EXISTING
K. WIDAS (1 / 5)

4.16

W. 40.1 W. 50.1

52
60
48
DL 46

66
64
62
DL 60

0   50   100   150   200 (M)

Fig. 4.1.1   **TYPICAL CROSS SECTIONS OF THE EXISTING K. WIDAS (2 / 5)**

K. 1. 0 K. 4.5

46
44
42
DL 40

46
44
42
DL 40

K. 10. 0

50
48
46
DL 44

0   50   100   150   200 (M)

Fig. 4.1.1   **TYPICAL CROSS-SECTIONS OF THE EXISTING
K. KEDUNGSOKO   (3/5)**

4.17

U. 0.5

U. 5.0

U. 9.5

U. 16.0

U. 18.5

U. 23.5
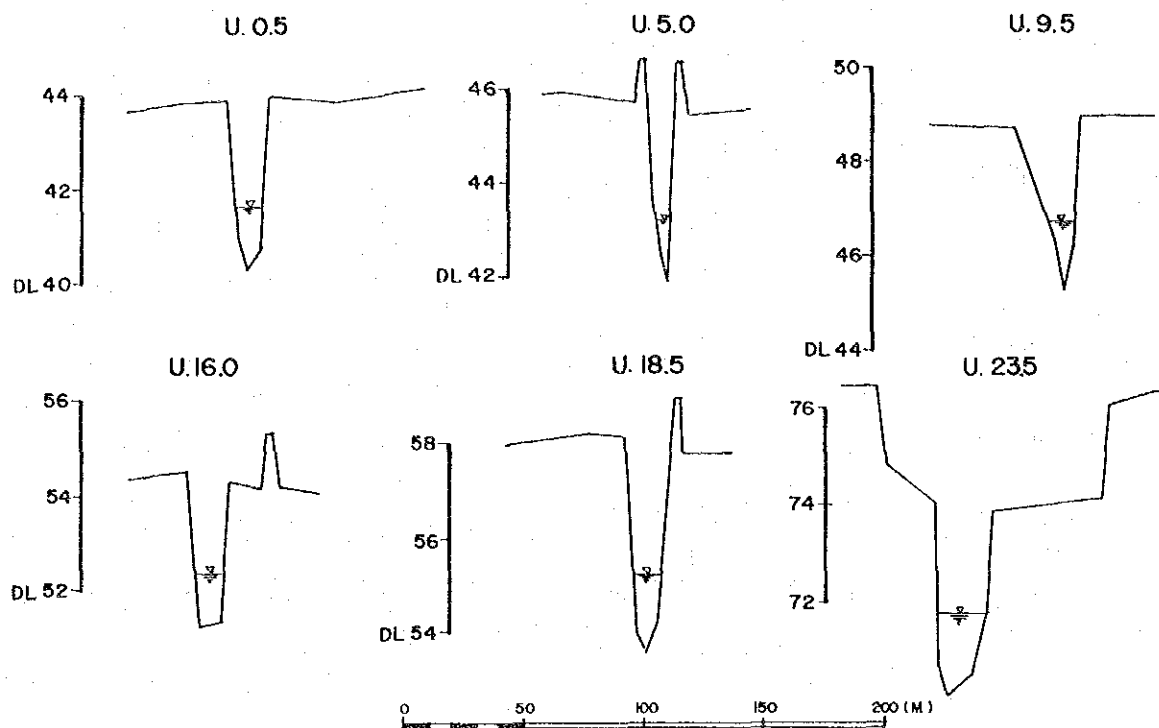
Fig. 4.1.1   **TYPICAL CROSS-SECTIONS OF THE EXISTING K. ULO**
(4/5)

KC. 1.0

KC. 10.0

KC 14.5

KC. 20.5
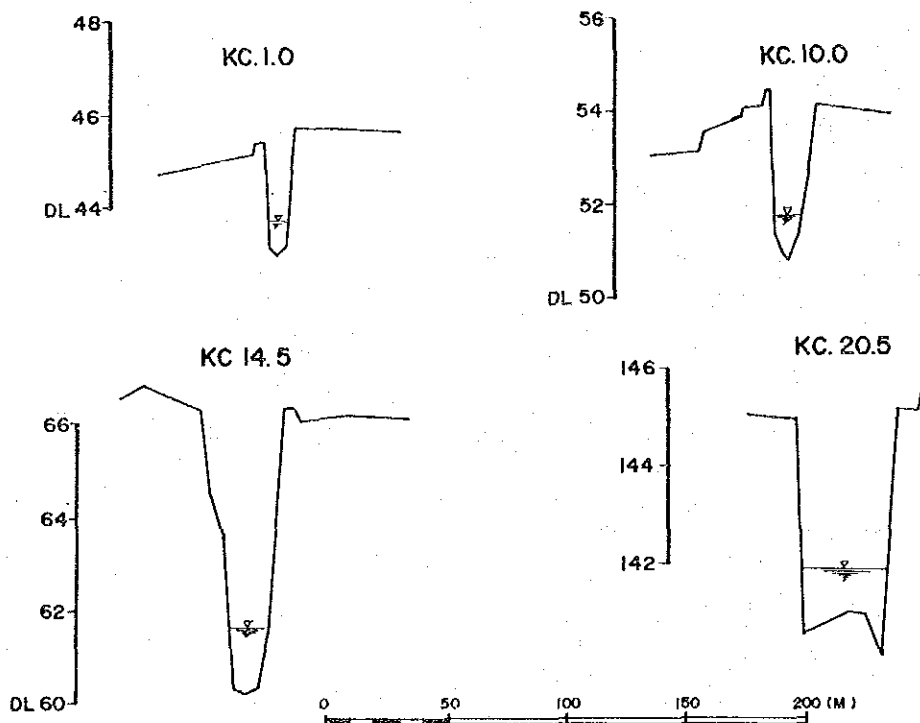
Fig. 4.1.1   **TYPICAL CROSS-SECTIONS OF THE EXISTING**
K. KUNCIR (5/5)

4.18
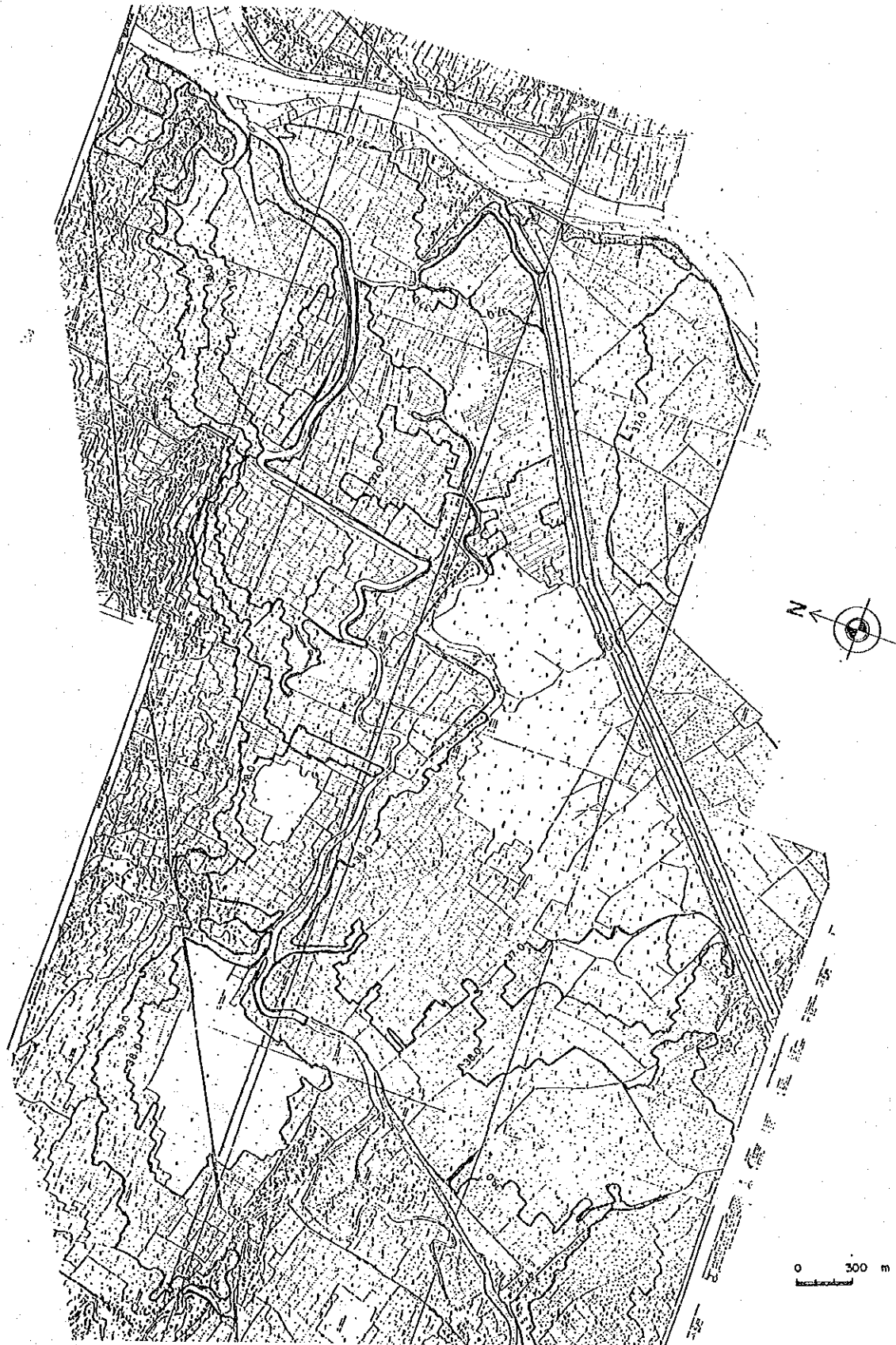
Fig. 4.1.2 CONTOUR MAP OF WIDAS RETARDING BASIN (1/3)

Fig. 4.1.2   CONTOUR MAP OF ULO RETARDING BASIN (2/3)

Fig. 4.1.2 CONTOUR MAP OF KEDUNGSOKO RETARDING BASIN (3/3)

4.21

WIDAS RETARDING BASIN

	J	F	M	A	M	J	J	A	S	O	N	D	J
EL. 36/37													
P-P-K/M			P*				P			K/M			
EL. 38			P			P/M			M/K				
P - P - M / M - K													
EL. 39			P				T/M						
P - M/T**													

ULO RETARDING BASIN

	J	F	M	A	M	J	J	A	S	O	N	D	J
EL. 43						P		M/S		K			
P - M/S - K													
EL. 44		P				P		M					
P - P - M													
EL. 45 = 46		P			P		Ro/M						
P - P - Ro/M / Ro - P/M													

KEDUNGSOKO RETARDING BASIN

	J	F	M	A	M	J	J	A	S	O	N	D	J
EL. 43 (P.M)					P		M						
EL. 44 (P. P.M)		P			P		M			P			
EL.45(46)(P P M/S / S P)		P			P		M/S						
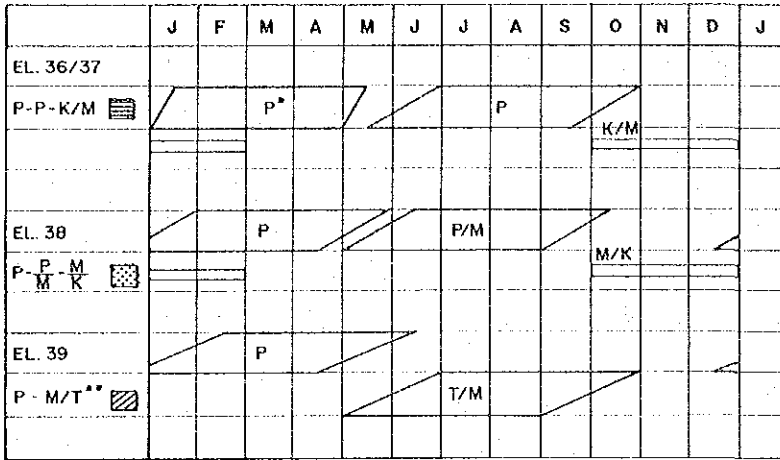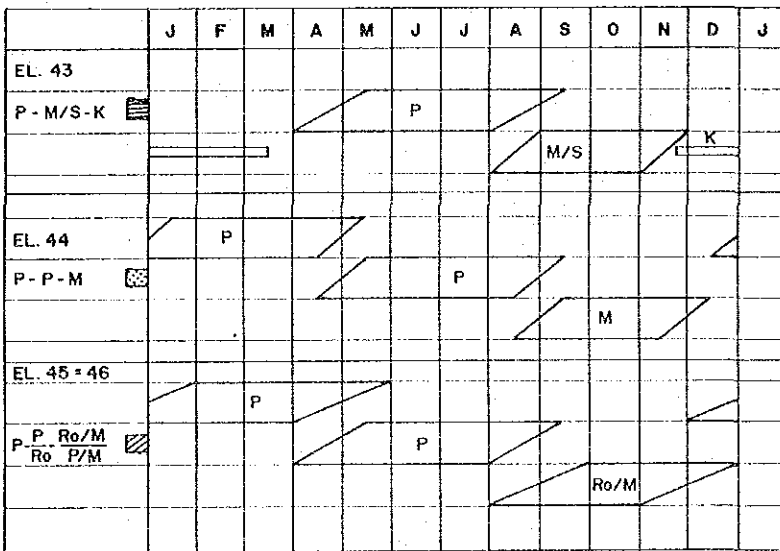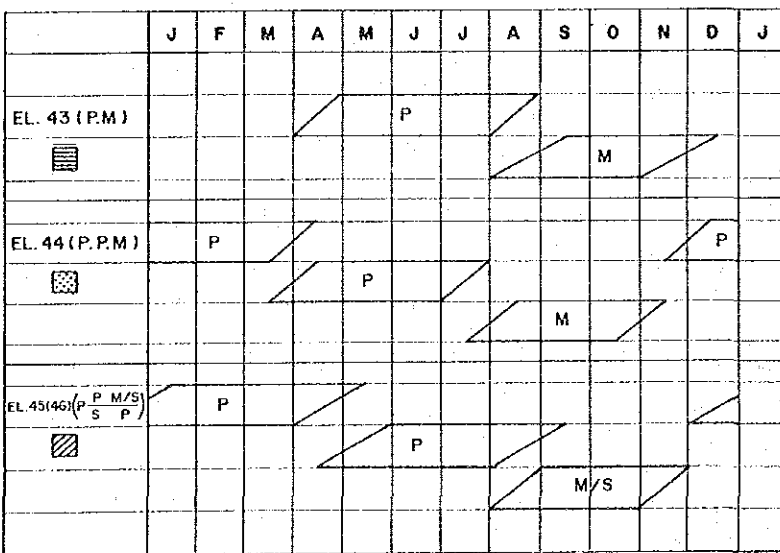
LEGEND :

*)	: Little area only
* *)	: Tobacco is planted in Lengkong area only
P	: Paddy
M	: Maize
S	: Soybean
Ro	: Red onion
K	: Kenaf
PSP	: Pattern is small area

Fig. 4.1.3   CROPPING PATTERN IN RETARDING BASINS (1/4)

Fig. 4.1.3 CROPPING PATTERN IN RETARDING BASINS (2/4)

WIDAS RETARDING BASIN

Scale

0   350   870 m

N

Fig. 4.1.3 CROPPING PATTERN IN RETARDING BASINS (3/4)
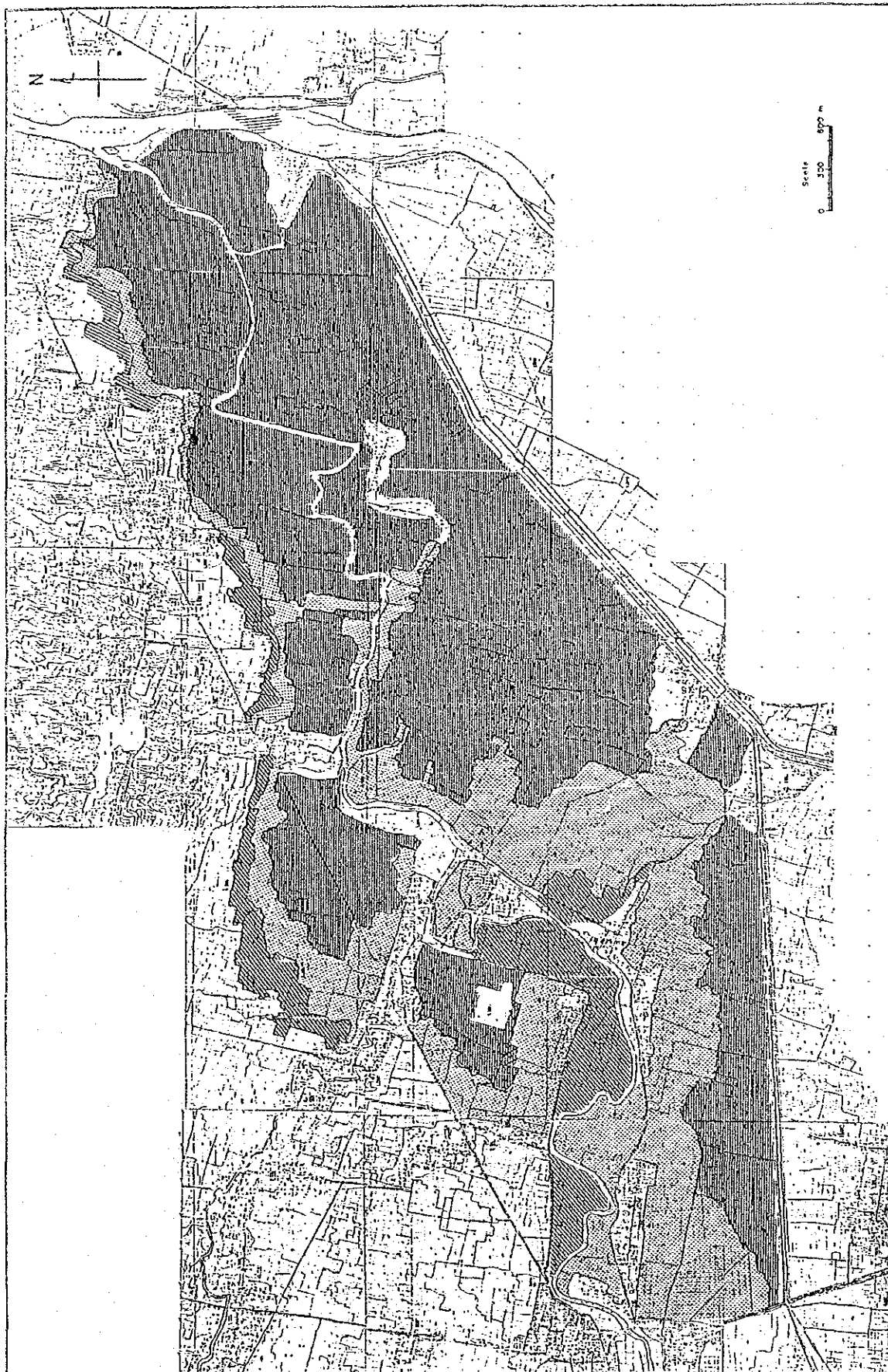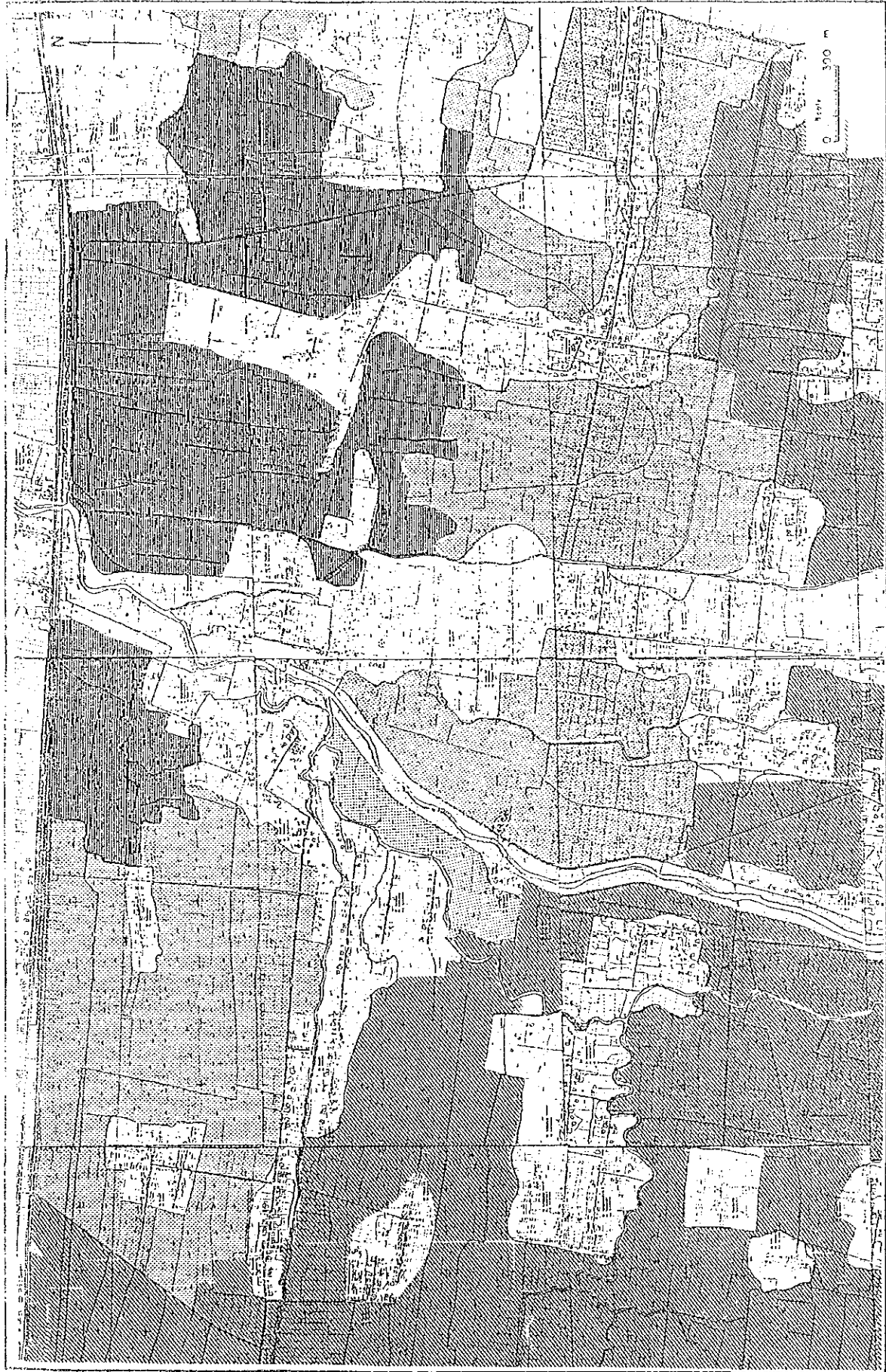
ULO RETARDING BASIN

Fig.4.1.3 CROPPING PATTERN IN RETARDING BASINS (4/4)

KEDUNGSOKO RETARDING BASIN

Fig. 4.1.4. LOCATION MAP OF HYDROLOGICAL OBSERVATION
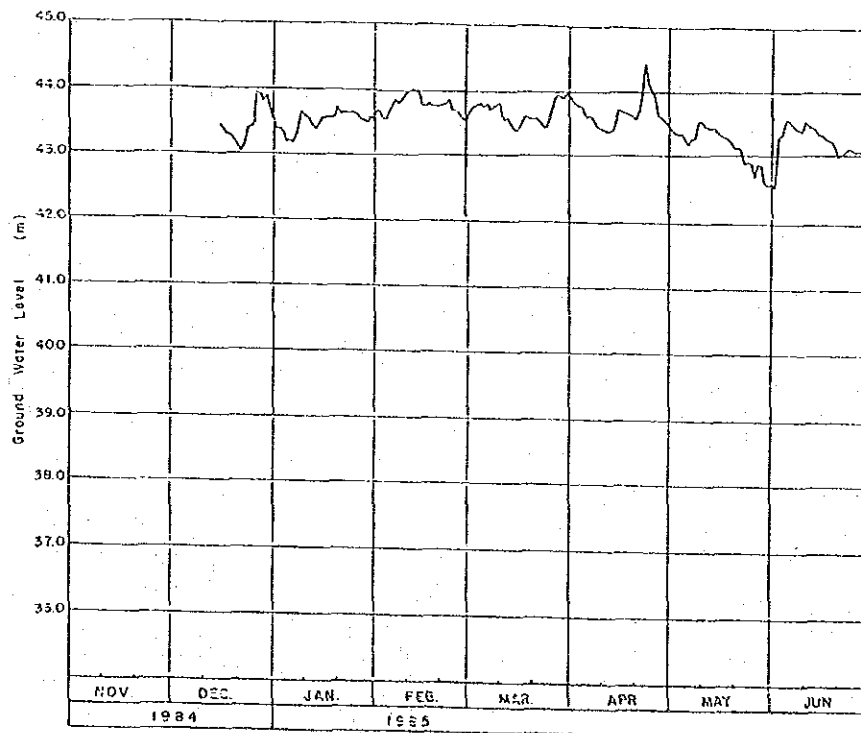SITES IN WIDAS RIVER IMPROVEMENT AREA
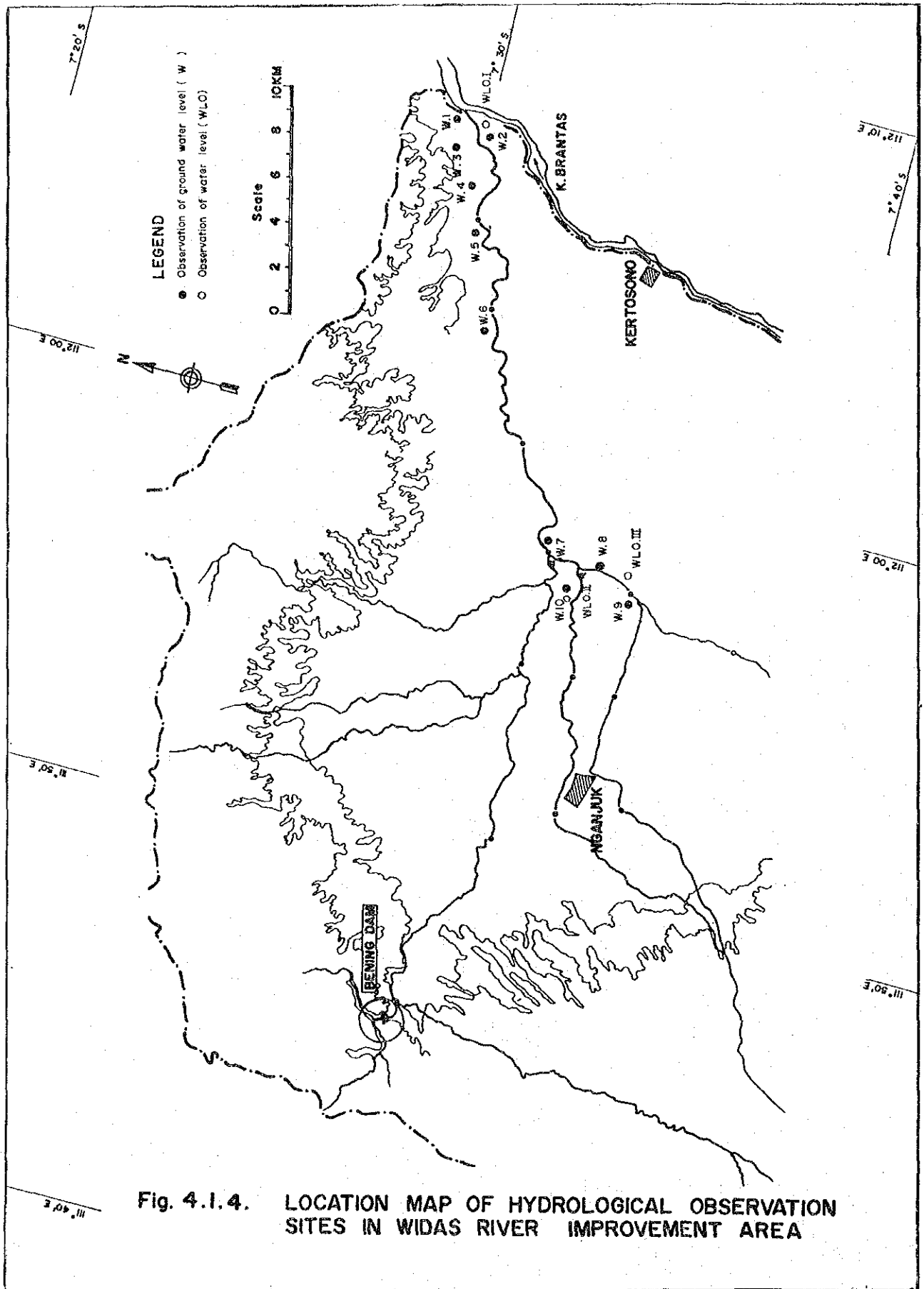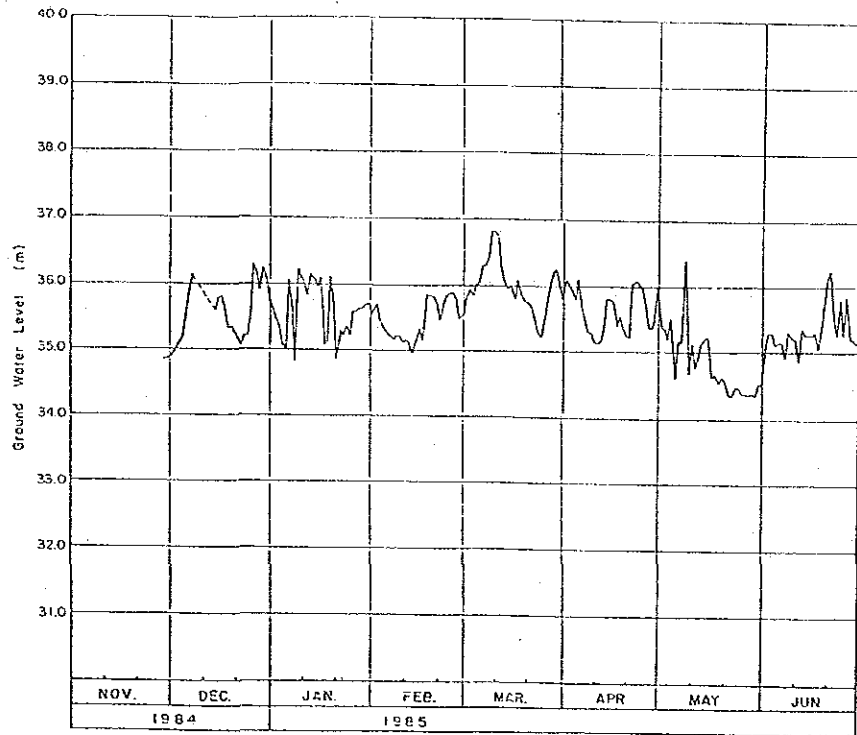
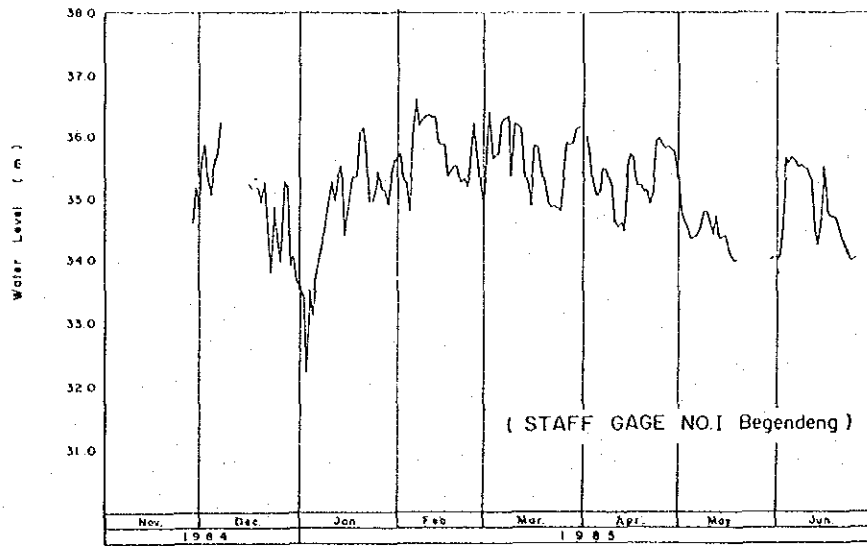Fig. **4.1.5** OBSERVATION RECORD OF GROUND WATER LEVEL (1/10)
(NO. W.1, BEGENDENG)
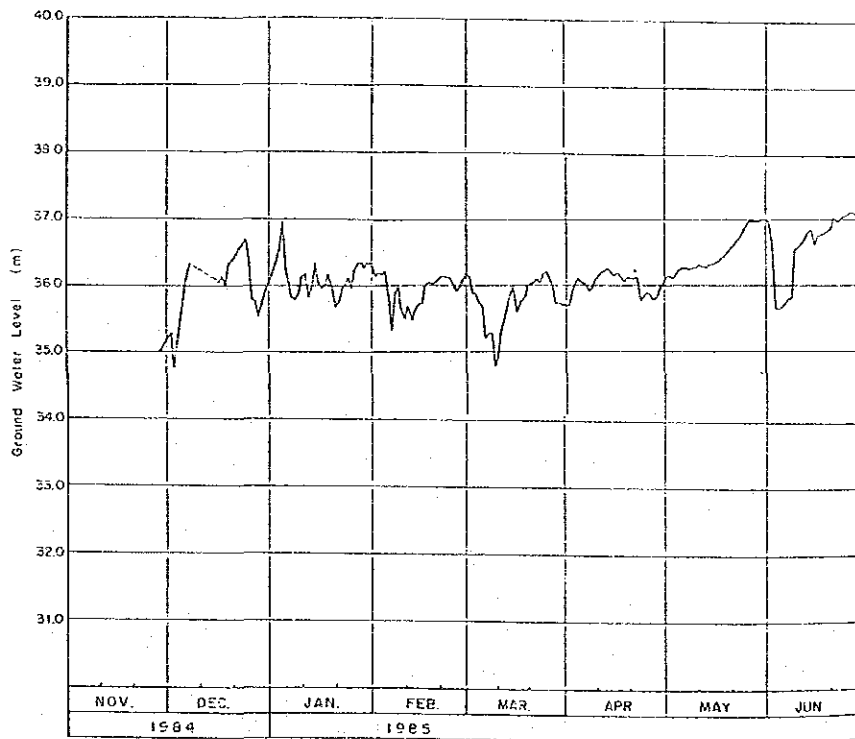
Fig. **4.1.5** OBSERVATION RECORD OF GROUND WATER LEVEL (2/10)
(NO. W.2, TAMBAK)

4.27
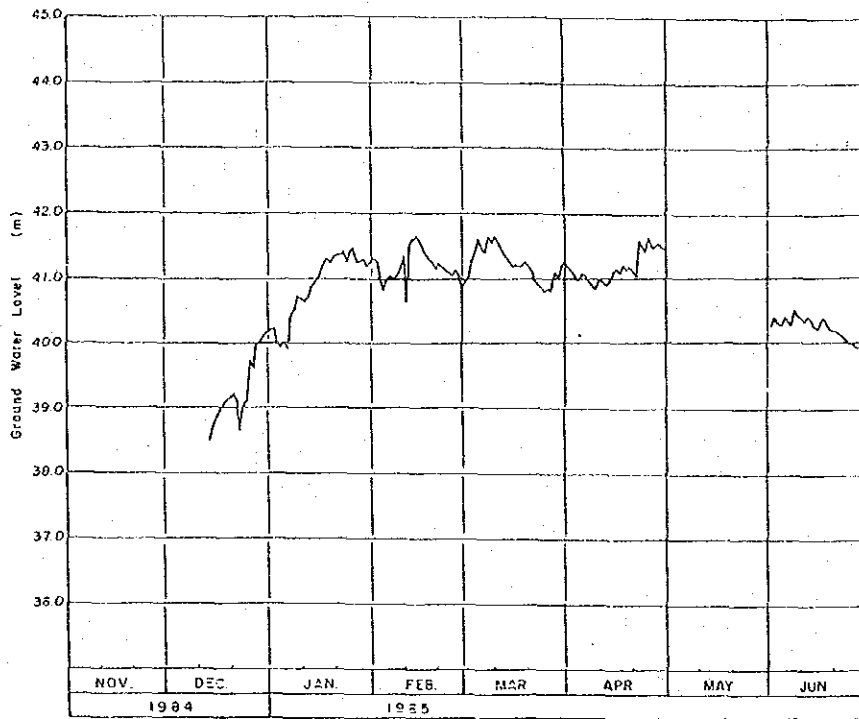
Fig. **4.1.5** OBSERVATION RECORD OF GROUND WATER LEVEL (3/10)
(NO. W.3, JATIKALEN - MASJIT)
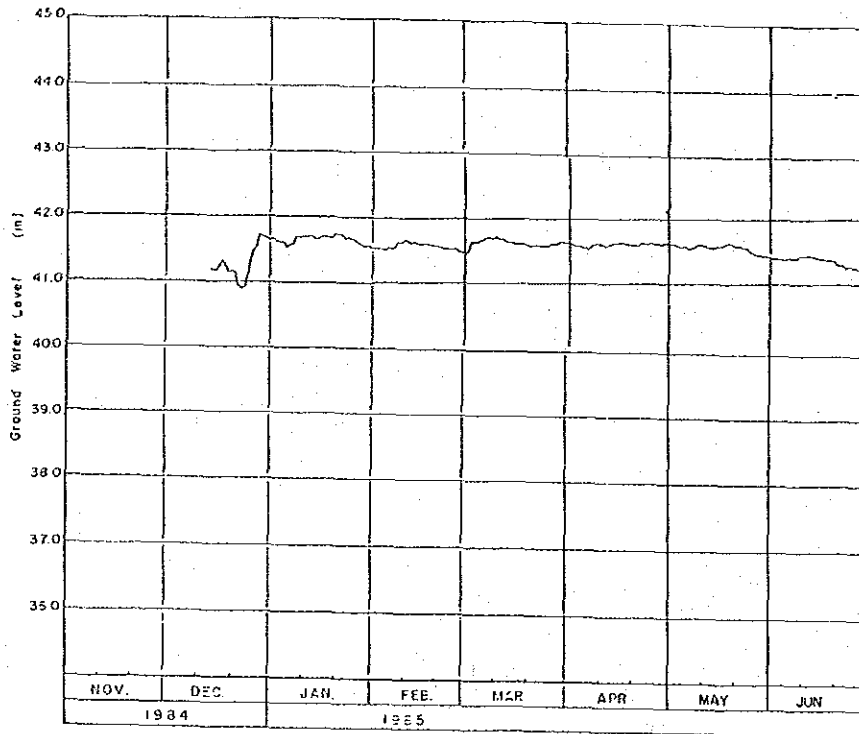
Fig. **4.1.5** OBSERVATION RECORD OF GROUND WATER LEVEL (4/10)
(NO. W.4, JATIKALEN - JOGOBOYO)

4.28
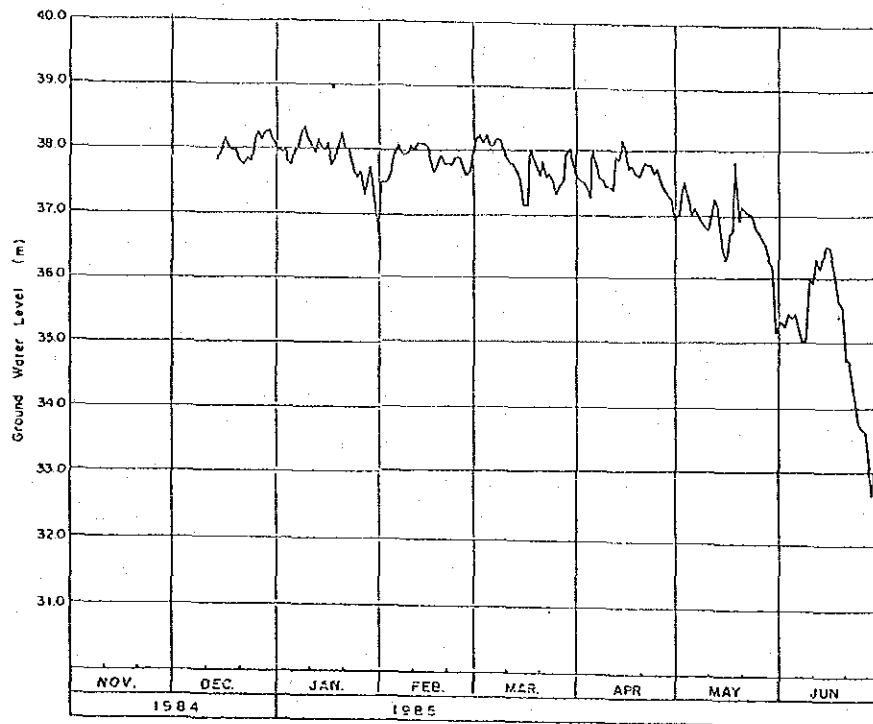
Fig. 4.1.5 OBSERVATION RECORD OF GROUND WATER LEVEL (5/10)
(NO. W.5, KEDUNGMLATEN)
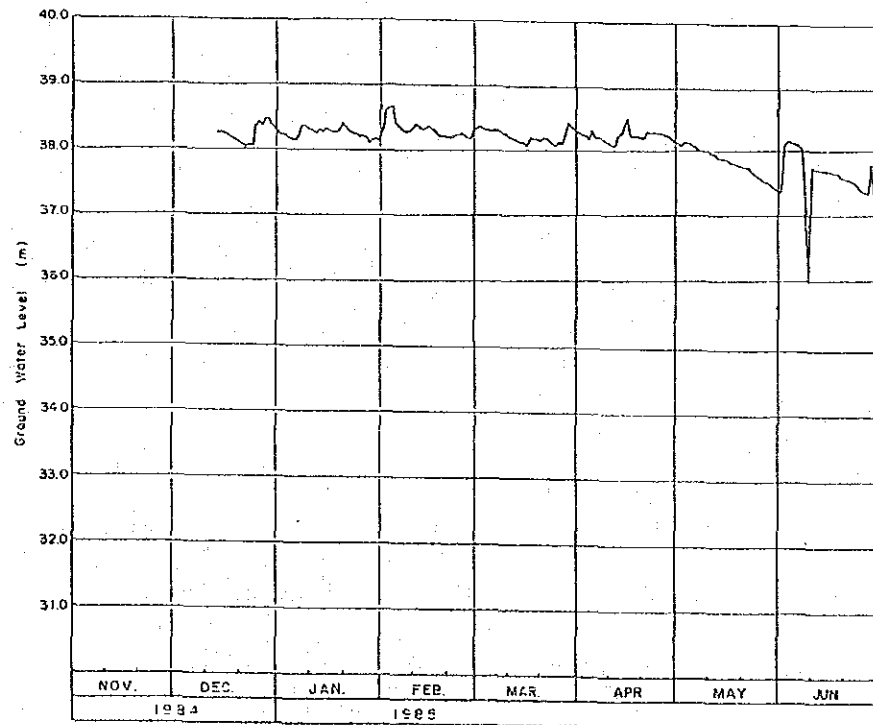
Fig. 4.1.5 OBSERVATION RECORD OF GROUND WATER LEVEL (6/10)
(NO. W.6, BANJARDOWO)

4.29
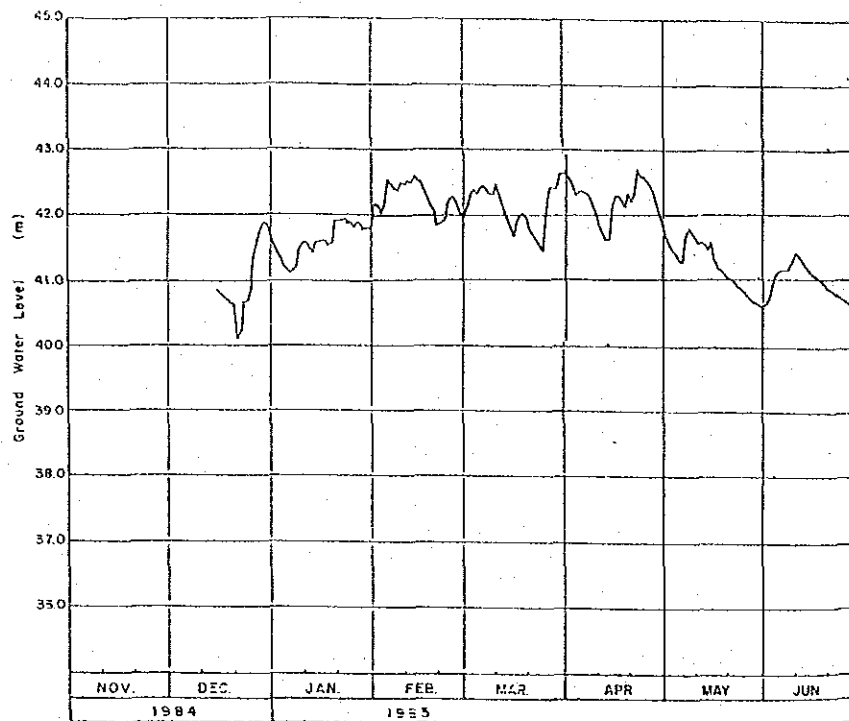
Fig. **4.1.5** OBSERVATION RECORD OF GROUND WATER LEVEL (7/10)

(NO. W.7 , PANCAR)
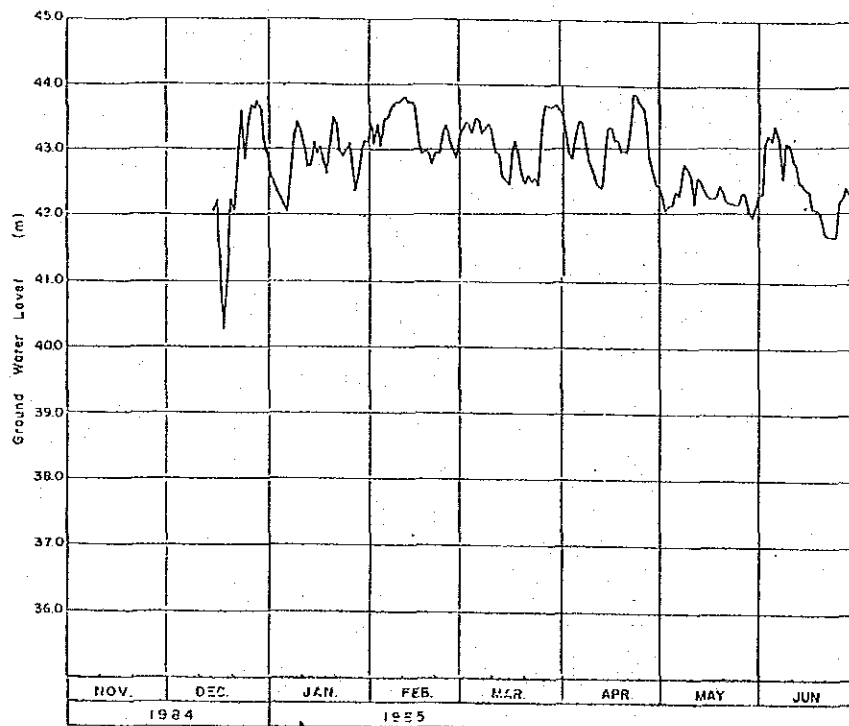
Fig. **4.1.5** OBSERVATION RECORD OF GROUND WATER LEVEL (8/10)

(NO. W.8 , KEDUNGREGUL)

4.30
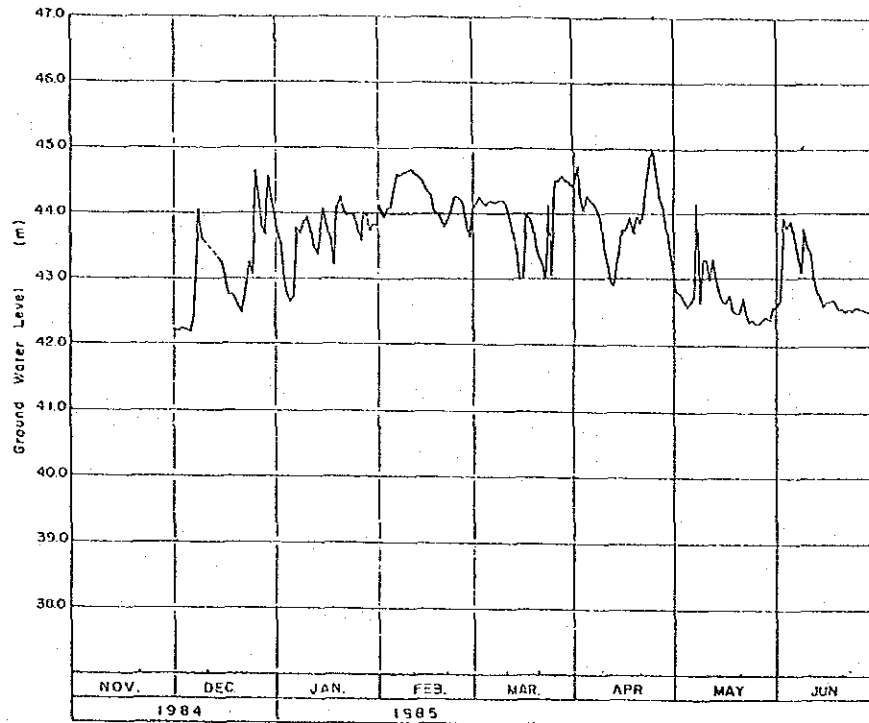
Fig. 4.1.5   OBSERVATION RECORD OF GROUND WATER LEVEL (9 / 10)
(NO. W.9 , SUMBERWARU)

Fig. 4.1.5 OBSERVATION RECORD OF GROUND WATER LEVEL (10/10)
(NO. W.10, GOBANG)

4.31
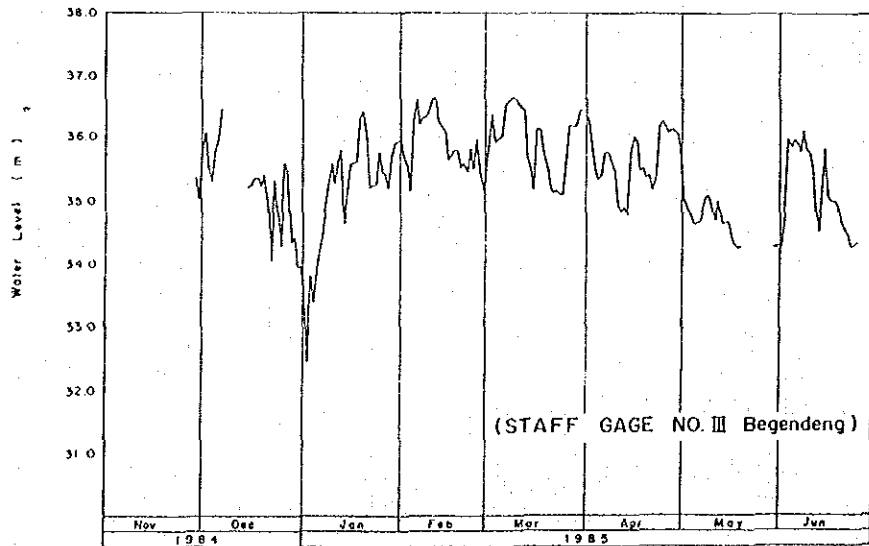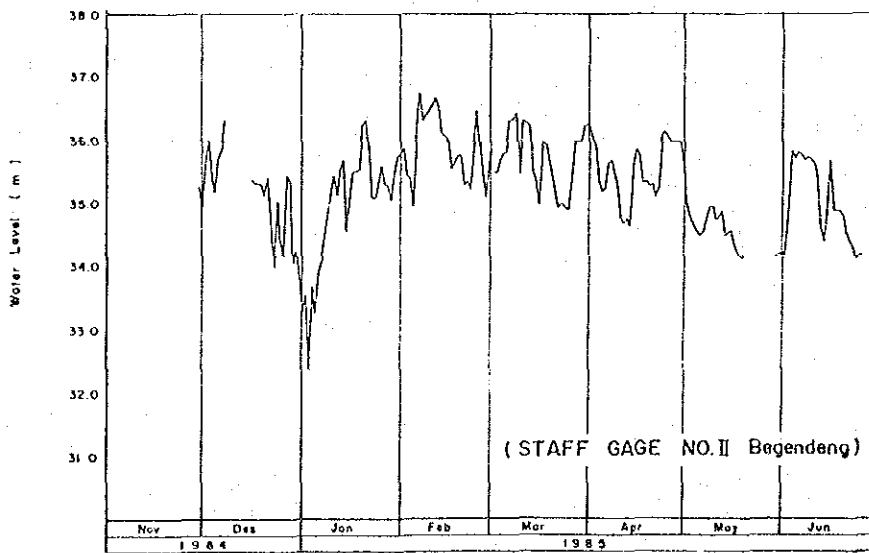
Fig. 4.1.6   OBSERVATION RECORD OF WATER LEVEL IN THE WIDAS RIVER (1/3)

4.32
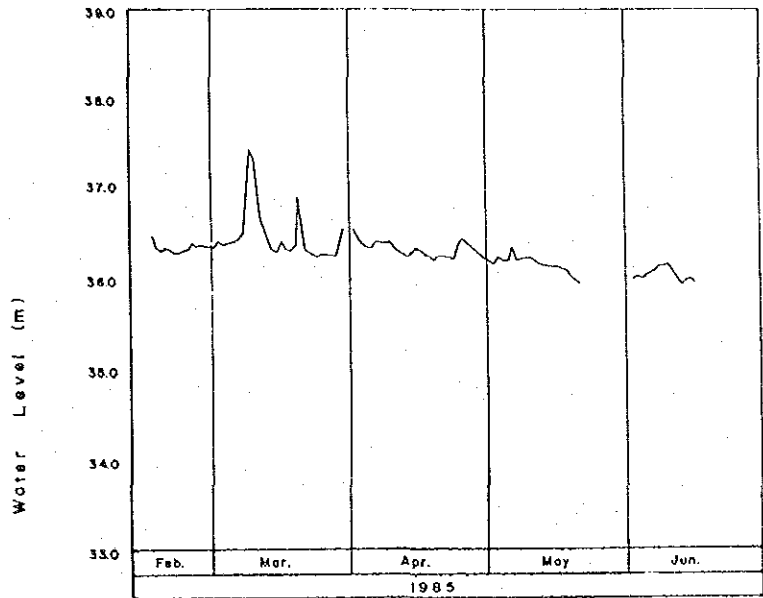
Fig. 4.1.6.　　OBSERVATION　RECORD　OF　WATER　LEVEL　IN
WIDAS　RETARDING　BASIN　(2/3)
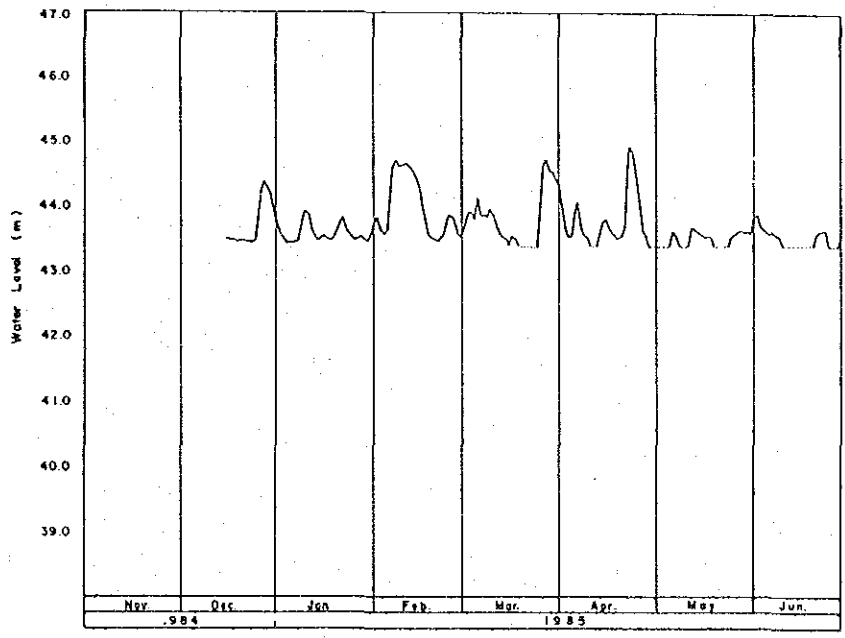
Fig. 4.1.6.　OBSERVATION　RECORD　OF　WATER　LEVEL　IN
KEDUNGSOKO　RETARDING　BASIN　(3/3)

4.33

STAGE - DISCHARGE CURVE

(m)

GUAGE READ (m)

$Q = 8.956 H^2 + 72.158H + 150.402$

LEGEND:
⊙ | Observed

1.5
1.0
0.0
-1.0
-2.0
-3.0
-4.0

0   100   200   300   400
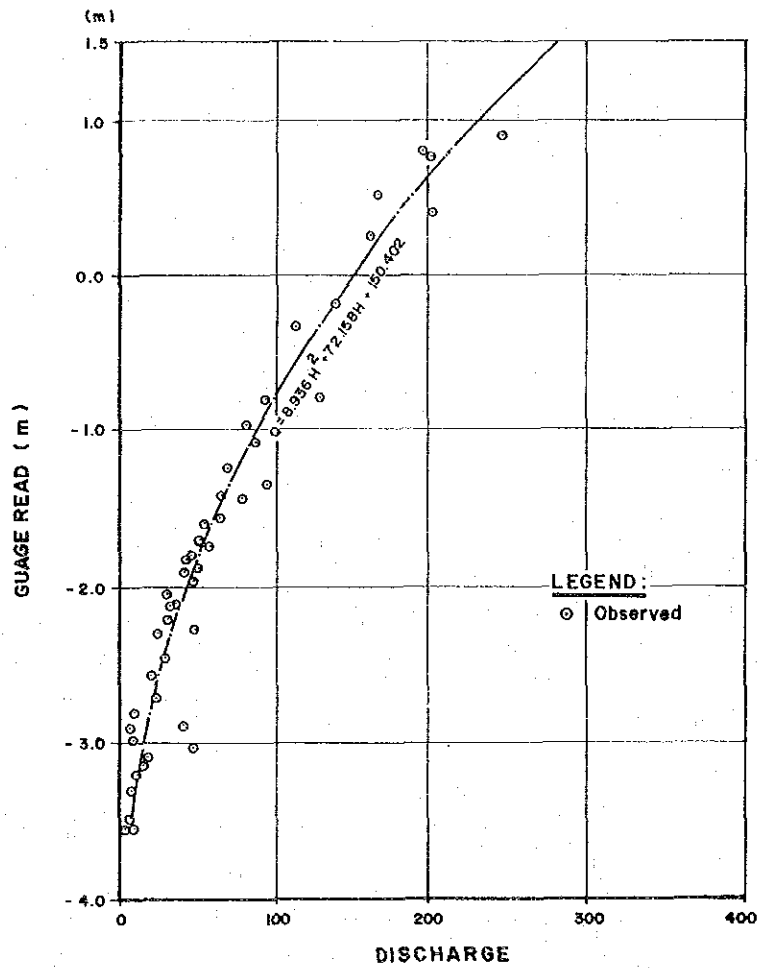
DISCHARGE

STAGE - DISCHARGE CURVE

YEAR	HEIGH	DISCHARGE
	M	M³/sec
1973	1.30	259
1974	0.88	221
1975	0.96	228
1976	1.55	288
1977	1.00	231
1978	1.36	265
1979	1.39	268
1980	1.16	246
1981	0.64	200
1982	1.17	247

ESTIMATED ANNUAL MAX. DISCHARGES

Fig. 4.1.7.   ANNUAL MAXIMUM DISCHARGE AT LENGKONG BRIDGE
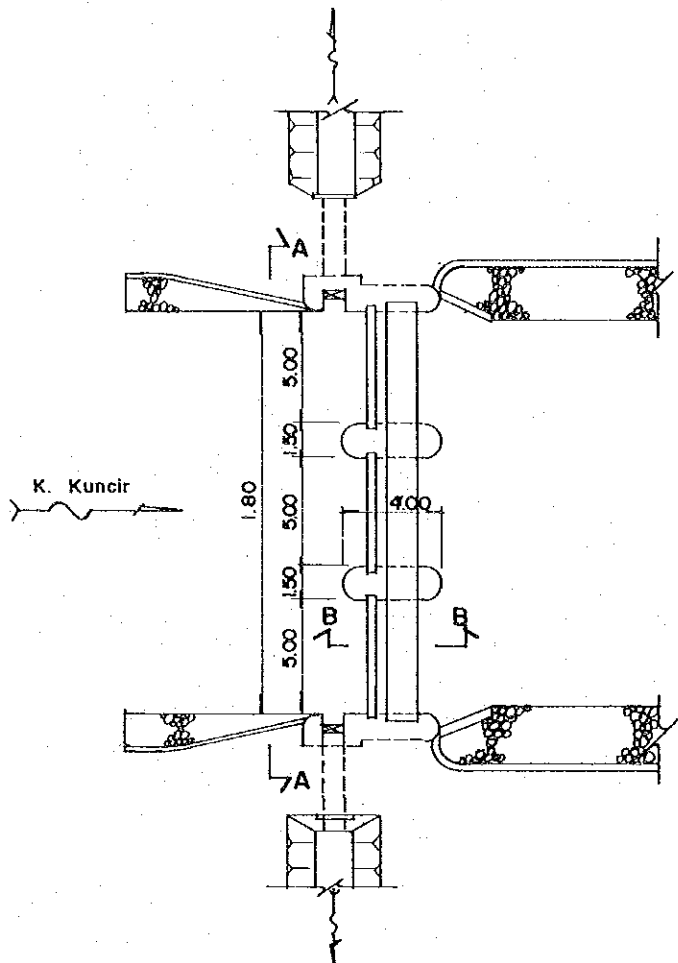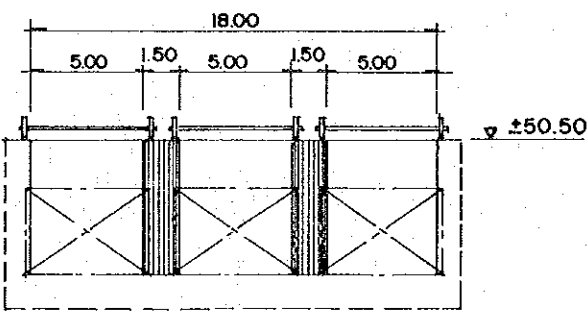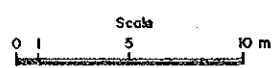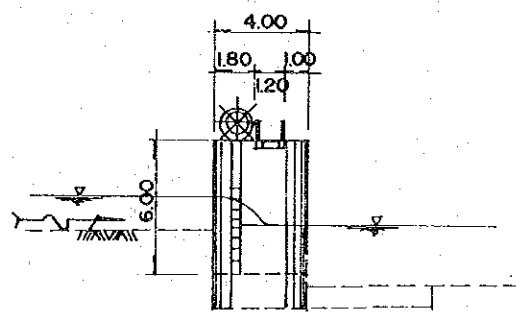
4.34

PLAN

Scale
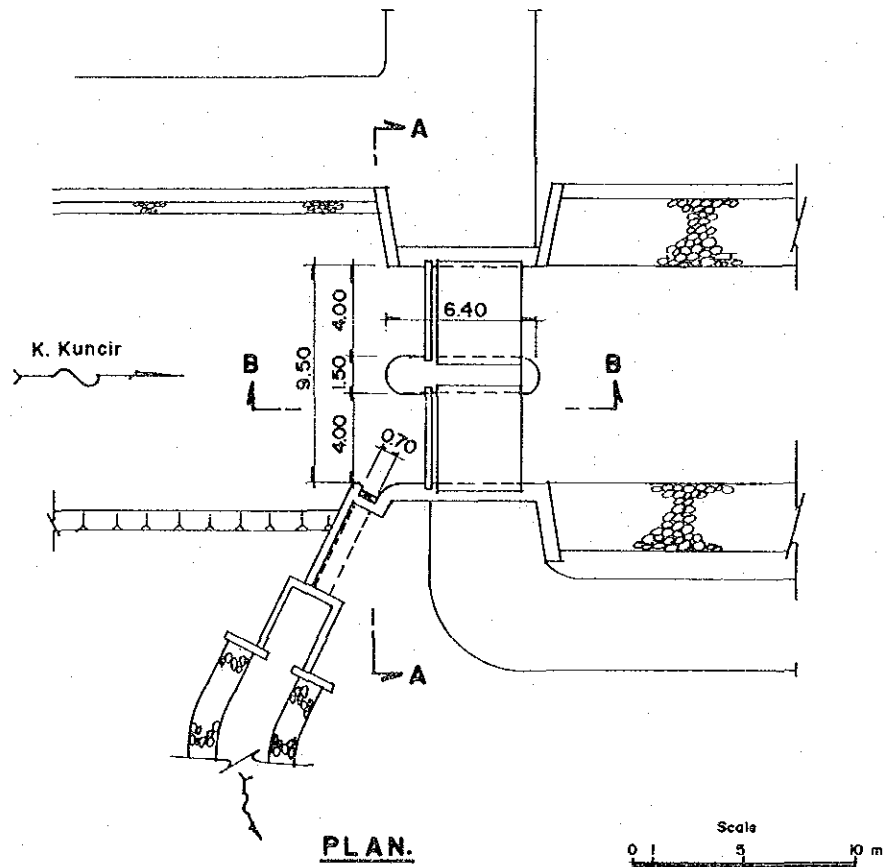
0 1   5   10 m
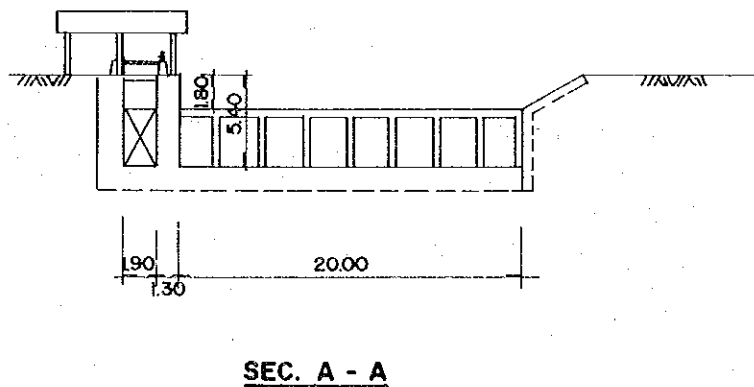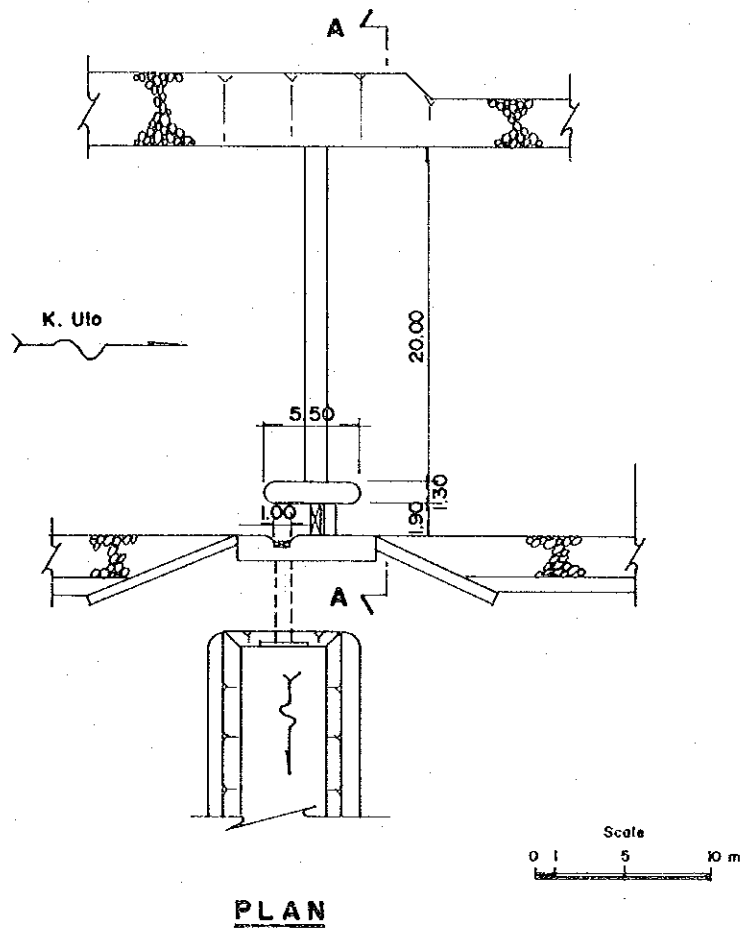
SEC. A - A

SEC. B - B

Note : Base structure is based on data collected at Pengairan Seksi Nganjuk offices

Fig. 4.1.8.   SKETCH OF KAPAS DAM (1/4)
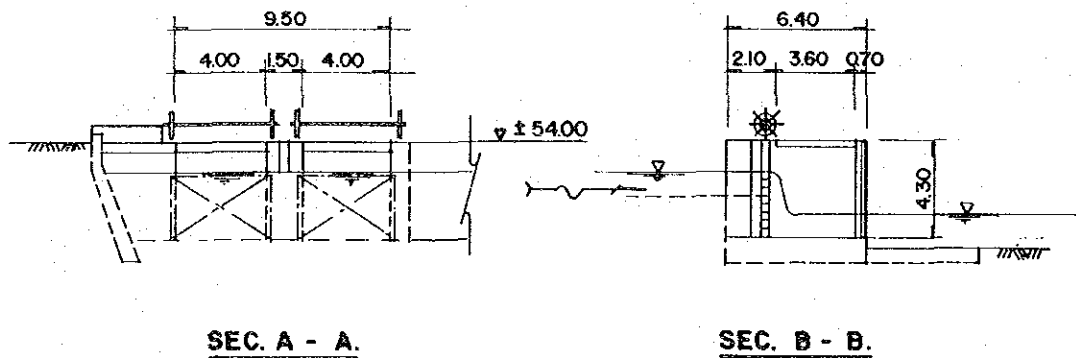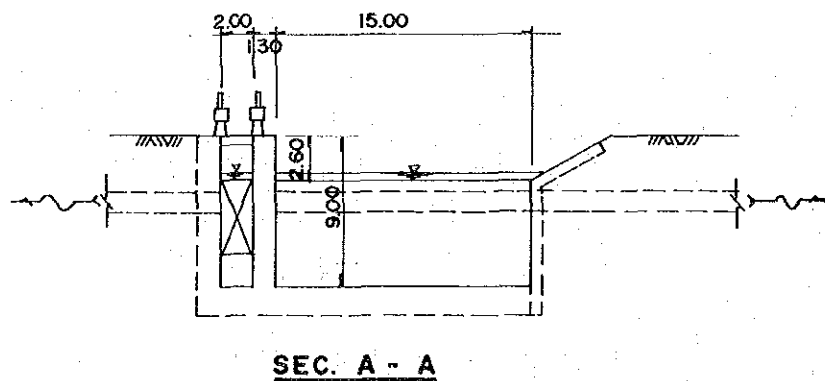
4.35

PLAN.

Scale
0 1   5   10 m

K. Kuncir

SEC. A - A.

SEC. B - B.

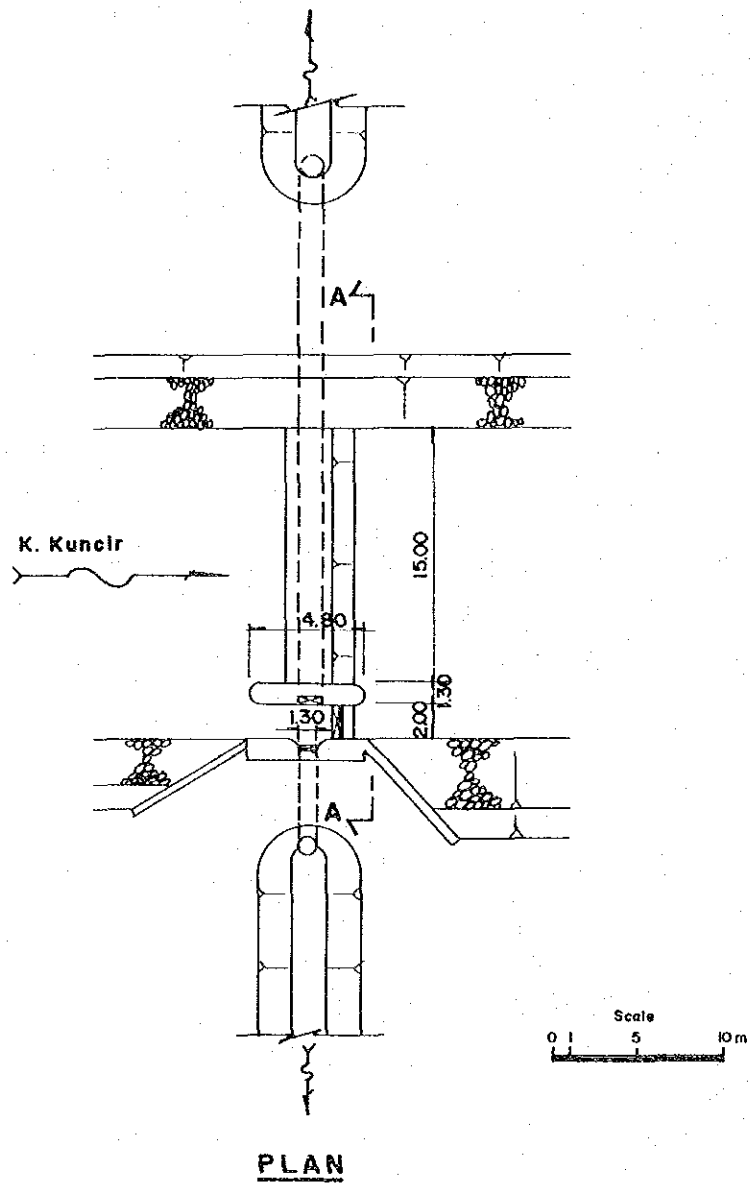Note : Base structure is based on data collected at Pengairan Seksi Nganjuk offices

Fig. 4.1.8.   SKETCH OF KRAMAT (TANJUNG) DAM (2/4)

4.36

PLAN

SEC. A - A

Note : Base structure is based on data collected at Pengairan Seksi Nganjuk offices

Fig. 4.1.8.   SKETCH OF BULAKMOJO WEIR (3/4)

4.37

PLAN

SEC. A - A

Note : Base structure is based on data collected at Pengairan Seksi Nganjuk offices

Fig. 4.1.8.   SKETCH OF KEDUNGGERIT DAM (4/4)

4.38