4.2 Comparative Study on Alternative Flood Control Plan

Supplement data in this section are as follows;

- Breakdown of work quantity and construction cost for alternatives (Table 4.2.1)
- Design discharge distributions for alternatives (Fig. 4.2.1)
- Design profiles of the Widas river for alternatives (Fig. 4.2.2)

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (1/26)

(SCHEME I ,CASE 1)

(MILLION. RP)

WORK ITEM RIVER	WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING (1000 CM)	2282	6947	720	2520								
EXCAVATION (1000 CM)	2282	5020	720	1584	890	2047	265	583				
EMBANKMENT (1000 CM)	733	2799	316	790	441	970	416	915				
REVETMENT												
WETMASONRY (SM)	46116	1845	12243	368	21665	542	30913	773				
DRYMASONRY (SM)	46115	1015	7682	161	21665	433	30912	618				
BRIDGE												
ROAD I (NOS)			1		1							
(SM)			765	1017	1260	1676						
II (NOS)	1				2		3					
(SM)	1190	1428			588	706	882	1058				
III (NOS)	9		2		6		8					
(SM)	2350	2350	600	600	1064	1064	1183	1183				
RAILWAY (NOS)			1		1							
(M)			85	1318	84	1050						
DRAINAGE CULVERT												
I (NOS)	4	180	2	90	6	270	4	180				
II (NOS)	4	260	4	260	3	195	1	65				
III (NOS)	4	380	1	95			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		2		3					
(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE (NOS)	3											
(M)	2600	1820										
DROP STRUCTURE (NOS)												
(M)												
AQUEDUCT (NOS)												
(M)												
SYPHONE (NOS)					1		1					
(M)					70	105	70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		23746		12103		11808		8125				
LAND AQUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 SM)	5127	5127	800	800	954	954	689	689				
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	245	343	55	77	395	553	400	560				
III (NOS)												
SUB-TOTAL		5470		877		1507		1249				
TOTAL		29416		12980		13315		9374				65085

(SCHEME I ,CASE 2)

(MILLION. RP)

WORK ITEM RIVER	WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING (1000 CM)	2293	6619	721	2524								
EXCAVATION (1000 CM)	2293	5001	720	1584	1144	2629	230	524				
EMBANKMENT (1000 CM)	933	2799	316	790	520	1144	374	867				
REVETMENT												
WETMASONRY (SM)	46116	1845	12243	367	30045	751	26953	674				
DRYMASONRY (SM)	46115	1015	7682	161	30045	601	26952	539				
BRIDGE												
ROAD I (NOS)			1		1							
(SM)			765	1017	126	1676						
II (NOS)	1				2		3					
(SM)	1190	1428			588	705	882	1058				
III (NOS)	9		2		9		5					
(SM)	2380	2380	600	600	1274	1274	798	798				
RAILWAY (NOS)			1		1							
(M)			85	1318	84	1050						
DRAINAGE CULVERT												
I (NOS)	4	180	2	90	6	270	3	135				
II (NOS)	4	260	4	260	3	195	1	65				
III (NOS)	4	380	1	95			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		2		2					
(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE (NOS)	3											
(M)	2600	1820										
DROP STRUCTURE (NOS)												
(M)												
AQUEDUCT (NOS)												
(M)												
SYPHONE (NOS)					1		1					
(M)					70	105	70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		23927		12106		13851		6710				
LAND AQUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 SM)	5153	5153	800	800	1029	1029	612	612				
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	245	343	55	77	445	623	400	560				
III (NOS)												
SUB-TOTAL		5496		877		1652		1172				
TOTAL		29423		12983		15503		7882				65791

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (2/26)

(SCHEME I , CASE 3)

(MILLION. RP)

WORK ITEM RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	U L O QUANTITY	U L O COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	T O T A L QUANTITY	T O T A L COST
DREDGING	(1000 CM)	2373	7134	722	2527								
EXCAVATION	(1000 CM)	2299	5229	722	1588	311	715	238	524	500	1500		
EMBANKMENT	(1000 CM)	933	2799	316	790	170	374	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	12243	367	15105	378	265	674	12330	370		
DRYMASONRY	(SM)	46115	1015	7682	161	15105	303	265	539	12330	260		
BRIDGE													
ROAD I	(NOS)			1						1			
	(SM)			765	1017					315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		2		5		5		4			
	(SM)	2681	2681	600	600	620	620	798	798	630	630		
RAILWAY	(NOS)			1						1			
	(M)			85	1318					35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180	2	90	2	90	3	135	2	90		
II	(NOS)	4	260	4	260			1	65	1	65		
III	(NOS)	4	300	1	95			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	44	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3											
	(M)	2600	1620										
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			24771		11564		4330		6710		4059		
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	800	800	183	183	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	270	55	77	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		877		309		1172		214		
T O T A L			30493		12441		4639		7882		4273		59728

(SCHEME II , CASE 1)

(MILLION. RP)

WORK ITEM RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	U L O QUANTITY	U L O COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	T O T A L QUANTITY	T O T A L COST
DREDGING	(1000 CM)	2283	5849	728	2548								
EXCAVATION	(1000 CM)	2282	5020	728	1602	890	2047	265	583				
EMBANKMENT	(1000 CM)	933	2799	316	790	441	970	416	915				
REVETMENT													
WETMASONRY	(SM)	46116	1845	7683	231	21665	542	30913	773				
DRYMASONRY	(SM)	46115	1015	7682	161	21665	433	30912	618				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			765	1017	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	682	1058				
III	(NOS)	9		2		6		8					
	(SM)	2350	2350	600	600	1064	1064	1183	1183				
RAILWAY	(NOS)			1		1							
	(M)			85	1318	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180	2	90	6	270	4	120				
II	(NOS)	4	260	4	260	3	195	1	65				
III	(NOS)	4	380	1	95			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		3					
	(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE	(NOS)	3	1820										
	(M)	2600											
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23946		12103		11808		8125				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5127	5127	800	800	954	954	689	689				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	55	77	395	553	400	560				
III	(NOS)												
SUB-TOTAL			5410		877		1507		1249				
T O T A L			29416		12980		13315		9374				65085

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (3/26)

ULO : 2.0

(SCHEME II , CASE 1)

(MILLION. RP)

WORK ITEM RIVER		MIDAS		KEDUNGSOKO		U L O		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	2122	6366	621	2174								
EXCAVATION	(1000 CM)	2121	4666	620	1364	784	1803	265	583				
EMBANKMENT	(1000 CM)	925	2775	316	790	362	796	416	915				
REVETMENT													
WETMASONRY	(SM)	46116	1845	7683	231	19330	483	30913	773				
DRYMASONRY	(M)	46115	1015	7682	161	19330	387	30912	618				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			765	1017	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		2		6		8					
	(SM)	2350	2350	600	600	1064	1064	1183	1183				
RAILWAY	(NOS)			1		1							
	(M)			85	1318	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180	2	90	6	270	4	180				
II	(NOS)	4	260	4	260	3	195	1	65				
III	(NOS)	5	475	1	95			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		3					
	(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE	(NOS)	3	2013										
	(M)	2875											
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23373		11400		11285		8125				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5127	5127	800	800	816	816	689	689				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	55	77	365	511	400	560				
III	(NOS)												
SUB-TOTAL			5470		877		1327		1249				
T O T A L			28843		12277		12612		9374				63106

ULO : 4.0

(SCHEME II , CASE 1)

(MILLION. RP)

WORK ITEM RIVER		MIDAS		KEDUNGSOKO		U L O		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	2007	6021	621	2174								
EXCAVATION	(1000 CM)	2007	4415	620	1364	784	1803	265	583				
EMBANKMENT	(1000 CM)	925	2775	316	790	362	796	416	915				
REVETMENT													
WETMASONRY	(SM)	46116	1845	7683	231	19330	483	30913	773				
DRYMASONRY	(M)	46115	1045	7682	161	19330	387	30912	618				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			765	1017	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		2		6		8					
	(SM)	2350	2350	600	600	1064	1064	1183	1183				
RAILWAY	(NOS)			1		1							
	(M)			85	1318	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180	2	90	6	270	4	180				
II	(NOS)	4	260	4	260	3	195	1	65				
III	(NOS)	6	570	1	95			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		3					
	(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE	(NOS)	3	2188										
	(M)	3125											
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23077		11400		11285		8125				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5127	5127	800	800	816	816	689	689				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	55	77	365	511	400	560				
III	(NOS)												
SUB-TOTAL			5470		877		1327		1249				
T O T A L			28547		12277		12612		9374				62810

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (4/26)

ULO : 6.0

(SCHEME II ,CASE 1)

(MILLION, RP)

WORK ITEM RIVER		WIDAS		KEDUNGSOKO		U L O		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	1814	5442	6121	2174								
EXCAVATION	(1000 CM)	1813	3789	620	1364	764	1903	265	583				
EMBANKMENT	(1000 CM)	925	2775	316	790	362	796	416	915				
REVETMENT													
WETMASONRY	(SM)	46116	1845	7683	231	19330	483	30913	773				
DRYMASONRY	(SM)	46115	1015	7682	161	19330	387	30912	618				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			765	1017	260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		2		6		8					
	(SM)	2350	2350	600	600	1064	1064	1183	1183				
RAILWAY	(NOS)			1		1							
	(M)			85	1318	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180	2	90	6	270	4	180				
II	(NOS)	4	260	4	260	3	195	1	65				
III	(NOS)	6	570	1	95			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		3					
	(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE	(NOS)	3	2237										
	(M)	3195											
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			22091		11400		11285		8125				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5127	5127	800	800	816	816	689	689				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	55	77	365	511	400	560				
III	(NOS)												
SUB-TOTAL			5470		877		1327		1249				
T O T A L			27561		12277		12612		9374				61824

ULO : 0.0

(SCHEME II ,CASE 2)

(MILLION, RP)

WORK ITEM RIVER		WIDAS		KEDUNGSOKO		U L O		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	2293	6919	721	2524								
EXCAVATION	(1000 CM)	2293	5001	720	1534	1143	2629	238	524				
EMBANKMENT	(1000 CM)	933	2799	316	790	520	1144	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	12243	367	30045	751	26953	674				
DRYMASONRY	(SM)	46115	1015	7682	161	30045	601	26952	539				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			765	1017	126	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		2		9		5					
	(SM)	2380	2380	600	600	1274	1274	798	798				
RAILWAY	(NOS)			1		1							
	(M)			85	1318	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180	2	90	6	270	3	135				
II	(NOS)	4	260	4	260	3	195	1	65				
III	(NOS)	4	380	1	95			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3	1820										
	(M)	2600											
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23927		12106		13851		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	800	800	1029	1029	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	55	77	445	623	400	560				
III	(NOS)												
SUB-TOTAL			5496		877		1652		1172				
T O T A L			29423		12983		15503		7882				65791

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (5/26)

ULO : 2.0

(SCHEME II ,CASE 2)

(MILLION. RP)

WORK ITEM RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	U L O QUANTITY	U L O COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	T O T A L QUANTITY	T O T A L COST
DREDGING	(1000 CM)	2137	6411	618	2163								
EXCAVATION	(1000 CM)	2137	4701	617	1357	959	2206	238	524				
EMBANKMENT	(1000 CM)	925	2775	316	790	404	889	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	7683	230	27710	693	26953	674				
DRYMASONRY	(SM)	46115	1015	7682	161	27710	554	26952	539				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			765	1017	126	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		2		9		5					
	(SM)	2380	2380	600	600	1274	1274	798	798				
RAILWAY	(NOS)			1		1							
	(M)			85	1318	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180	2	90	6	270	3	135				
II	(NOS)	4	260	4	260	3	195	1	65				
III	(NOS)	4	475	1	95			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3	2013										
	(M)	2875											
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23483		11381		13068		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	800	800	878	878	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	55	77	415	581	400	560				
III	(NOS)												
SUB-TOTAL			5496		877		1459		1172				
T O T A L			28979		12258		14527		7882				63646

ULO : 4.0

(SCHEME II ,CASE 2)

(MILLION. RP)

WORK ITEM RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	U L O QUANTITY	U L O COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	T O T A L QUANTITY	T O T A L COST
DREDGING	(1000 CM)	2024	6073	618	2163								
EXCAVATION	(1000 CM)	2024	4453	617	1357	959	2206	238	524				
EMBANKMENT	(1000 CM)	925	2775	316	790	404	889	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	7683	230	27710	693	26953	674				
DRYMASONRY	(SM)	46116	1015	7682	161	27710	554	26952	539				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			765	1017	126	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		2		9		5					
	(SM)	2380	2380	600	600	1274	1274	798	798				
RAILWAY	(NOS)			1		1							
	(M)			85	1318	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180	2	90	6	270	3	135				
II	(NOS)	4	260	4	260	3	195	1	65				
III	(NOS)	6	571	1	95	1		1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3	2205										
	(M)	3150											
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23184		11381		13068		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	800	800	878	878	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	55	77	415	581	400	560				
III	(NOS)												
SUB-TOTAL			5496		877		1459		1172				
T O T A L			28680		12258		14527		7882				63347

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (6/26)

ULO : 6.0

(SCHEME II ,CASE 2)

(MILLION. RP)

WORK ITEM RIVER	WIDAS		KEDUNGSOKO		U L O		KUNCIR		DIVERSION CHANNEL		T O T A L	
	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING (1000 CM)	1880	5640	618	2163								
EXCAVATION (1000 CM)	1879	4134	617	1357	959	2206	238	524				
EMBANKMENT (1000 CM)	925	2775	316	790	404	889	394	867				
REVETMENT												
WETMASONRY (SM)	46116	1845	7683	230	27710	693	26953	674				
DRYMASONRY (SM)	46115	1015	7682	161	27710	554	26952	539				
BRIDGE												
ROAD I (NOS)			1		1							
(SM)			765	1017	126	1676						
II (NOS)	1				2		3					
(SM)	1190	1428			588	706	882	1058				
III (NOS)	9		2		9		5					
(SM)	2380	2380	600	600	1274	1274	798	798				
RAILWAY (NOS)			1		1							
(M)			85	1318	84	1050						
DRAINAGE CULVERT												
I (NOS)	4	180	2	90	6	270	3	135				
II (NOS)	4	260	4	260	3	195	1	65				
III (NOS)	6	570	1	95			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		2		2					
(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE (NOS)	3	2289										
(M)	3270											
DROP STRUCTURE (NOS)												
(M)												
AQUEDUCT (NOS)												
(M)												
SYPHONE (NOS)					1		1					
(M)					70	105	70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		22516		11381		13068		6710				
LAND ADUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 M)	5153	5153	800	800	878	878	612	612				
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	245	343	55	77	415	581	400	560				
III (NOS)												
SUB-TOTAL		5496		877		1459		1172				
T O T A L		28012		12258		14527		7382				62679

ULO : 0.0

(SCHEME II ,CASE 3)

(MILLION. RP)

WORK ITEM RIVER	WIDAS		KEDUNGSOKO		U L O		KUNCIR		DIVERSION CHANNEL		T O T A L	
	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING (1000 CM)	2227	6681	626	2191								
EXCAVATION (1000 CM)	2227	4079	625	1375	311	715	238	524	500	1500		
EMBANKMENT (1000 CM)	933	2799	316	790	170	374	374	867	40	120		
REVETMENT												
WETMASONRY (SM)	46116	1845	12243	367	15105	378	26953	674	12330	370		
DRYMASONRY (SM)	46115	1015	7682	161	15105	303	26952	539	12330	260		
BRIDGE												
ROAD I (NOS)			1						1			
(SM)			765	1017					315	419		
II (NOS)	1						3					
(SM)	1190	1428					882	1058				
III (NOS)	9		2		5		5		4			
(SM)	2681	2681	600	600	620	620	798	798	630	630		
RAILWAY (NOS)			1						1			
(M)			85	1318					35	438		
DRAINAGE CULVERT												
I (NOS)	4	180	2	90	2	90	3	135	2	90		
II (NOS)	4	260	4	260			1	65	1	65		
III (NOS)	4	380	1	95			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		1		2					
(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE (NOS)	3	1820										
(M)	2600											
DROP STRUCTURE (NOS)									1			
(M)									40	120		
AQUEDUCT (NOS)									1			
(M)									60	47		
SYPHONE (NOS)							1					
(M)							70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		24771		11564		4330		6710		4059		
LAND ADUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 M)	5344	5344	800	800	183	183	612	612	186	186		
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	270	378	55	77	90	126	400	560	20	28		
III (NOS)												
SUB-TOTAL		5722		877		309		1172		214		
T O T A L		30493		12441		4639		7882		4273		59728

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (7/26)

ULD : 2.0

(SCHEME II ,CASE 3)

(MILLION. RP)

WORK ITEM RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	U L O QUANTITY	U L O COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	T O T A L QUANTITY	T O T A L COST
DREDGING	(1000 CM)	2164	6472	618	2163								
EXCAVATION	(1000 CM)	2164	4761	617	1357	326	750	238	524	500	1500		
EMBANKMENT	(1000 CM)	925	2775	316	790	116	255	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	7583	230	15105	378	26953	674	12330	370		
DRYMASONRY	(SM)	46115	1015	7682	161	15105	303	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)			1						1			
	(SM)			765	1017					315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		2		5		5		4			
	(SM)	2681	2681	600	600	620	620	798	798	630	630		
RAILWAY	(NOS)			1						1			
	(M)			85	1318					35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180	2	90	2	90	3	135	2	90		
II	(NOS)	4	260	4	260			1	65	1	65		
III	(NOS)	5	475	1	95			1	75				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3	2013										
	(M)	2875											
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23925		11381		4246		6710		4059		
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	800	800	240	240	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	55	77	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		877		366		1172		214		
T O T A L			29647		12258		4612		7882		4273		58672

ULD : 4.0

(SCHEME II ,CASE 3)

(MILLION, RP)

WORK ITEM RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	U L O QUANTITY	U L O COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	T O T A L QUANTITY	T O T A L COST
DREDGING	(1000 CM)	2019	6057	618	2163								
EXCAVATION	(1000 CM)	2018	4440	617	1357	326	750	238	524	500	1500		
EMBANKMENT	(1000 CM)	925	2775	316	790	116	255	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	7603	230	15105	378	26953	674	12330	370		
DRYMASONRY	(SM)	46115	1015	7682	161	15105	305	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)			1						1			
	(SM)			765	1017					315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		2		5		5		4			
	(SM)	2681	2681	600	600	620	620	798	798	630	630		
RAILWAY	(NOS)			1						1			
	(M)			85	1318					35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180	2	90	2	90	3	135	2	90		
II	(NOS)	4	260	4	260			1	65	1	65		
III	(NOS)	6	570	1	95			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3	2205										
	(M)	3150											
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23456		11381		4133		6710		4059		
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	800	800	240	240	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	55	77	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		877		366		1172		214		
T O T A L			29173		12258		4612		7882		4273		58203

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (8/26)

(SCHEME II ,CASE 3)

ULO : 6.0

(MILLION. RP)

WORK ITEM RIVER	WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	U L O QUANTITY	U L O COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	T O T A L QUANTITY	T O T A L COST
DREDGING (1000 CM)	1842	5526	618	2163								
EXCAVATION (1000 CM)	1842	4052	617	1357	326	750	238	524	500	1500		
EMBANKMENT (1000 CM)	925	2775	316	790	116	255	394	867	40	120		
REVETMENT												
WETMASONRY (SM)	46116	1845	7683	230	15105	378	26953	674	12330	370		
DRYMASONRY (SM)	46115	1015	7682	161	15105	305	26952	539	12330	260		
BRIDGE												
ROAD I (NOS)			1						1			
(SM)			765	1017					315	419		
II (NOS)	1						3					
(SM)	1190	1428					882	1058				
III (NOS)	9		2		5		5		4			
(SM)	2681	2681	600	600	620	620	798	798	630	630		
RAILWAY (NOS)			1						1			
(M)			85	1318					35	438		
DRAINAGE CULVERT												
I (NOS)	4	180	2	70	2	90	3	135	2	90		
II (NOS)	4	260	4	260			1	65	1	65		
III (NOS)	6	570	1	95			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		1		2					
(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE (NOS)	3	2237										
(M)	3195											
DROP STRUCTURE (NOS)									1			
(M)									40	120		
AQUEDUCT (NOS)									1			
(M)									60	47		
SYPHONE (NOS)							1					
(M)							70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		23925		11381		4246		6710		4059		
LAND AQUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 SM)	5344	5344	800	800	240	240	612	612	186	186		
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	270	378	55	77	90	126	400	560	20	28		
III (NOS)												
SUB-TOTAL		5722		877		366		1172		214		
T O T A L		28291		12258		4612		7882		4273		57316

(SCHEME III ,CASE 1)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES, Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 6.7 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 0.0 X MILLION CM

(MILLION. RP)

WORK ITEM RIVER	WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	U L O QUANTITY	U L O COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	T O T A L QUANTITY	T O T A L COST
DREDGING (1000 CM)	2031	6093	490	1470								
EXCAVATION (1000 CM)	2031	4466	487	1076	890	2047	265	583				
EMBANKMENT (1000 CM)	733	2799	308	770	441	970	416	915				
REVETMENT												
WETMASONRY (SM)	46116	1845	7253	218	21665	542	30913	773				
DRYMASONRY (SM)	46115	1015	7252	152	21665	433	30912	618				
BRIDGE												
ROAD I (NOS)					1							
(SM)					1269	1676						
II (NOS)	1				2		3					
(SM)	1190	1428			589	706	882	1058				
III (NOS)	9		1		6		8					
(SM)	2350	2350	300	300	1064	1064	1183	1183				
RAILWAY (NOS)					1							
(M)					84	1050						
DRAINAGE CULVERT												
I (NOS)	4	180			6	270	4	180				
II (NOS)	4	260			3	195	1	65				
III (NOS)	3	285	5	475			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		2		3					
(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE (NOS)	2		2									
(M)	1740	1218	1000	700								
DROP STRUCTURE (NOS)												
(M)												
AQUEDUCT (NOS)												
(M)												
SYPHONE (NOS)					1		1					
(M)					70	105	70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		21739		8461		11808		8125				
LAND AQUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 SM)	5127	5127	766	766	954	954	689	689				
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	245	343	50	70	395	553	400	560				
III (NOS)												
SUB-TOTAL		5470		836		1507		1249				
T O T A L		27409		9297		13315		9374				59395

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (9/26)

(SCHEME III ,CASE I)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES, Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 6.7 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 2.0 X MILLION CM

(MILLION. RP)

WORK ITEM RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	U L O QUANTITY	U L O COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	T O T A L QUANTITY	T O T A L COST
DREDGING	(1000 CM)	1868	5604	435	1523								
EXCAVATION	(1000 CM)	1868	4110	434	955	784	1083	265	583				
EMBANKMENT	(1000 CM)	925	2775	308	770	362	796	416	915				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	19330	483	30913	773				
DRYMASONRY	(SM)	46115	1015	4559	96	19330	387	30912	618				
BRIDGE													
ROAD I	(NOS)					1							
	(SM)					260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		6		8					
	(SM)	2350	2350	300	300	1064	1064	1183	1183				
RAILWAY	(NOS)					1							
	(M)					84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	4	180				
II	(NOS)	4	260			3	195	1	65				
III	(NOS)	4	380	5	475			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		3					
	(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE	(NOS)	3		2									
	(M)	2015	1411	1000	700								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			21358		8256		11285		8125				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5127	5127	766	766	816	816	689	689				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	50	70	365	511	400	560				
III	(NOS)												
SUB-TOTAL			5470		836		1327		1249				
T O T A L			26828		9092		12612		9374				57906

(SCHEME III ,CASE I)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES, Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 6.7 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 4.0 X MILLION CM

(MILLION. RP)

WORK ITEM RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	U L O QUANTITY	U L O COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	T O T A L QUANTITY	T O T A L COST
DREDGING	(1000 CM)	1736	5208	435	1523								
EXCAVATION	(1000 CM)	1736	3819	434	955	784	1083	265	583				
EMBANKMENT	(1000 CM)	925	2775	308	770	362	796	416	915				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	19330	483	30913	773				
DRYMASONRY	(SM)	46115	1015	4559	96	19330	387	30912	618				
BRIDGE													
ROAD I	(NOS)					1							
	(SM)					260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		6		8					
	(SM)	2350	2350	300	300	1064	1064	1183	1183				
RAILWAY	(NOS)					1							
	(M)					84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	4	180				
II	(NOS)	4	260			3	195	1	65				
III	(NOS)	5	475	5	475			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		3					
	(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE	(NOS)	3		2									
	(M)	2290	1603	1000	700								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			20958		8256		11285		8125				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5127	5127	766	766	816	816	689	689				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	50	70	365	511	400	560				
III	(NOS)												
SUB-TOTAL			5470		836		1327		1249				
T O T A L			26428		9092		12612		9374				57506

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (10/26)

(SCHEME III ,CASE 1)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES, Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 6.7 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 6.0 X MILLION CM

(MILLION. RP)

WORK ITEM RIVER	WIDAS		KEDUNGSOKO		U L O		KUNCIR		DIVERSION CHANNEL		T O T A L	
	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING (1000 CM)	1514	4542	435	1523								
EXCAVATION (1000 CM)	1514	3331	434	955	784	1083	265	583				
EMBANKMENT (1000 CM)	925	2775	308	770	362	796	416	915				
REVETMENT												
WETMASONRY (SM)	46116	1845	4560	137	17330	483	30713	773				
DRYMASONRY (SM)	46115	1015	4559	96	17330	387	30712	618				
BRIDGE												
ROAD I (NOS)					1							
(SM)					260	1676						
II (NOS)	1				2		3					
(SM)	1190	1428			588	706	882	1058				
III (NOS)	9		1		6		8					
(SM)	2350	2350	300	300	1064	1064	1183	1183				
RAILWAY (NOS)					1							
(M)					84	1050						
DRAINAGE CULVERT												
I (NOS)	4	180			6	270	4	180				
II (NOS)	4	260			3	195	1	65				
III (NOS)	5	475	5	475			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		2		3					
(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE (NOS)	3		2									
(M)	2345	1642	1000	700								
DROP STRUCTURE (NOS)												
(M)												
AQUEDUCT (NOS)												
(M)												
SYPHONE (NOS)					1		1					
(M)					70	105	70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		19853		8256		11285		8125				
LAND AQUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 SM)	5127	5127	766	766	816	816	689	689				
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	245	343	50	70	365	511	400	560				
III (NOS)												
SUB-TOTAL		5470		836		1327		1249				
T O T A L		25313		9092		12612		9374				56391

(SCHEME III , CASE 1)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 0.0 X MILLION CM

(MILLION. RP)

WORK ITEM RIVER	WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING (1000 CM)	2119	6357	521	1824								
EXCAVATION (1000 CM)	2118	4660	521	1146	890	2047	265	583				
EMBANKMENT (1000 CM)	933	2799	303	770	441	970	416	915				
REVETMENT												
WETMASONRY (SM)	46116	1845	7253	218	21665	542	30913	773				
DRYMASONRY (SM)	46115	1015	7252	152	21665	433	30912	618				
BRIDGE												
ROAD I (NOS)			1		1							
(SM)			405	162	1260	1676						
II (NOS)	1				2		3					
(SM)	1190	1428			588	706	882	1058				
III (NOS)	9		1		6		8					
(SM)	2350	2350	300	300	1064	1064	1183	1183				
RAILWAY (NOS)			1		1							
(M)			45	207	84	1050						
DRAINAGE CULVERT												
I (NOS)	4	180			6	270	4	180				
II (NOS)	4	260	2	130	3	195	1	65				
III (NOS)	3	285	4	380			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		2		3					
(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE (NOS)	3		2									
(M)	2020	1414	700	490								
DROP STRUCTURE (NOS)												
(M)												
AQUEDUCT (NOS)												
(M)												
SYPHONE (NOS)					1		1					
(M)					70	105	70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		22593		9079		11808		8125				
LAND AQUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 SM)	5127	5127	766	766	954	954	689	689				
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	245	343	50	70	395	553	400	560				
III (NOS)												
SUB-TOTAL		5470		836		1507		1249				
T O T A L		28063		9915		13315		9374				60667

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (II/26)

(SCHEME III , CASE 1)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 2.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER	WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING (1000 CM)	1945	5835	452	1582								
EXCAVATION (1000 CM)	1944	4277	451	992	784	1083	265	583				
EMBANKMENT (1000 CM)	925	2775	308	770	362	796	416	915				
REVETMENT												
WETMASONRY (SM)	46116	1845	4560	137	19330	483	30713	773				
DRYMASONRY (SM)	46115	1015	4559	96	19330	387	30912	618				
BRIDGE												
ROAD I (NOS)			1		1							
(SM)			405	162	1260	1676						
II (NOS)	1				2		3					
(SM)	1190	1428			588	706	882	1058				
III (NOS)	9		1		6		8					
(SM)	2350	2350	300	300	1064	1064	1183	1183				
RAILWAY (NOS)			1		1							
(M)			45	207	84	1050						
DRAINAGE CULVERT												
I (NOS)	4	180			6	270	4	180				
II (NOS)	4	260	2	130	3	195	1	65				
III (NOS)	4	380	4	380			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		2		3					
(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE (NOS)	3		2									
(M)	2295	1607	700	490								
DROP STRUCTURE (NOS)												
(M)												
AQUEDUCT (NOS)												
(M)												
SYPHONE (NOS)					1		1					
(M)					70	105	70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		21952		8546		11285		8125				
LAND AQUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 SM)	5127	5127	766	766	816	816	689	689				
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	245	343	50	70	365	511	400	560				
III (NOS)												
SUB-TOTAL		5470		836		1327		1249				
T O T A L		27422		9382		12612		9374				58790

(SCHEME III , CASE 1)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 4.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER	WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING (1000 CM)	1816	5448	452	1582								
EXCAVATION (1000 CM)	1816	3995	451	1992	784	1003	265	583				
EMBANKMENT (1000 CM)	925	2775	308	770	362	796	416	915				
REVETMENT												
WETMASONRY (SM)	46116	1845	4560	137	19330	483	30913	773				
DRYMASONRY (SM)	46115	1015	4559	96	19330	387	30912	618				
BRIDGE												
ROAD I (NOS)			1		1							
(SM)			405	162	200	1676						
II (NOS)	1				2		3					
(SM)	1190	1428			588	706	882	1058				
III (NOS)	9		1		6		8					
(SM)	2350	2350	300	300	1064	1064	1183	1183				
RAILWAY (NOS)			1		1							
(M)			45	207	84	1050						
DRAINAGE CULVERT												
I (NOS)	4	180			6	270	4	180				
II (NOS)	4	260	2	130	3	195	1	65				
III (NOS)	5	475	4	380			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		2		3					
(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE (NOS)	3		2									
(M)	2550	1785	700	490								
DROP STRUCTURE (NOS)												
(M)												
AQUEDUCT (NOS)												
(M)												
SYPHONE (NOS)					1		1					
(M)					70	105	70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		21556		8546		11285		8125				
LAND AQUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 SM)	5127	5127	766	766	816	816	689	689				
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	245	343	50	70	365	511	400	560				
III (NOS)												
SUB-TOTAL		5470		836		1327		1249				
T O T A L		27026		9382		12612		9374				58394

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (12/26)

(SCHEME III , CASE 1)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 6.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	1603	4809	452	1582								
EXCAVATION	(1000 CM)	1603	3527	451	1992	784	1083	265	583				
EMBANKMENT	(1000 CM)	925	2775	308	770	362	796	416	915				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	19330	483	30713	773				
DRYMASONRY	(SM)	46115	1015	4559	96	19330	387	30912	618				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			405	162	260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		6		8					
	(SM)	2350	2350	300	300	1064	1064	1183	1183				
RAILWAY	(NOS)					1							
	(M)					84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	4	180				
II	(NOS)	4	260	2	130	3	175	1	65				
III	(NOS)	5	475	4	380			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		3					
	(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE	(NOS)	3		2									
	(M)	2525	1768	700	490								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			20432		8546		11285		8125				
LAND AGUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5127	5127	766	766	816	816	689	689				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	50	70	365	511	400	560				
III	(NOS)												
SUB-TOTAL			5470		836		1327		1249				
T O T A L			25902		9382		12612		9374				57270

(SCHEME III , CASE 1)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 1.9 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 0.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	2179	6510	633	2216								
EXCAVATION	(1000 CM)	2169	4772	633	1393	890	2047	265	583				
EMBANKMENT	(1000 CM)	933	2799	308	770	441	970	416	915				
REVETMENT													
WETMASONRY	(SM)	46116	1845	7253	218	21665	542	30913	773				
DRYMASONRY	(SM)	46115	1015	4252	152	21665	433	30912	619				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			630	838	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			598	706	882	1058				
III	(NOS)	9		1		6		8					
	(SM)	2350	2350	300	300	1064	1064	1183	1183				
RAILWAY	(NOS)			1		1							
	(M)			70	1085	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	4	180				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	3	285	3	285			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		3					
	(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2420	1694	500	350								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23138		11037		11808		8125				
LAND AGUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5127	5127	766	766	954	954	689	689				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	50	70	395	553	400	560				
III	(NOS)												
SUB-TOTAL			5470		836		1507		1249				
T O T A L			28608		11873		13315		9374				63170

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (13/26)

(SCHEME III , CASE 1)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 1.9 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 2.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING	(1000 CM)	2065	6195	520	1820								
EXCAVATION	(1000 CM)	2064	4541	517	1142	784	1083	265	583				
EMBANKMENT	(1000 CM)	925	2775	308	770	362	796	416	915				
REVETMENT													
WETMASONRY	(SM)	46116	1345	4560	137	19330	483	30913	773				
DRYMASONRY	(SM)	46115	1015	4559	96	19330	387	30912	618				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			630	838	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	892	1058				
III	(NOS)	9		1		6		8					
	(SM)	2350	2350	300	300	1064	1064	1183	1183				
RAILWAY	(NOS)			1		1							
	(M)			70	1085	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	4	180				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	4	280	3	285			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		3					
	(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2725	1908	500	350								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			22377		10253		11285		8125				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5127	5127	766	766	816	816	689	689				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	50	70	365	511	400	560				
III	(NOS)												
SUB-TOTAL			5470		836		1327		1249				
T O T A L			28347		11089		12612		9374				61422

(SCHEME III , CASE 1')

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 1.7 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 4.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING	(1000 CM)	1385	5655	520	1820								
EXCAVATION	(1000 CM)	1885	4147	519	1142	784	1083	265	583				
EMBANKMENT	(1000 CM)	925	2775	308	770	362	796	416	915				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	19330	483	30913	773				
DRYMASONRY	(SM)	46115	1015	4550	96	19330	387	30912	618				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			630	838	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		6		8					
	(SM)	2350	1015	300	300	1064	1064	1183	1183				
RAILWAY	(NOS)			1		1							
	(M)			70	1085	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	185			6	270	4	180				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	5	475	3	285			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		3					
	(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2570	1799	500	350								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			21929		10253		11285		8125				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5127	5127	766	766	816	816	689	689				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	50	70	365	511	400	560				
III	(NOS)												
SUB-TOTAL			5470		836		1327		1249				
T O T A L			27399		11089		12612		9374				60474

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (14/26)

(SCHEME III , CASE 1)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 1.9 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 6.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	1743	5229	520	1820								
EXCAVATION	(1000 CM)	1742	3832	519	1142	784	1083	265	583				
EMBANKMENT	(1000 CM)	925	2775	308	770	362	796	416	915				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	19330	483	30913	773				
DRYMASONRY	(SM)	46115	1015	4559	96	19330	387	30912	618				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			630	838	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		6		8					
	(SM)	2350	2350	300	300	1064	1064	1183	1183				
RAILWAY	(NOS)			1		1							
	(M)			70	1085	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	185			6	270	4	180				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	5	475	3	285			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		3					
	(M)			33	3300	23	2300	21	2100				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2845	1992	500	350								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			21381		10253		11285		8125				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5127	5127	766	766	816	816	689	689				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	50	70	365	511	400	560				
III	(NOS)												
SUB-TOTAL			5470		836		1327		1249				
T O T A L			26851		11089		12612		9374				59926

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.8 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 0.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	2077	6231	514	1799								
EXCAVATION	(1000 CM)	2076	4657	514	1131	1143	2629	238	524				
EMBANKMENT	(1000 CM)	933	2799	308	770	520	1144	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	7253	218	30045	751	26953	674				
DRYMASONRY	(SM)	46115	1015	7252	152	30045	601	26952	539				
BRIDGE													
ROAD I	(NOS)					1							
	(SM)					1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		9		5					
	(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY	(NOS)					1							
	(M)					84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	160			6	270	3	135				
II	(NOS)	4	260	2	130	3	195	1	55				
III	(NOS)	3	285	5	475			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		2									
	(M)	2020	1414	1000	700								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			22404		8975		13851		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	718	718	1027	1029	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	45	63	445	623	400	560				
III	(NOS)												
SUB-TOTAL			5496		781		1652		1172				
T O T A L			27900		9756		15503		7882				61041

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (15/26)

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.8 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 2.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING	(1000 CM)	1924	5772	441	1544								
EXCAVATION	(1000 CM)	1923	4231	440	968	959	2206	238	524				
EMBANKMENT	(1000 CM)	925	2775	308	770	404	887	394	367				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	27710	693	26953	674				
DRYMASONRY	(SM)	46115	1015	4559	96	27710	554	26952	539				
BRIDGE													
ROAD I	(NOS)					1							
	(SM)					1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			538	706	882	1058				
III	(NOS)	9		1		9		5					
	(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY	(NOS)					1							
	(M)					84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	3	135				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	3	380	5	475			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		2									
	(M)	2275	1593	1000	700								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			21859		8420		13068		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	718	718	878	878	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	45	63	415	581	400	560				
III	(NOS)												
SUB-TOTAL			5496		781		1459		1172				
TOTAL			27355		9201		14527		7882				58765

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.8 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 4.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING	(1000 CM)	1809	5420	441	1544								
EXCAVATION	(1000 CM)	1809	5980	440	968	959	2206	238	524				
EMBANKMENT	(1000 CM)	925	2775	308	770	404	887	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	27710	693	26953	674				
DRYMASONRY	(SM)	46115	1015	4559	96	27710	554	26952	539				
BRIDGE													
ROAD I	(NOS)					1							
	(SM)					1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		9		5					
	(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY	(NOS)					1							
	(M)					84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	3	135				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	5	475	5	475			1	75				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		2									
	(M)	2550	1785	1000	700								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			21551		8420		13068		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	718	718	878	878	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	45	63	415	581	400	560				
III	(NOS)												
SUB-TOTAL			5496		781		1459		1172				
TOTAL			27047		9201		14527		7882				58657

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (16/26)

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.8 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 6.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER	WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING (1000 CM)	1624	4872	441	1544								
EXCAVATION (1000 CM)	1623	3571	440	768	959	2206	238	524				
EMBANKMENT (1000 CM)	725	2775	308	770	404	889	374	867				
REVETMENT												
WETMASONRY (SM)	46116	1845	4560	137	27710	693	26953	674				
DRYMASONRY (SM)	46115	1015	4559	76	27710	554	26952	539				
BRIDGE												
ROAD I (NOS)					1							
(SM)					1260	1676						
II (NOS)	1				2		3					
(SM)	1190	1428			588	706	882	1058				
III (NOS)	9		1		9		5					
(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY (NOS)					1							
(M)					84	1050						
DRAINAGE CULVERT												
I (NOS)	4	180			6	270	3	135				
II (NOS)	4	260	2	130	3	195	1	65				
III (NOS)	5	475	5	475			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		2		2					
(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE (NOS)	3		2									
(M)	2665	1866	1000	700								
DROP STRUCTURE (NOS)												
(M)												
AQUEDUCT (NOS)												
(M)												
SYPHONE (NOS)					1		1					
(M)					70	105	70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		20667		8420		13068		6710				
LAND AQUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 SM)	5153	5153	718	718	878	878	612	612				
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	245	343	45	63	415	581	400	560				
III (NOS)												
SUB-TOTAL		5476		781		1459		1172				
T O T A L		26143		9201		14527		7882				57773

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 3.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 0.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER	WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING (1000 CM)	2135	6405	553	1936								
EXCAVATION (1000 CM)	2134	4695	552	1214	1143	2629	238	524				
EMBANKMENT (1000 CM)	933	2799	308	770	520	1144	374	867				
REVETMENT												
WETMASONRY (SM)	46116	1845	7253	218	30045	751	26953	674				
DRYMASONRY (SM)	46115	1015	7252	152	30045	601	26952	539				
BRIDGE												
ROAD I (NOS)			1		1							
(SM)			405	162	126	1676						
II (NOS)	1				2		3					
(SM)	1190	1428			588	706	882	1058				
III (NOS)	9		1		9		5					
(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY (NOS)			1		1							
(M)			45	207	84	1050						
DRAINAGE CULVERT												
I (NOS)	4	180			6	270	3	135				
II (NOS)	4	260	2	130	3	195	1	65				
III (NOS)	3	285	4	380			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		2		2					
(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE (NOS)	3		1									
(M)	2240	1568	700	490								
DROP STRUCTURE (NOS)												
(M)												
AQUEDUCT (NOS)												
(M)												
SYPHONE (NOS)					1		1					
(M)					70	105	70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		22860		9259		13531		6710				
LAND AQUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 SM)	5153	5153	718	718	1029	1029	612	612				
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	245	343	45	63	445	623	400	560				
III (NOS)												
SUB-TOTAL		5496		781		1652		1172				
T O T A L		28356		10040		15503		7882				61781

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (17/26)

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 3.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 2.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING	(1000 CM)	1999	5997	465	1628								
EXCAVATION	(1000 CM)	1998	4396	464	1021	959	2206	238	524				
EMBANKMENT	(1000 CM)	925	2775	308	770	404	889	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	27710	693	26953	674				
DRYMASONRY	(SM)	46115	1015	4559	96	27710	554	26952	539				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			405	162	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		9		5					
	(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY	(NOS)			1		1							
	(M)			45	207	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	3	135				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	4	380	4	380			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2515	1761	700	490								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			22417		8621		13063		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	718	718	878	878	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	45	63	415	581	400	560				
III	(NOS)												
SUB-TOTAL			5496		781		1459		1172				
TOTAL			27913		9402		14527		7882				59724

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 3.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 4.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING	(1000 CM)	1886	5657	465	1628								
EXCAVATION	(1000 CM)	1885	4148	464	1021	959	2206	238	524				
EMBANKMENT	(1000 CM)	925	2775	308	770	404	889	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	27710	693	26953	674				
DRYMASONRY	(SM)	46115	1015	4559	96	27710	554	26952	539				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			405	162	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		7		5					
	(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY	(NOS)			1		1							
	(M)			45	207	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	3	135				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	5	475	4	380			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2790	1953	700	490								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			22116		8621		13068		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	718	718	878	878	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	45	63	415	581	400	560				
III	(NOS)												
SUB-TOTAL			5496		781		1459		1172				
TOTAL			27612		9402		14527		7882				59423

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (18/26)

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 3.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 6.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	1716	5148	465	1628								
EXCAVATION	(1000 CM)	1715	3773	464	1021	959	2206	238	524				
EMBANKMENT	(1000 CM)	925	2775	308	770	404	889	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	27710	693	26953	674				
DRYMASONRY	(SM)	46115	1015	4559	96	27710	554	26952	539				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			405	162	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		7		5					
	(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY	(NOS)			1		1							
	(M)			45	207	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	3	135				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	5	475	4	380			1	75				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2885	2020	700	490								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			21299		8621		13068		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	718	718	878	878	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	45	63	415	581	400	560				
III	(NOS)												
SUB-TOTAL			5496		781		1459		1172				
T O T A L			26795		9402		14527		7882				58606

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 1.6 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 0.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	2201	6603	645	2272								
EXCAVATION	(1000 CM)	2201	4942	648	1426	1143	2629	238	524				
EMBANKMENT	(1000 CM)	933	2799	308	770	520	1144	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	7253	218	30045	751	26953	674				
DRYMASONRY	(SM)	46115	1015	7252	152	30045	601	26952	539				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			630	838	125	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		9		5					
	(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY	(NOS)			1		1							
	(M)			70	1085	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	3	135				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	3	285	5	285			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2540	1778	500	350								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23415		11126		13851		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	718	718	1029	1029	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	45	63	445	623	400	560				
III	(NOS)												
SUB-TOTAL			5496		781		1652		1172				
T O T A L			28911		11907		15503		7882				64203

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (19/26)

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 1.6 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 2.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	2104	6312	530	1855								
EXCAVATION	(1000 CM)	2104	4629	530	1166	959	2206	238	524				
EMBANKMENT	(1000 CM)	925	2775	308	770	404	889	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4650	137	27710	693	26953	674				
DRYMASONRY	(SM)	46115	1015	4559	96	27710	554	26952	539				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			630	838	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		9		5					
	(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY	(NOS)			1		1							
	(M)			70	1085	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	3	135				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	4	380	5	285			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2815	1971	500	350								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23175		10312		13068		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	718	718	878	878	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	45	63	415	581	400	560				
III	(NOS)												
SUB-TOTAL			5496		781		1459		1172				
T O T A L			28671		11093		14527		7882				62173

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 1.6 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 4.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	1790	5971	530	1855								
EXCAVATION	(1000 CM)	1990	4370	530	1166	757	2206	238	524				
EMBANKMENT	(1000 CM)	925	2775	308	770	404	889	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	27710	693	26953	674				
DRYMASONRY	(SM)	46115	1015	4559	96	27710	554	26952	539				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			630	838	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		9		5					
	(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY	(NOS)			1		1							
	(M)			70	1085	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	3	135				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	5	475	5	285			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	3090	2163	500	350								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			22871		10312		13068		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	718	718	878	878	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	45	63	415	581	400	560				
III	(NOS)												
SUB-TOTAL			5496		781		1459		1172				
T O T A L			28367		11093		14527		7882				61369

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (20/26)

(SCHEME III , CASE 2)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 1.6 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 6.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	1840	5520	530	1855								
EXCAVATION	(1000 CM)	1840	4048	530	1166	959	2206	270	524				
EMBANKMENT	(1000 CM)	925	2775	308	770	404	889	394	867				
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	27710	693	26953	674				
DRYMASONRY	(SM)	46115	1015	4559	96	27710	554	26952	539				
BRIDGE													
ROAD I	(NOS)			1		1							
	(SM)			630	838	1260	1676						
II	(NOS)	1				2		3					
	(SM)	1190	1428			588	706	882	1058				
III	(NOS)	9		1		9		5					
	(SM)	2380	2380	300	300	1274	1274	798	798				
RAILWAY	(NOS)			1		1							
	(M)			70	1085	84	1050						
DRAINAGE CULVERT													
I	(NOS)	4	180			6	270	3	135				
II	(NOS)	4	260	2	130	3	195	1	65				
III	(NOS)	5	475	5	285			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		2		2					
	(M)			33	3300	30	3000	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	3185	2230	500	350								
DROP STRUCTURE	(NOS)												
	(M)												
AQUEDUCT	(NOS)												
	(M)												
SYPHONE	(NOS)					1		1					
	(M)					70	105	70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			22156		10312		13068		6710				
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5153	5153	718	718	878	878	612	612				
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	245	343	45	63	415	581	400	560				
III	(NOS)												
SUB-TOTAL			5496		781		1459		1172				
T O T A L			27652		11093		14527		7882				61154

(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.8 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 0.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	2194	6582	442	1547								
EXCAVATION	(1000 CM)	2193	4824	442	972	311	715	238	524	500	1500		
EMBANKMENT	(1000 CM)	933	2799	308	770	170	374	394	867	10	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	7253	218	15105	378	26953	674	12330	370		
DRYMASONRY	(SM)	46115	1015	7252	152	15105	303	26752	539	12330	260		
BRIDGE													
ROAD I	(NOS)									1			
	(SM)									315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		1		5		5		4			
	(SM)	2681	2681	300	300	620	620	798	798	630	630		
RAILWAY	(NOS)									1			
	(M)									35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180			2	90	3	135	2	90		
II	(NOS)	4	260	2	130			1	65	1	65		
III	(NOS)	3	285	5	475			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2120	1484	1000	700								
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23383		8564		4330		6710		4059		
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	718	718	183	183	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	45	63	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		781		309		1172		214		
T O T A L			29105		9345		4639		7882		4273		55244

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (21/26)

(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.8 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 2.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING	(1000 CM)	1927	5787	441	1544								
EXCAVATION	(1000 CM)	1728	4242	440	960	326	750	238	524	500	1500		
EMBANKMENT	(1000 CM)	925	2775	308	770	116	255	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46115	1845	4560	137	15105	378	26753	674	12330	370		
DRYMASONRY	(SM)	46115	1015	4559	96	15105	303	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)									1			
	(SM)									315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		1		5		5		4			
	(SM)	2681	2681	300	300	620	620	798	798	630	630		
RAILWAY	(NOS)									1			
	(M)									35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180			2	90	3	135	2	90		
II	(NOS)	4	260	2	130			1	65	1	65		
III	(NOS)	4	380	5	475			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2393	1677	1000	700								
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			22270		8420		4246		6710		4059		
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	718	718	240	240	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	45	63	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		781		366		1172		214		
T O T A L			27992		9201		4612		7882		4273		53960

(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.8 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 4.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING	(1000 CM)	1777	5331	441	1544								
EXCAVATION	(1000 CM)	1777	3907	440	960	326	750	238	524	500	1500		
EMBANKMENT	(1000 CM)	925	2775	308	770	116	255	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	15105	378	26753	674	12330	370		
DRYMASONRY	(SM)	46115	1015	4559	96	15105	303	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)									1			
	(SM)									315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		1		5		5		4			
	(SM)	2681	2681	300	300	620	620	798	798	630	630		
RAILWAY	(NOS)									1			
	(M)									35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180			2	90	3	135	2	90		
II	(NOS)	4	260	2	130			1	65	1	65		
III	(NOS)	5	475	5	475			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2650	1855	1000	700								
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			21754		8420		4246		6710		4059		
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	718	718	240	240	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	45	63	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		781		366		1172		214		
T O T A L			27476		9201		4612		7882		4273		53444

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (22/26)

(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 145 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.8 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 6.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING (1000 CM)		1586	4758	441	1544								
EXCAVATION (1000 CM)		1586	3497	440	968	326	750	238	524	500	1500		
EMBANKMENT (1000 CM)		925	2775	308	770	116	255	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	15105	378	26953	674	12330	370		
DRYMASONRY	(SM)	46115	1015	4559	96	15105	303	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)									1			
	(SM)									315	417		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		1		5		5		4			
	(SM)	2681	2681	300	300	620	620	798	798	630	630		
RAILWAY	(NOS)									1			
	(M)									35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180			2	90	3	135	2	90		
II	(NOS)	4	260	2	130			1	65	1	65		
III	(NOS)	5	475	5	475			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2725	1408	1000	700								
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			20814		8420		4246		6710		4057		
LAND AQUISITION													
RESIDENTIAL (1000 SM)													
OTHERS (1000 SM)		5344	5344	718	718	240	240	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	45	63	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		781		366		1172		214		
TOTAL			26536		9201		4612		7882		4273		52504

(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 3.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 6.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING (1000 CM)		2207	6621	477	1670								
EXCAVATION (1000 CM)		2206	4853	476	1047	311	715	238	524	500	1500		
EMBANKMENT (1000 CM)		933	2799	308	770	170	374	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	7253	218	15105	378	26953	674	12330	370		
DRYMASONRY	(SM)	46115	1015	7252	152	15105	303	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)			1						1			
	(SM)			405	162					315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		1		5		5		4			
	(SM)	2681	2681	300	300	620	620	798	798	630	630		
RAILWAY	(NOS)			1						1			
	(M)			45	207					35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180			2	90	3	135	2	90		
II	(NOS)	4	260	2	130			1	65	1	65		
III	(NOS)	3	285	4	380			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2320	1624	700	490								
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23591		8826		4330		6710		4059		
LAND AQUISITION													
RESIDENTIAL (1000 SM)													
OTHERS (1000 SM)		5344	5344	718	718	103	103	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	45	63	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		781		309		1172		214		
TOTAL			29313		9607		4639		7882		4273		55714

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (23/26)

(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 3.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 2.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING (1000 CM)		2009	6027	465	1628								
EXCAVATION (1000 CM)		2007	4420	464	1021	326	750	238	524	500	1500		
EMBANKMENT (1000 CM)		925	2775	308	770	116	255	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	15105	378	26953	674	12330	370		
DRYMASONRY	(SM)	46115	1015	4559	96	15105	303	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)			1						1			
	(SM)			405	162					315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		1		5		5		4			
	(SM)	2681	2681	300	300	620	620	798	798	630	630		
RAILWAY	(NOS)			1						1			
	(M)			45	207					35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180			2	90	3	135	2	90		
II	(NOS)	4	260	2	130			1	65	1	65		
III	(NOS)	4	380	4	380			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2595	1817	700	490								
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			22828		8621		4246		6710		4059		
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	718	718	240	240	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	45	63	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		781		366		1172		214		
T O T A L			28550		9402		4612		7882		4273		54719

(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 3.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 4.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING (1000 CM)		1862	5586	465	1628								
EXCAVATION (1000 CM)		1862	4096	464	1021	326	750	238	524	500	1500		
EMBANKMENT (1000 CM)		925	2775	308	770	116	255	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	15105	378	26953	674	12330	370		
DRYMASONRY	(SM)	46115	1015	4559	96	15105	303	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)			1						1			
	(SM)			405	162					315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		1		5		5		4			
	(SM)	2681	2681	300	300	620	620	798	798	630	630		
RAILWAY	(NOS)			1						1			
	(M)			45	207					35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180			2	90	3	135	2	90		
II	(NOS)	4	260	2	130			1	65	1	65		
III	(NOS)	5	475	4	380			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2850	1995	700	490								
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			22336		8621		4246		6710		4059		
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	718	718	240	240	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	45	63	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		781		366		1172		214		
T O T A L			28053		9402		4612		7882		4273		54227

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (24/26)

(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 195 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 3.2 X MILLION CM
CAPACITY OF ULO RETARDING BASIN. , V = 6.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING	(1000 CM)	1680	5040	465	1628								
EXCAVATION	(1000 CM)	1679	3374	464	1021	326	750	238	524	500	1500		
EMBANKMENT	(1000 CM)	925	2775	308	770	116	255	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	15105	378	26953	674	12330	370		
DRYMASONRY	(SM)	46115	1015	4559	96	15105	303	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)			1						1			
	(SM)			405	162					315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		1		5		5		4			
	(SM)	2681	2681	300	300	620	620	799	798	630	630		
RAILWAY	(NOS)			1						1			
	(M)			45	207					35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180			2	90	3	135	2	70		
II	(NOS)	4	260	2	130			1	65	1	65		
III	(NOS)	5	475	4	380			1	75				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2925	2048	700	490								
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			21441		8621		4246		6710		4059		
LAND AGUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	718	718	240	240	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	45	63	90	126	400	560	20	29		
III	(NOS)												
SUB-TOTAL			5722		781		366		1172		214		
T O T A L			27163		9402		4612		7882		4273		53332

(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 4.6 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 0.0 X MILLION CM

(MILLION, RP)

WORK ITEM/RIVER		WIDAS QUANTITY	WIDAS COST	KEDUNGSOKO QUANTITY	KEDUNGSOKO COST	ULO QUANTITY	ULO COST	KUNCIR QUANTITY	KUNCIR COST	DIVERSION CHANNEL QUANTITY	DIVERSION CHANNEL COST	TOTAL QUANTITY	TOTAL COST
DREDGING	(1000 CM)	2292	6846	578	2023								
EXCAVATION	(1000 CM)	2281	5018	578	1272	311	715	238	524	500	1500		
EMBANKMENT	(1000 CM)	933	2799	308	770	170	374	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	7253	218	15105	378	26953	674	12330	370		
DRYMASONRY	(SM)	46115	1015	7252	152	15105	303	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)			1						1			
	(SM)			630	838					315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		1		5		5		4			
	(SM)	2681	1681	300	300	620	620	798	798	630	630		
RAILWAY	(NOS)			1						1			
	(M)			70	1085					35	438		
DRAINAGE CULVERT													
I	(NOS)	4	190			2	90	3	135	2	70		
II	(NOS)	4	260	2	130			1	65	1	65		
III	(NOS)	3	285	3	285			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2600	1820	500	350								
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			24177		10723		4330		6710		4059		
LAND AGUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	718	718	183	183	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	45	63	90	126	400	560	20	29		
III	(NOS)												
SUB-TOTAL			5722		781		309		1172		214		
T O T A L			29899		11504		4639		7882		4273		58197

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (25/26)

(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 1.6 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 2.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	2124	6372	530	1855								
EXCAVATION	(1000 CM)	2124	4673	530	1166	326	715	238	524	500	1500		
EMBANKMENT	(1000 CM)	925	2775	308	770	116	255	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	15105	378	26953	674	12330	370		
DRYMASONRY	(SM)	46115	1015	4559	96	15105	303	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)			1						1			
	(SM)			630	838					315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		1		5		5		4			
	(SM)	2681	1681	300	300	620	620	798	798	630	630		
RAILWAY	(NOS)									1			
	(M)									35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180			2	90	3	135	2	90		
II	(NOS)	4	260	2	130			1	65	1	65		
III	(NOS)	4	380	3	285			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	2875	2013	500	350								
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23622		10312		4246		6710		4059		
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	718	718	240	240	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	45	63	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		781		366		1172		214		
T O T A L			29344		11093		4612		7882		4273		57204

(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 1.6 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 4.0 X MILLION CM

(MILLION. RP)

WORK ITEM/RIVER		WIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
		QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING	(1000 CM)	1980	5940	530	1855								
EXCAVATION	(1000 CM)	1979	4354	530	1166	326	750	238	524	500	1500		
EMBANKMENT	(1000 CM)	925	2775	308	770	116	255	394	867	40	120		
REVETMENT													
WETMASONRY	(SM)	46116	1845	4560	137	15105	378	26953	674	12330	370		
DRYMASONRY	(SM)	46115	1015	4559	96	15105	303	26952	539	12330	260		
BRIDGE													
ROAD I	(NOS)			1						1			
	(SM)			630	838					315	419		
II	(NOS)	1						3					
	(SM)	1190	1428					882	1058				
III	(NOS)	9		1		5		5		4			
	(SM)	2691	2681	300	300	620	620	798	798	630	630		
RAILWAY	(NOS)			1						1			
	(M)			70	1085					35	438		
DRAINAGE CULVERT													
I	(NOS)	4	180			2	90	3	135	2	90		
II	(NOS)	4	260	2	130			1	65	1	65		
III	(NOS)	5	475	3	285			1	95				
DIVERSION WEIR	(NOS)					1		1					
	(M)					15	450	15	450				
IRRIGATION HEAD WORKS	(NOS)			1		1		2					
	(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE	(NOS)	3		1									
	(M)	3110	2177	500	350								
DROP STRUCTURE	(NOS)									1			
	(M)									40	120		
AQUEDUCT	(NOS)									1			
	(M)									60	47		
SYPHONE	(NOS)							1					
	(M)							70	105				
GRAVEL METALLING	(M)												
RELOCATION OF ROAD	(M)												
SUB-TOTAL			23130		10312		4246		6710		4059		
LAND AQUISITION													
RESIDENTIAL	(1000 SM)												
OTHERS	(1000 SM)	5344	5344	718	718	240	240	612	612	186	186		
BUILDING COMPENSATION													
I	(NOS)												
II	(NOS)	270	378	45	63	90	126	400	560	20	28		
III	(NOS)												
SUB-TOTAL			5722		781		366		1172		214		
T O T A L			28852		11093		4612		7882		4273		56712

Table 4.2.1. BREAKDOWN OF CONSTRUCTION COST (26/26)

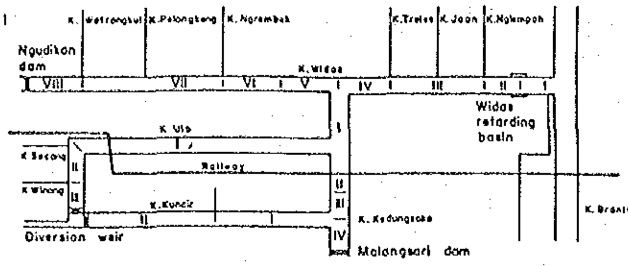
(SCHEME III , CASE 3)

LIMITED CARRYING CAPACITY AT K.SOKO BRIDGES , Q = 300 CM/SEC
CAPACITY OF K.SOKO RETARDING BASIN , V = 1.6 X MILLION CM
CAPACITY OF ULO RETARDING BASIN , V = 6.0 X MILLION CM

(MILLION. RP)

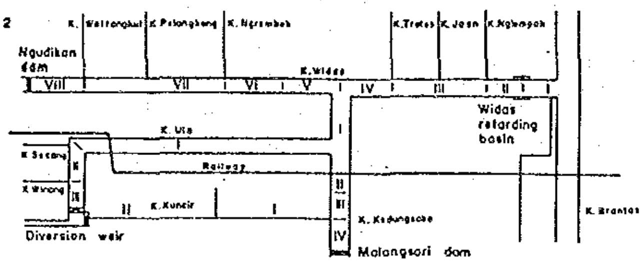
WORK ITEM/RIVER	NIDAS		KEDUNGSOKO		ULO		KUNCIR		DIVERSION CHANNEL		T O T A L	
	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
DREDGING (1000 CM)	1802	5406	530	1855								
EXCAVATION (1000 CM)	1802	3964	530	1166	326	750	238	524	500	1500		
EMBANKMENT (1000 CM)	925	2775	308	770	116	255	394	867	40	120		
REVETMENT												
WETMASONRY (SM)	46116	1845	4560	137	15105	378	26953	674	12330	370		
DRYMASONRY (SM)	46115	1015	4559	96	15105	303	26952	539	12330	260		
BRIDGE												
ROAD I (NOS)			1						1			
(SM)			630	838					315	419		
II (NOS)	1						3					
(SM)	1190	1428					882	1058				
III (NOS)	9		1		5		5		4			
(SM)	2681	2681	300	300	620	620	798	798	630	630		
RAILWAY (NOS)			1						1			
(M)			70	1085					35	438		
DRAINAGE CULVERT												
I (NOS)	4	180			2	90	3	135	2	90		
II (NOS)	4	260	2	130			1	65	1	65		
III (NOS)	5	475	3	285			1	95				
DIVERSION WEIR (NOS)					1		1					
(M)					15	450	15	450				
IRRIGATION HEAD WORKS (NOS)			1		1		2					
(M)			33	3300	14	1400	14	1400				
SIDE OVERFLOW DIKE (NOS)	3		1									
(M)	3205	2244	500	350								
DROP STRUCTURE (NOS)									1			
(M)									40	120		
AQUEDUCT (NOS)									1			
(M)									60	47		
SYPHONE (NOS)							1					
(M)							70	105				
GRAVEL METALLING (M)												
RELOCATION OF ROAD (M)												
SUB-TOTAL		22273		10312		4246		6710		4059		
LAND AQUISITION												
RESIDENTIAL (1000 SM)												
OTHERS (1000 SM)	5344	5344	718	718	240	240	612	612	186	186		
BUILDING COMPENSATION												
I (NOS)												
II (NOS)	270	378	45	63	90	126	400	560	20	28		
III (NOS)												
SUB-TOTAL		5722		781		366		1172		214		
T O T A L		27995		11093		4612		7882		4273		55855

Scheme I Case 1



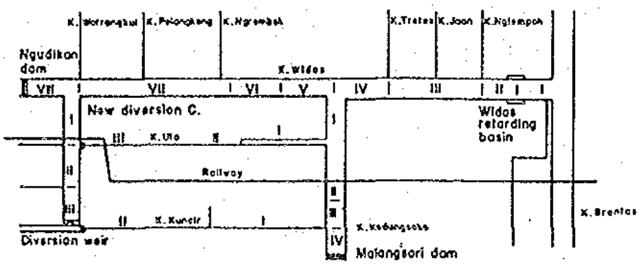
RETARDING CAPACITY (x 10^6 m^3)			DESIGN DISCHARGE (m^3/sec)																			
ULO R.B	WIDAS R.B	KED.SOKO R.B	WIDAS RIVER								KED.SOKO RIVER				ULO RIVER			KUNCIR RIVER		NEW DIVERSION CHANNEL		
			I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	I	II	III	I	II	I	II	III
	9.2		270	449	606	573	544	544	559	433	448	463	470	460	219	156	94	101	94			

Scheme I Case 2



RETARDING CAPACITY (x 10^6 m^3)			DESIGN DISCHARGE (m^3/sec)																			
ULO R.B	WIDAS R.B	KED.SOKO R.B	WIDAS RIVER								KED.SOKO RIVER				ULO RIVER			KUNCIR RIVER		NEW DIVERSION CHANNEL		
			I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	I	II	III	I	II	I	II	III
	9.3		270	450	609	576	544	544	559	433	446	455	465	460	223	216	188	94	0			

Scheme I Case 3

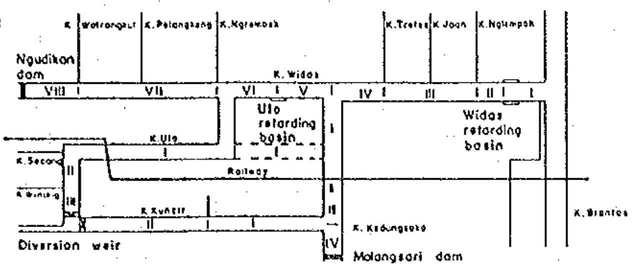


Note: ::::: incase without ulo retarding basin

RETARDING CAPACITY (x 10^6 m^3)			DESIGN DISCHARGE (m^3/sec)																			
ULO R.B	WIDAS R.B	KED.SOKO R.B	WIDAS RIVER								KED.SOKO RIVER				ULO RIVER			KUNCIR RIVER		NEW DIVERSION CHANNEL		
			I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	I	II	III	I	II	I	II	III
	9.4		270	457	657	622	584	534 (640)	586	433	325	455	465	460	33	33	0	94	0	223	216	188

Fig. 4.2.1 DESIGN DISCHARGE DISTRIBUTIONS FOR SCHEME I (1/5)

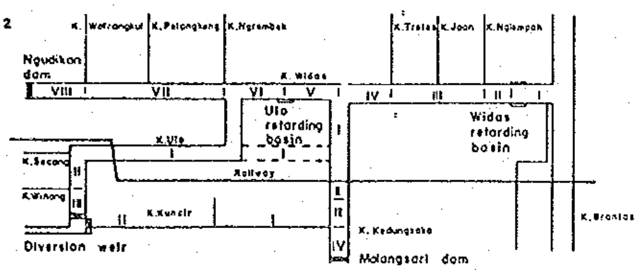
Scheme II Case 1



Note : ===== Incase without Ulo retarding basin

RETARDING CAPACITY (x 10^6 m^3)			DESIGN DISCHARGE (m^3/sec)																			
ULO R.B	WIDAS R.B	KED.SOKO R.B	WIDAS RIVER								KED.SOKO RIVER				ULO RIVER			KUNCIR RIVER		NEW DIVERSION CHANNEL		
			I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	I	II	III	I	II	I	II	III
0.0	9.2		270	449	606	573	544	544	559	433	448	463	470	460	219	156	94	101	94			
2.0	9.2		270	432	627	593	450	614	559	433	322	463	"	"	"	"	"	"	"			
4.0	9.2		"	451	604	569	360	"	"	"	"	"	"	"	"	"	"	"	"			
6.0	8.4		"	437	542	511	283	"	"	"	"	"	"	"	"	"	"	"	"			

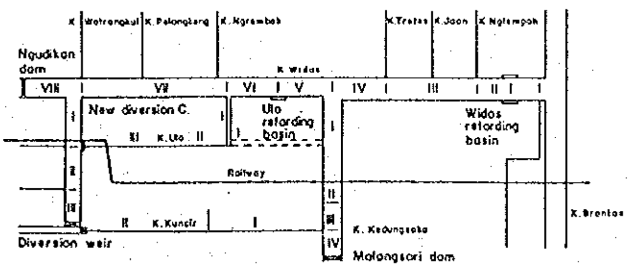
Scheme II Case 2



Note : ===== Incase without Ulo retarding basin

RETARDING CAPACITY (x 10^6 m^3)			DESIGN DISCHARGE (m^3/sec)																			
ULO R.B	WIDAS R.B	KED.SOKO R.B	WIDAS RIVER								KED.SOKO RIVER				ULO RIVER			KUNCIR RIVER		NEW DIVERSION CHANNEL		
			I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	I	II	III	I	II	I	II	III
0.0	9.3		270	450	609	576	544	544	559	433	446	455	465	460	223	216	188	94	0			
2.0	9.3		"	453	630	596	460	621	"	"	318	"	"	"	"	"	"	"	"			
4.0	9.3		"	453	613	576	375	"	"	"	"	"	"	"	"	"	"	"	"			
6.0	8.7		"	444	560	528	310	"	"	"	"	"	"	"	"	"	"	"	"			

Scheme II Case 3

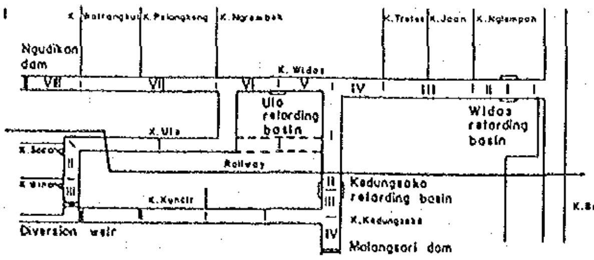


Note : ====== Incase without Ulo retarding basin

RETARDING CAPACITY (x 10^6 m^3)			DESIGN DISCHARGE (m^3/sec)																			
ULO R.B	WIDAS R.B	KED.SOKO R.B	WIDAS RIVER								KED.SOKO RIVER				ULO RIVER			KUNCIR RIVER		NEW DIVERSION CHANNEL		
			I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	I	II	III	I	II	I	II	III
0.0	9.4		270	457	657	622	584	544 (640)	586	433	325	455	465	460	33	33	0	94	0	223	216	188
2.0	9.4		"	458	656	622	455	591 (640	"	"	318	"	"	"	"	"	"	"	"	"	"	"
4.0	9.3		"	436	615	583	370	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
6.0	8.6		"	446	561	530	370	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

Fig. 4.2.1 DESIGN DISCHARGE DISTRIBUTIONS FOR SCHEME II (2/5)

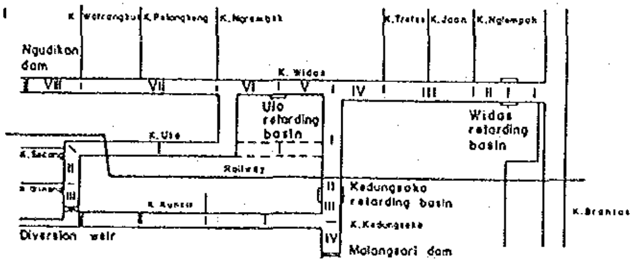
Scheme III Case I



Note : ═══ Incase without Ulo retording basin

RETARDING CAPACITY (x 10⁶ m³) ULO R.B	WIDAS R.B	KED.SOKO R.B	DESIGN DISCHARGE (m³/sec) WIDAS RIVER I	II	III	IV	V	VI	VII	VIII	KED.SOKO RIVER I	II	III	IV	ULO RIVER I	II	III	KUNCIR RIVER I	II	NEW DIVERSION CHANNEL I	II	III
0.0	6.4	6.7	270	410	533	496	544	544 (606)	559	433	233	145	470	460	219	156	94	101	94			
2.0	6.4	"	"	409	549	510	450	614	"	"	138	"	"	"	"	"	"	"	"			
4.0	6.4	"	"	406	513	480	360	"	"	"	"	"	"	"	"	"	"	"	"			
6.0	5.7	"	"	389	445	415	285	"	"	"	"	"	"	"	"	"	"	"	"			

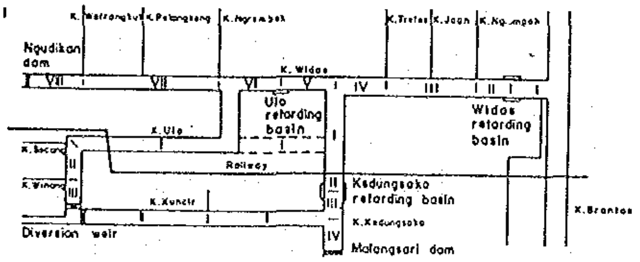
Scheme III Case I



Note : ═══ Incase without Ulo retording basin

RETARDING CAPACITY (x 10⁶ m³) ULO R.B	WIDAS R.B	KED.SOKO R.B	DESIGN DISCHARGE (m³/sec) WIDAS RIVER I	II	III	IV	V	VI	VII	VIII	KED.SOKO RIVER I	II	III	IV	ULO RIVER I	II	III	KUNCIR RIVER I	II	NEW DIVERSION CHANNEL I	II	III
0.0	7.4	4.2	270	421	555	518	544	544 (606)	559	433	261	195	470	460	219	156	94	101	94			
2.0	7.4	"	"	423	572	535	450	614	"	"	167	"	"	"	"	"	"	"	"			
4.0	7.3	"	Y	420	539	503	360	"	"	"	"	"	"	"	"	"	"	"	"			
6.0	6.3	"	"	403	484	444	285	"	"	"	"	"	"	"	"	"	"	"	"			

Scheme III Case I

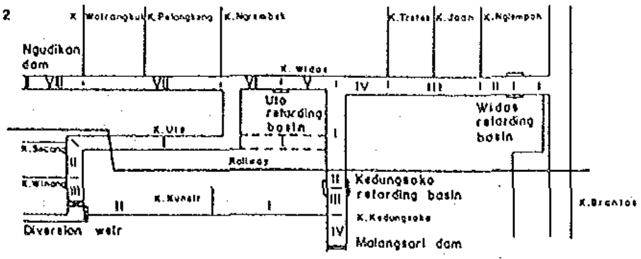


Note : ═══ Incase without Ulo retording basin

RETARDING CAPACITY (x 10⁶ m³) ULO R.B	WIDAS R.B	KED.SOKO R.B	DESIGN DISCHARGE (m³/sec) WIDAS RIVER I	II	III	IV	V	VI	VII	VIII	KED.SOKO RIVER I	II	III	IV	ULO RIVER I	II	III	KUNCIR RIVER I	II	NEW DIVERSION CHANNEL I	II	III
0.0	8.8	1.9	270	440	589	554	544	544 (606)	559	433	398	300	470	460	249	156	94	101	94			
2.0	8.9	"	"	443	609	574	430	614	"	"	234	"	"	"	"	"	"	"	"			
4.0	7.4	"	"	426	563	529	360	"	"	"	"	"	"	"	"	"	"	"	"			
6.0	7.4	"	"	425	509	469	285	"	"	"	"	"	"	"	"	"	"	"	"			

Fig. 4.2.1 DESIGN DISCHARGE DISTRIBUTIONS FOR SCHEME III (3/5)

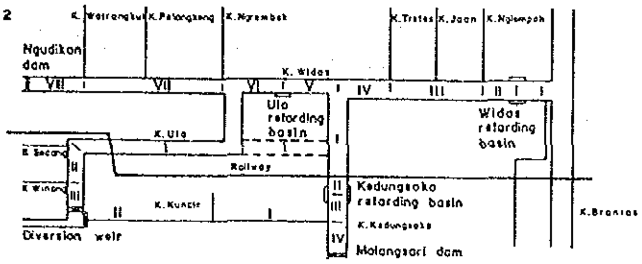
Scheme III Case 2



Note : ::::: incase without Ulo retarding basin

RETARDING CAPACITY (x 10^6 m^3)			DESIGN DISCHARGE (m^3/sec)																			
ULO R.B	WIDAS R.B	KED.SOKO R.B	WIDAS RIVER								KED.SOKO RIVER				ULO RIVER			KUNCIR RIVER		NEW DIVERSION CHANNEL		
			I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	I	II	III	I	II	I	II	III
0.0	7.2	4.8	270	419	543	506	544	544 (606)	559	433	256	145	465	460	223	216	188	94	0			
2.0	7.2	"	"	423	563	521	460	621	"	"	143	"	"	"	"	"	"	"	"			
4.0	7.2	"	"	421	538	501	375	"	"	"	"	"	"	"	"	"	"	"	"			
6.0	6.7	"	"	412	473	441	310	"	"	"	"	"	"	"	"	"	"	"	"			

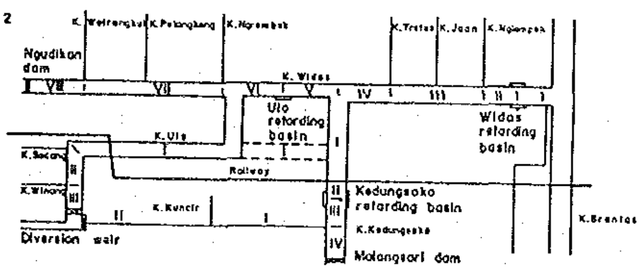
Scheme III Case 2



Note : ::::: incase without Ulo retarding basin

RETARDING CAPACITY (x 10^6 m^3)			DESIGN DISCHARGE (m^3/sec)																			
ULO R.B	WIDAS R.B	KED.SOKO R.B	WIDAS RIVER								KED.SOKO RIVER				ULO RIVER			KUNCIR RIVER		NEW DIVERSION CHANNEL		
			I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	I	II	III	I	II	I	II	III
0.0	8.0	3.2	270	431	565	529	544	544 (606)	559	433	293	195	465	460	223	216	188	94	0			
2.0	8.0	"	"	435	586	546	460	621	"	"	179	"	"	"	"	"	"	"	"			
4.0	8.0	"	"	435	561	525	375	"	"	"	"	"	"	"	"	"	"	"	"			
6.0	7.4	"	"	424	504	472	310	"	"	"	"	"	"	"	"	"	"	"	"			

Scheme III Case 2

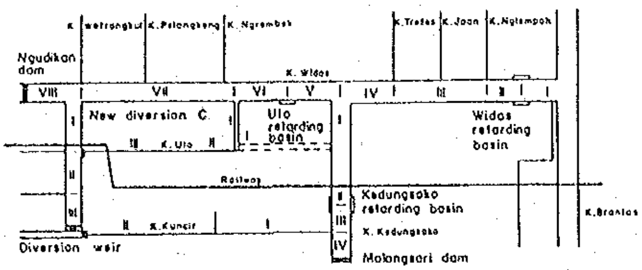


Note : ::::: incase without Ulo retarding basin

RETARDING CAPACITY (x 10^6 m^3)			DESIGN DISCHARGE (m^3/sec)																			
ULO R.B	WIDAS R.B	KED.SOKO R.B	WIDAS RIVER								KED.SOKO RIVER				ULO RIVER			KUNCIR RIVER		NEW DIVERSION CHANNEL		
			I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	I	II	III	I	II	I	II	III
0.0	9.0	1.6	270	446	598	563	544	544 (606)	559	433	390	300	465	460	223	216	188	94	0			
2.0	9.0	"	"	450	619	583	460	621	"	"	239	"	"	"	"	"	"	"	"			
4.0	9.0	"	"	450	599	561	375	"	"	"	"	"	"	"	"	"	"	"	"			
6.0	8.4	"	"	440	546	514	310	"	"	"	"	"	"	"	"	"	"	"	"			

Fig. 4.2.1 DESIGN DISCHARGE DISTRIBUTIONS FOR SCHEME III (4/5)

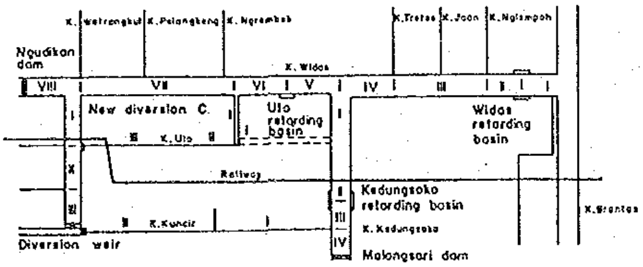
Scheme III Case 3



Note: ::::: Incase without Ulo retarding basin

RETARDING CAPACITY (x 10^6 m^3) ULO R.B	WIDAS R.B	KED.SOKO R.B	DESIGN DISCHARGE (m^3/sec) WIDAS RIVER I	II	III	IV	V	VI	VII	VIII	KED.SOKO RIVER I	II	III	IV	ULO RIVER I	II	III	KUNCIR RIVER I	II	NEW DIVERSION CHANNEL I	II	III
0.0	7.5	4.8	270	430	575	546	584	584 (640)	586	433	150	145	465	460	33	33	0	94	0	223	216	188
2.0	7.5	"	"	430	575	545	455	491 (640)	"	"	143	"	"	"	"	"	"	"	"	"	"	"
4.0	7.4	"	"	428	533	500	370	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
6.0	6.7	"	"	414	474	463	310	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

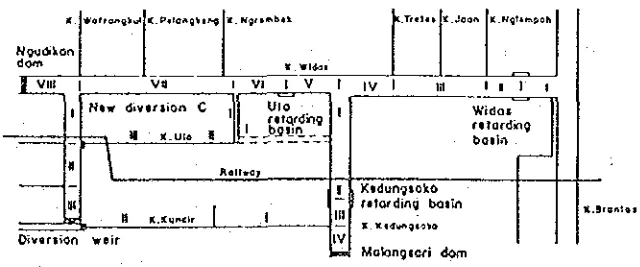
Scheme III Case 3



Note: ::::: Incase without Ulo retarding basin

RETARDING CAPACITY (x 10^6 m^3) ULO R.B	WIDAS R.B	KED.SOKO R.B	DESIGN DISCHARGE (m^3/sec) WIDAS RIVER I	II	III	IV	V	VI	VII	VIII	KED.SOKO RIVER I	II	III	IV	ULO RIVER I	II	III	KUNCIR RIVER I	II	NEW DIVERSION CHANNEL I	II	III
0.0	8.2	3.2	270	442	604	569	584	584 (640)	586	433	185	195	465	460	33	33	0	94	0	223	216	188
2.0	8.2	"	"	442	603	568	455	591 (640)	"	"	179	"	"	"	"	"	"	"	"	"	"	"
4.0	8.1	"	"	440	562	527	370	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
6.0	7.4	"	"	426	506	474	310	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

Scheme III Case 3



Note: ::::: Incase without Ulo retarding basin

RETARDING CAPACITY (x 10^6 m^3) ULO R.B	WIDAS R.B	KED.SOKO R.B	DESIGN DISCHARGE (m^3/sec) WIDAS RIVER I	II	III	IV	V	VI	VII	VIII	KED.SOKO RIVER I	II	III	IV	ULO RIVER I	II	III	KUNCIR RIVER I	II	NEW DIVERSION CHANNEL I	II	III
0.0	9.2	1.6	270	455	643	607	584	584 (640)	586	433	245	300	465	460	33	33	0	94	0	223	216	188
2.0	9.2	"	"	455	642	607	455	591 (640)	"	"	239	"	"	"	"	"	"	"	"	"	"	"
4.0	9.1	"	"	454	601	568	370	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
6.0	8.4	"	"	442	547	516	310	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

Fig. 4.2.1 DESIGN DISCHARGE DISTRIBUTIONS FOR SCHEME III (5/5)

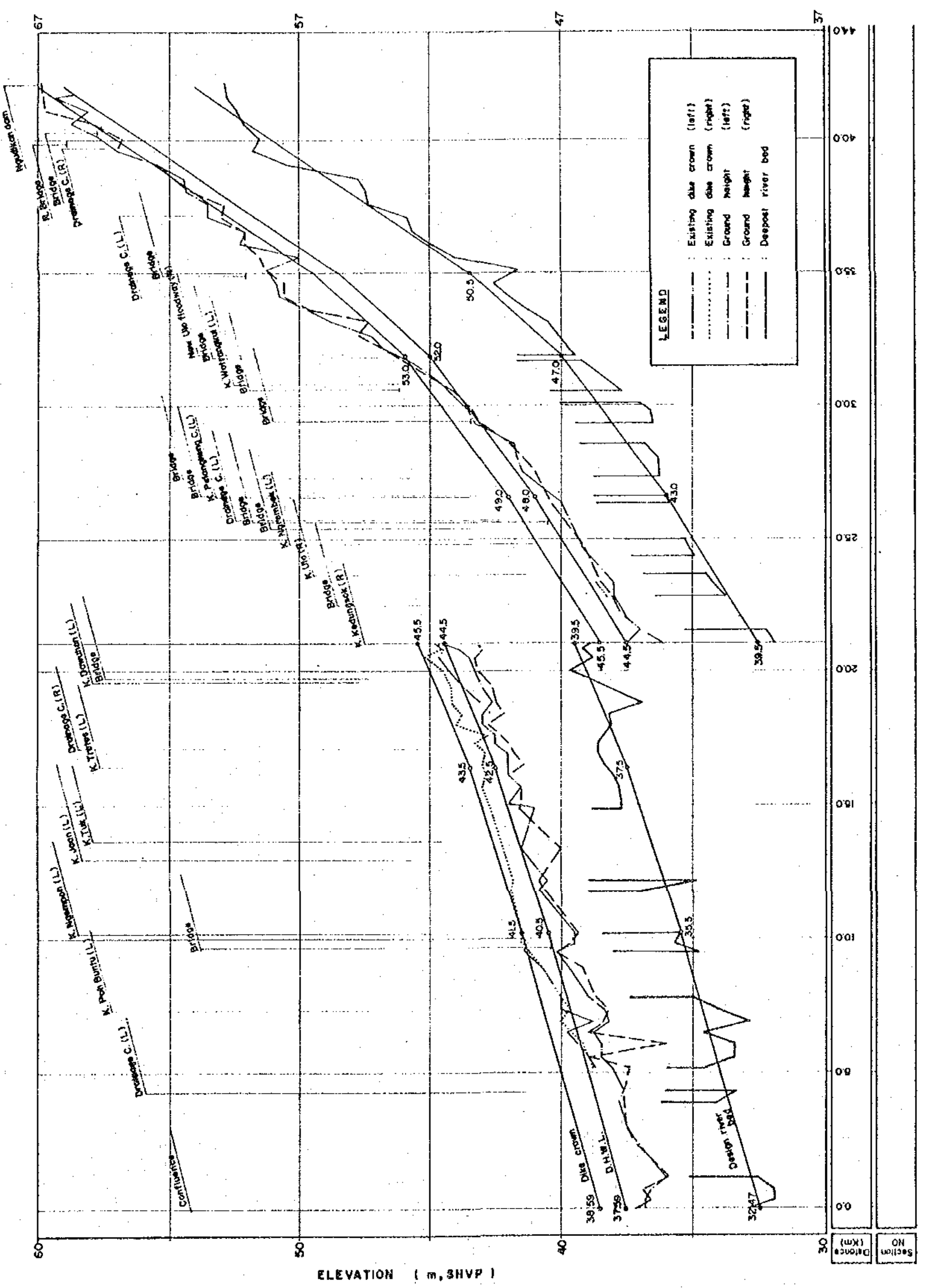
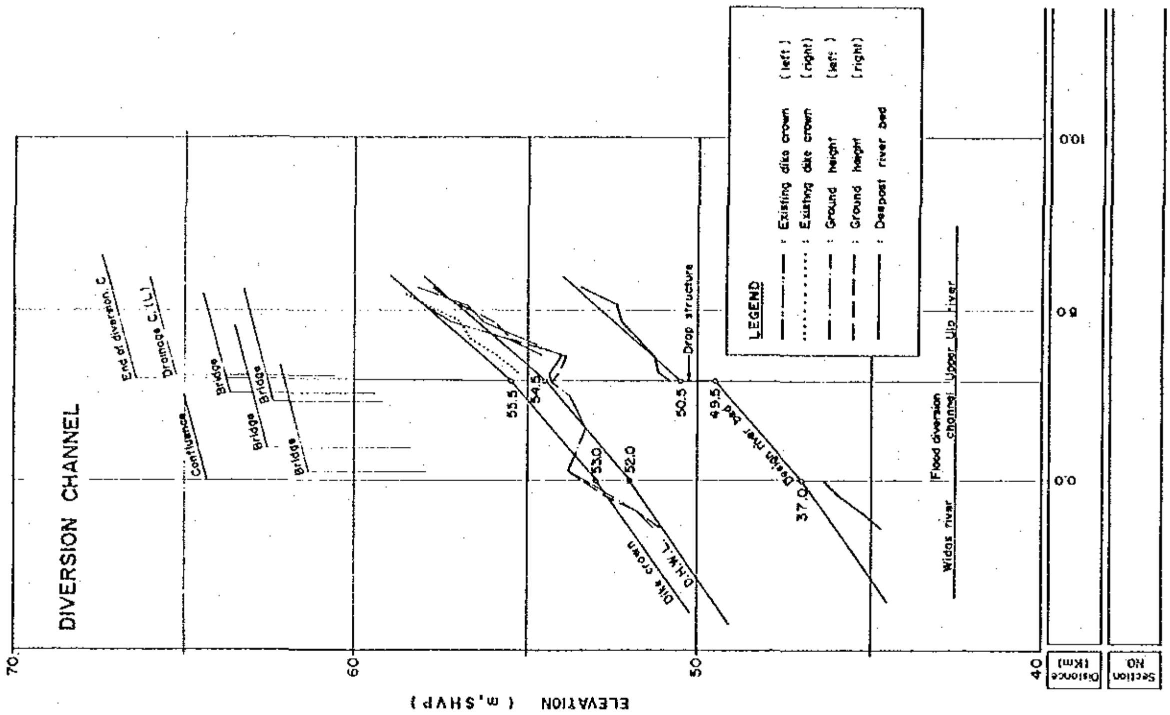


Fig. 4.2.2 DESIGN PROFILE OF THE WIDAS RIVER (1/3)



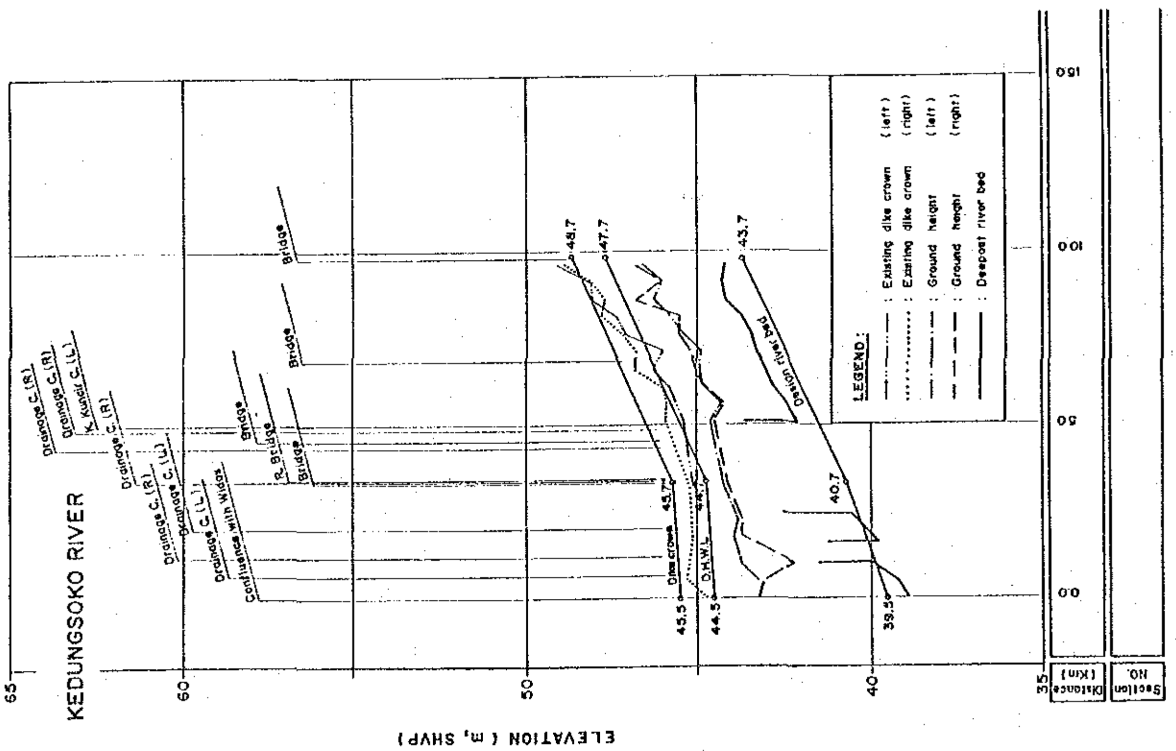
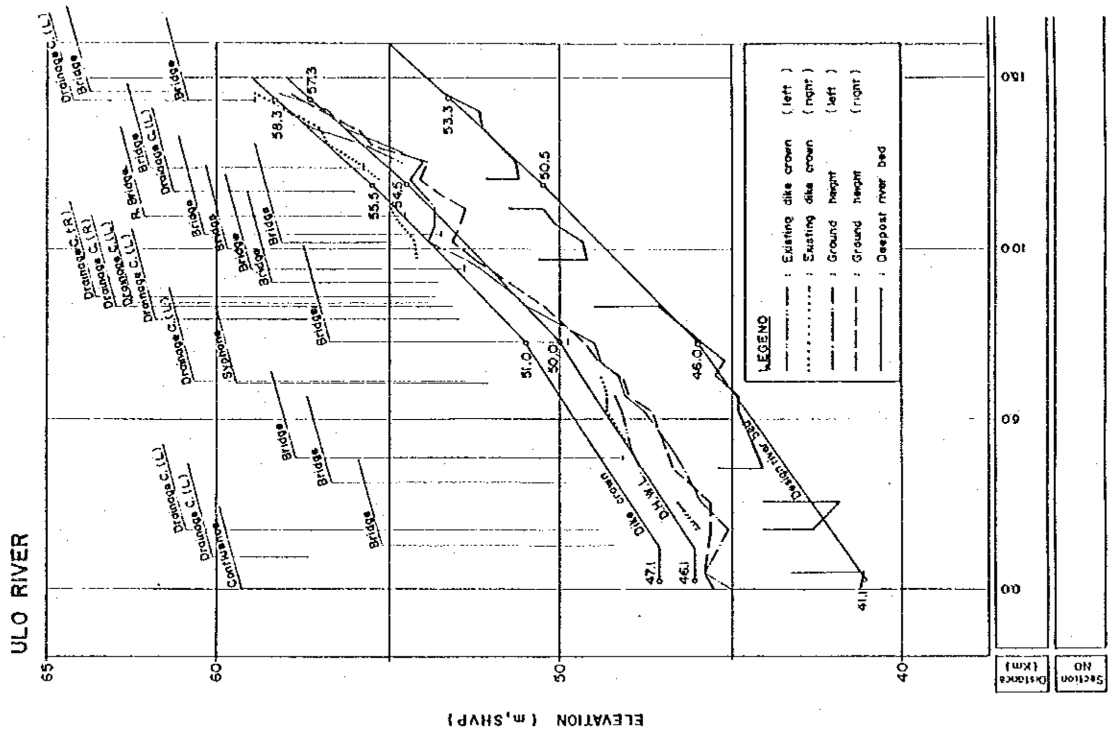


Fig. 4.2.2 DESIGN PROFILE OF THE KEDUNGSOKO AND NEW DIVERSION CHANNEL (2/3)



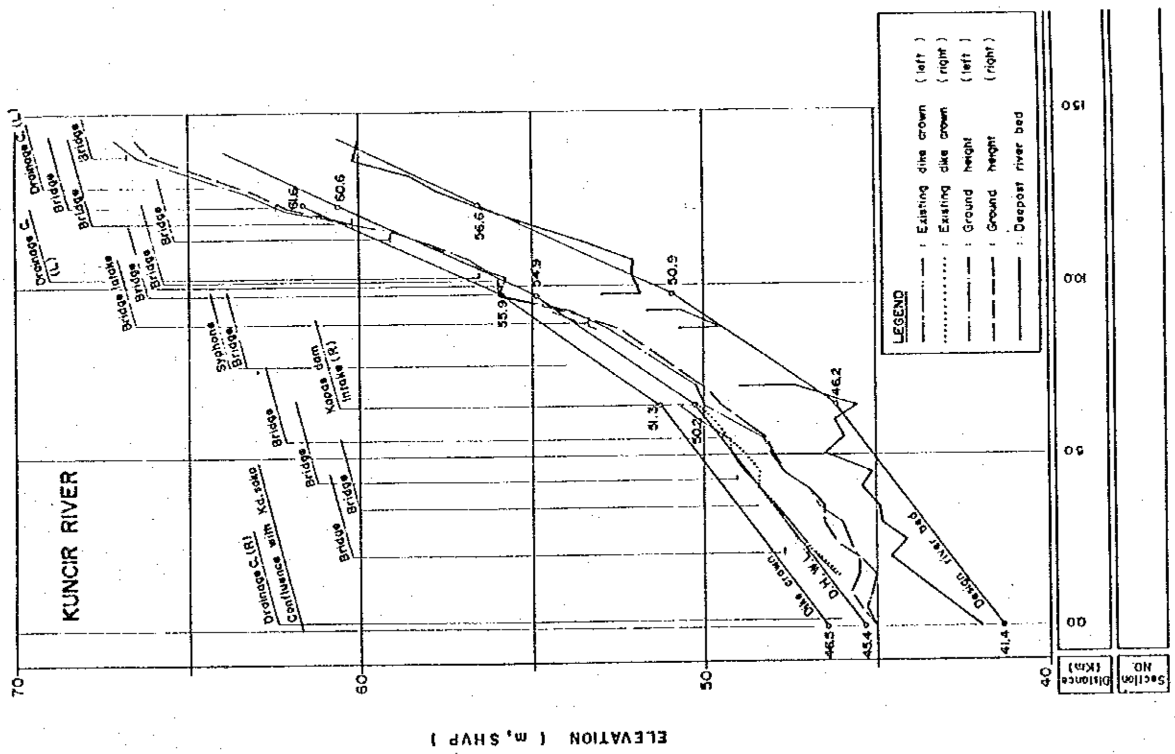


Fig. 4.2.2 DESIGN PROFILE OF THE KUNCIR AND ULO RIVERS (3/3)

4.3 Hydraulic study on retarding basin

4.3.1 Side overflow dike

(1) General

Side overflow dike is to be constructed on the alignment of river dike as a lower part of river dike to reduce flood peaks immediately downstream in the river. The degree of flood peak reduction is determined by the location, the length, and the crest elevation of the side overflow dike. These dimensions are studied here on the Widas, the Ulo and the Kedungsoko retarding basins to satisfy the design flood discharge distribution in the Widas river basin river system for the 25-yr probable flood.

(2) Fundamental equations

Fundamental equations used for flood routing at a retarding basin with side overflow dike are as follows;

In a river :

(a) Continuity equation

$$\frac{dQ}{dx} = -q$$

(b) Equation of motion of non-uniform flow

$$\frac{dH}{dx} = \frac{i - \frac{Q^2}{C^2 R A^2} + \frac{\alpha . Q^2 . \partial A}{g . A^3 . \partial x} + \frac{\alpha . q . Q}{g . A^2}}{1 - \frac{\alpha Q^2}{g A^3} \frac{\partial A}{\partial H}}$$

In a retarding basin :

(a) Continuity equation

$$\frac{dV}{dt} = q$$

At a side overflow dike :

(a) Discharge equation

$$q = K . \sqrt{2g}\ h^{3/2} \quad \text{(perfect overflow)}$$

$$= K' . h_2 \sqrt{2g\ (h_1 - h_2)} \quad \text{(submerged overflow)}$$

Here, Q : discharge in a river (m^3/s)
x : distance along the river (m)
q : overflow discharge (m^3/s)
H : water depth (m)
i : slope of the river bed
C : Chezy's coefficient
R : hydraulic mean radius (m)

A : cross sectional area (m^2)
α : coefficient of velocity distribution
g : gravity acceleration (m/sec^2)

V : storage volume in the retarding basin (m^3)
t : time
K : coefficient of perfect overflow
K' : coefficient of submerged overflow
h : water depth over the crest of side overflow dike
h_1, h_2 : water depths over the crest of side overflow dike in the river and the retarding basin

(3) Routing method

Flood routing is conducted to get the flood discharge hydrograph in the river immediately downstream of the side overflow dike and the variation of water level in the retarding basin due to the overflow discharge over the side overflow dike, to a given probable flood discharge hydrograph in the river immediately upstream of the side overflow dike.

The procedure to calculate the streamflow downstream QD (t) from the streamflow upstream QU (t) of the side overflow dike at a time point t is as follows.

(a) The reach of the side overflow dike is divided into ten reaches along the river course, and accordingly eleven cross sections are considered in the reach of the side overflow dike. Number is given to the cross sections from 1 to 11, from the downstream to the upstream.

(b) The value of Q_1 as the discharge at the cross section 1 most downstream is assumed.

(c) The water depth H_1 at the cross section 1 is calculated with Q_1 through the stage discharge relation at the cross section 1.

(d) Overflow discharge q_1 at the cross section 1 is calculated with H_1 and the water level in the retarding basin H_B through the overflow discharge equation.

(e) The water depth H_2 at the cross section 2 is calculated with Q_1, q_1 and H_1 through the equation of motion of non-uniform flow.

(f) Overflow discharge q_2 at the cross section 2 is calculated with H_2 and H_B through the overflow discharge equation.

(g) The discharge Q_2 at the cross section 2 is calculated with Q_1, q_1 and q_2 through the equation : $Q_2 = Q_1 + (q_1 + q_2)/2 \times \Delta x$, where Δx is the distance between the cross section 1 and 2.

(h) The water depth H_3 at the cross section 3 is calculated with Q_2, q_2 and H_2 through the equation of motion of non-uniform flow.

(i) The above same procedure is repeated up to the cross section 11, the cross section most upstream.

(j) The calculated discharge Q_{11} at the cross section most upstream with the above procedure is checked if Q_{11} is equal to the given hydrograph discharge QU (t).

(k) When the discharge Q_{11} is not equal to QU (t), a new value Q_1 is assumed again and the procedure from (c) to (j) is conducted again.

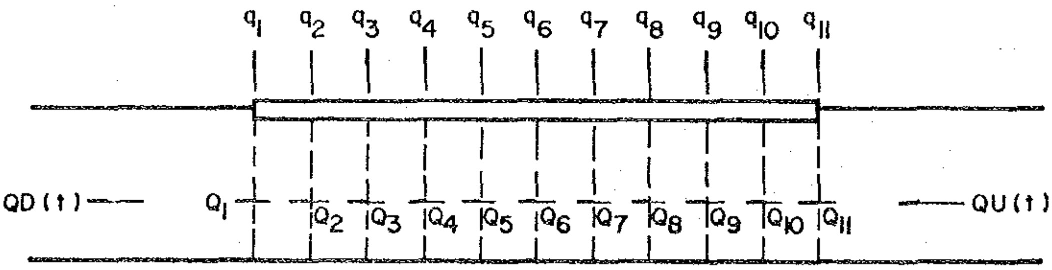
(l) When the calculated discharge Q_{11} is equal to QU (t), then Q_1 is the discharge downstream of the side overflow dike, QD (t).

After getting the value QD (t), the streamflow downstream of the side overflow dike, the water level in the retarding basin is calculated through the following procedure.

(a) The additional volume of overflow discharge over the side overflow dike is calculated.

(b) The accumulated volume of stored flood water in the retarding basin is calculated.

(c) The water level in the retarding basin is calculated through the relation between the elevation and the volume capacity of the retarding basin.



(4) Widas retarding basin

The needed function of the Widas retarding basin is determined through the study on the optimum flood control plan of the Widas river systems. The Widas retarding basin should reduce the flood peak of about 410 m^3/s of the Widas river for 25-year probable flood to less than 240 m^3/s. This comes from the limit of 270 m^3/s allowed to inflow to K. Brantas. The remaining 30 m^3/s is the outflow from Al canal.

At the same time, the maximum storage volume of the Widas retarding basin is determined around 13.6×10^6 m^3 for 25-year probable flood through the study on the optimum flood control plan.

The dimensions of side overflow dike of the Widas retarding basin are determined on the basis of the above criteria as follows.

(a) Storage capacity and area

Storage capacity and area curves used for the flood routing of the Widas retarding basin are shown in Table 4.3.1 and Fig. 4.3.1.

The curves are obtained from the topographic map of the scale 1/10,000.

In measuring the area, the design plan of the retarding basin shown in Fig. 4.4.4 is considered.

(b) Stage discharge relation

Stage discharge relation at the downstream end of the side overflow dike is calculated by the unifrom flow formula.

The longitudinal profile and the river cross section used for the calculation is shown in Figs. 4.3.2 and 4.3.3.

The calculated stage discharge relation is shown in Table 4.3.2 and Fig. 4.3.4.

(c) River cross section

River cross section in the reach of the side overflow dike is assumed to be the same as that in the reach downstream of the side overflow dike except the side overflow dike.

(d) Location

The location of the side overflow dike of the Widas retarding basin is determined in view of the necessary storage capacity of the retarding basin and the design alignment of the river dike. When the location of the side overflow dike is too down-stream near to the confluence with K. Brantas, the design high water level in the retarding basin inevitably becomes lower ang the storage capacity of the retarding basin could not be enough for the necessary flood peak reduction of the Widas river.

The location is determined at the same time selecting the reach where the alignment of the river dike is straight.

Thus the downstream end of the side overflow dike is determined to be 4,900 m from the confluence with K. Brantas.

(e) Slope of river bed

The slope of river bed in the reach of the side overflow dike is planned to be the same with that in the downstream reach. The slope of design river bed downstream of the side overflow dike is 1/3,400.

(f) Dead volume of retarding basin

The dead volume of the Widas retarding basin is assumed to be the storage volume of the retarding basin when the water level in the retarding basin is as high as the design high water level of K. Brantas 37.59 m, from the conservative viewpoint.

(g) Length and crest elevation

The longer the side overflow dike is, the less the discharge in the river downstream of the side overflow dike becomes, and the more the storage volume in the retarding basin becomes. And this relation is the function of the crest elevation of the side overflow dike. With certain length of the side overflow dike, the heigher the crest is, the more the discharge downstream in the river becomes and the less the storage volume of the retarding basin becomes.

These relations are shown in Fig. 4.3.5.

In consideration of these relations shown in Fig. 4.3.5 and that the maximum overflow depth over the crest of side overflow dike should be at least around 0.5 m from the practical view point, and the criteria for the Widas retarding basin aforementioned, the length and the crest elevation of the side overflow dike is determined as follows:

L = 400 m
W = 4.4 m

where L is the length and W is the relative height of the crest to the design river bed.

(h) Cross-section and longitudinal profile

The design river cross-section and the longitudinal profile in the reach of the side overflow dike is shown in Figs. 4.3.2 and 4.3.3.

(i) Flood routing

Flood routing is conducted with the dimensions of the side overflow dike decided in the above and the other features of the design of the river and the retarding basin on the following conditions.

(i) River condition

River cross section for 25-year probable flood and that for 10-year probable flood.

(ii) Flood hydrograph

Flood hydrograph with the return periods of 25-year, 10-year, 5-year, 2-year and 1.05-year.

The results are given in Table 4.3.4 and Figs. 4.3.7 - 4.3.9 the summary is given in Tables 4.3.5 - 4.3.6.

The results for 25-year river cross-section and for 25-yr flood is as follows.

(i) Flood peak 410.3 m^3/s
(ii) Reduced flood peak 210.9 m^3/s
(iii) Peak cut volume 9.88 x 106 m^3
(iv) Maximum water level in the retarding basin 38.6 m SHVP
(v) Maximum inundation area in the retarding basin 13.2 km^2

(j) Supplement

Stage discharge relation

Stage discharge relation at the downstream end of the side overflow dike used for determining the dimensions of side overflow dike is calculated by the uniform flow formula. Actual stage discharge relation varies according to the water level in K. Brantas at the confluence with the Widas river. Some stage discharge relations are made depending on the water levels in K. Brantas by using non-uniform formula. The results are shown in Fig. 4.3.10 , showing that the stage discharge relation made by the uniform formula has a substantial basis for designing the side overflow dike.

Flood hydrograph

Flood hydrograph used for designing the side overflow dike is only of one type, the type that the flood peak is almost in the midst of a flood, center concentrated type so to speak. Flood routing is also conducted assuming other two types of flood hydrographs. The one is of a flat type and the other is of a type that the flood peak occurs in the end of a flood. They are named type 1 for the former and type 2 for the latter and the results of flood routing are shown in Fig. 4.3.11.

The comparison is given below briefly.

	Original type	Type 1	Type 2
Peak discharge	$410m^3/s$ -- $211m^3/s$	$325m^3/s$ -- $201m^3/s$	$499m^3/s$ -- $221m^3/s$
Max. water level	38.57 m SHVP	38.60 m SHVP	38.62 m SHVP

Left and right retarding basins

In the calculation of overflow discharge, the following are assumed.

(i) The overflow discharge is twice of the discharge calculated in the equation previously given because the side overflow dike is planned on the both sides of the river.

(ii) Although the storage capacity of the Widas retarding basin is different on the left side and the right side, the water levels on the both sides will be raised on the same rate.

Actually, because of the difference of the storage capacity of the retarding basin on the left side and the right side, the water levels are different on the left and the right sides. Accordingly in the hydraulic condition of submerged overflow, the total overflow discharge can not be the twice of the overflow discharge calculated with the said equation on the above assumption.

For the confirmation of the adequacy of the result obtained on the said assumption the flood routing for 25-yr probable flood and 25-yr cross section is conducted with the final dimensions of the side overflow dike for left and right sides and the comparison is given below.

Assumption : same water level

(i)	Q peak	:	210.9 m^3/s
(ii)	V max.	:	13.57 x 10^6 m^3
(iii)	H max.	:	38.57 m SHVP

Different water level

(i)	Q peak	:	215.9 m^3/s
(ii)	V max.	:	13.37 x 10^6 m^3
(iii)	H_L, max.	:	38.69 m SHVP
	H_R, max.	:	38.56 m SHVP

where;	Q peak	:	peak discharge downstream in river
	V max.	:	maximum storage volume
	H max.	:	maximum water level in retarding basin
	V max.	:	maximum total storage volume in retarding basin
	H_L max.	:	maximum water level in the left retarding basin
	H_R max.	:	maximum water level in the right retarding basin

(5) Ulo retarding basin

The needed function of the Ulo retarding basin is determined through the study on the optimum flood control plan of the Widas river systems as well as that of the Widas retarding basin as follows.

(i) The flood peak of about 591 m^3/s of the Widas river for 25-year probable flood should be reduced to less than 370 m^3/s.

(ii) The maximum storage volume of the Ulo retarding basin should be around 4.8 x 10^6 m^3 for 25-year probable flood.

The dimensions of side overflow dike along the Widas river of the Ulo retarding basin are determined on the basis of the above criteria as follows.

(a) Storage capacity and area

Storage capacity and area curves used for the flood routing of the Ulo retarding basin are shown in Table 4.3.1 and Fig.4.3.1.

The curves are obtained from the topographic map of the scale 1/10,000.

In measuring the area, the design plan of the retarding basin shown in Fig. 4.4.4 is considered.

(b) Stage discharge relation

Stage discharge relation at the downstream end of the side overflow dike is calculated by the uniform flow formula. The longitudinal profile and the river cross section used for the calculation is shown in Figs. 4.3.2 and 4.3.3.

The calculated stage discharge relation is shown in Table 4.3.2 and Fig. 4.3.4.

(c) Cross section

River cross section in the reach of the side overflow dike is assumed to be the same as that in the reach downstream of the side overflow dike except the side overflow dike.

(d) Location

The location of the side overflow dike of the Ulo retarding basin is determined in consideration that the site should be as downstream as possible so long as the storage capacity is enough for the flood peak reduction and that the crest elevation of the side overflow dike should be heigher than the design high water level in the Widas river at the confluence with the Kedungsoko river.

The downstream end of the side overflow dike is thus determined to be 700 m from the confluence with the Kedungsoko river.

(e) Slope of river bed

The slope of river bed in the reach of the side overflow dike is planned to be the same with that in the downstream reach. The slope of design river bed downstream of the side overflow dike is 1/1,590.

(f) Dead volume of retarding basin

The dead volume of the Ulo retarding basin is assumed to be zero because the river course of the Ulo river is planned to be changed to join the Widas river before coming into the Ulo retarding basin. Accordingly the drainage area of the Ulo retarding basin is so small as same as about 5 km^2.

(g) Length and crest elevation

The relations between the length of the side overflow dike, the crest elevation of the side overflow dike, the discharge in the river downstream of the side overflow dike, and the storage volume in the retarding basin are as mentioned in the part of the Widas retarding basin. And such relations are shown in Fig. 4.3.5.

In consideration of these relations shown in Fig. 4.3.5 and that the maximum overflow depth over the crest of side overflow dike should be at least arround 0.5 m from the practical view point, and the criteria for the Ulo retarding basin, the length and the crest elevation of the side overflow dike is determined as follows;

L = 550 m
W = 4.5 m

where L is the length and W is the relative height of the crest to the design river bed.

(h) Cross section and longitudinal profile

The design river cross section and the longitudinal profile in the reach of the side overflow dike is shown in Figs. 4.3.6 and 4.3.2.

(i) Flood routing

Flood routing is conducted with the dimensions of the side overflow dike decided in the above and the other features of the design of the river and the retarding basin on the following conditions.

(i) River condition

River cross section for 25-year probable flood and that for 10-year probable flood.

(ii) Flood hydrograph

Flood hydrograph with the return periods of 25-year, 10-year, 5-year, 2-year and 1.05-year.

The results are given in Table 4.3.4 and Figs. 4.3.7 - 4.3.9 and the summary is given in Tables 4.3.5 - 4.3.6.

The results for 25-year river cross section and for 25-year flood is as follows;

(i) Flood peak 590.7 m^3/s
(ii) Reduced flood peak 364.0 m^3/s
(iii) Peak cut volume 4.78 x 10^6 m^3
(iv) Maximum water level in the retarding basin 44.4 m SHVP
(v) Maximum inundation area in the retarding basin 6.3 km^2

(j) Supplement

Stage discharge relation

In consideration of the same matters described in the section of the Widas retarding basin, the stage discharge relation made by the uniform flow formula and some stage discharge relations made by non-uniform flow formula depending on some water levels in the Widas river at the confluence with the Kedungsoko river are compared in Fig. 4.3.10 . This also shows that the stage discharge relation made by the uniform flow formula has a substantial basis for designing the side overflow dike.

Flood hydrograph

As discussed in the section of the Widas retarding basin, flood routing is conducted for other types of flood hydrograph and the result is shown in Fig. 4.3.11 . The brief comparison is given below.

	Original type	Type 1	Type 2
Peak discharge	591m^3/s -- 364m^3/s	426 m^3/s -- 330 m^3/s	665 m^3/s -- 378 m^3/s
Max. water level	44.36 m SHVP	44.30 m SHVP	44.43 m SHVP

(6) Kedungsoko retarding basin

The needed function of the Kedungsoko retarding basin is determined through the study on the optimum flood control plan of the Widas river systems as well as that of the other retarding basins as follows.

(i) The flood peak of about 455 m^3/s of the Kedungsoko river for 25-year probable flood should be reduced to less than 200 m^3/s.

(ii) The maximum storage volume of the Kedungsoko retarding basin should be around 4.8 x 10^6 m^3 for 25-year probable flood.

The dimensions of side overflow dike along the Kedungsoko river of the Kedungsoko retarding basin are determined on the basis of the above criteria as follows.

(a) Storage capacity and area

Storage capacity and area curves used for the flood routing of the Kedungsoko retarding basin are shown in Table 4.3.1 and Fig. 4.3.1.

The curves are obtained from the topographic map of the scale of 1/10,000. In measuring the area, the design plan of the retarding basin shown in Fig. 4.4.4 is considered.

(b) Stage discharge relation

Stage discharge relation at the downstream end of the side overflow dike is calculated by the uniform flow formula. The longitudinal profile and the river cross section used for the calculation is shown in Figs. 4.3.2 and 4.3.3.

The calculated stage discharge relation is shown in Table 4.3.2 and Fig. 4.3.4.

(c) Cross section

River cross section in the reach of the side overflow dike is assumed to be the same as that in the reach downstream of the side overflow dike except the side overflow dike.

(d) Location

The location of the side overflow dike of the Kedungsoko retarding basin is determined in consideration of the topographic conditions. The Kedungsoko retarding basin should reduce the flood peaks of the Kedungsoko river and the Kuncir river.

Thus the location of the side overflow dike should be downstream of the confluence of the Kuncir river with the Kedungsoko river. And at the same time the side overflow dike can not be so near to the railway bridge. The distance between the two is only about 1.3 km.

The location is determined at around the middle of this reach. The downstream end of the side overflow dike is thus determined to be 500 m from the railway bridge.

(e) Slope of river bed

The slope of river bed in the reach of the side overflow dike is planned to be the same with that in the downstream reach. The slope of design river bed downstream of the side overflow dike is 1/1,950.

(f) Dead volume of retarding basin

The dead volume of the Kedungsoko retarding basin is assumed to be $1.0 \times 10^6 m^3$ on the basis of the run-off analysis result because the Kedungsoko retarding basin has its own drainage area of about 34 km^2.

(g) Length and crest elevation

The relations between the length of the side overflow dike, the crest elevation of the side overflow dike, the discharge in the river downstream of the side overflow dike, and the storage volume in the retarding basin, are as mentioned in the preseding part of the other retarding basins. And such relations are shown in Fig. 4.3.5.

In consideration of these relations shown in Fig. 4.3.5 and that the maximum overflow depth over the crest of side overflow dike should be at least around 0.5 m from the practical view point, and the criteria for the Kedungsoko retarding basin aforementioned, the length and the crest elevation of the side overflow dike is determined as follows;

L = 360 m
W = 3.5 m

where L is the length and W is the relative height of the crest to the design river bed.

(h) Cross section and longitudinal profile

The design river cross section and the longitudinal profile in the reach of the side overflow dike is shown in Figs. 4.3.6 and 4.3.2.

(i) Flood routing

Flood routing is conducted with the dimensions of the side overflow dike decided in the above and the other features of the design of the river and the retarding basin on the following conditions.

(i) River condition

River cross section for 25-year probable flood and that for 10-year probable flood.

(ii) Flood hydrograph

Flood hydrographs with the return periods of 25-year, 10-year, 5-year, 2-year and 1.05-year.

The results are given in Table 4.3.4 and Figs.4.3.7 - 4.3.9 and the summary is given in Tables 4.3.5 - 4.3.6.

The result for 25-year river cross section and for 25-year probable flood is as follows;

(i) Flood peak 455.3 m^3/s
(ii) Reduced flood peak 196.6 m^3/s
(iii) Peak cut volume 4.12 x 10^6 m^3
(iv) Maximum water level in the retarding basin 44.6 m SHVP
(v) Maximum inundation area in the retarding basin 6.5 km^2

(j) Supplement

Stage discharge relation

As well as the other retarding basins, the stage discharge relation made by the uniform flow formula and some stage discharge relations made by non-uniform flow formula depending on some water levels in the Widas river at the confluence with the Kedungsoko river are compared in Fig. 4.3.10 . This also shows that the stage discharge relation made by the uniform formula has a substantial basis for designing the side overflow dike.

Flood hydrograph

As well as the other retarding basins, flood routing is conducted for other types of flood hydrograph, and the result is shown in Fig. 4.3.11 . The brief comparison is given below.

	Original type	Type 1	Type 2
Peak discharge	455 m^3/s -- 197 m^3/s	322 m^3/s -- 179 m^3/s	491 m^3/s -- 201 m^3/s
Max. water level	44.59 m SHVP	44.66 m SHVP	44.66 m SHVP

Left and right retarding basins

The side overflow dike of the Kedungsoko retarding basin is planned on the both sides of the Kedungsoko river similar to the Widas retarding basin. Accordingly the same problem on the overflow discharge over the side overflow dike and the water level in the retarding basin on the left side and on the right side exists. But in the case of the Kedungsoko retarding basin, because of the locational constraint the side overflow dike is planned in the reach where the alignment of the river dike is convex to the right. It can be said that the overflow discharge to the right side retarding basin would be more than that to the left side because of the design alignment of the river dike convex to the right.

And the storage capacity of the right side retarding basin is about 4 times of that of the left side retarding basin. The effect of the bend of river dike alignment is not included in the equation of overflow discharge. This should be later confirmed by model test on the stage of detailed design.

(7) Summary

The fundamental dimensions of the three retarding basins are given below for summary, and partly shown in Fig. 4.3.12.

(a) Widas retarding basin

(i) Length of side overflow dike

L = 400 m on both sides of the Widas river

(ii) Relative height of the crest of side overflow dike to the design river bed

W = 4.4 m

(iii) Design flood peak cut : 455.3 m^3/s ------- 210.9 m^3/s

(iv) Design dead volume : 3.7×10^6 m^3

(v) Design maximum storage volume 13.6×10^6 m^3

(vi) Design peak cut volume : 9.9×10^6 m^3

(vii) Design maximum inundation area : 13.2 km^2

(viii) Design maximum inundation depth : 2.4 m

(ix) Design high water level : 38.6 m SHVP

(b) Ulo retarding basin

(i) Length of side overflow dike

L = 550 m on the right side of the Widas river

(ii) Relative height of the crest of side overflow dike to the design river bed

W = 4.5 m

(iii) Design flood peak cut : 590.7 m^3/s ----- 364.0 m^3/s

(iv) Design dead volume : 0.0 x 10^6 m^3

(v) Design maximum storage volume : 4.8 x 10^6 m^3

(vi) Design peak cut volume : 4.8 x 10^6 m^3

(vii) Design maximum inundation area : 6.3 km^2

(viii) Design high water level : 44.4 m.SHVP

(c) Kedungsoko retarding basin

(i) Length of side overflow dike

L = 360 m on the both sides of the Kedungsoko river

(ii) Relative height of the crest of side overflow dike to the design river bed

W = 3.5 m

(iii) Design flood peak cut : 455.3 m^3/s ---- 196.6 m^3/s

(iv) Design dead volume : 1.0 x 10^6 m^3

(v) Design maximum storage volume : 5.1 x 10^6 m^3

(vi) Design peak cut volume : 4.1 x 10^6 m^3

(vii) Design maximum inundation area : 6.5 km^2

(viii) Design high water level : 44.6 m.SHVP

4.3.2 Drainage sluice

(1) General

Flood water stored in a retarding basin should be drained as soon as practicable after a flood. Because the storage capacity of the retarding basin should be reserved for a next coming flood during a rainy season.

The rate of draw down of the retarding basin depends on the dimensions of drainage sluice to be constructed to the retarding basin.

The dimensions of drainage sluices of the Widas, the Ulo and the Kedungsoko retarding basins are studied here.

(2) Fundamental equations

Fundamental equations for emptying a retarding basin with a drainage sluice used here are as follows;

(a) Continuity equation

$$\frac{dV}{dt} = -Q$$

(b) Discharge equation

$$Q = C1 \cdot B \cdot W \cdot \sqrt{2g \cdot \Delta H}$$

(pipe flow, submerged)

$$Q = C2 \cdot B \cdot h2 \cdot \sqrt{2g \cdot \Delta H}$$

(open channel, submerged)

$$Q = C3 \cdot B \cdot h1 \cdot \sqrt{2g \cdot h1}$$

(open channel, perfect flow)

$$Q = C1 \cdot B \cdot W \cdot \sqrt{2g \cdot h1}$$

(pipe flow, perfect flow)

Here;

V	:	storage volume in the retarding basin (m^3)
t	:	time
Q	:	discharge through drainage sluice (m^3/s)
C1,C2,C3	:	constants
B	:	width of sluice (m)
W	:	height of sluice (m)
g	:	gravity acceleration (m/s^2)
ΔH	:	H1 - H2 (m)
H1	:	water level in the retarding basin
H2	:	water level in the river
h1	:	water depth in the retarding basin

(3) Drainage calculation

Drainage calculation is carried out to get the draw down conditions of the retarding basin and the discharge hydrograph through the drainage sluice. On the condition that the drainage sluice would be opened after a flood, it is assumed that there is no inflow to the retarding basin in the drainage calculation.

The procedure to calculated the draw down of the retarding basin and the discharge hydrograph through the drainage sluice is as follows.

(a) At a time point t, the water level in the retarding basin HB(t) is assumed.

(b) Then the outflow discharge through drainage sluice QO(t) is calculated with the discharge equation by using HB(t) and the water level in the river HR(t).

(c) The average outflow discharge is calculated with QO(t) and the outflow discharge at a precceding time point QO(t-1).

(d) The storage volume in the retarding basin at a time point t is calculated with the equation ;

$$V(t) = V(t-1) - (QO(t) + QO(t-1)) / 2.0 \times \Delta t$$

where Δt is the time interval.

(e) The water level in the retarding basin HB'(t) is calculated with V(t) through the volume curve of the retarding basin.

(f) When HB'(t) is not equal to HB(t), then the new value HB(t) is assumed, and the procedure from (b) to (e) is again conducted.

(g) When these two values are the same, then the water level in the retarding basin at time point t is obtained as HB(t).

(h) In the above calculation, the influence of the outflow discharge in the river is taken into account.

(4) Widas retarding basin

The dimensions of the drainage sluice of the Widas retarding basin are determined here so as to drain the storage volume of about 13.6×10^6 m^3 in about 2-3 days. The storage volume of 13.6×10^6 m^3 is the design storage volume for 25-year probable flood. In determining the dimensions of the drainage sluice, it is taken into account that the flow velocity in the drainage sluice does not exceed 3.5 m/sec as a standard.

The dimensions are determined as follows;

(a) Storage capacity and area

Storage capacity and area curves used here are the same ones used in the study of overflow dike and are shown in Fig.4.3.1.

(b) Discharge hydrograph in river

In the case of the Widas retarding basin, actually there are two retarding basins on the left side and on the right side of the Widas river. But in the drainage calculation, it is assumed that the retarding basin is just one and the stored flood water in the retarding basin is released to K. Brantas.

The design flood discharge hydrograph in K. Brantas is shown in Table 4.3.8.

(c) Stage discharge relation

Stage discharge relation in K. Brantas is the one in K. Brantas of the Brantas River Middle Reach Improvement Project, and is shown in Table 4.3.7.

(d) Dimensions of sluice

The dimensions of the sluice discussed here are the bed elevation, width and the height of the opening of the sluice.

By assuming some values on these dimensions, drainage calculations are carried out. And the relations between these values and the necessary time to empty the retarding basin and the maximum flow velocity through the sluice are obtained and shown in Fig.4.3.13.

In consideration of the relations shown in Fig.4.3.13 and the criteria for determining the dimensions of sluice aforementioned, the dimensions of the drainage sluice are determined and the drawdown of the water level in the retarding basin and the outflow discharge hydrograph are shown in Fig. 4.3.14.

The dimensions of the sluices are determined as follows;

The left side

bed elevation	35.0 m SHVP
height	4.0 m
width	3.0 m x 2 gates

The right side

bed elevation	35.0 m SHVP
height	4.0 m
width	4.0 m x 2 gates

Necessary time to empty the retarding basin is 1.8 days.

In determining the dimensions of the sluices on the left side and the right side, the following are considered.

(i) The necessary width is divided into two approximately proportional to the storage volume of the retarding basins on the left and right sides.

(ii) In consideration of an emergency case, each sluice should have two gates.

(iii) When the width of a gate is too narrow, obstacles would be stopped at the gate and the smooth flow through the sluice would be disturbed.

The locations of the sluices are shown in Fig. 4.4.4.

(5) Ulo retarding basin

The design storage volume of the Ulo retarding basin is 4.8 x 10^6 m^3. The same criteria as those of the Widas retarding basin to determine the dimensions of the sluice are used here for the Ulo retarding basin.

(a) Storage capacity and area

Storage capacity and area curves used here are the same ones used in the study of side overflow dike and are shown in Fig.4.3.1.

(b) Discharge hydrograph in river

The flood water stored in the Ulo retarding basin is to be released to the Kedungsoko river at the confluence of the existing Ulo river and the Kedungsoko river. But the confluence is not so far from the confluence of the Kedungsoko river with the Widas river.

And the distance is about 1.3 km and the design river bed slope is 1/2,800. Accordingly, taking into account the influence of the backwater from the Widas river, the 25-yr probable flood hydrograph in the Widas river is used here. The hydrograph is shown in Table 4.3.8.

(c) Stage discharge relation

In consideration of the above mentioned matter, the stage discharge relation is calculated in Table 4.3.7.

(d) Dimensions of sluice

The dimensions of the sluice of the Ulo retarding basin are determined with the same procedure as that of the Widas retarding basin.

The relations between the bed elevation, width, height of the opening of the sluice, and, necessary time to empty the retarding basin and maximum flow velocity through the sluice are shown in Fig 4.3.13.

With the same consideration as in the case of the Widas retarding basin, the dimensions of the sluice of the Ulo retarding basin are determined and the drawdown hydrograph of the basin and the outflow discharge hydrograph are shown in Fig. 4.3.14.

The dimensions are as follows;

bed elevation 42.0 m SHVP
height 3.0 m
width 4.0 m x 2 gates
Necessary time to empty the retarding basin is 2.2 days.

The location of the sluice is shown in Fig. 4.4.4.

(6) Kedungsoko retarding basin

The design storage volume of the Kedungsoko retarding basin is 5.1×10^6 m^3.

The same criteria as the other retarding basins to determine the dimensions of the sluice are used here for the Kedungsoko retarding basin.

(a) Storage capacity and area

Storage capacity and area curves used here are the same ones used in the study of side overflow dike and are shown in Fig. 4.3.1.

(b) Discharge hydrograph in river

The flood water stored in the Kedungsoko retarding basin is to be released to Kedungsoko river after a flood.

Accordingly the discharge hydrograph in the Kedungsoko river for 25-yr probable flood is used and shown in Table. 4.3.8.

(c) Stage discharge relation

Stage discharge relation in the Kedungsoko river at the planned location is calculated in uniform flow and shown in Table 4.3.7.

(d) Dimensions of sluice

The dimensions of the sluice of the Kedungsoko retarding basin are determined with the same procedure as that of the other retarding basins. The relations between the bed elevation, width, height of the opening of the sluice, and, necessary time to empty the retarding basin and maximum flow velocity through the sluice are shown in Fig. 4.3.13.

With the same consideration as in the other retarding basins, the dimensions of the sluices of the Kedungsoko retarding basin are determined and the drawdown hydrograph and the outflow discharge hydrograph are shown in Fig. 4.3.14.

The dimensions of the sluices are as follow.

The left side :
bed elevation 41.0 m SHVP

height 2.0 m
width 2.0 m x 2 gates

The right side :

bed elevation	41.0 m SHVP
height	2.5 m
width	2.5 m x 2 gates

Necessary time to empty the retarding basin is 1.8 days.

In determining the dimensions of the sluices on the left side and the right side, the same consideration is given as in the case of the Widas retarding basin.

The locations of the sluices are shown in Fig. 4.4.4.

4.3.3 Drainage canal

(1) General

Flood water stored in a retarding basin should be drained as soon as practicable after a flood. In this case, it is needed to provide a drainage canal so as to lead the flood water smoothly to the drainage sluice.

The drainage canal also functions as a canal to drain the runoff in the retarding basin even when there occurs no overflow over the side overflow dike.

(2) Widas retarding basin

In the case of the Widas retarding basin the drainage condition is not in a condition that the flood water stored in the retarding basin can smoothly reach the location of planned drainage sluices.

Accordingly new drainage canals are planned as shown in Fig.4.3.15.

(a) Canal width

The design width of the canal is principally based on the width of the drainage sluice.

(b) Slope of canal bed

The design slope of the canal bed is principally based on the design bed slope of the Widas river.

(3) Ulo retarding basin

The downstream reach of the existing Ulo river is planned to change the river course to join the Widas river in the upstream of the Ulo retarding basin in order to minimize the dead volume of the retarding basin. Accordingly the existing Ulo river in the Ulo retarding basin can be used as the drainage canal. The other existing drainage canals, presently joining the Kedungsoko river separately are to be connected to the existing Ulo river in front of the planned drainage sluice of the Ulo retarding basin as shown in Fig. 4.4.4.
A new canal to connect the drainage sluice to the location of side overflow is also planned as shown in Fig. 4.4.4 in consideration of the existing drainage canals.

(4) Kedungsoko retarding basin

Kedungsoko retarding basin has two retarding basins on the left and the right sides of the Kedungsoko river.

As for the left side, the existing Kuncir river is planned to join the Kedungsoko river rather upstream of the existing confluence. Accordingly the existing Kuncir river near the drainage sluice can be used as a drainage canal. Therefore no new drainage canal is planned on the left side.

As for the right side, there exist irrigation and drainage canals in the Kedungsoko retarding basin presently joining the Kedungsoko river. Accordingly no new drainage canal is planned on the side except the connecting canal of these canals to lead them to the drainage sluice as shown in Fig. 4.4.4.

4.3.4 Sediment volume

(1) General

Sediment volume in the retarding basins is studied here. Though the sediment discharge formula for the Widas river is not available, a sediment discharge formula is studied for K. Brantas because the sediment measurement has been carried out in K. Brantas. It is said that the sediment load in the Widas river is less than that in K. Brantas because of the vegetation condition in the basin. For the study of sediment volume of the retarding basins in the Widas river basin, the sediment discharge formula in K. Brantas is employed here.

(2) Sediment discharge formula

Sediment volume in retarding basin is mainly expected from the suspended load and wash load contained in flood water overflowing the side overflow dike of a retarding basin.

It is assumed here that the bed load will not overflow the side overflow dike.

According to the hydrological analysis result, the sediment discharge formula for suspended load and wash load is

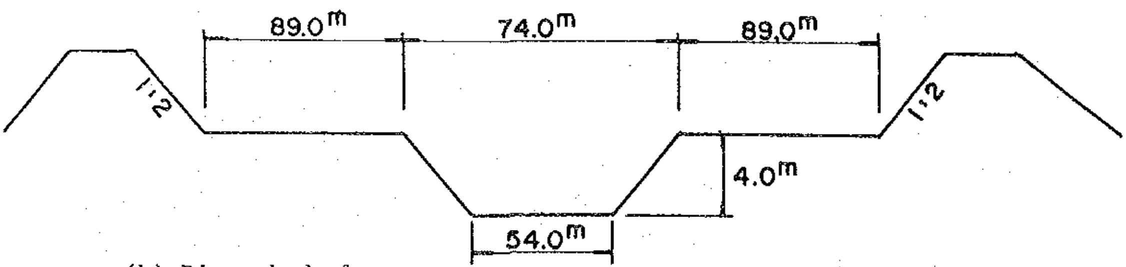
$$q_{sw} = 4.901 \times 10^{-3} \times (h \times U_*^2)^{0.733}$$

where ; q_{sw} : suspended load + wash load ($m^3/s/m$)
h : water depth (m)
U_* : friction velocity (m/s)

(3) Widas retarding basin

(a) Cross section of the Widas river

Design cross-section of the Widas river in the upstream reach of the side overflow dike of the Widas retarding basin is as follows.



(b) River bed slope

Design river bed slope is planned to be 1/3,400.

(c) Manning's coefficient of roughness

Design coefficient of roughness is 0.03 for low water channel and 0.05 for high water channel.

(d) Hydraulic characteristics

Assuming the uniform flow in the channel, the hydraulic characteristics are as follows.

(i) Low-water channel

h (m)	P (m)	A (m^2)	R (m)	Q (m^3/s)
4.0	75.54	256.0	3.389	330.2
4.5	75.54	293.0	3.389	413.5
5.0	75.54	330.0	4.369	504.1

(ii) High-water channel

h (m)	P (m)	A (m^2)	R (m)	Q (m^3/s)
4.0	0	0	0	0
4.5	180.7	89.6	0.496	19.3
5.0	183.4	180.5	0.984	61.3

In the above,

h : water depth (m),
P : wetted perimeter (m),
A : cross sectional area (m^2),
R : hydraulic mean radius (m),
Q : discharge (m3/s)

Although the flood discharge in this reach of the Widas river varies during a flood, the design peak discharge is 410.3 m^3/s. The water depth corresponding to this discharge in the above table is 4.405 m.
Hydraulic characteristics to this water depth for low-water channel and high water channel are as follows.

(i) Low-water channel

h (m)	R (m)	Q (m^2)	B_* (m)	U_*^2 (m^3/s)	$h.U_*^2$ (m^3/s^2)
4.405	3.786	397.1	54	0.01091	0.04807

(ii) High water channel

h (m)	R (m)	Q (m^2)	B_* (m)	U_*^2 (m^3/s)	$(h-4).U_*^2$ (m^3/s^2)
4.405	0.402	13.6	178	0.001159	0.0004693

(e) Sedimentation in the Widas retarding basin

(i) Sediment discharge

(i) Sediment discharge

Substituting the hydraulic values obtained in the above to the sediment discharge formula previously mentined, the sediment discharge to the design flood peak 410.3 m^3/s is obtained as follows.

$Q_{sw1} = q_{sw1} \times B_* = 0.02861$: low water channel

$Q_{sw2} = q_{sw2} \times B_* = 0.003169$: high water channel

Accordingly the total sediment discharge Q_{sw} is as follows.

$Q_{sw} = Q_{sw1} + Q_{sw2} = 0.0318\ m^3/s$

Therefore ;

$Q_{sw}/Q = 0.0318/410.3 = 7.7452 \times 10^{-5}$

(ii) Sediment volume

Assuming that the retarding basin is filled with the flood water when the flood discharge is 410.3 m^3/s, the sediment volume and the mean depth of the sediment of the Widas retarding basin are,

$V_{sw} = 7.745 \times 10^{-5} \times 13.6 \times 10^6\ m^3 = 1053.3\ m^3$

$h_{sw} = 1053.3\ m^3/13.2\ km^2 = 0.08\ mm$

Where ;

V_{sw} : volume of sediment (m^3)

h_{sw} : mean depth of sediment (mm)

Even when the retarding basin is fully filled with the 25-yr probable flood every year, the sediment depth is only 0.08 mm per year.

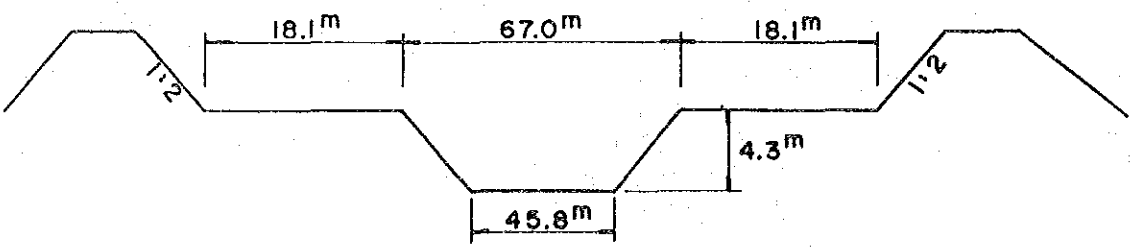
Accordingly it is concluded that there is no need to take into account the design dead volume due to sediment, though the very local sedimentation in the retarding basin should be taken care of.

(4) Ulo retarding basin

With the same procedure as that of the Widas river, the sediment volume in the Ulo retarding basin is calculated as follows.

(a) Cross-section

Design cross-section of the Widas river in the upstream reach of the side overflow dike of the Ulo retarding basin is as follows.



(b) River bed slope

Design river bed slope is planned to be 1/1,590.

(c) Manning's coefficient of roughness

Design coefficient of roughness is 0.03 for low water channel and 0.05 for high water channel.

(d) Hydraulic characteristics

For the design flood peak discharge 590.7 m^3/s, the hydraulic characteristics are as follows.

(i) Low-water channel

h	R	Q	B_*	U_*^2	$h.U_*^2$
(m)	(m)	(m^3/s)	(m)	(m/s)	(m^3/s^2)
4.813	4.015	584.8	45.8	0.02475	0.1191

(ii) High-water channel

h	R	Q	B_*	U_*^2	$(h-4.3).U_*^2$
4.813	0.494	6.0	36.2	0.003045	0.001562

(e) Sedimentation in the Ulo retarding basin

(i) *Sediment discharge*

Substituting the hydraulic values in the sediment discharge formula, the sediment discharge to the design flood peak 590.7 m^3/s is obtained as follows.

$Q_{sw1} = q_{sw1} \times B_* = 0.0472$: low-water channel

$Q_{sw2} = q_{sw2} \times B_* = 0.001556$: high-water channel

The total sediment discharge is then,

$$Q_{sw} = Q_{sw1} + Q_{sw2} = 0.04876 \ m^3/s$$

Therefore,

$$Q_{sw}/Q = 0.04876/590.7 = 8.2539 \times 10^{-5}$$

(ii) Sediment volume

On the same assumption as that of the Widas retarding basin, the sediment volume and the mean depth of the sediment in the Ulo retarding basin per year are,

$$V_{sw} = 8.2539 \times 10^{-5} \times 4.8 \times 10 = 396.2 \ m^3$$

$$h_{sw} = 396.2 \ m^3/6.3 \ km^2 = 0.06 \ mm$$

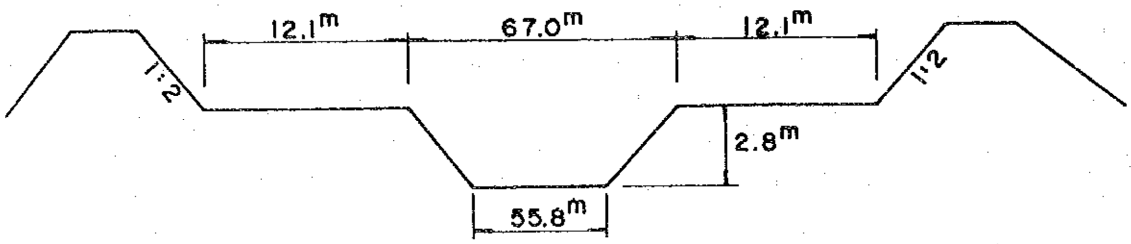
Accordingly it is concluded that there is no need to take into account the design dead volume due to sediment.

(5) Kedungsoko retarding basin

With the same procedure, the sediment volume in the Kedungsoko retarding basin is calculated as follows.

(a) Cross-section

Design cross-section of the Kedungsoko river in the upstream reach of the side overflow dike of the Kedungsoko retarding basin is as follows.



(b) River bed slope

Design river bed slope is planned to be 1/1,950.

(c) Manning's coefficient of roughness

Design coefficient of roughness is 0.03 for low-water channel and 0.05 for high water channel.

(d) Hydraulic charactiristics

For the design flood peak discharge 455.3 m^3/s, the hydraulic characteristics are as follows.

(i) Low-water channel

h	R	Q	B_*	U_*^2	$h.U_*^2$
(m)	(m)	(m^3/s)	(m)	(m^2/s^2)	(m^3/s^2)
3.94	3.634	443.0	55.8	0.01826	0.07194

(ii) High-water channel

h	R	Q	B_*	U_*^2	$h.U_*^2$
(m)	(m)	(m^3/s)	(m)	(m^2/s^2)	(m^3/s^2)
3.94	1.030	13.947	24.2	0.00518	0.00591

(e) Sedimentation in the Kedungsoko retarding basin

(i) Sediment discharge

Substituting the hydraulic values in the sediment discharge formula, the sediment discharge to the design flood peak 455.3 m^3/s

is obtained as follows.

$Q_{sw1} = q_{sw1} \times B_* = 0.03973$: low-water channel

$Q_{sw2} = q_{sw2} \times B_* = 0.00276$: high-water channel

Accordingly the total sediment discharge Q_{sw} is,

$Q_{sw} = Q_{sw1} + Q_{sw2} = 0.04249\ m^3/s$

Therefore ,

$Q_{sw}/Q = 0.04249/455.3 = 9.3323 \times 10^{-5}$

(ii) Sediment volume

On the same assumption as that of the Widas retarding basin, the sediment volume and the mean depth of the sediment in the Kedung-soko retarding basin per year are,

$V_{sw} = 9.3323 \times 10^{-5} \times 5.1 \times 10^6\ m^3 = 475.9\ m^3$

$h_{sw} = 475.9\ m^3/6.5\ km^2 = 0.07\ mm$

Accordingly it is concluded that there is no need to take into account the design dead volume due to sediment.

Table 4.3.1 STORAGE CAPACITY AND AREA OF WIDAS RETARDING BASIN (1/3)

1. Right side

H (m)	A (km^2)	$\bar{V}$ ($x10^6$ m^3)
36.2	0.0	0.0
37.0	1.222	0.489
38.0	7.051	4.625
39.0	10.394	13.348

2. Left side

H (m)	A (km^2)	$\bar{V}$ ($x10^6$ m^3)
36.4	0.0	0.0
37.0	0.992	0.298
38.0	3.268	2.428
39.0	4.751	6.437

3. Total

H (m)	A (km^2)	$\bar{V}$ ($x10^6$ m^3)
36.2	0.0	0.0
37.0	2.214	0.786
38.0	10.319	7.053
39.0	15.145	19.785

Table 4.3.1 STORAGE CAPACITY AND AREA OF KEDUNGSOKO RETARDING BASIN (3/3)

1. Right side

H (m)	A (km^2)	$\bar{V}$ ($x10^6$ m^3)
43.50	2.858	0.0
44.00	2.858	1.429
45.00	7.591	6.653

2. Left side

H (m)	A (km^2)	$\bar{V}$ ($x10^6$ m^3)
43.2	0.0	0.0
44.0	0.399	0.160
45.0	2.754	1.736

3. Total

H (m)	A (km^2)	$\bar{V}$ ($x10^6$ m^3)
43.2	0.0	0.0
44.0	3.257	1.589
45.0	10.345	8.389

Table 4.3.1 STORAGE CAPACITY AND AREA OF ULO RETARDING BASIN (2/3)

H (m)	A (km^2)	$\bar{V}$ ($x10^6$ m^3)
43.0	0.0	0.0
44.0	5.589	2.794
45.0	7.505	9.341
46.0	9.553	17.870

Table 4.3.2 STAGE DISCHARGE RELATION OF WIDAS RIVER AT WIDAS RETARDING BASIN (1/3)

Cross-section for 25-year probable flood

h (m)	3.9	4.0	4.4	4.8	5.2	5.6	6.0
Q (m^3/s)	133.4	141.1	171.3	220.3	269.2	323.5	383.0

Table 4.3.2 STAGE DISCHARGE RELATION OF WIDAS RIVER AT DOWNSTREAM OF ULO RETARDING BASIN (2/3)

Cross-section for 25-year probable flood

h (m)	4.3	4.4	4.8	5.2	5.6	6.0
Q (m^3/s)	265.9	278.2	341.8	416.4	500.6	593.7

Cross-section for 10-year probable flood

h (m)	4.3	4.4	4.8	5.2	5.6	6.0
Q (m^3/s)	218.4	230.2	286.8	354.4	431.7	517.8

Table 4.3.2 STAGE DISCHARGE RELATION OF KEDUNGSOKO RIVER OF KEDUNGSOKO RETARDING BASIN (3/3)

Cross-section for 25-year probable flood

h (m)	3.1	3.4	3.8	4.2	4.6	5.0
Q (m^3/s)	112.8	139.0	182.1	232.8	290.3	354.2

Cross-section for 10-year probable flood

h (m)	3.1	3.4	3.8	4.2	4.6	5.0
Q (m^3/s)	98.3	122.3	162.4	210.1	264.6	325.5

Legend :

h = elevation from the design low-water channel bed

Q = discharge

Table 4.3.3 PROBABLE FLOOD AT WIDAS RETARDING BASIN (1/3)

Return Period / Time	River Condition: For 10-year flood 1.05	2	5	10	For 25-year flood 2	5	10	25
1	60.1	79.4	97.0	106.5	79.4	97.1	106.5	119.6
2	75.4	99.5	122.6	135.2	99.5	122.8	135.5	151.4
3	102.7	135.6	163.4	177.6	135.7	164.0	178.4	195.9
4	137.6	181.7	212.6	227.9	182.0	213.8	230.4	249.6
5	175.2	231.4	260.4	266.0	232.0	261.0	267.9	275.7
6	199.8	263.8	277.5	285.5	264.2	278.7	289.3	300.9
7	209.7	276.9	295.8	305.6	277.6	297.8	311.6	325.8
8	219.5	289.8	313.2	324.3	291.0	316.0	332.2	348.1
9	228.4	301.6	328.9	340.9	303.3	332.4	350.3	367.7
10	235.9	311.5	341.9	354.8	313.6	346.2	365.5	384.3
11	241.4	318.8	351.5	365.5	321.2	356.5	377.3	397.3
12	244.5	322.8	357.2	372.3	325.6	362.8	385.2	406.3
13	245.0	323.5	358.5	374.7	326.5	364.7	388.5	410.3
14	242.9	320.7	356.2	372.6	323.9	362.5	386.9	410.1
15	238.0	314.3	349.9	366.5	317.9	356.2	380.7	405.0
16	229.3	302.8	339.9	356.8	306.7	346.5	370.6	395.0
17	216.7	286.1	324.6	342.4	290.0	331.6	356.3	381.3
18	201.8	266.4	304.0	322.5	270.2	310.9	336.3	362.5
19	167.3	220.9	281.1	299.1	231.5	287.5	312.0	338.1
20	129.1	170.4	258.2	274.9	176.8	264.0	286.5	311.1
21	103.8	137.0	191.5	238.5	140.8	207.2	262.0	284.4
22	86.7	114.5	148.8	177.8	116.8	158.0	200.2	259.5
23	75.5	99.7	121.7	140.0	100.9	127.2	153.1	192.4
24	68.6	90.6	104.5	116.5	91.3	107.7	124.3	148.7
25	63.8	84.3	94.9	102.3	84.8	96.6	106.9	122.8
26	61.3	80.9	89.9	95.8	81.2	90.9	98.2	108.7
27	61.0	80.6	89.0	94.3	80.8	89.7	95.9	103.6

Table 4.3.3 PROBABLE FLOOD AT ULO RETARDING BASIN (2/3)

	Return Period (yr)				Unit : m^3/s
Time (hr)	1.05	2	5	10	25
1	25.4	40.0	47.1	52.1	56.3
2	32.0	50.5	63.0	73.2	81.3
3	63.1	99.6	133.9	161.2	186.5
4	121.8	192.1	254.6	304.7	352.8
5	179.2	282.7	366.5	434.8	494.9
6	215.8	340.5	436.8	515.1	570.0
7	234.7	370.3	468.6	547.4	590.7
8	238.1	375.6	467.6	539.8	584.1
9	225.6	355.9	435.8	497.1	554.0
10	200.0	315.6	380.7	430.5	498.1
11	168.1	265.2	315.6	354.2	424.8
12	136.2	214.9	251.9	281.3	348.3
13	108.8	171.7	197.2	218.8	278.7
14	87.0	137.3	154.4	169.8	219.6
15	70.7	111.5	122.7	134.1	173.1
16	59.3	93.5	101.2	109.1	138.6
17	50.8	80.2	86.1	92.2	113.6

Table 4.3.3 PROBABLE FLOOD AT KEDUNGSOKO RETARDING BASIN (3/3)

	Return Period (yr)				Unit : m^3/s
Time (hr)	1.05	2	5	10	25
1	14.0	18.2	21.9	24.1	27.3
2	28.4	37.0	47.1	54.5	64.0
3	63.3	82.5	107.9	128.0	152.5
4	114.2	148.9	195.0	230.6	274.3
5	166.3	216.9	280.2	326.9	384.5
6	206.4	269.2	341.3	392.4	455.3
7	217.0	283.0	351.0	398.3	455.2
8	189.4	247.1	298.7	333.8	374.8
9	146.2	190.7	224.1	246.9	272.1
10	111.1	144.9	166.7	181.6	197.2
11	88.1	114.9	130.4	140.7	151.2
12	73.2	95.5	107.3	115.1	123.0
13	62.4	81.4	90.8	97.0	103.6
14	53.4	69.8	77.5	82.6	88.0
15	46.4	60.5	66.8	71.1	75.5

Table 4.3.4 FLOOD ROUTING IN THE WIDAS RETARDING BASIN (1/7)

(Q-1.05yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
60.1	36.937	60.1	36.873	0	37.59	3.69
75.4	37.149	75.4	37.069	0	37.59	3.69
102.7	37.521	102.7	37.419	0	37.59	3.69
137.6	37.984	137.6	37.866	0	37.59	3.69
175.1	38.405	175.1	38.287	0	37.59	3.69
199.8	38.480	183.1	38.365	16.7	37.59	3.69
209.7	38.496	184.9	38.382	24.8	37.60	3.75
219.4	38.509	186.5	38.397	32.9	37.61	3.84
228.4	38.521	188.0	38.410	40.4	37.63	3.96
235.9	38.531	189.1	38.421	46.8	37.64	4.11
241.4	38.536	189.9	38.428	51.5	37.66	4.27
244.5	38.541	190.4	38.433	54.1	37.69	4.44
243.0	38.542	190.5	38.433	52.3	37.71	4.65
242.0	38.539	190.1	38.430	52.7	37.74	4.85
238.0	38.333	189.4	38.426	48.6	37.76	5.04
229.2	38.522	188.1	38.411	41.1	37.78	5.21
216.6	38.506	186.1	38.393	30.5	37.80	5.35
201.8	38.483	183.5	38.369	18.3	37.81	5.47
167.2	38.318	167.2	38.200	0	37.82	5.54
129.1	37.873	129.1	37.757	0	37.82	5.54
103.1	37.534	103.1	37.433	0	37.82	5.54
86.7	37.304	86.7	37.214	0	37.82	5.54
75.5	37.131	75.5	37.030	0	37.82	5.56

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qw : overflow discharge
Hb : water level in retarding basin
Vb : storage volume in retarding basin

(Q-2yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
79.4	37.204	79.4	37.120	0	37.59	3.69
99.5	37.478	99.5	37.378	0	37.59	3.69
135.6	37.958	135.6	37.840	0	37.59	3.69
181.6	38.444	178.9	38.326	2.7	37.59	3.69
231.3	38.525	188.4	38.414	42.9	37.59	3.70
263.7	38.563	193.1	38.458	70.6	37.61	3.85
276.9	38.577	194.9	38.475	82.0	37.64	4.11
289.8	38.590	196.6	38.490	93.2	37.68	4.41
301.6	38.602	198.1	38.504	103.5	37.72	4.74
311.5	38.611	199.3	38.516	112.2	37.77	5.11
318.7	38.618	200.2	38.254	118.5	37.82	5.52
322.8	38.621	200.7	38.529	122.1	37.87	5.94
323.5	38.622	200.8	38.530	122.7	37.92	6.38
320.7	38.619	200.5	38.526	120.2	37.98	6.83
314.3	38.614	199.7	38.519	114.6	38.02	7.26
302.8	38.603	198.2	38.506	104.6	38.06	7.67
286.0	38.586	196.1	38.486	89.9	38.09	8.05
266.4	38.566	193.5	38.461	72.9	38.13	8.37
220.8	38.511	186.8	38.399	34.0	38.15	8.63
170.3	38.352	170.3	38.234	0	38.16	8.76
137.0	37.976	137.0	37.858	0	38.16	8.76
114.5	37.679	114.5	37.570	0	38.16	8.76
99.7	37.481	99.7	37.380	0	38.16	8.76

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qw : overflow discharge
Hb : water level in retarding basin
Vb : storage volume in retarding basin

(Q-5yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
97.0	37.444	97.0	37.346	0	37.59	3.69
122.6	37.787	122.6	37.676	0	37.59	3.69
163.3	38.276	163.3	38.157	0	37.59	3.69
212.6	38.500	185.4	38.386	27.2	37.59	3.69
260.3	38.559	192.6	38.456	67.7	37.60	3.79
277.5	38.578	195.0	38.475	82.5	37.64	4.03
295.8	38.596	197.3	38.497	98.5	37.67	4.33
313.2	38.613	199.5	38.518	113.7	37.72	4.69
328.9	38.627	201.5	38.536	127.4	37.77	5.09
341.9	38.638	203.0	38.550	138.9	37.82	5.55
351.5	38.647	204.2	38.561	147.3	37.88	6.05
357.1	38.651	204.8	38.567	152.3	37.95	6.58
358.4	38.052	205.0	38.568	153.4	38.01	7.13
356.1	38.650	204.7	38.559	151.4	38.04	7.68
349.9	38.645	204.0	38.559	145.9	38.11	8.23
339.9	38.637	202.8	38.548	137.1	38.16	8.75
324.6	38.623	200.9	38.531	123.7	38.21	9.25
303.9	38.604	198.4	38.507	105.5	38.25	9.69
281.1	38.581	195.4	38.480	85.7	38.29	10.07
258.1	38.557	192.3	38.451	65.8	38.31	10.38
191.5	38.465	181.4	38.349	10.1	38.34	10.62
148.8	38.127	149.9	38.008	-1.1	38.34	10.66
121.7	37.789	122.8	37.676	-1.1	38.34	10.65
104.5	37.559	105.6	37.455	-1.1	38.34	10.65
94.9	37.429	95.9	37.322	-1.0	38.36	10.64
89.9	37.361	90.9	37.267	-1.0	38.34	10.64

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qw : overflow discharge
Hb : water level in retarding basin
Vb : storage volume in retarding basin

(Q-10yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
106.5	37.572	106.5	37.467	0	37.39	3.69
135.2	37.953	135.2	37.835	0	37.59	3.69
177.5	38.430	177.4	38.312	0	37.59	3.69
227.9	38.521	187.9	38.409	40.0	37.59	3.69
265.0	38.565	193.4	38.461	72.6	37.61	3.86
285.4	38.586	196.0	38.485	89.4	37.64	4.10
305.6	38.605	198.6	38.509	107.0	37.68	4.42
324.3	38.623	200.9	38.530	123.4	37.73	4.81
340.9	38.637	202.9	38.549	138.0	37.78	5.25
354.7	38.649	204.5	38.564	150.2	37.85	5.75
365.4	38.658	205.8	38.576	159.6	37.98	6.46
372.3	38.664	206.6	38.583	165.7	37.98	6.86
374.7	38.666	206.9	38.586	167.8	38.04	7.46
372.6	38.664	206.6	38.584	166.0	38.10	8.06
366.4	38.659	205.9	38.577	160.5	38.15	8.66
356.7	38.651	204.8	38.567	151.9	38.21	9.24
342.4	38.639	203.1	38.551	139.3	38.26	9.78
322.5	38.621	200.7	38.528	121.8	38.31	10.29
299.1	38.599	197.8	38.501	101.3	38.35	10.72
274.9	38.575	194.6	38.472	80.3	38.38	11.09
238.5	38.535	189.6	38.426	48.9	38.41	11.38
177.8	38.476	183.4	38.368	-5.6	38.42	11.53
139.9	38.250	161.3	38.134	-21.4	38.42	11.53
116.5	38.951	135.2	37.835	-18.7	38.41	11.44
102.3	37.734	118.8	37.625	-16.5	38.41	11.39
95.8	37.623	110.5	37.519	-14.7	38.40	11.33
94.3	37.580	107.4	37.479	-13.1	38.40	11.28
98.4	37.616	110.0	37.512	-11.6	38.39	11.23
109.4	37.747	119.8	37.637	-10.4	38.39	11.19

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qw : overflow discharge
Hb : water level in retarding basin
Vb : storage volume in retarding basin

Table 4.3.4 FLOOD ROUTING IN THE WIDAS RETARDING BASIN (2/7)

(Q-2yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
79.4	37.204	79.4	37.120	0	37.59	3.69
95.5	37.478	95.5	37.378	0	37.59	3.69
135.7	37.960	35.7	37.842	0	37.59	3.69
181.9	38.445	179.0	38.327	2.9	37.59	3.69
232.0	38.526	188.5	38.413	43.5	37.59	3.70
264.1	38.563	193.2	38.459	70.9	37.61	3.86
277.6	38.578	195.0	38.475	82.6	37.64	4.11
291.0	38.591	196.7	38.492	94.3	37.68	4.41
303.2	38.603	198.3	38.506	104.3	37.72	4.75
313.6	38.613	199.6	38.518	114.0	37.76	5.13
321.2	38.620	200.5	38.527	120.7	37.82	5.54
325.6	38.626	201.1	38.532	124.5	37.87	5.97
326.5	38.625	201.2	38.625	125.3	37.93	6.42
323.9	38.622	200.8	38.530	123.1	37.98	6.87
317.8	38.617	200.1	38.523	117.7	38.03	7.32
306.7	38.606	198.7	38.510	108.0	38.07	7.74
290.0	38.590	196.6	38.490	93.4	38.11	8.13
270.2	38.570	194.0	38.466	76.2	38.14	8.47
231.6	38.525	188.6	38.415	43.0	38.16	8.74
176.7	38.422	176.7	38.304	0	38.18	8.89
140.8	38.005	140.8	37.907	0	38.18	8.89
116.8	37.710	116.8	37.599	0	38.18	8.89
100.9	37.497	100.9	37.396	0	38.18	8.89
91.3	37.347	91.3	37.273	0	38.18	8.89
84.8	37.278	84.8	37.189	0	38.18	8.89
81.2	37.229	81.2	37.143	0	38.18	8.89
80.8	37.224	80.8	37.138	0	38.18	8.89

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qw : overflow discharge
Hb : water level in retarding basin
Vb : storage volume in retarding basin

(Q-5yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
97.1	37.446	97.1	37.347	0	37.59	3.69
122.8	37.790	122.8	37.676	0	37.59	3.69
163.9	38.282	163.9	38.163	0	37.59	3.69
213.8	38.502	185.6	38.388	28.2	37.59	3.69
260.9	38.560	192.7	38.456	68.2	37.61	3.79
278.7	38.579	195.1	38.477	83.6	37.64	4.06
297.8	38.598	197.6	38.500	100.2	37.67	4.34
315.9	38.615	199.9	38.521	116.0	37.72	4.70
332.4	38.630	201.9	38.540	130.5	37.77	5.12
346.2	38.642	203.5	38.555	142.7	37.83	5.59
356.4	38.651	204.7	38.566	151.7	37.89	6.10
362.7	38.656	205.5	38.573	157.2	37.96	6.65
364.6	38.658	205.7	38.575	158.9	38.02	7.21
362.4	38.658	205.4	38.573	157.0	38.07	7.79
356.1	38.650	204.7	38.566	151.4	38.13	8.35
346.5	38.642	203.6	38.555	142.9	38.18	8.90
331.6	38.629	201.8	38.539	129.8	38.22	9.41
310.9	38.610	199.2	38.515	111.7	38.27	9.88
287.4	38.586	196.3	38.487	91.1	38.31	10.28
263.9	38.563	193.1	38.458	70.8	38.34	10.61
207.1	38.492	184.4	38.378	22.7	38.36	10.86
157.9	38.267	162.7	38.149	- 4.8	38.37	10.95
127.2	37.905	131.7	37.790	- 6.5	38.37	10.93
107.7	37.642	111.9	37.536	- 4.2	38.36	10.91
96.6	37.490	100.5	37.391	- 3.9	38.35	10.90
90.9	37.410	94.6	37.315	- 3.7	38.36	10.88
89.7	37.391	93.2	37.297	- 3.5	38.36	10.87

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qw : overflow discharge
Hb : water level in retarding basin
Vb : storage volume in retarding basin

(Q-10yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
106.5	37.572	106.5	37.467	0	37.59	3.69
135.5	37.957	135.5	37.839	0	37.59	3.69
178.3	38.433	177.8	38.316	0.5	37.59	3.69
230.3	38.524	188.3	38.413	42.0	37.59	3.69
267.9	38.567	193.7	38.463	74.2	37.61	3.85
289.3	38.590	196.5	38.490	92.8	37.64	4.11
311.6	38.611	199.3	38.516	112.3	37.69	4.45
332.2	38.630	201.9	38.539	130.3	37.74	4.85
350.3	38.646	204.0	38.560	146.3	37.79	5.32
365.6	38.658	205.8	38.576	159.8	37.86	5.85
377.3	38.668	207.2	38.589	170.1	37.93	6.42
385.2	38.674	208.1	38.579	177.1	38.00	7.03
388.5	38.677	208.4	38.601	180.1	38.06	7.07
386.9	38.676	208.3	38.599	178.6	38.12	8.32
380.7	38.671	207.6	38.592	173.1	38.18	8.96
370.6	38.663	206.4	38.582	164.2	38.24	9.59
356.2	38.651	204.7	38.566	151.5	38.30	10.18
336.3	38.633	202.3	38.546	134.0	38.35	10.72
312.0	38.611	199.4	38.516	112.6	38.39	11.20
286.5	38.587	196.1	38.486	90.4	38.42	11.61
262.0	38.564	193.5	38.457	68.5	38.45	11.94
200.3	38.523	189.7	38.426	10.8	38.47	12.18
153.0	38.496	185.7	38.389	-32.7	38.47	12.22
124.3	38.362	171.3	38.245	-47.0	38.46	12.10
106.9	38.076	145.4	37.959	-38.5	38.45	11.93
98.2	37.888	130.2	37.772	-32.0	38.44	11.79
95.9	37.790	123.0	37.678	-27.1	38.43	11.68

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qw : overflow discharge
Hb : water level in retarding basin
Vb : storage volume in retarding basin

Table 4.3.4 FLOOD ROUTING IN THE WIDAS RETARDING BASIN (3/7)

(Q-25yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{d/s}$ (m)	qw (m^3/s)	Wb (m)	Vb ($x10^6m^3$)
151.4	38.144	151.4	38.025	0	37.59	3.69
195.8	38.473	182.3	38.358	13.5	37.59	3.69
249.6	38.547	191.1	38.440	58.5	37.60	3.74
275.7	38.576	194.7	38.473	81.0	37.62	3.93
300.9	38.601	198.0	38.503	102.9	37.66	4.24
325.8	38.624	201.1	38.532	124.7	37.71	4.61
348.1	38.644	203.8	38.557	144.3	37.76	5.08
367.7	38.650	206.0	38.578	161.7	37.83	5.58
384.3	38.674	208.0	38.596	176.3	37.90	6.16
397.3	38.684	209.4	38.610	187.9	37.98	6.80
406.3	38.691	210.5	38.619	195.8	38.04	7.47
410.3	38.694	210.9	38.624	199.1	38.11	8.18
410.1	38.694	210.9	38.623	199.2	38.18	8.90
405.0	38.690	210.3	38.618	194.7	38.24	9.61
393.0	38.682	209.2	38.608	183.8	38.31	10.32
381.3	38.671	207.6	38.593	173.7	38.37	10.98
362.5	38.656	205.4	38.573	157.1	38.42	11.61
338.1	38.635	202.6	38.546	135.5	38.47	12.18
311.1	38.616	200.6	38.527	110.5	38.50	12.66
284.4	38.610	200.6	38.528	83.8	38.55	13.06
259.5	38.611	201.1	38.532	58.4	38.56	13.38
192.4	38.601	199.5	38.517	- 7.1	38.57	13.57
148.6	38.569	197.2	38.497	-48.6	38.57	13.55
122.8	38.571	194.5	38.471	-71.7	38.55	13.37
108.7	38.547	191.1	38.439	-82.4	38.54	13.11
103.5	38.519	187.2	38.403	-83.7	38.52	12.82
107.0	38.430	177.5	38.313	-70.5	38.49	12.52
117.9	38.387	173.6	38.270	-55.7	38.47	12.26
133.2	38.435	178.2	38.319	-45.0	38.46	12.06
148.3	38.466	181.6	38.351	-33.3	38.45	11.90
161.3	38.471	182.7	38.361	-21.4	38.44	11.78
171.0	38.477	183.5	38.368	-12.5	38.43	11.70
176.6	38.480	184.0	38.373	- 7.4	38.43	11.66
177.2	38.480	183.9	38.372	- 6.7	38.43	11.63
172.4	38.473	183.0	38.364	-10.6	38.42	11.61
163.0	38.457	180.9	38.343	-17.9	38.42	11.57
153.0	38.382	173.4	38.268	-20.4	38.42	11.51
144.5	38.262	162.4	38.146	-17.9	38.41	11.43
135.7	38.142	151.5	38.026	-15.8	38.41	11.37
125.8	38.011	140.0	37.896	-14.2	38.40	11.31
115.6	37.858	128.1	37.745	-12.5	38.40	11.26
105.9	37.710	117.0	37.602	-11.1	38.39	11.21
97.4	37.581	107.4	37.479	-10.0	38.39	11.17
89.8	37.465	98.8	37.369	- 9.0	38.38	11.14
83.0	37.361	91.2	37.271	- 8.2	38.38	11.11
77.3	37.274	84.8	37.189	- 7.5	38.38	11.08
73.1	37.208	80.0	37.127	- 6.9	38.38	11.05
71.4	37.178	77.7	37.098	- 6.3	38.37	11.03
73.8	37.204	79.6	37.123	- 5.8	38.37	11.00
81.3	37.302	86.7	37.214	- 5.4	38.37	10.98
93.5	37.463	98.6	37.366	- 5.1	38.37	10.96
108.5	37.660	113.2	37.556	- 4.7	38.37	10.94
122.8	37.847	127.2	37.733	- 4.4	38.37	10.93
132.6	37.972	136.8	37.855	- 4.2	38.36	10.91

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qw : overflow discharge
Wb : water level in retarding basin
Vb : storage volume in retarding basin

Table 4.3.4 FLOOD ROUTING IN THE ULO RETARDING BASIN (4/7)

(Q-2yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qv (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
192.1	44.352	192.1	44.028	0	43.00	0
282.4	44.882	257.0	44.530	25.6	43.00	0
340.4	44.978	270.7	44.621	69.7	43.04	0.09
370.3	45.022	277.0	44.662	93.3	43.16	0.34
375.6	45.029	278.0	44.669	97.6	43.31	0.68
355.8	45.001	274.0	44.642	81.8	43.48	1.03
315.5	44.939	265.2	44.584	50.3	43.61	1.33
265.2	44.847	251.9	44.497	13.3	43.66	1.53
214.9	44.555	214.9	44.212	0	43.67	1.55
171.7	44.165	171.7	43.863	0	43.67	1.55
137.3	43.840	137.3	43.586	0	43.67	1.55
111.5	43.568	111.5	43.378	0	43.67	1.55
93.5	43.407	93.5	43.233	0	43.67	1.55
80.2	43.271	80.2	43.125	0	43.67	1.55

(Q-5yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qv (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
133.9	43.807	133.9	43.559	0	43.00	0
254.5	44.822	248.4	44.424	6.1	43.00	0
366.5	45.016	276.2	44.657	90.3	43.01	0.02
436.7	45.111	289.6	44.765	147.1	43.16	0.35
468.6	45.151	295.3	44.782	173.3	43.40	0.88
467.6	45.150	295.1	44.781	172.5	43.65	1.50
435.8	45.110	289.4	44.744	146.4	43.82	2.12
380.7	45.036	279.0	44.675	101.7	43.96	2.65
315.5	44.939	265.2	44.584	50.3	44.04	3.01
251.9	44.815	247.4	44.467	4.5	44.07	3.20
197.2	44.397	197.2	44.069	0	44.07	3.21
154.4	44.003	154.4	43.724	0	44.07	3.21
122.7	43.698	122.7	43.460	0	44.07	3.21
101.2	43.485	101.2	43.295	0	44.07	3.21
84.1	43.332	85.1	43.175	0	44.07	3.21

(Q-10yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qv (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
161.2	44.067	161.2	43.779	0	43.00	0
304.6	44.921	262.6	44.567	42.0	43.00	0
434.8	45.109	289.3	44.763	145.5	43.07	0.15
515.1	45.207	303.2	44.836	211.9	43.31	0.68
547.4	45.245	308.4	44.869	239.0	43.64	1.44
539.8	45.236	307.2	44.860	232.6	43.87	2.30
497.1	45.186	300.1	44.814	197.0	44.06	3.14
430.4	45.103	288.5	44.737	141.9	44.19	3.84
354.2	44.999	273.7	44.640	80.5	44.28	4.36
281.2	44.879	256.6	44.528	24.6	44.34	4.65
218.8	44.589	218.8	44.243	0	44.35	4.73
169.8	44.147	169.8	43.848	0	44.35	4.73
134.1	43.809	134.1	43.560	0	44.35	4.73
109.1	43.564	109.1	43.359	0	44.35	4.73
92.2	43.394	92.2	43.222	0	44.35	4.73

(Q-25yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qv (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
186.5	44.300	186.5	43.983	0	43.00	0
352.8	44.997	273.4	44.638	79.4	43.00	0
494.9	45.183	299.8	44.812	195.1	43.13	0.29
570.0	45.271	312.0	44.892	258.0	43.46	0.29
590.7	45.295	315.3	44.914	278.4	43.76	1.92
584.1	45.287	314.2	44.907	269.9	44.02	2.91
554.0	45.253	309.5	44.875	244.5	44.20	3.86
498.1	45.187	300.3	44.815	197.8	44.36	4.76
424.8	45.096	287.4	44.731	137.4	44.47	5.47
348.3	44.990	272.4	44.633	75.9	44.54	5.97
278.8	44.881	258.6	44.542	20.2	44.58	6.24
219.5	44.683	232.3	44.352	-12.8	44.59	6.31
173.1	44.269	184.6	43.968	-11.5	44.58	6.27
138.6	43.937	149.1	43.681	-10.5	44.57	6.22
113.6	43.697	123.2	43.472	-9.6	44.57	6.19

(Q-2yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qv (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
192.1	43.951	192.1	43.640	0	43.00	0
282.6	44.716	282.6	44.369	0	43.00	0
340.4	44.891	309.5	44.546	30.9	43.00	0
370.3	44.938	317.3	44.593	53.0	43.03	0.11
375.6	44.946	318.7	44.601	56.9	43.14	0.30
355.8	44.916	313.6	44.571	42.2	43.23	0.51
315.6	44.845	302.3	44.499	13.3	43.30	0.66
265.2	44.580	265.2	44.234	0	43.33	0.71
214.9	44.151	214.9	43.875	0	43.33	0.71
171.7	43.768	171.7	43.474	0	43.33	0.71
137.3	43.449	137.3	43.194	0	43.33	0.71
111.5	43.200	111.5	42.985	0	43.33	0.71
93.5	43.021	93.5	42.838	0	43.33	0.71
80.2	42.885	80.2	42.720	0	43.33	0.71

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qv : overflow discharge
Hb : water level in retarding basin
Vb : storage volume in retarding basin

(Q-5yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qv (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
133.9	43.416	133.9	43.167	0	43.00	0
234.6	44.491	234.6	44.148	0	43.00	0
366.4	44.932	316.4	44.587	50.0	43.00	0
435.8	45.029	332.7	44.685	104.1	43.08	0.18
468.6	45.068	339.4	44.725	129.2	43.26	0.55
467.6	45.067	339.2	44.724	128.4	43.47	1.02
435.8	45.027	332.5	44.684	103.3	43.65	1.48
380.7	44.953	319.9	44.608	60.8	43.75	1.85
315.6	44.865	302.2	44.499	13.3	43.81	2.07
251.9	44.468	251.9	44.126	0	43.82	2.12
197.2	43.996	197.2	43.681	0	43.82	2.12
154.4	43.609	154.4	43.333	0	43.82	2.12
122.7	43.309	122.7	43.076	0	43.82	2.12
101.2	43.098	101.2	42.901	0	43.82	2.12
84.1	42.966	84.1	42.778	0	43.82	2.12

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qv : overflow discharge
Hb : water level in retarding basin
Vb : storage volume in retarding basin

Table 4.3.4 FLOOD ROUTING IN THE ULO RETARDING BASIN (5/7)

(Q-10yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($x10^6m^3$)
161.2	43.672	161.1	43.389	0	43.00	0
304.6	44.821	298.5	44.474	6.1	43.00	0
434.8	45.026	332.2	44.683	102.6	43.01	0.02
515.1	45.122	349.0	44.780	166.1	43.18	0.39
547.4	45.158	355.5	44.816	191.9	43.46	0.99
539.8	45.150	354.0	44.808	185.8	43.70	1.68
497.1	45.101	345.3	44.759	142.8	43.88	2.35
430.5	45.020	331.3	44.677	99.2	44.02	2.89
354.1	44.913	313.2	44.568	40.9	44.08	3.25
281.2	44.706	281.2	44.360	0	44.11	3.40
218.8	44.185	218.8	43.857	0	44.11	3.40
169.8	43.751	169.8	43.459	0	44.11	3.40
134.1	43.418	134.1	43.168	0	44.11	3.40
109.1	43.176	109.1	42.965	0	44.11	3.40
92.2	43.005	92.2	42.828	0	44.11	3.40

(Q-25yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($x10^6m^3$)
186.5	43.901	186.5	43.394	0	43.00	0
352.7	44.911	312.8	44.566	39.9	43.00	0
494.9	45.099	344.8	44.757	150.1	43.07	0.14
570.0	45.182	360.0	44.841	210.0	43.32	0.68
590.7	45.204	364.0	44.863	226.7	43.64	1.44
584.1	45.197	362.7	44.856	221.4	43.85	2.26
553.9	45.165	356.8	44.823	197.1	44.05	3.05
498.1	45.102	345.5	44.760	152.6	44.18	3.76
424.8	45.013	330.1	44.669	94.7	44.27	4.31
348.2	44.904	311.6	44.559	36.6	44.34	4.65
278.6	44.689	278.6	44.343	0	44.36	4.78
219.6	44.192	219.6	43.864	0	44.36	4.78
173.1	43.781	173.1	43.486	0	44.36	4.78
138.6	43.461	138.6	43.205	0	44.36	4.78
113.4	43.220	113.4	43.007	0	44.36	4.78

Table 4.3.4 FLOOD ROUTING IN THE KEDUNGSOKO RETARDING BASIN (6/7)

(Q-1.03yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($x10^6m^3$)
114.2	44.455	114.2	44.269	0	43.85	0.99
164.3	44.732	139.5	44.547	26.8	43.85	0.99
206.4	44.794	145.8	44.609	60.6	43.87	1.10
217.0	44.809	147.4	44.623	69.6	43.93	1.31
189.4	44.770	143.2	44.584	46.2	43.99	1.57
146.2	44.693	135.8	44.508	10.4	44.03	1.73
111.1	44.418	111.1	44.232	0	44.03	1.77
88.1	44.101	88.1	43.926	0	44.03	1.77
73.2	43.878	73.2	43.720	0	44.03	1.77
62.6	43.712	62.6	43.572	0	44.03	1.77
53.5	43.572	53.5	43.449	0	44.03	1.77
46.4	43.459	46.4	43.352	0	44.03	1.77

(Q-2yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($x10^6m^3$)
148.6	44.599	136.3	44.513	12.3	43.85	0.99
216.9	44.809	147.3	44.623	69.6	43.86	1.05
269.2	44.875	154.5	44.691	114.7	43.92	1.30
283.0	44.892	156.2	44.707	126.8	44.02	1.71
247.0	44.848	151.5	44.663	95.5	44.11	2.16
190.7	44.771	143.4	44.586	47.3	44.18	2.51
144.9	44.690	135.5	44.505	9.4	44.21	2.68
114.9	44.463	114.9	44.278	0	44.22	2.71
95.5	44.210	95.5	44.027	0	44.22	2.71
81.4	44.001	81.4	43.833	0	44.22	2.71
69.8	43.826	69.8	43.674	0	44.22	2.71
60.5	43.682	60.5	43.546	0	44.22	2.71

(Q-5yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($x10^6m^3$)
195.0	44.778	144.1	44.592	50.9	43.85	0.99
280.2	44.889	155.9	44.704	124.3	43.90	1.18
341.3	44.958	163.4	44.775	177.9	44.01	1.63
351.0	44.968	164.6	44.786	186.4	44.13	2.27
298.6	44.910	158.2	44.726	140.4	44.26	2.94
224.1	44.819	148.4	44.633	75.7	44.34	3.45
166.7	44.733	139.5	44.547	27.2	44.39	3.72
130.3	44.634	130.3	44.450	0	44.40	3.82
107.3	44.372	107.3	44.187	0	44.40	3.82
90.8	44.141	90.8	43.963	0	44.40	3.82
77.5	43.943	77.5	43.780	0	44.40	3.82
66.8	43.780	66.8	43.632	0	44.40	3.82

Legend :

- $Q_{u/s}$: discharge upstream of side overflow dike
- $H_{u/s}$: water level upstream of side overflow dike
- $Q_{d/s}$: discharge downstream of side overflow dike
- $H_{d/s}$: water level downstream of side overflow dike
- qw : overflow discharge
- Hb : water level in retarding basin
- Vb : storage volume in retarding basin

(Q-10yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($x10^6m^3$)
127.9	44.610	127.9	44.425	0	43.85	0.99
230.5	44.827	149.3	44.643	81.2	43.85	0.99
326.9	44.942	161.6	44.759	165.3	43.92	1.29
392.3	45.012	169.7	44.830	222.6	44.06	1.89
398.2	45.018	170.5	44.836	227.7	44.21	2.69
333.8	44.950	162.5	44.767	171.3	44.35	3.51
246.8	44.848	151.5	44.663	95.3	44.45	4.13
181.6	44.757	141.9	44.572	39.7	44.50	4.47
140.6	44.663	135.1	44.501	5.5	44.52	4.61
115.1	44.494	117.8	44.312	- 2.7	44.52	4.63
97.0	44.266	99.6	44.083	- 2.6	44.52	4.63
82.6	44.032	85.0	43.883	- 2.4	44.52	4.61
71.1	43.877	73.4	43.723	- 2.3	44.51	4.60

Legend :

- $Q_{u/s}$: discharge upstream of side overflow dike
- $H_{u/s}$: water level upstream of side overflow dike
- $Q_{d/s}$: discharge downstream of side overflow dike
- $H_{d/s}$: water level downstream of side overflow dike
- qw : overflow discharge
- Hb : water level in retarding basin
- Vb : storage volume in retarding basin

Table 4.3.4 FLOOD ROUTING IN THE KEDUNGSOKO RETARDING BASIN (7/7)

(Q-25yr & River 10-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
132.4	44.704	137.0	44.521	15.4	43.85	0.99
274.3	44.892	155.1	44.697	119.2	43.86	1.06
384.4	45.004	168.8	44.822	215.6	43.97	1.48
455.3	45.077	177.2	44.895	278.1	44.13	2.26
455.2	45.076	177.2	44.895	278.0	44.31	3.26
374.8	44.994	167.6	44.811	207.2	44.47	4.26
272.0	44.879	154.8	44.694	117.2	44.57	5.01
197.1	44.787	146.9	44.619	50.2	44.63	5.43
151.2	44.740	144.2	44.593	7.0	44.65	5.61
123.0	44.713	141.6	44.569	-18.6	44.66	5.64
103.5	44.687	138.4	44.535	-34.9	44.65	5.57
87.9	44.556	125.0	44.395	-37.1	44.63	5.44
75.5	44.307	103.9	44.143	-28.4	44.61	5.31
65.7	44.086	88.4	43.929	-22.7	44.60	5.21
57.9	43.903	76.3	43.763	-18.4	44.59	5.13
51.5	43.760	66.8	43.632	-15.3	44.58	5.06
46.1	43.641	59.1	43.526	-13.0	44.57	5.01
41.5	43.541	52.7	43.438	-11.2	44.57	4.96
37.6	43.457	47.3	43.364	- 9.7	44.56	4.92
34.3	43.387	42.9	43.303	- 8.6	44.55	4.88
31.6	43.329	39.3	43.253	- 7.7	44.55	4.85
29.4	43.281	36.3	43.212	- 6.9	44.55	4.83
27.6	43.239	33.8	43.175	- 6.2	44.54	4.80
28.7	43.252	34.3	43.186	- 5.6	44.54	4.78
39.2	43.416	44.4	43.324	- 5.2	44.54	4.77

(Q-2yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
148.8	44.646	148.8	44.461	0	43.85	0
216.9	44.779	163.2	44.599	53.7	43.85	0
269.2	44.845	171.3	44.670	97.9	43.96	1.19
283.0	44.861	173.3	44.687	109.7	43.99	1.55
247.1	44.818	168.0	44.641	79.1	44.07	1.94
190.7	44.740	158.7	44.558	32.0	44.13	2.23
144.8	44.607	144.8	44.422	0	44.15	2.34
114.9	44.278	114.9	44.093	0	44.15	2.34
95.5	44.023	95.5	43.852	0	44.15	2.34
81.4	43.832	81.4	43.676	0	44.15	2.34
69.8	43.672	69.8	43.532	0	44.15	2.34
60.5	43.540	60.5	43.416	0	44.15	2.34

(Q-10yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
128.0	44.631	128.0	44.245	0	43.85	0.99
230.6	44.797	165.4	44.618	65.2	43.85	0.99
326.9	44.908	179.3	44.741	147.6	43.91	1.23
392.4	44.975	188.2	44.816	204.2	44.03	1.77
388.2	44.981	189.0	44.822	209.2	44.18	2.50
333.8	44.916	180.2	44.749	153.6	44.31	3.25
246.9	44.818	168.0	44.640	78.9	44.40	3.81
181.6	44.725	157.1	44.542	24.5	44.44	4.09
140.6	44.566	140.6	44.381	0	44.45	4.18
115.1	44.280	115.1	44.095	0	44.45	4.18
97.0	44.043	97.0	43.870	0	44.45	4.18
82.6	43.849	82.6	43.691	0	44.45	4.18
71.1	43.690	71.1	43.548	0	44.45	4.18

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qw : overflow discharge
Hb : water level in retarding basin
Vb : storage volume in retarding basin

(Q-1.05yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
114.2	44.269	114.2	44.084	0	43.85	0
166.3	44.697	154.1	44.513	12.2	43.85	0.99
206.4	44.764	161.5	44.583	44.9	43.86	1.04
217.0	44.779	163.3	44.599	53.7	43.90	1.21
189.4	44.738	158.5	44.556	30.9	43.95	1.40
146.1	44.620	146.1	44.435	0	43.98	1.51
111.1	44.229	111.1	44.045	0	43.98	1.51
88.1	43.923	88.1	43.760	0	43.98	1.51
73.2	43.567	73.2	43.440	0	43.98	1.51
62.4	43.567	62.4	43.440	0	43.98	1.51
53.5	43.440	53.5	43.329	0	43.98	1.51
46.4	43.337	46.4	43.241	0	43.98	1.51

(Q-5yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
194.9	44.747	159.5	44.565	35.4	43.85	0.99
280.2	44.857	172.9	44.684	107.3	43.85	1.13
341.3	44.923	181.2	44.758	160.1	43.98	1.51
351.0	44.933	182.5	44.769	168.5	44.10	2.09
298.7	44.878	175.5	44.707	123.2	44.22	2.70
224.1	44.789	164.4	44.609	59.7	44.29	3.14
146.7	44.698	134.2	44.514	12.5	44.33	3.36
130.4	44.457	130.4	44.271	0	44.33	3.40
107.3	44.179	107.3	43.998	0	44.33	3.40
90.8	43.960	50.8	43.793	0	44.33	3.40
77.5	43.779	77.5	43.628	0	44.33	3.40
66.8	43.630	66.8	43.495	0	44.33	3.40

(Q-25yr & River 25-yr)

$Q_{u/s}$ (m^3/s)	$H_{u/s}$ (m)	$Q_{d/s}$ (m^3/s)	$H_{u/s}$ (m)	qw (m^3/s)	Hb (m)	Vb ($\times 10^6 m^3$)
132.4	44.664	130.6	44.479	1.8	43.85	0.99
274.3	44.851	172.0	44.676	102.3	43.85	1.01
384.5	44.967	187.2	44.807	197.3	43.94	1.37
455.3	45.035	196.4	44.884	258.7	44.10	2.09
455.2	45.035	196.5	44.886	258.7	44.27	3.02
374.8	44.957	185.8	44.796	189.0	44.42	3.95
272.1	44.848	171.7	44.674	100.4	44.52	4.63
197.3	44.752	160.5	44.574	36.7	44.57	4.99
151.1	44.691	155.2	44.524	- 4.1	44.59	5.17
123.0	44.551	140.6	44.379	-17.6	44.59	5.11
103.6	44.306	118.1	44.133	-14.5	44.58	5.04
88.0	44.077	100.4	43.913	-12.4	44.57	4.99
75.5	43.886	86.2	43.736	-10.7	44.56	4.95
65.7	43.733	75.1	43.598	- 9.4	44.56	4.91
57.9	43.609	66.2	43.488	- 8.3	44.55	4.87
51.5	43.507	58.9	43.397	- 7.4	44.55	4.84
46.1	43.419	52.8	43.320	- 6.7	44.55	4.82
41.5	43.343	47.5	43.235	- 6.0	44.54	4.79
37.6	43.279	43.1	43.200	- 5.5	44.54	4.77
34.3	43.224	39.3	43.153	- 5.0	44.54	4.75
31.6	43.179	36.2	43.115	- 4.6	44.53	4.73
29.4	43.141	33.7	43.083	- 4.3	44.53	4.72
27.4	43.107	31.4	43.034	- 4.0	44.53	4.70
28.7	43.123	32.4	43.067	- 3.7	44.53	4.69
39.2	43.275	42.4	43.194	- 3.6	44.52	4.67
64.1	43.631	67.3	43.501	- 3.2	44.52	4.66
92.5	44.019	95.5	43.852	- 3.0	44.52	4.65

Legend :

$Q_{u/s}$: discharge upstream of side overflow dike
$H_{u/s}$: water level upstream of side overflow dike
$Q_{d/s}$: discharge downstream of side overflow dike
$H_{d/s}$: water level downstream of side overflow dike
qw : overflow discharge
Hb : water level in retarding basin
Vb : storage volume in retarding basin

Table 4.3.5 FLOOD PEAK REDUCTION AND ITS VOLUME

Widas Retarding Basin

River Cross-section	Return Period of Flood (Year)	Peak Discharge Before reduction (m^3/s)	Peak Discharge After reduction (m^3/s)	Volume ($x10^6m^3$)
10-yr plan	10	375	207	7.86
	5	358	205	6.97
	2	324	201	5.07
	1.05	245	191	1.85
25-yr plan	25	410	211	9.88
	10	389	208	8.53
	5	365	206	7.26
	2	327	201	5.20

Ulo Retarding Basin

River Cross-section	Return Period of Flood (Year)	Peak Discharge Before reduction (m^3/s)	Peak Discharge After reduction (m^3/s)	Volume ($x10^6m^3$)
10-yr plan	10	547	308	4.73
	5	469	295	3.21
	2	376	278	1.55
25-yr plan	25	591	364	4.78
	10	547	356	3.39
	5	469	339	2.12
	2	376	319	0.71

Kedungsoko Retarding basin

River Cross-section	Return Period of Flood (Year	Peak Discharge Before reduction (m^3/s)	Peak Discharge After reduction (m^3/s)	Volume ($X10^6m^3$)
10-yr plan	10	398	171	3.63
	5	351	165	2.82
	2	283	156	1.71
	1.05	217	147	0.77
25-yr plan	25	455	197	4.12
	10	398	189	3.18
	5	351	183	2.40
	2	283	173	1.34
	1.05	217	163	0.51

Table 4.3.6 MAXIMUM WATER LEVEL, INUNDATION AREA AND STORAGE VOLUME IN RETARDING BASIN (Cross-section for 10-year probable flood) (1/2)

Return Period (Year)	Retarding Basin								
	Widas			U l o			Kedungsoko		
	Hb (m)	Vb ($x10^6m^3$)	A (km^2)	Hb (m)	Vb ($x10^6m^3$)	A (km^2)	Hb (m)	Vb ($x10^6m^3$)	A (km^2)
1.05	37.82	5.54	9.15	-	-	-	44.03	1.77	3.35
2	38.46	8.76	11.15	43.67	1.55	4.20	44.22	2.71	4.25
5	38.34	10.66	12.08	44.07	3.21	5.75	44.40	3.82	5.30
10	38.42	11.55	12.45	44.35	4.73	6.25	44.52	4.63	6.05

Legend :

Hb : maximum water level in retarding basin
Vb : maximum storage volume in retarding basin
A : maximum inundation area

Table 4.3.6 MAXIMUM WATER LEVEL, INUNDATION AREA AND STORAGE VOLUME IN RETARDING BASIN (Cross-section for 25-year probable flood) (2/2)

Return Period (Year)	Retarding Basin								
	Widas			U l o			Kedungsoko		
	Hb (m)	Vb ($x10^6m^3$)	A (km^2)	Hb (m)	Vb ($x10^6m^3$)	A (km^2)	Hb (m)	Vb ($x10^6m^3$)	A (km^2)
1.05	-	-	-	-	-	-	43.98	1.51	3.20
2	38.18	8.89	11.25	43.33	0.71	2.20	44.15	2.34	3.90
5	38.37	10.95	12.25	43.82	2.12	4.90	44.33	3.40	4.85
10	38.47	12.22	12.70	44.11	3.40	5.80	44.45	4.18	5.60
25	38.57	13.57	13.20	44.36	4.78	6.30	44.59	5.12	6.50

Legend :

Hb : maximum water level in retarding basin
Vb : maximum storage volume in retarding basin
A : maximum inundation area

Table 4.3.7 STAGE DISCHARGE RELATION IN K. BRANTAS USED FOR STUDY ON DRAINAGE SLUICE OF WIDAS RETARDING BASIN (1/3)

Elevation (m)	Q (m^3/s)
34.00	100.00
34.55	200.00
35.26	400.00
35.83	600.00
36.30	800.00
36.72	1000.00
37.10	1200.00
37.45	1400.00
37.59	1500.00
37.60	1600.00

Table 4.3.7 STAGE DISCHARGE RELATION IN THE KEDUNGSOKO RIVER USED FOR STUDY ON DRAINAGE SLUICE OF ULO RETARDING BASIN (2/3)

Elevation (m)	Q (m^3/s)
39.50	0
40.50	31.71
41.50	101.85
42.50	202.92
43.50	332.66
43.70	361.96
44.00	419.38
44.50	536.36
45.00	674.69
45.50	831.97

Table 4.3.7 STAGE DISCHARGE RELATION IN THE KEDUNGSOKO RIVER USED FOR STUDY ON DRAINAGE SLUICE OF KEDUNGSOKO RETARDING BASIN (3/3)

Elevation (m)	Q (m^3/s)
40.75	0
41.75	15.92
42.75	52.18
43.75	106.35
43.85	112.75
43.95	120.79
44.15	139.04
44.35	159.57
44.55	182.12
44.75	206.56
44.95	232.78
45.15	260.70
45.35	290.28
45.55	321.45
45.75	354.20

Table 4.3.8 DESIGN FLOOD DISCHARGE HYDROGRAPH IN K. BRANTAS USED FOR STUDY ON DRAINAGE SLUICE OF WIDAS RETARDING BASIN (1/3)

No.	Q (m^3/s)	No.	Q (m^3/s)	No.	Q (m^3/s)
1	1198.1	25	895.2	49	895.2
2	1180.8	26	895.2	50	895.2
3	1163.1	27	895.2	51	895.2
4	1145.0	28	895.2	52	895.2
5	1126.6	29	895.2	53	895.2
6	1107.9	30	895.2	54	895.2
7	1089.1	31	895.2	55	895.2
8	1070.2	32	895.2	56	895.2
9	1051.2	33	895.2	57	895.2
10	1032.1	34	895.2	58	895.2
11	1013.1	35	895.2	59	895.2
12	994.3	36	895.2	60	895.2
13	959.0	37	895.2	61	895.2
14	895.2	38	895.2	62	895.2
15	895.2	39	895.2	63	895.2
16	895.2	40	895.2	64	895.2
17	895.2	41	895.2	65	895.2
18	895.2	42	895.2	66	895.2
19	895.2	43	895.2	67	895.2
20	895.2	44	895.2	68	895.2
21	895.2	45	895.2	69	895.2
22	895.2	46	895.2	70	895.2
23	895.2	47	895.2	71	895.2
24	895.2	48	895.2	72	895.2

Table 4.3.8 25-YEAR PROBABLE FLOOD HYDROGRAPH IN THE WIDAS RIVER AT THE CONFLUENCE WITH THE KEDUNGSOKO RIVER (2/3)

No.	Q (m^3/s)	No.	Q (m^3/s)	No.	Q (m^3/s)
1	263.0	20	203.0	39	100.7
2	224.9	21	202.2	40	133.9
3	193.0	22	180.6	41	155.5
4	163.9	23	172.5	42	161.8
5	138.3	24	150.3	43	160.3
6	115.3	25	129.0	44	157.3
7	87.2	26	112.5	45	152.1
8	86.2	27	99.9	46	144.0
9	78.7	28	89.5	47	132.0
10	73.1	29	80.6	48	121.0
11	68.8	30	73.0	49	107.0
12	65.8	31	66.5	50	92.0
13	66.1	32	61.2	51	80.0
14	73.1	33	56.4	52	70.0
15	87.9	34	52.2	53	61.0
16	109.9	35	49.0	54	54.0
17	136.4	36	48.3	55	52.0
18	165.1	37	53.6	56	51.0
19	189.9	38	70.6		

Table 4.3.8 25-YEAR PROBABLE FLOOD HYDROGRAPH IN THE KEDUNGSOKO RIVER (3/3)

No.	Q (m^3/s)	No.	Q (m^3/s)
1	151.2	24	147.4
2	123.0	25	135.0
3	103.6	26	117.4
4	88.0	27	101.0
5	75.5	28	88.5
6	65.7	29	78.4
7	57.9	30	69.5
8	51.5	31	61.6
9	46.1	32	54.7
10	41.5	33	48.8
11	36.6	34	43.8
12	34.3	35	39.6
13	31.6	36	36.1
14	29.4	37	36.9
15	27.4	38	50.3
16	28.7	39	70.7
17	39.2	40	79.1
18	64.1	41	72.9
19	92.5	42	65.1
20	114.1	43	60.8
21	134.0	44	58.1
22	149.0	45	55.2
23	152.8	46	51.3

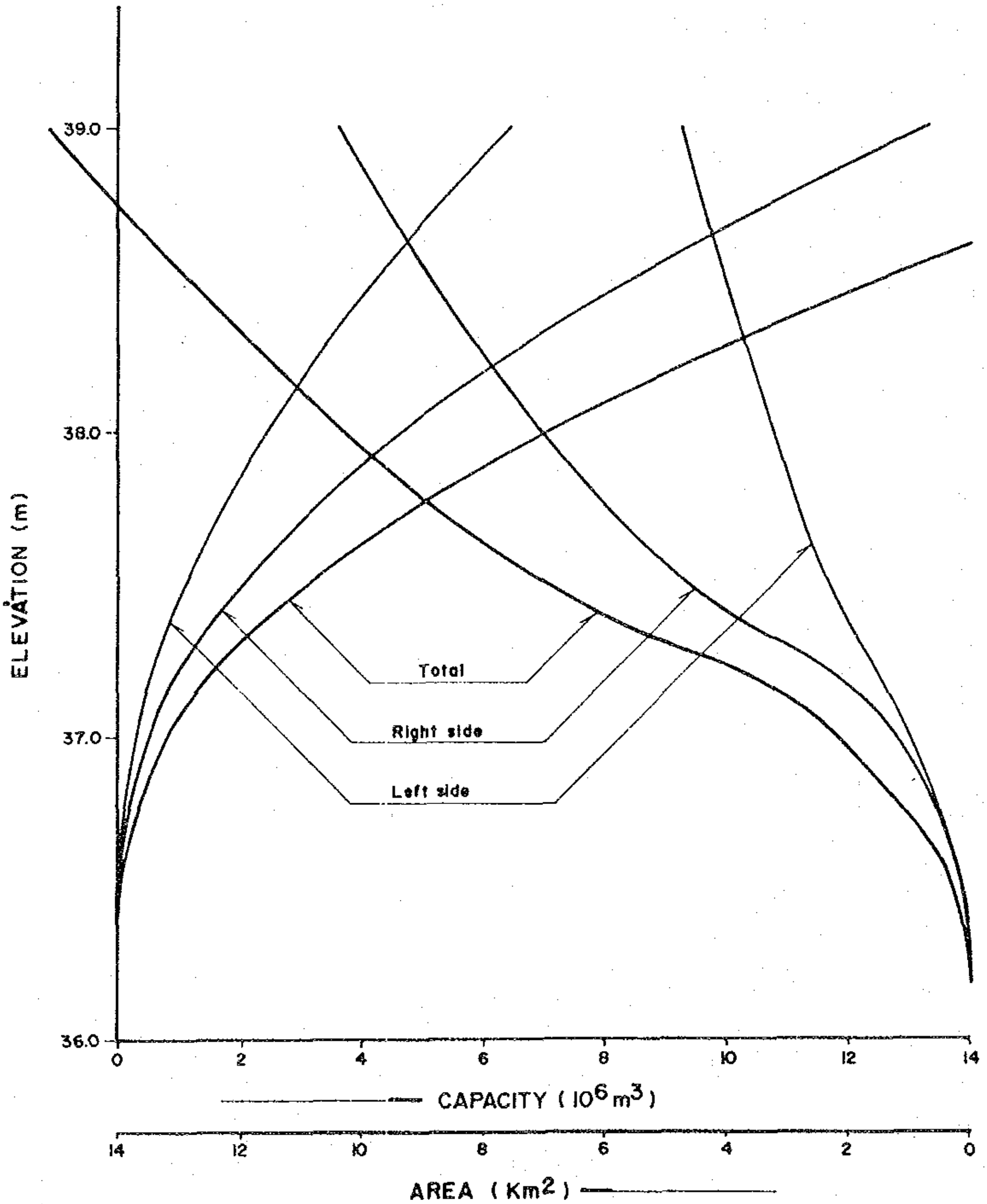


Fig. 4.3.1 STORAGE CAPACITY AND AREA OF WIDAS RETARDING BASIN (1/3)

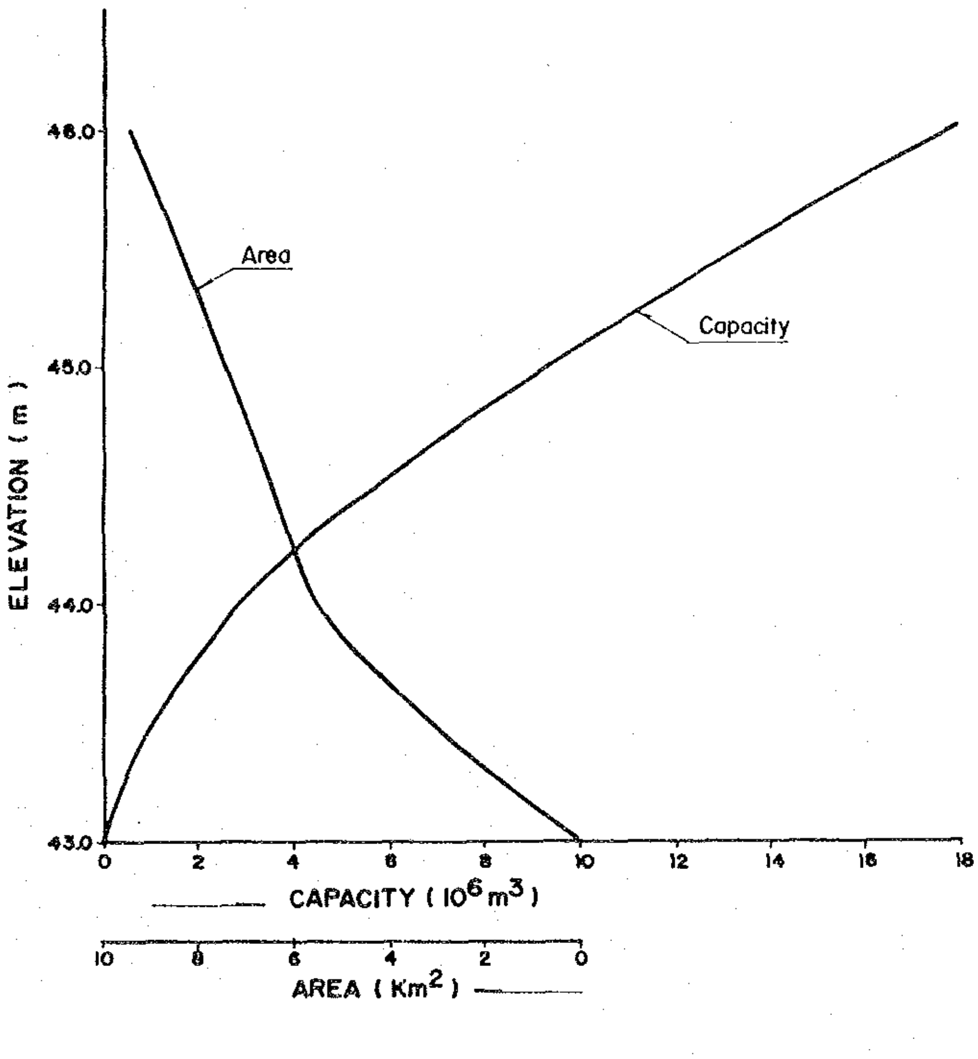


Fig. 4.3.1 STORAGE CAPACITY AND AREA OF ULO RETARDING BASIN (2/3)

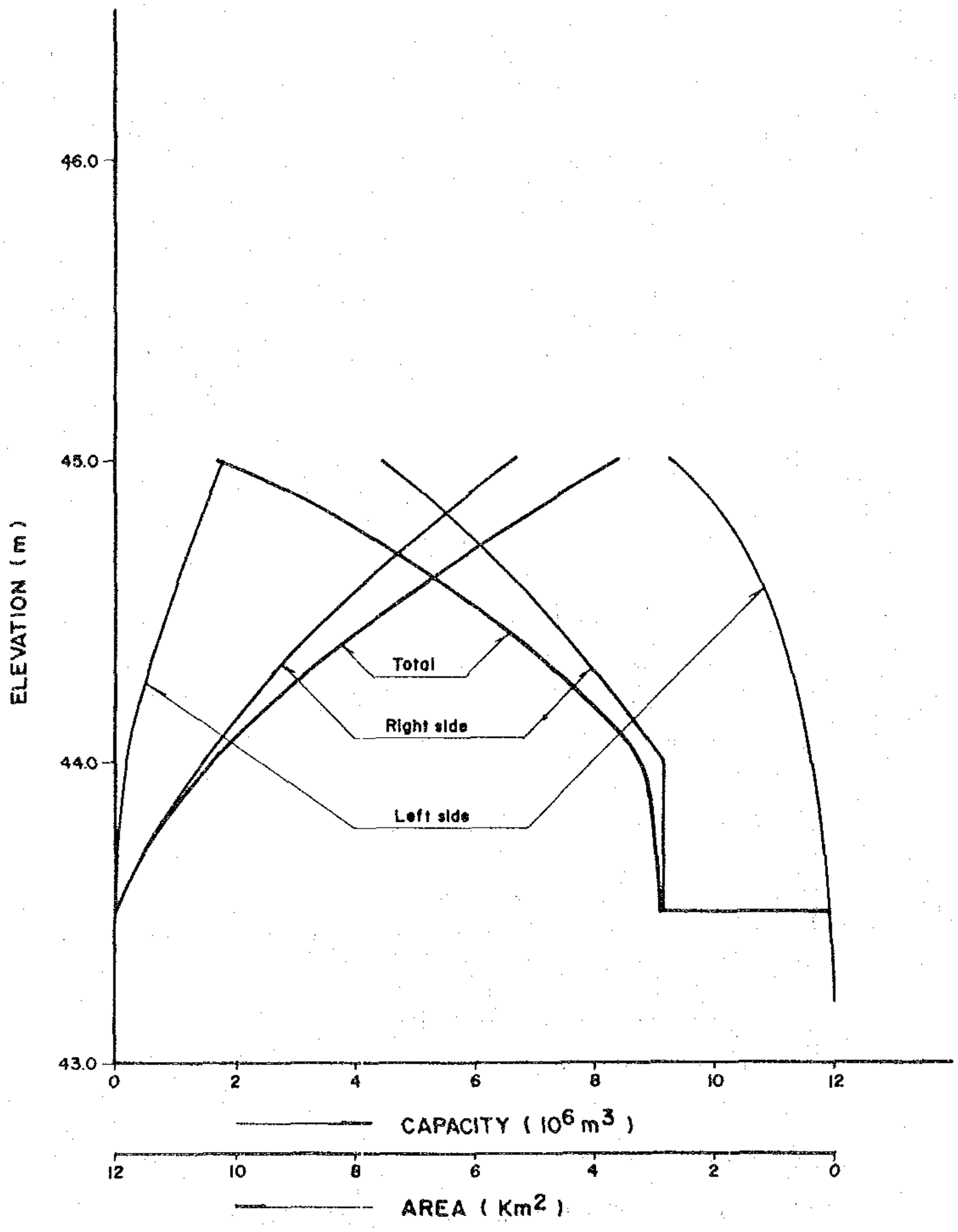


Fig. 4.3.1 STORAGE CAPACITY AND AREA OF KEDUNGSOKO RETARDING BASIN (3/3)

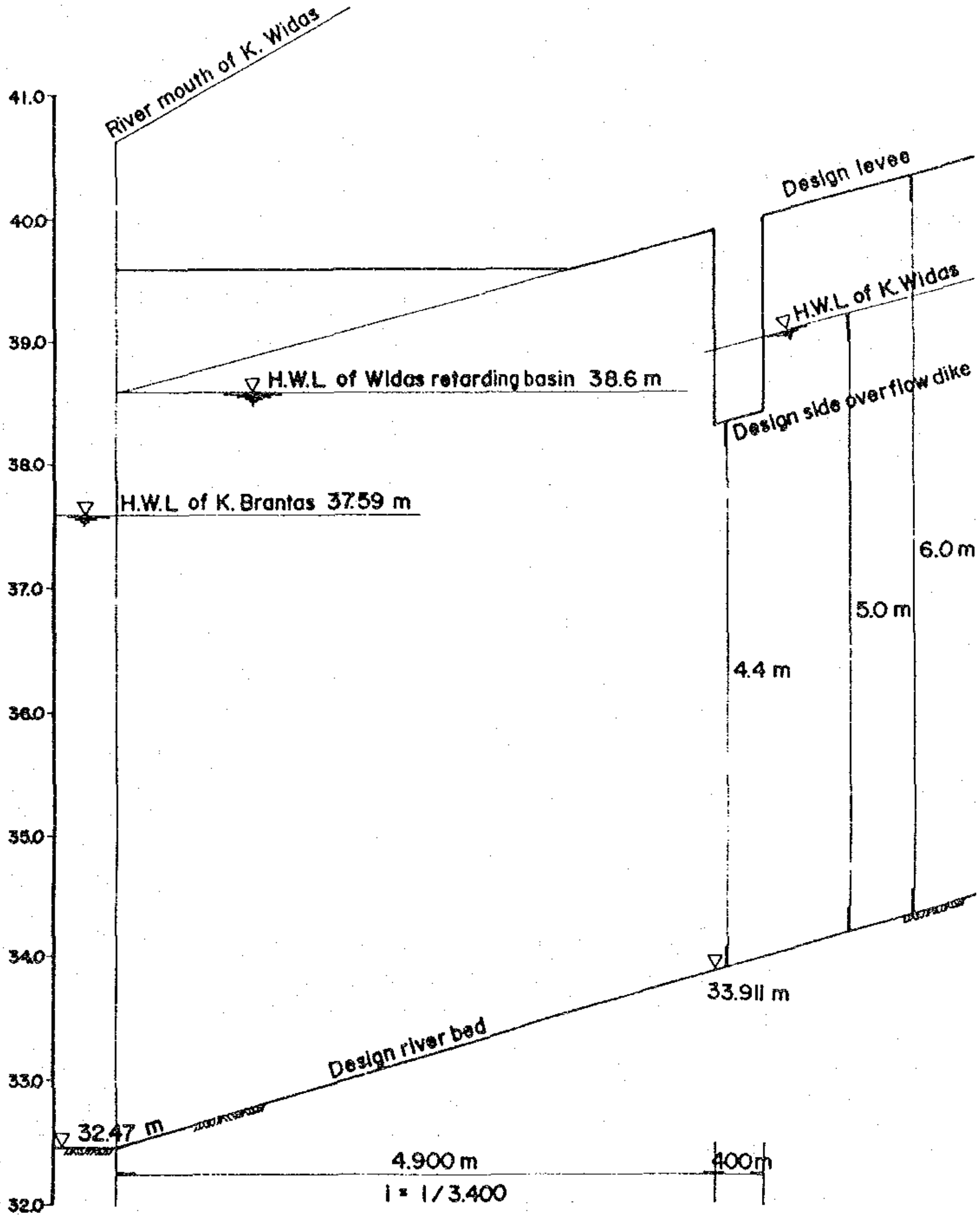


Fig. 4.3.2 LONGITUDINAL PROFILE OF WIDAS RIVER AT WIDAS RETARDING BASIN (1/3)

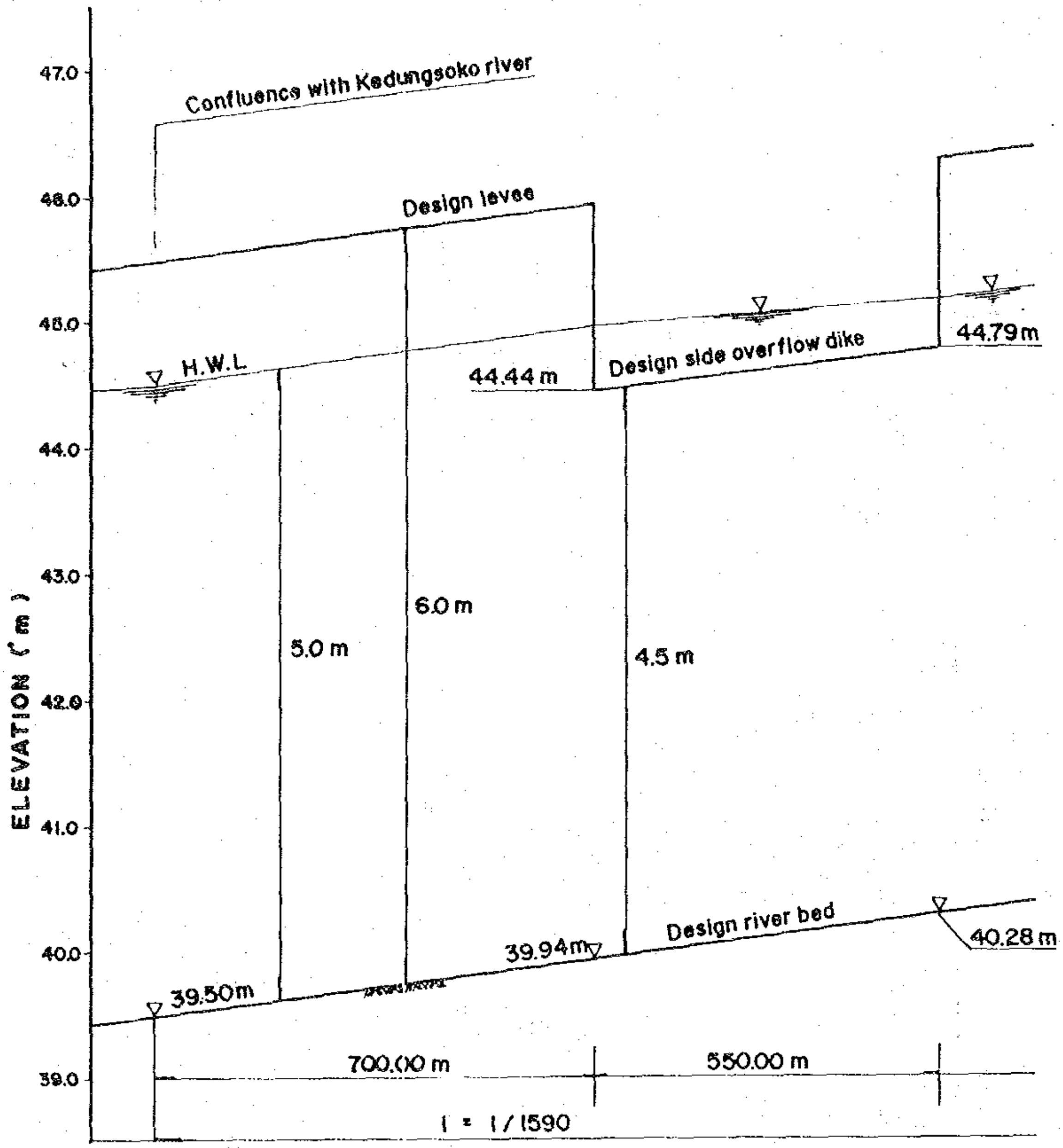


Fig. 4.3.2 LONGITUDINAL PROFILE OF WIDAS RIVER AT ULO RETARDING BASIN (2/3)

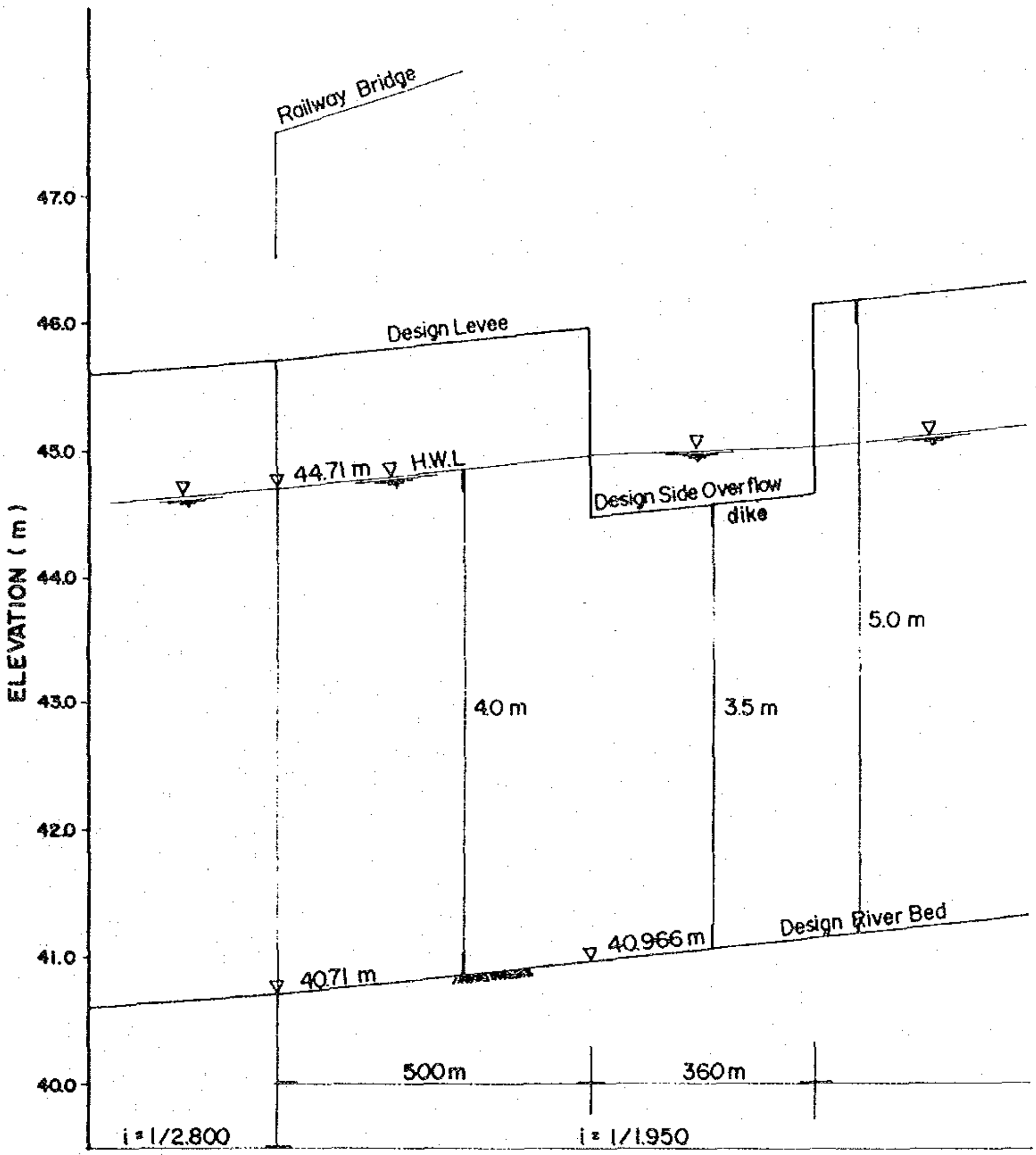
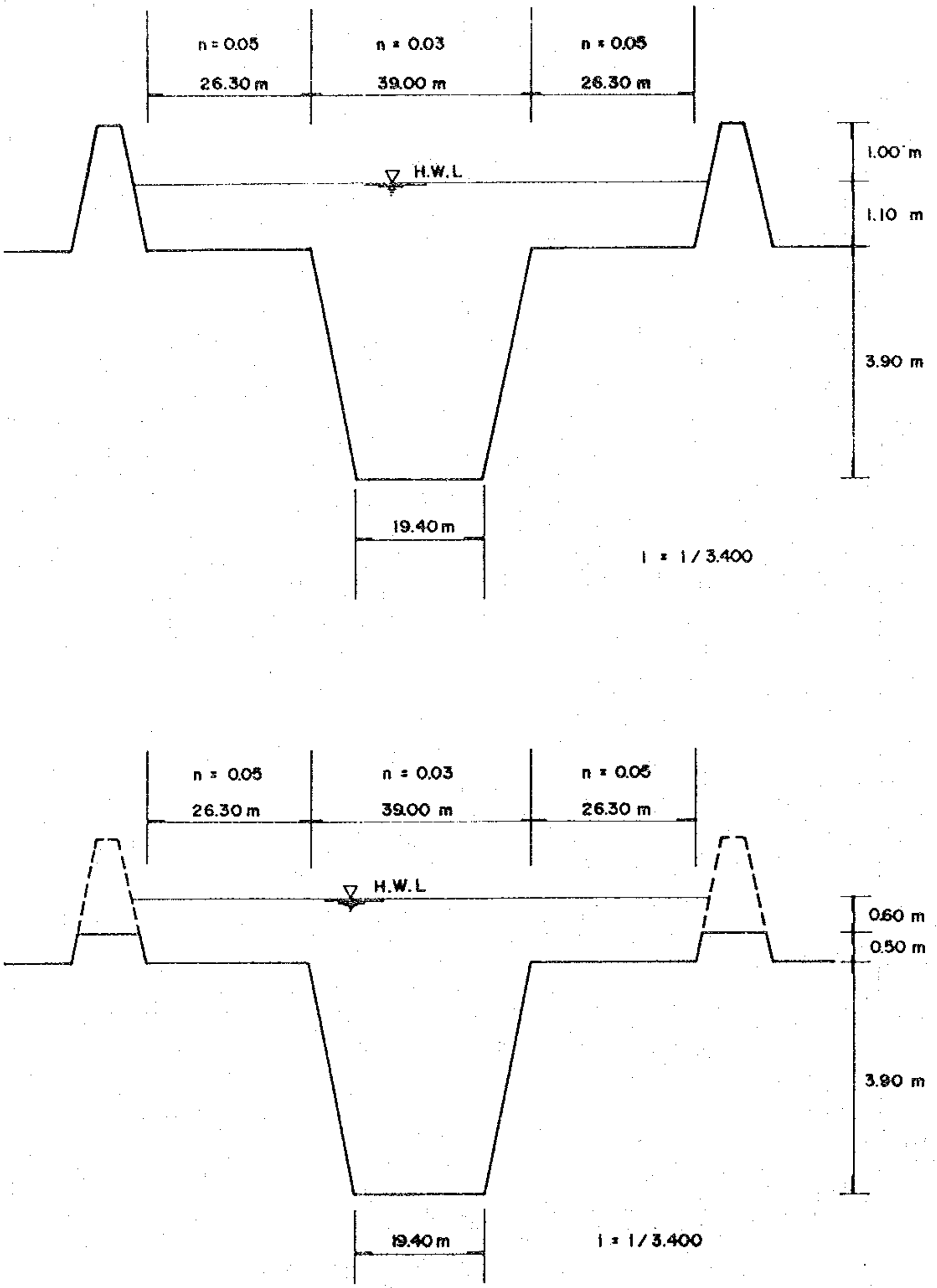


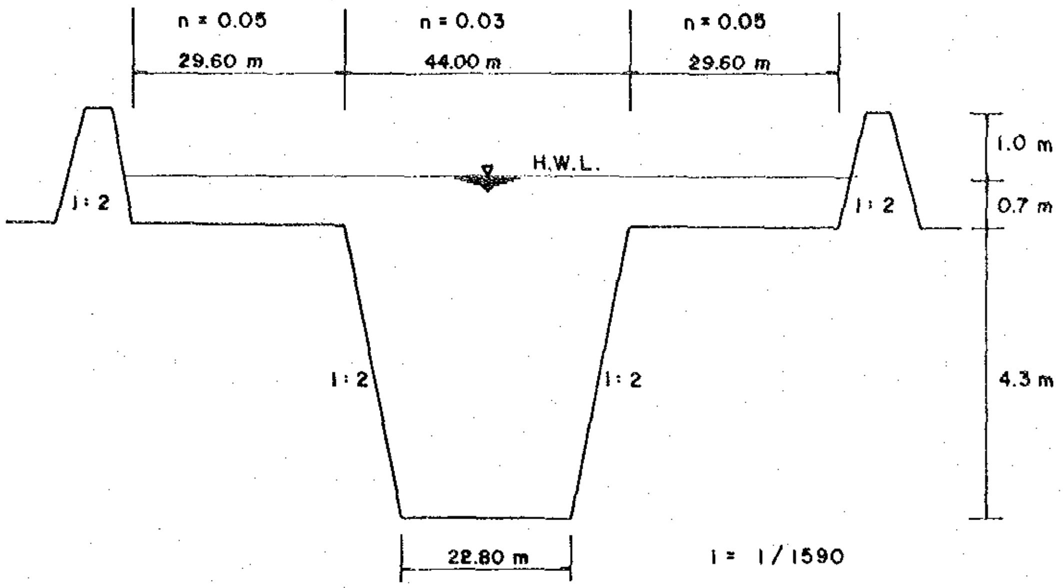
Fig. 4.3.2 LONGITUDINAL PROFILE OF KEDUNGSOKO RIVER AT KEDUNGSOKO RETARDING BASIN (3/3)



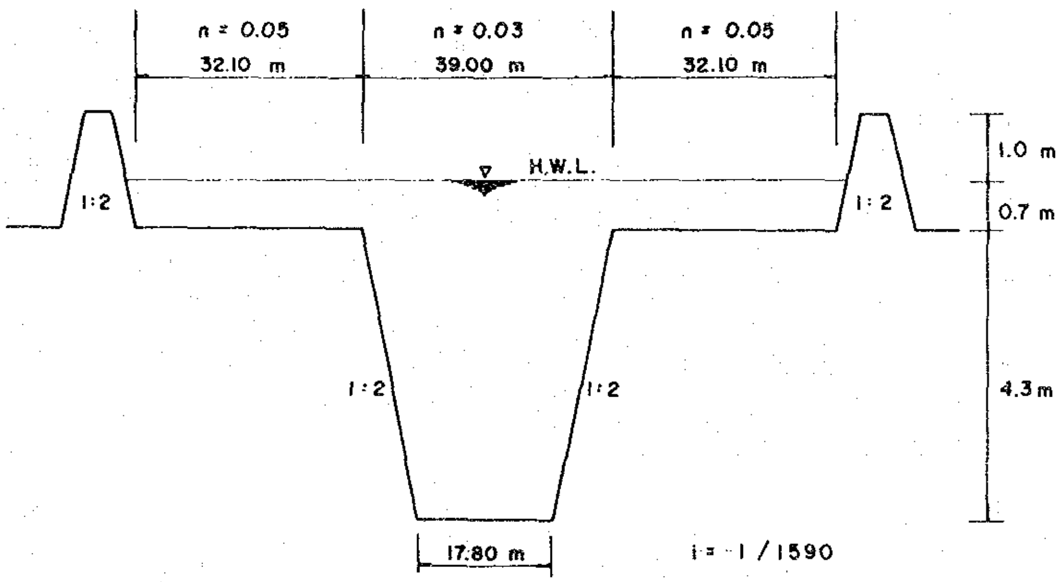
n : Monning's coefficient of roughness
i : Slope of design river bed

Fig. 4.3.3 DESIGN CROSS - SECTION OF WIDAS RIVER IN THE REACH OF WIDAS RETARDING BASIN (1/3)

1. Cross-section for 25-yr probable flood



2. Cross-section for 10-yr probable flood

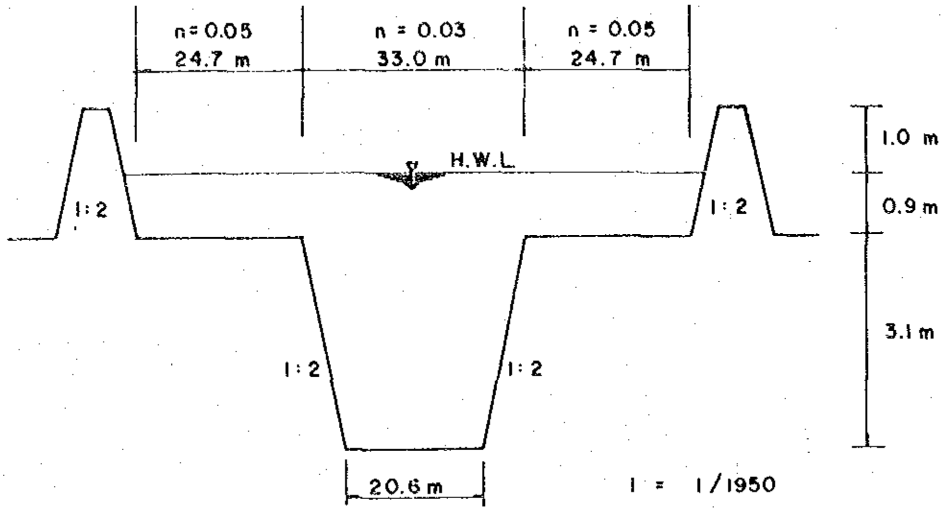


n : Manning coefficient of roughness

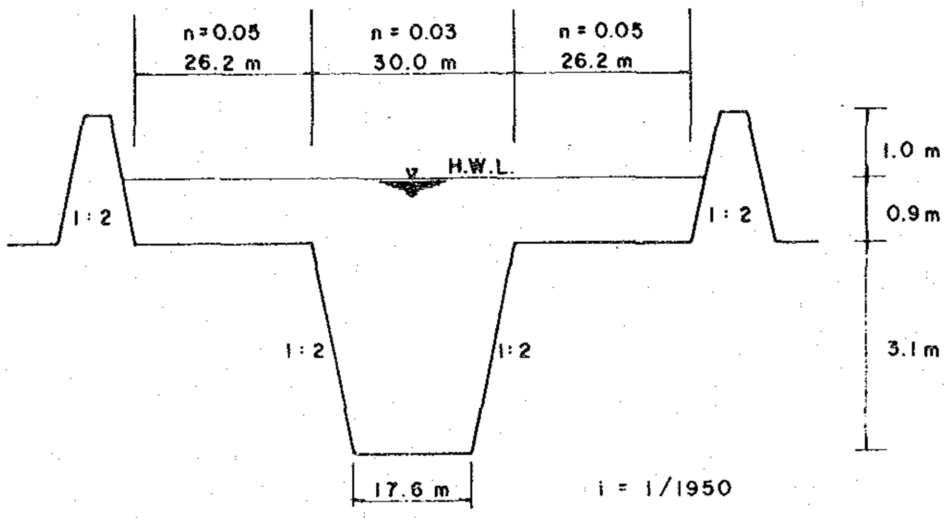
i : Slope of design river bed

Fig. 4.3.3 DESIGN CROSS-SECTION OF WIDAS RIVER DOWNSTREAM OF ULO RETARDING BASIN (2/3)

1. Cross-section for 25-yr probable flood



2. Cross-section for 10-yr probable flood



n : Manning's coefficient of roughness

i : Slope of design river bed

Fig. 4.3.3 DESIGN CROSS-SECTION OF KEDUNGSOKO RIVER DOWNSTREAM OF KEDUNGSOKO RETARDING BASIN (3/3)

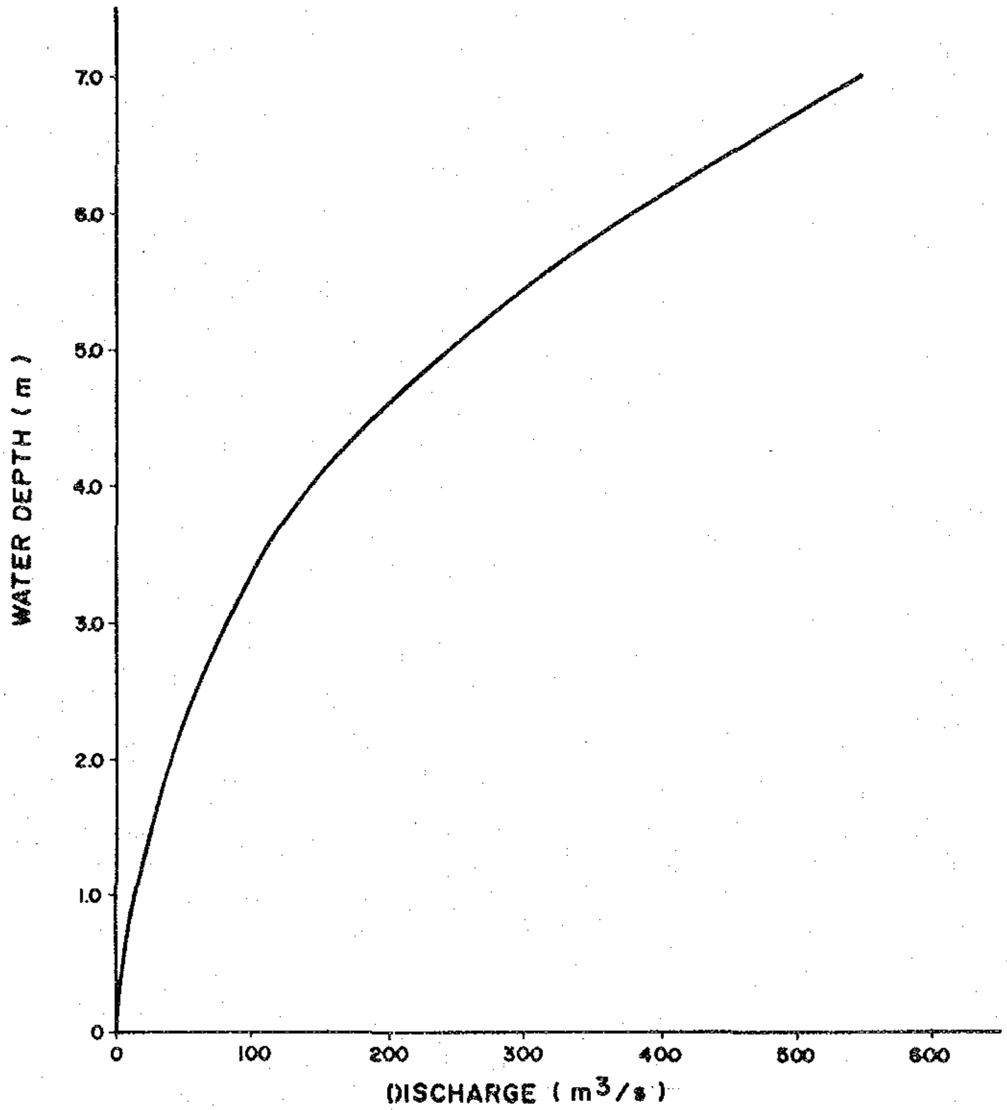


Fig. 4.3.4 STAGE DISCHARGE RELATION OF WIDAS RIVER DOWNSTREAM OF WIDAS RETARDING BASIN (1/3)

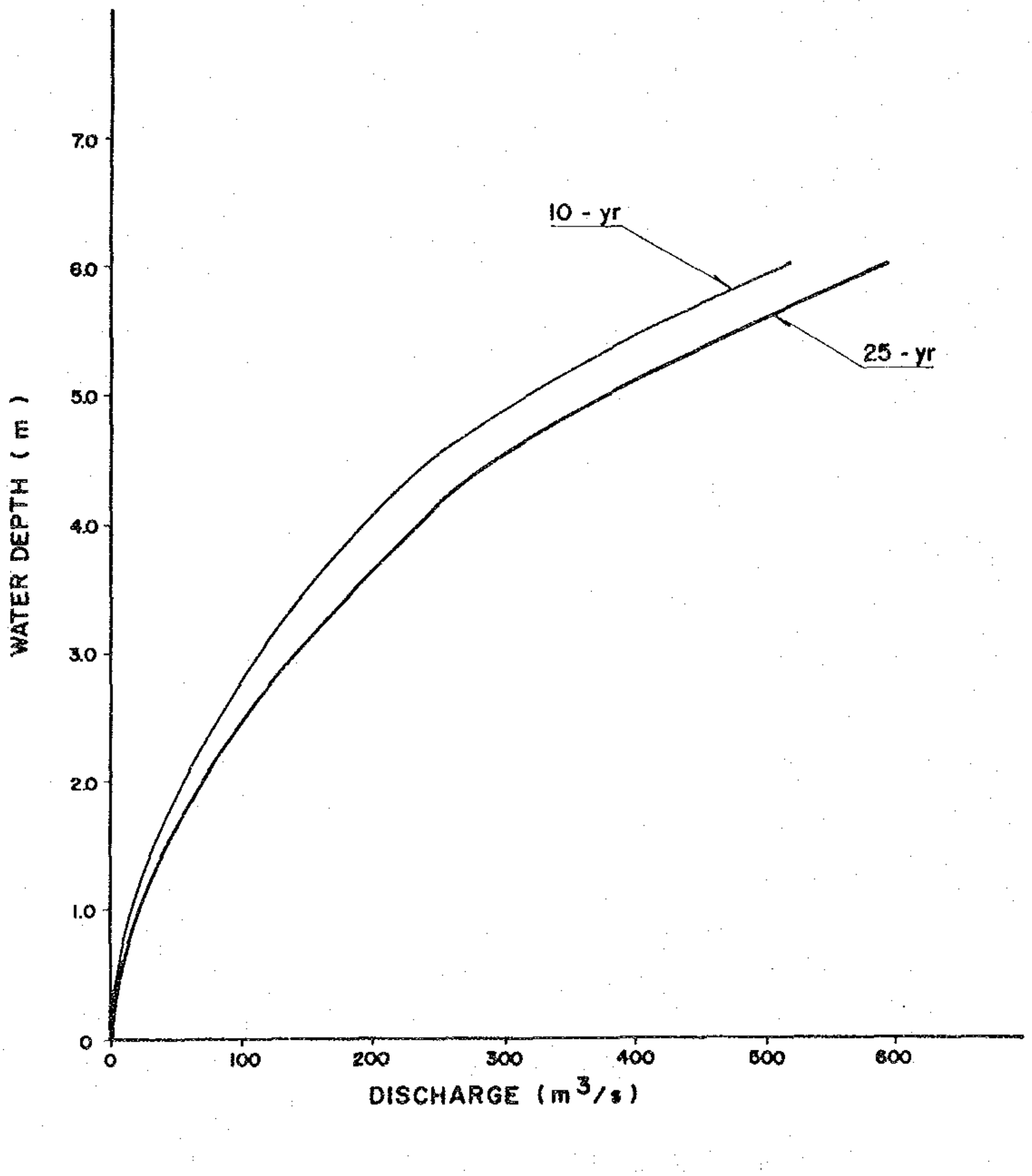


Fig. 4.3.4 STAGE DISCHARGE RELATION OF WIDAS RIVER DOWNSTREAM ULO RETARDING BASIN (2/3)

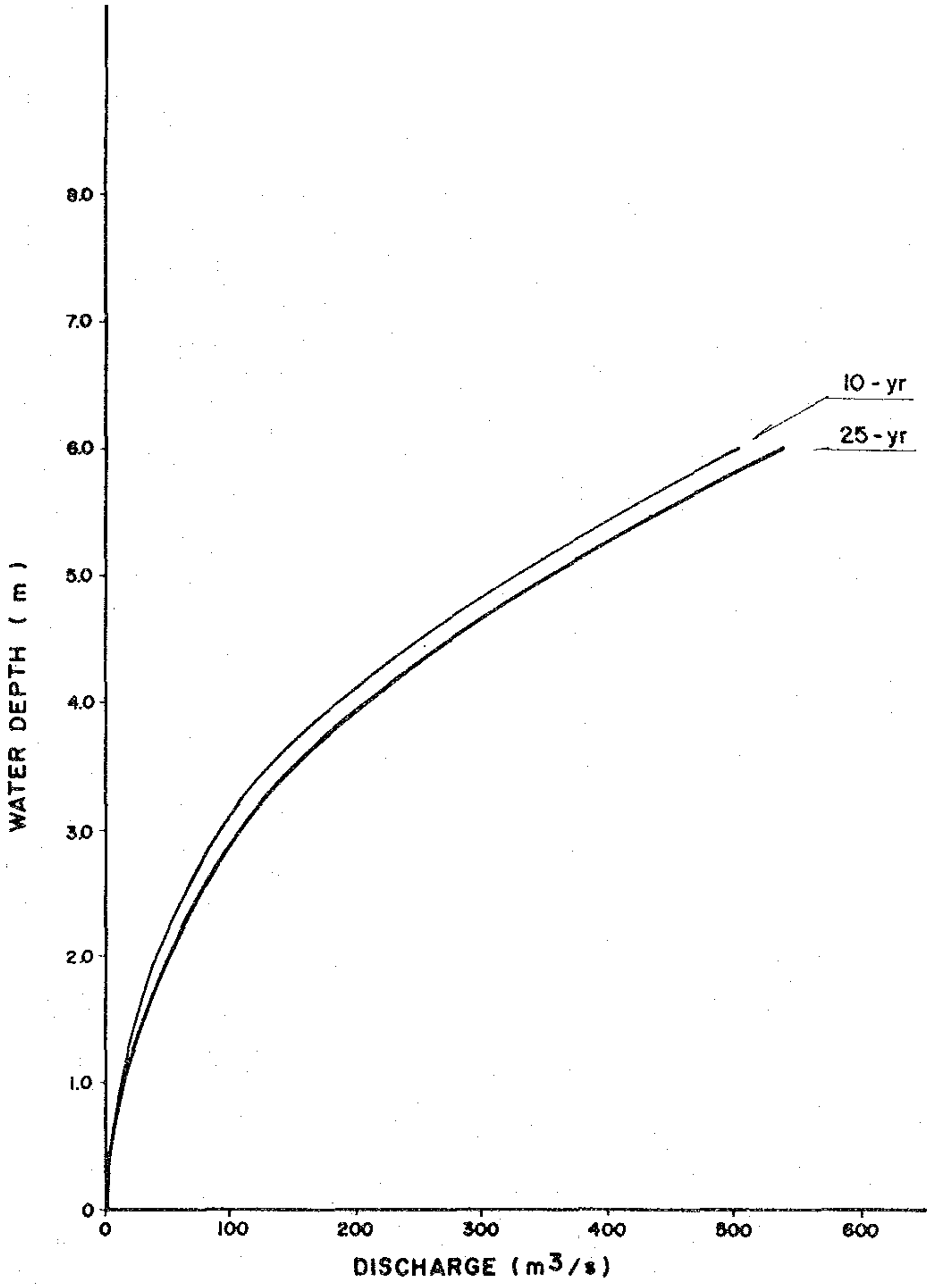


Fig. 4.3.4 STAGE DISCHARGE RELATION OF KEDUNGSOKO RIVER DOWNSTREAM OF KEDUNGSOKO RETARDING BASIN (3/3)

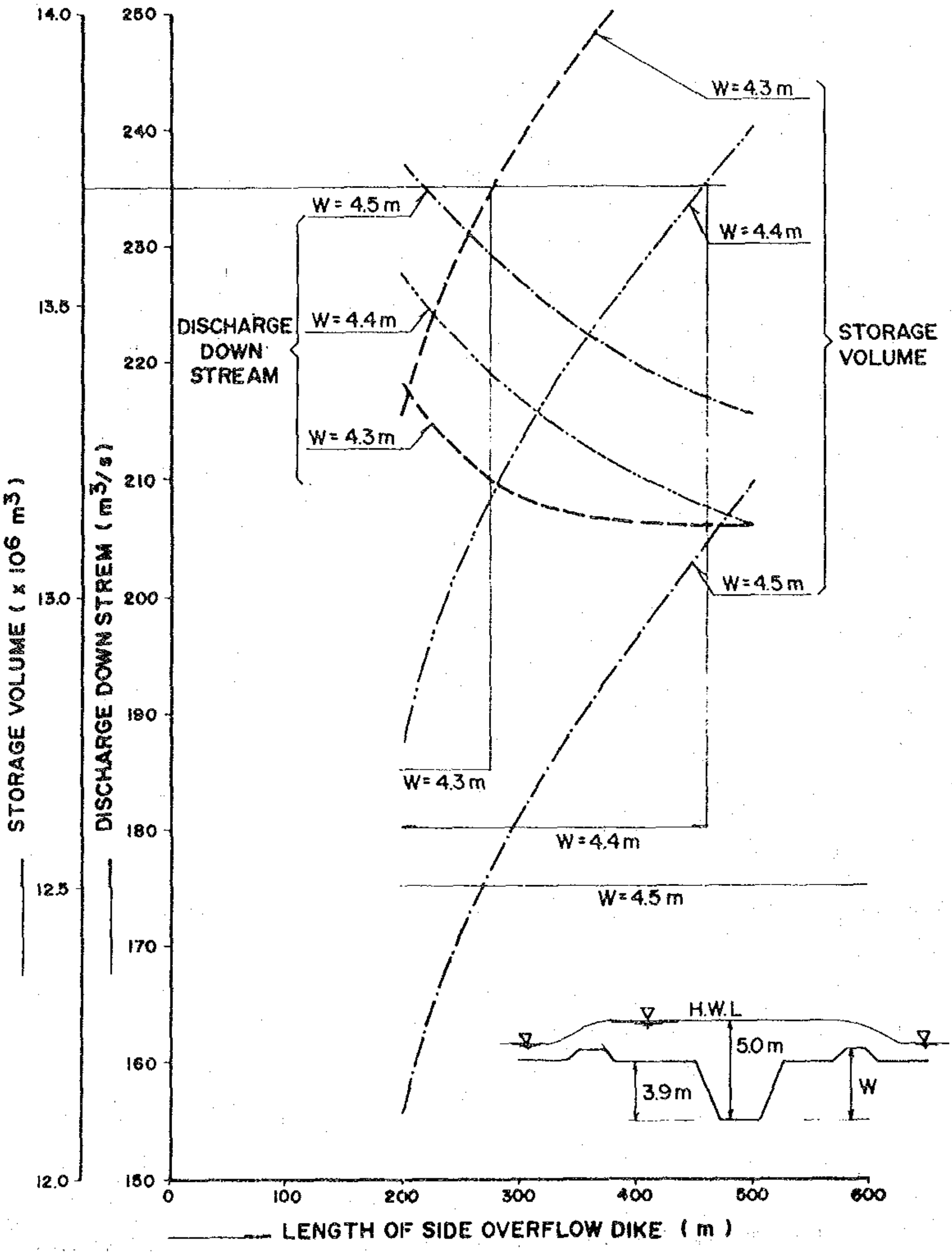


Fig. 4.3.5 FUNCTION OF SIDE OVERFLOW DIKE OF WIDAS RETARDING BASIN (1/3)

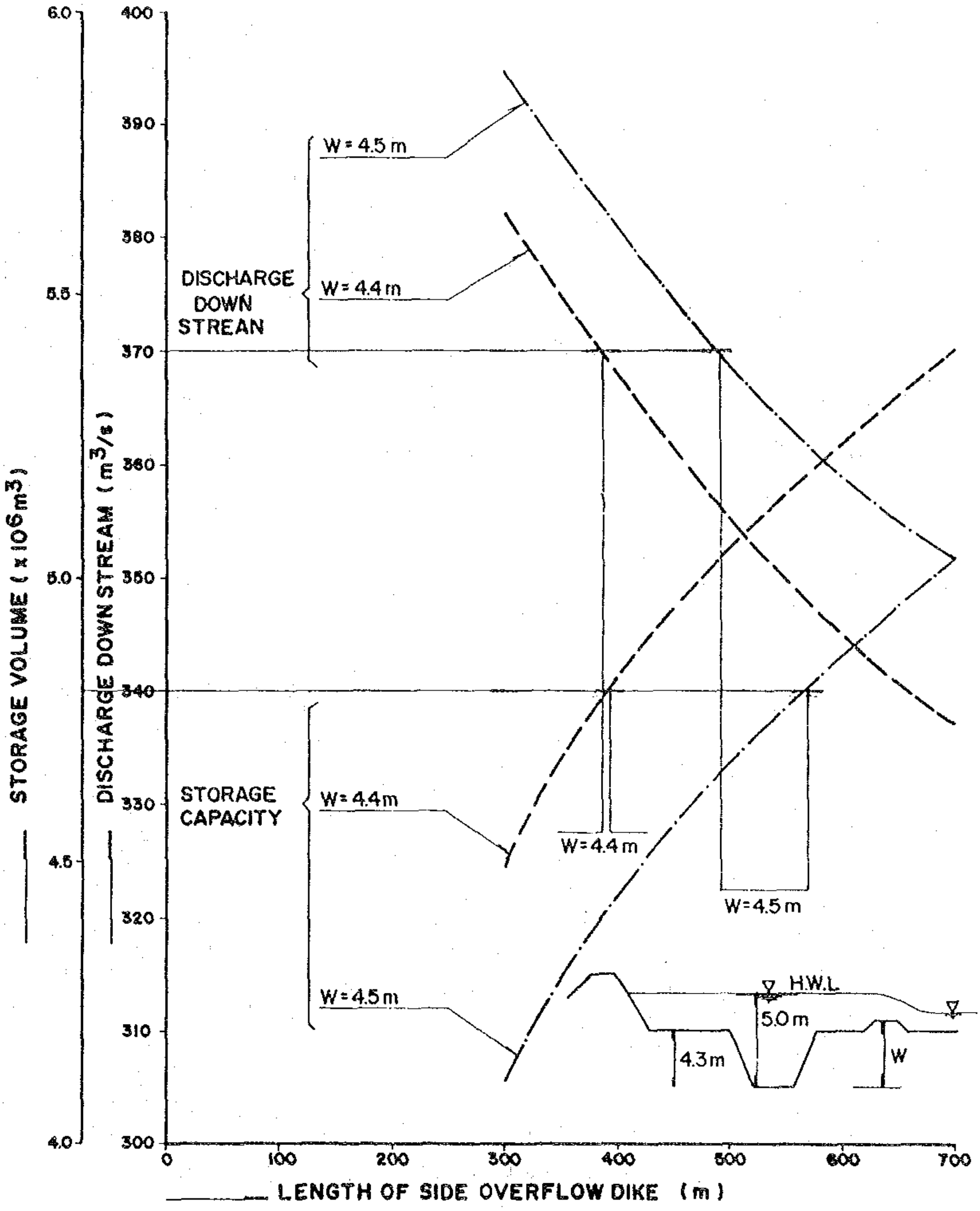


Fig. 4.3.5 FUNCTION OF SIDE OVERFLOW DIKE OF ULO RETARDING BASIN (2/3)

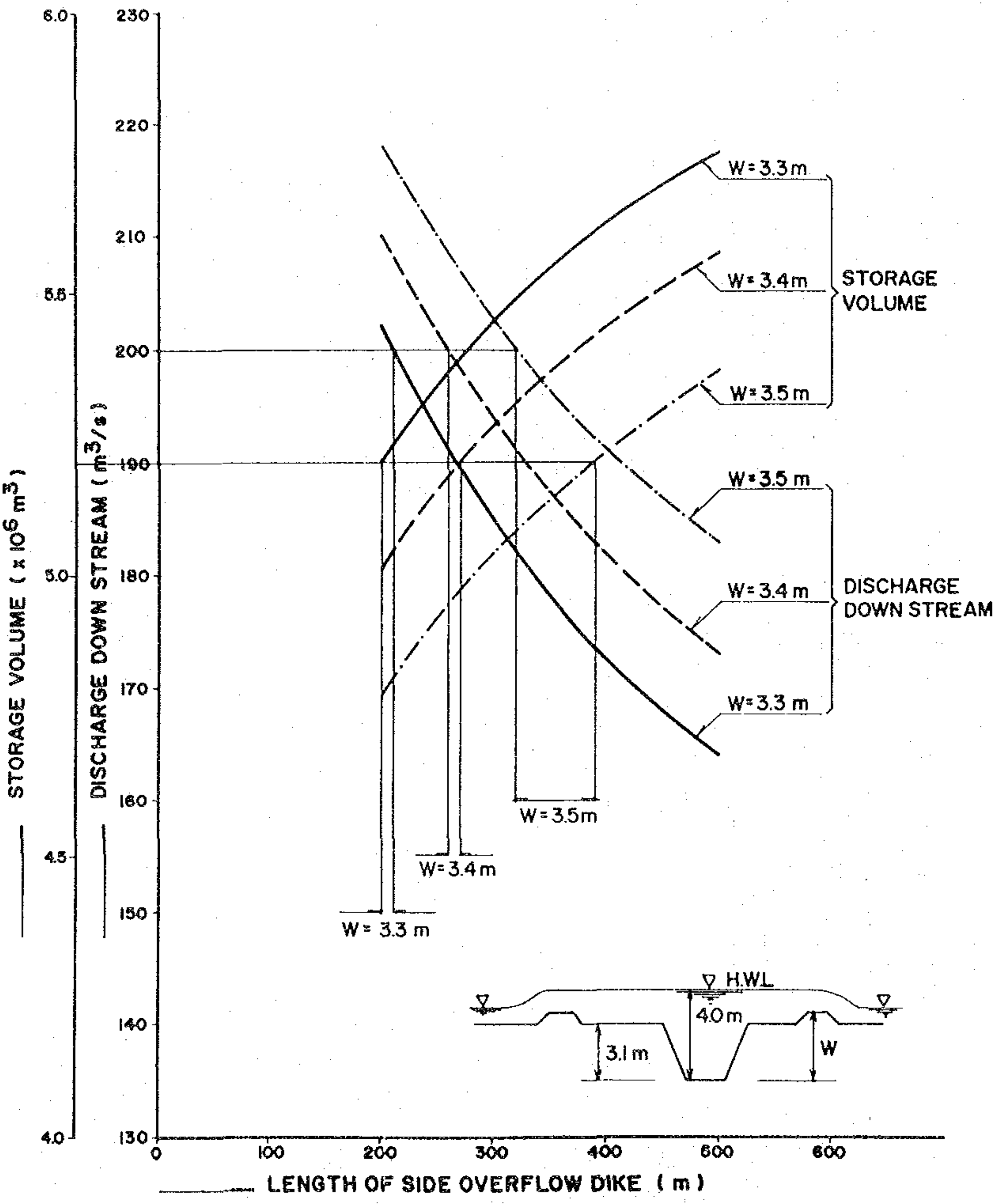
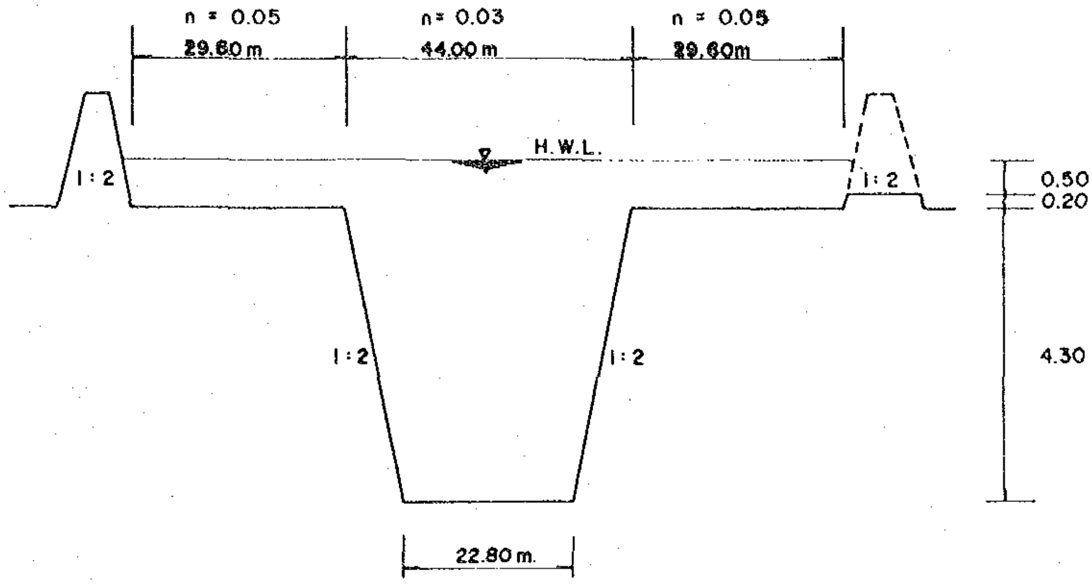


Fig. 4.3.5 FUNCTION OF SIDE OVERFLOW DIKE OF KEDUNGSOKO RETARDING BASIN (3/3)

1. Cross-section for 25-yr probable flood



2. Cross-section for 10-yr probable flood

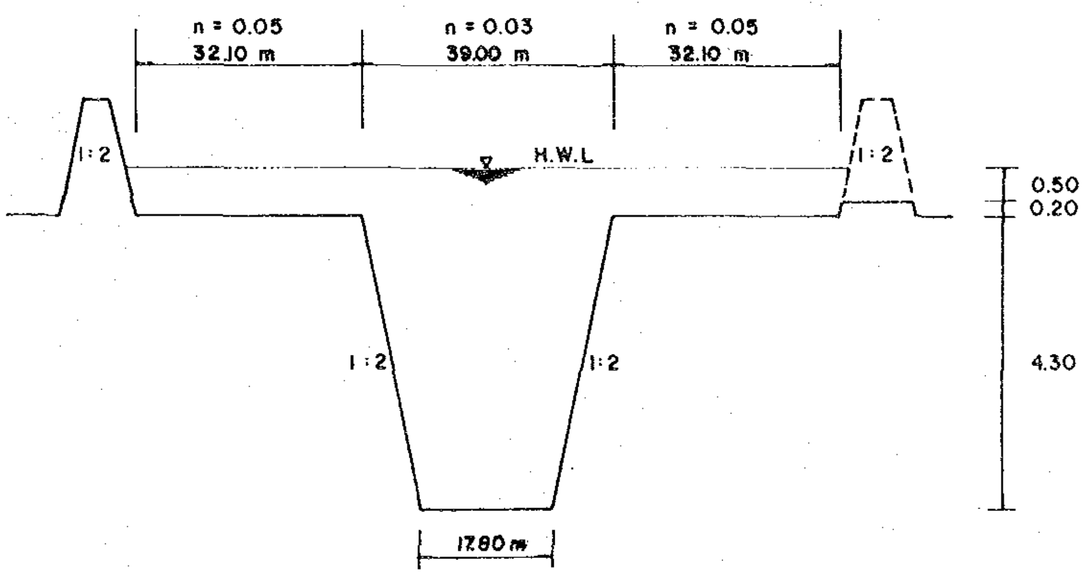
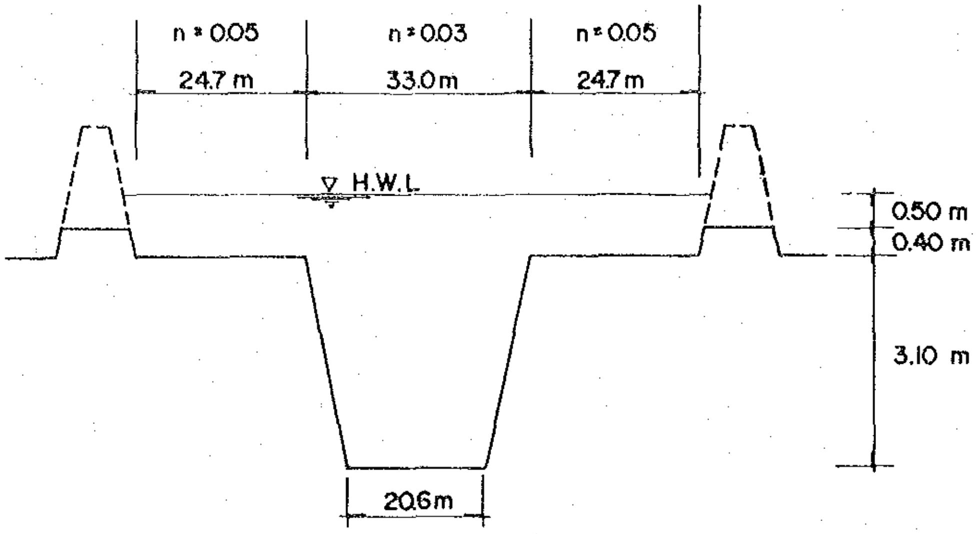


Fig. 4.3.6 DESIGN CROSS-SECTION OF WIDAS RIVER AT SIDE OVERFLOW DIKE OF ULO RETARDING BASIN (1/2)

1. CROSS SECTION FOR 25 - yr PROBABLE FLOOD



2. CROSS SECTION FOR 10 - yr PROBABLE FLOOD

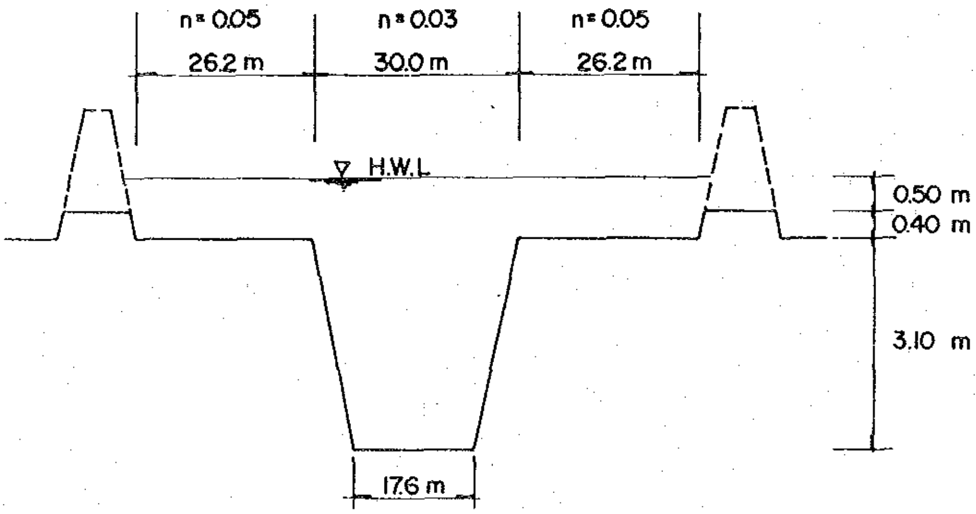


Fig. 4.3.6 DESIGN CROSS SECTION OF KEDUNGSOKO RIVER AT SIDE OVERFLOW DIKE OF KEDUNGSOKO RETARDING BASIN (2/2)

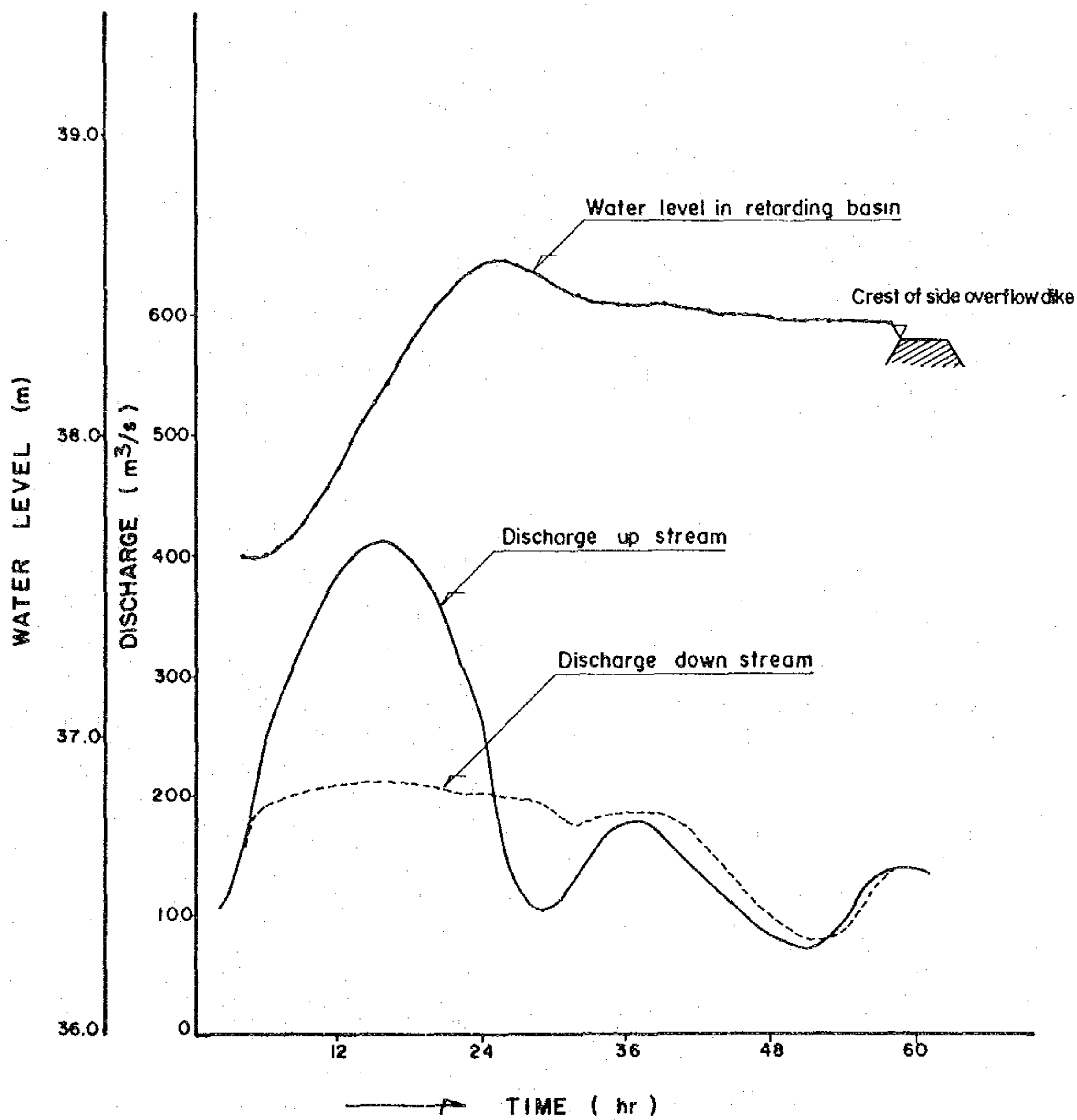


Fig. 4.3.7 FLOOD ROUTING IN THE WIDAS RETARDING BASIN (1/3)

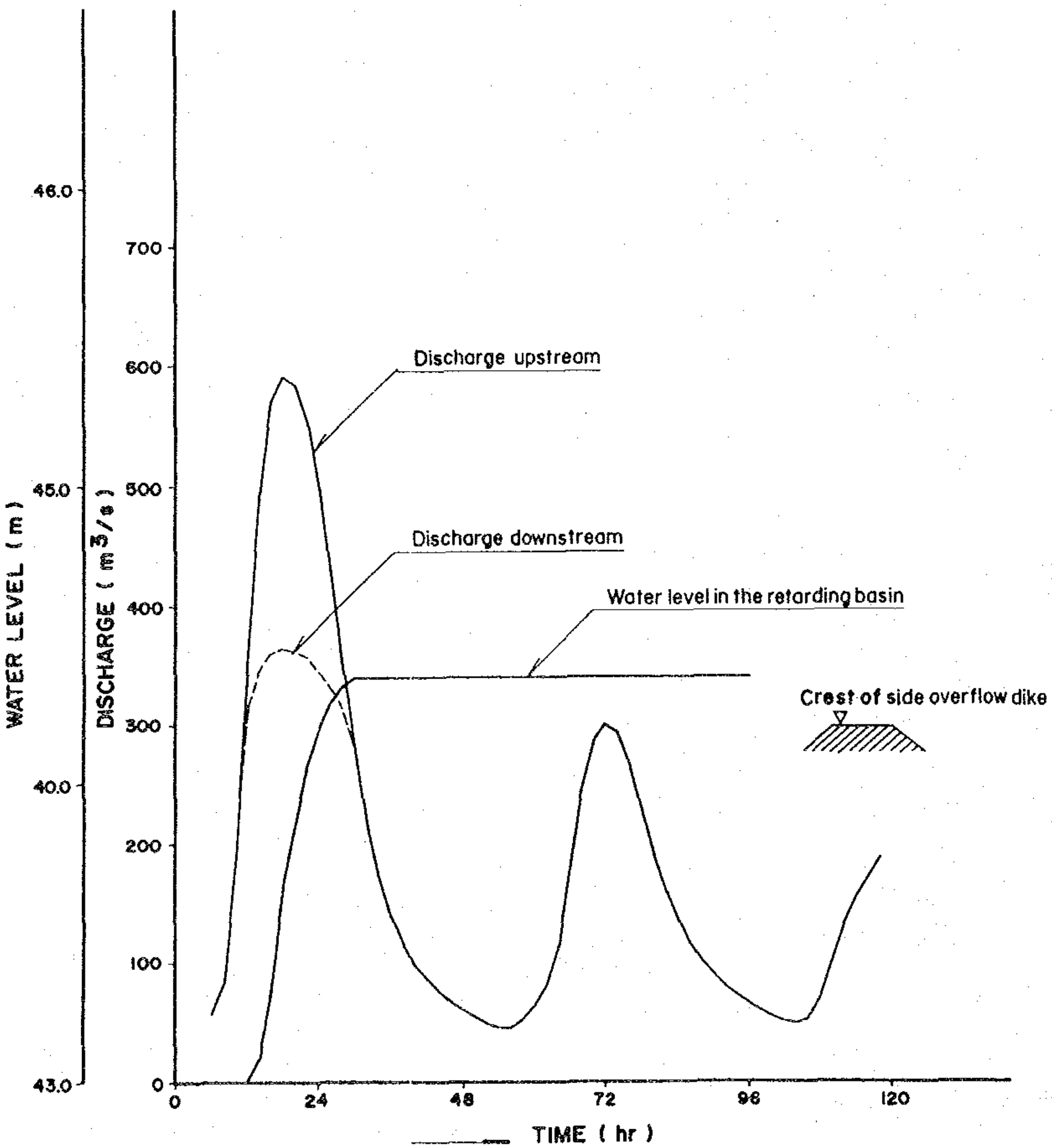


Fig. 4.3.7 FLOOD ROUTING IN THE ULO RETARDING BASIN (2/3)

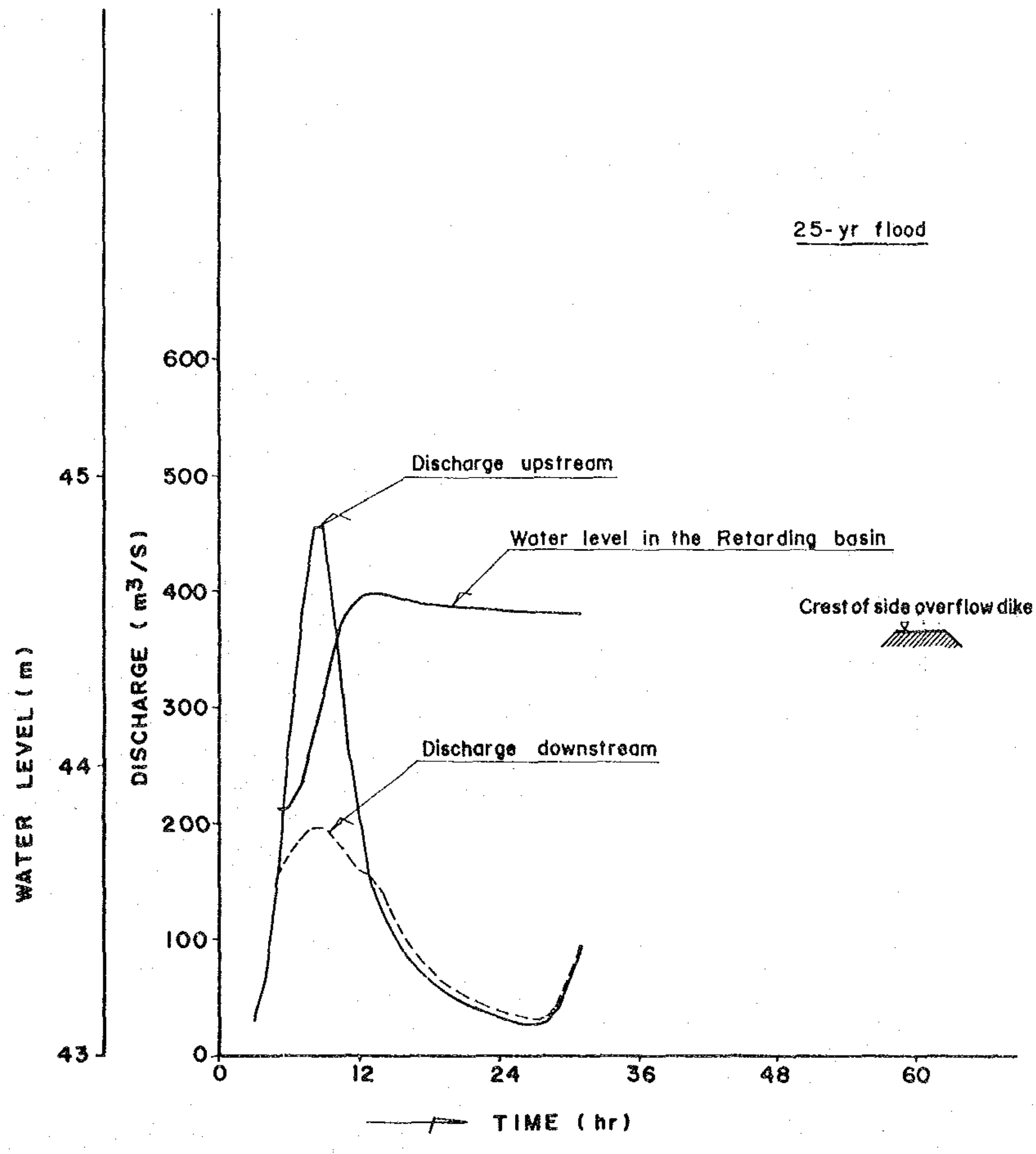


Fig. 4.3.7 FLOOD ROUTING IN THE KEDUNGSOKO RETARDING BASIN (3/3)

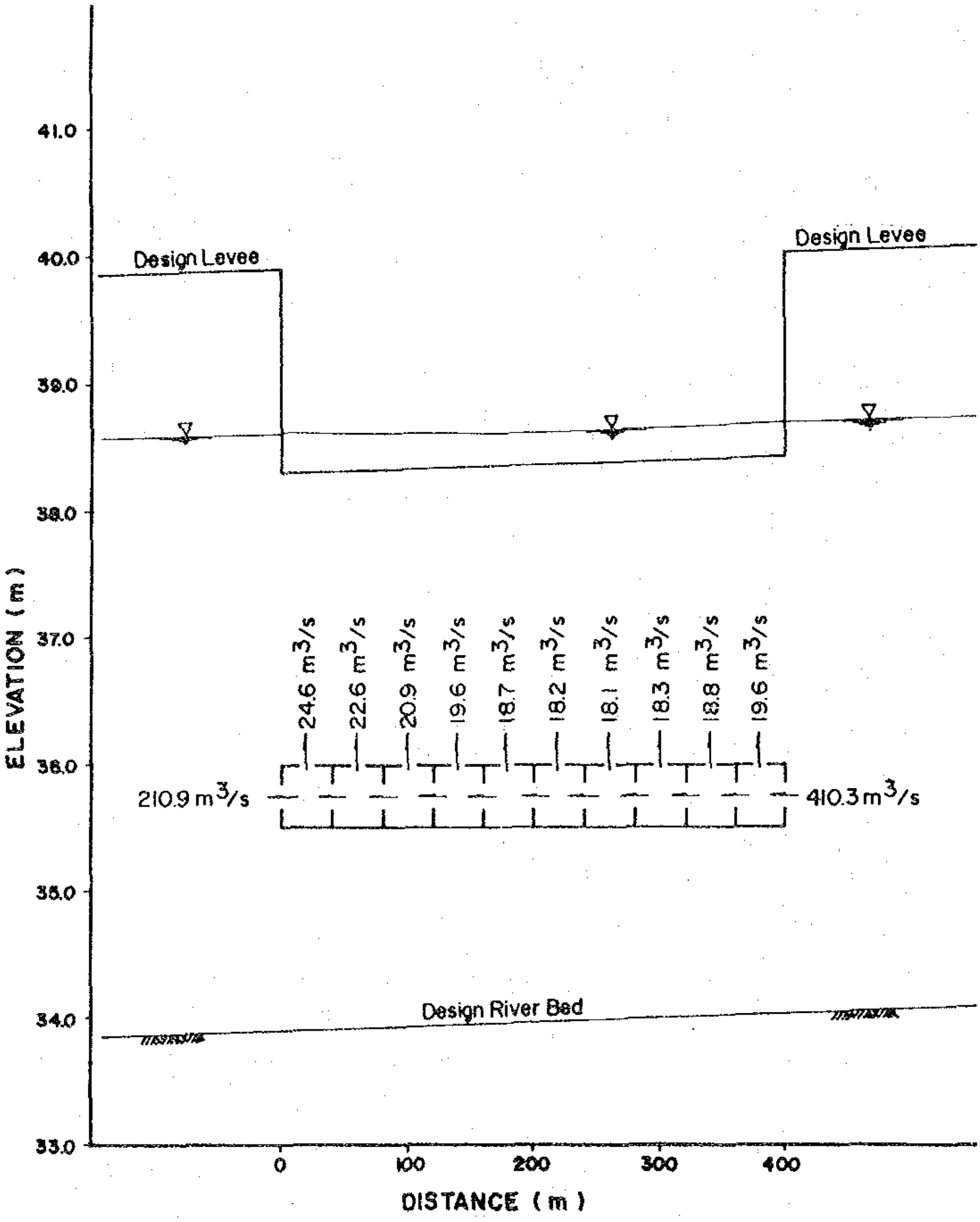


Fig. 4.3.8 WATER LEVEL AND DISCHARGE AT SIDE OVERFLOW DIKE OF WIDAS RETARDING BASIN (1/3)

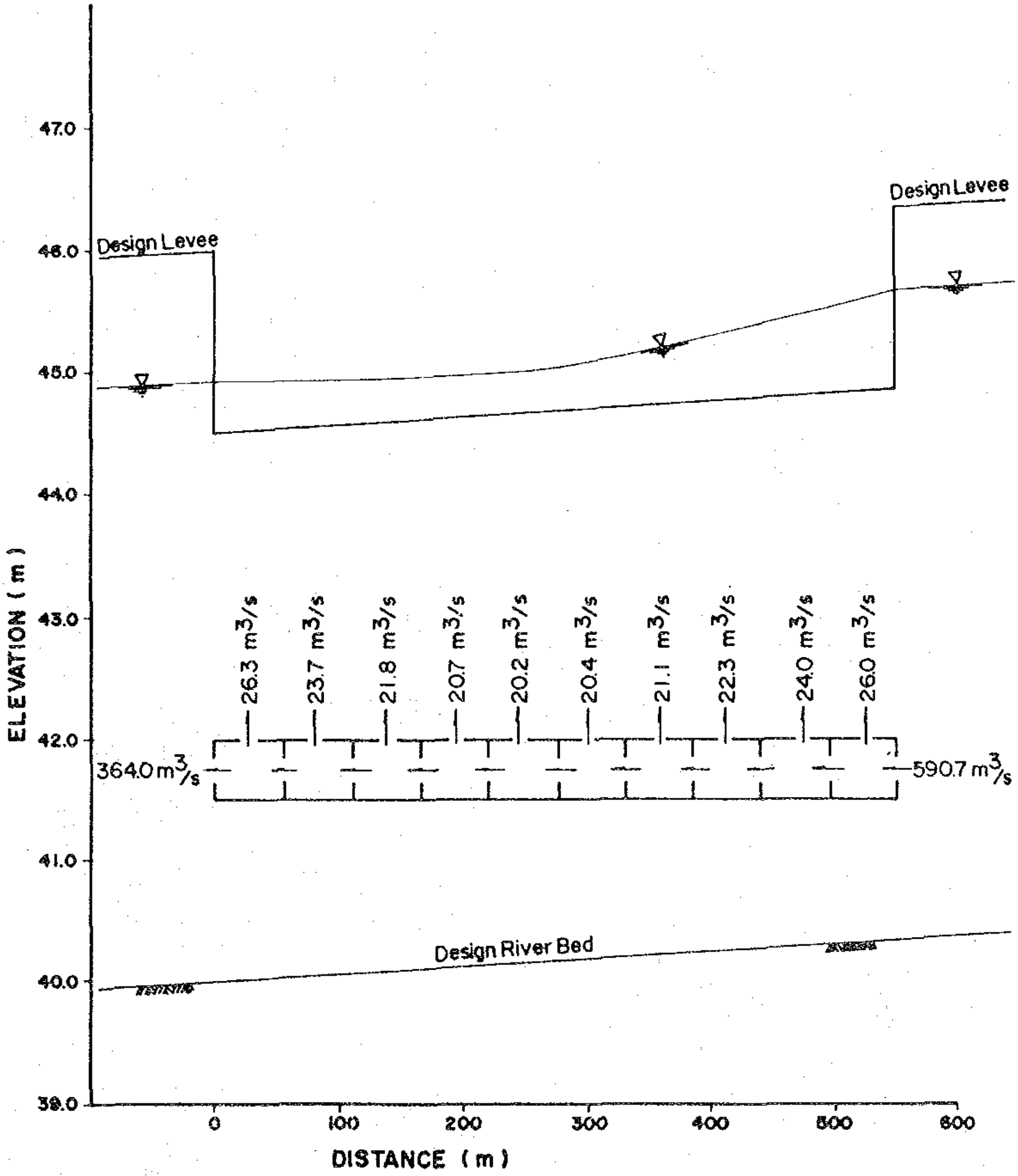


Fig. 4.3.8 WATER LEVEL AND DISCHARGE AT SIDE OVERFLOW DIKE OF ULO RETARDING BASIN (2/3)

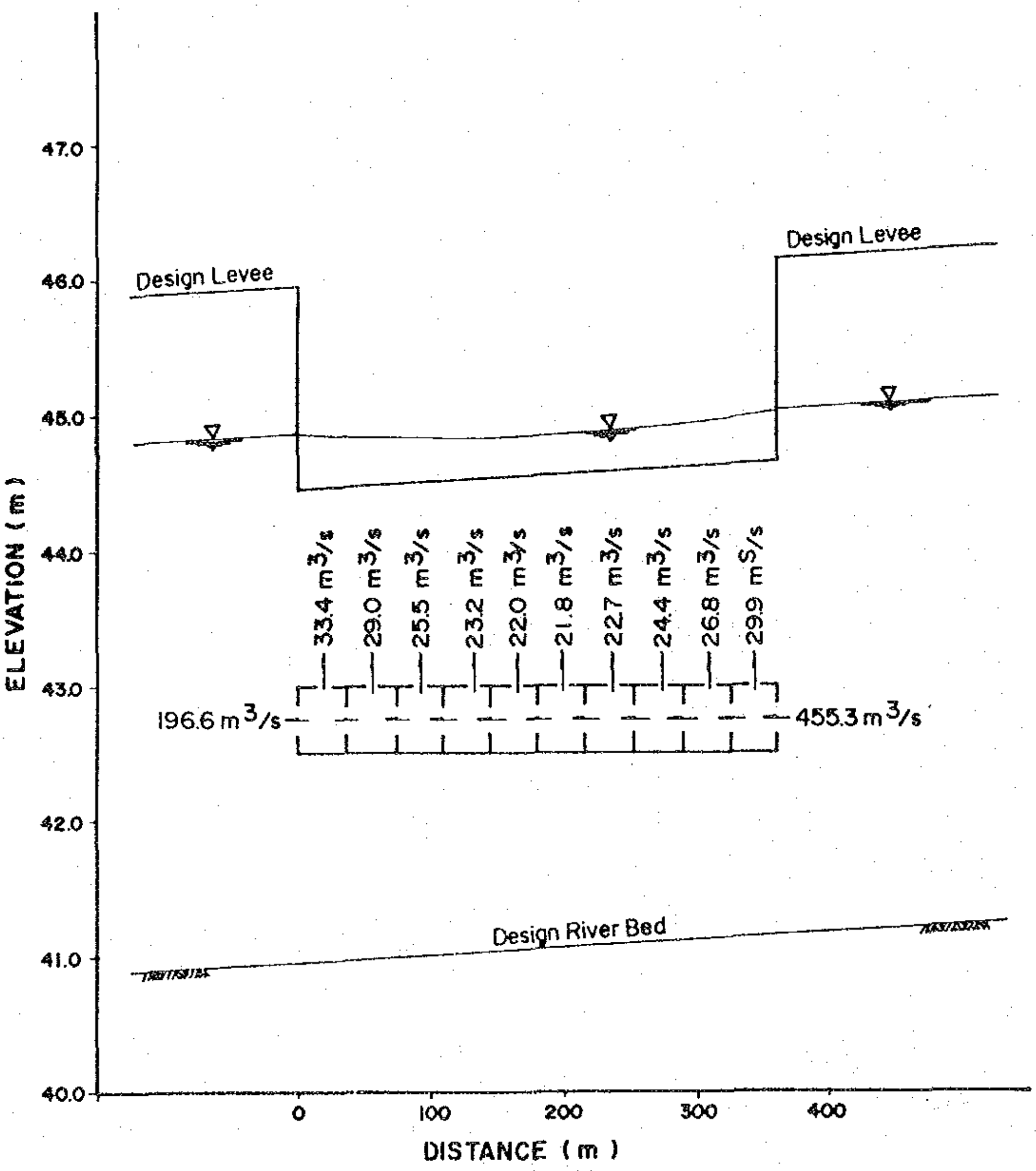


Fig. 4.3.8 WATER LEVEL AND DISCHARGE AT SIDE OVERFLOW DIKE OF KEDUNGSOKO RETARDING BASIN (3/3)

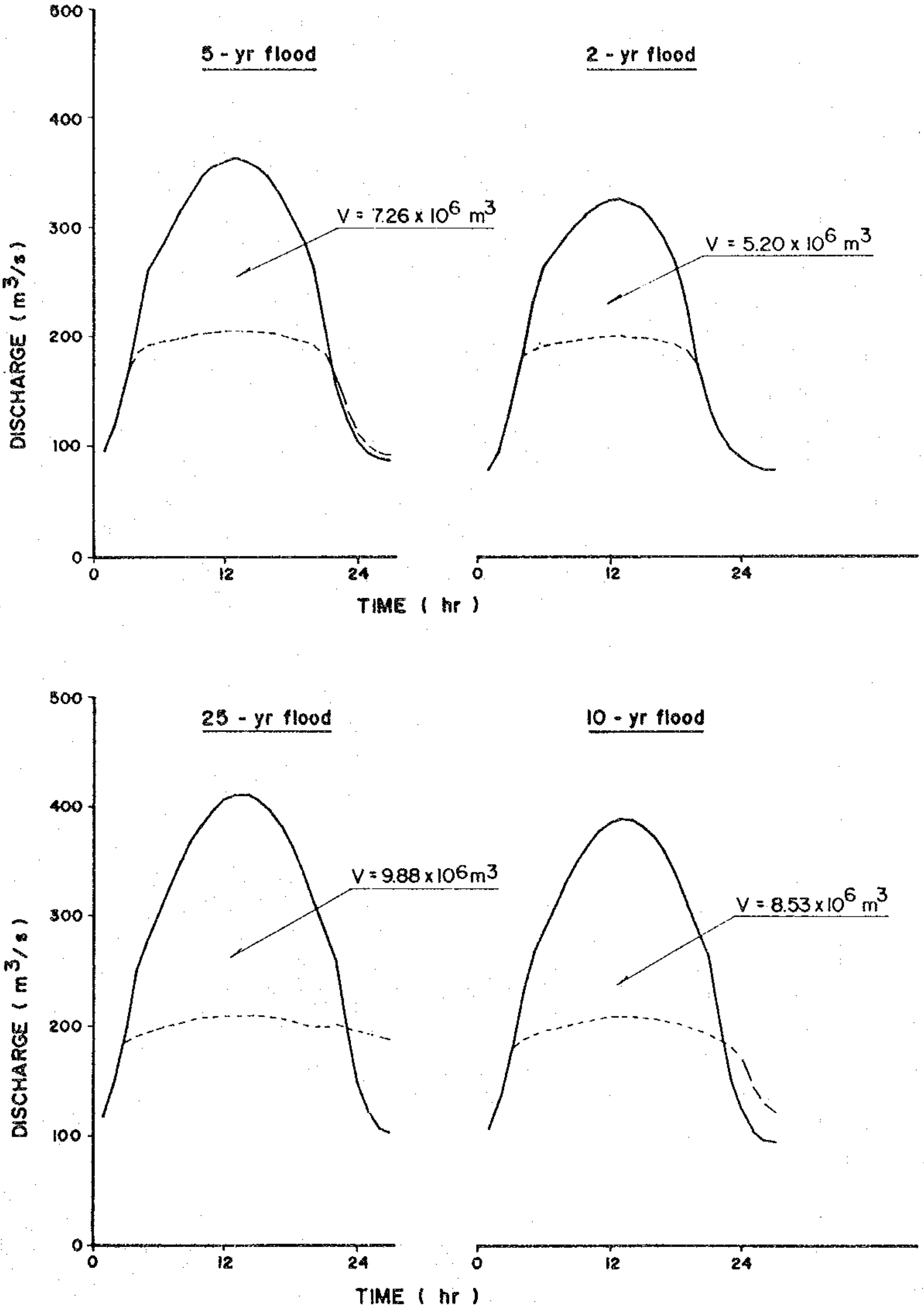


Fig. 4.3.9 REGULATING EFFECT OF WIDAS RETARDING BASIN (River cross - section for 25 - yr probable flood) (1/6)

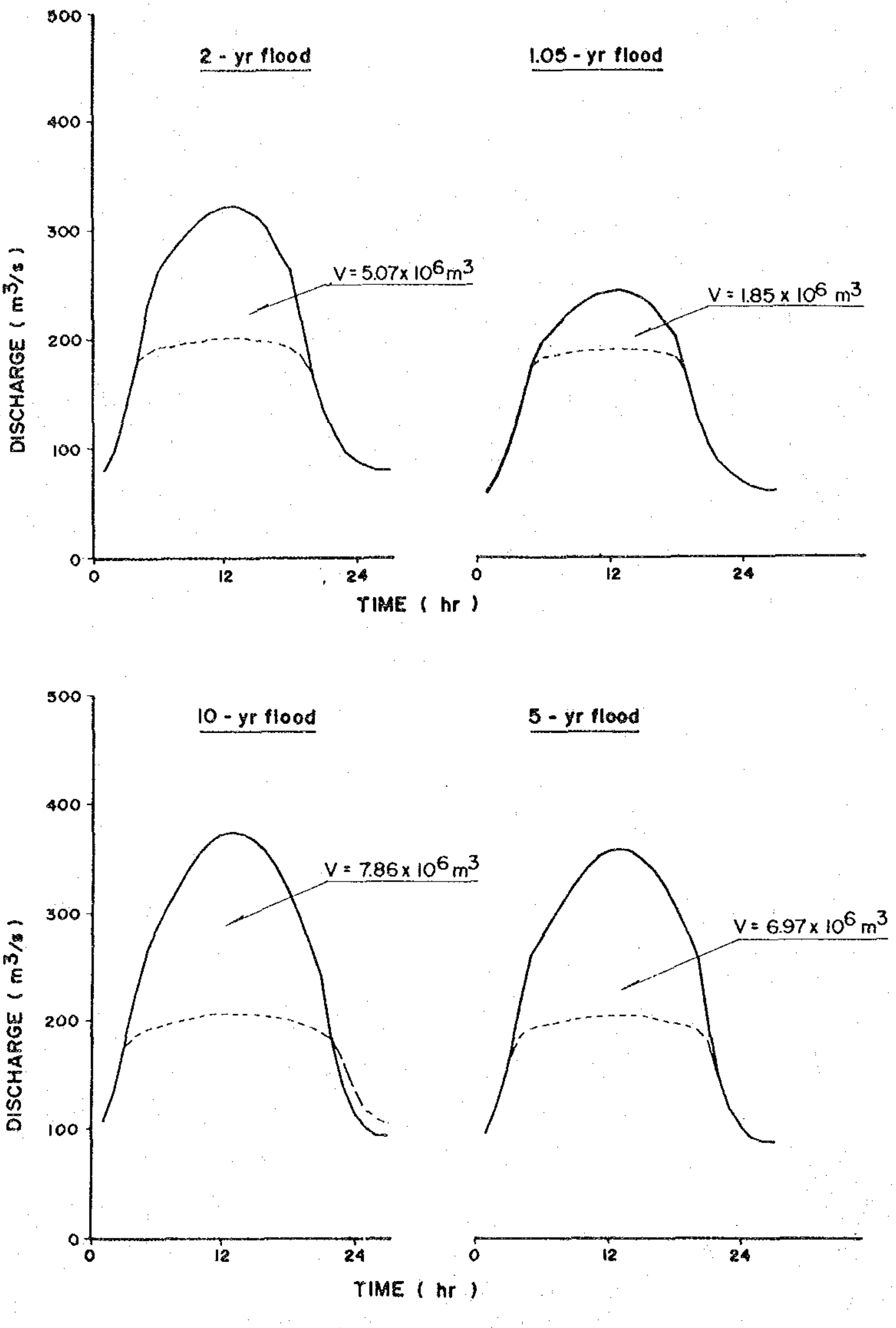


Fig. 4.3.9 REGULATING EFFECT OF WIDAS RETARDING BASIN
(River cross - section for 10 - yr probable flood) (2/6)

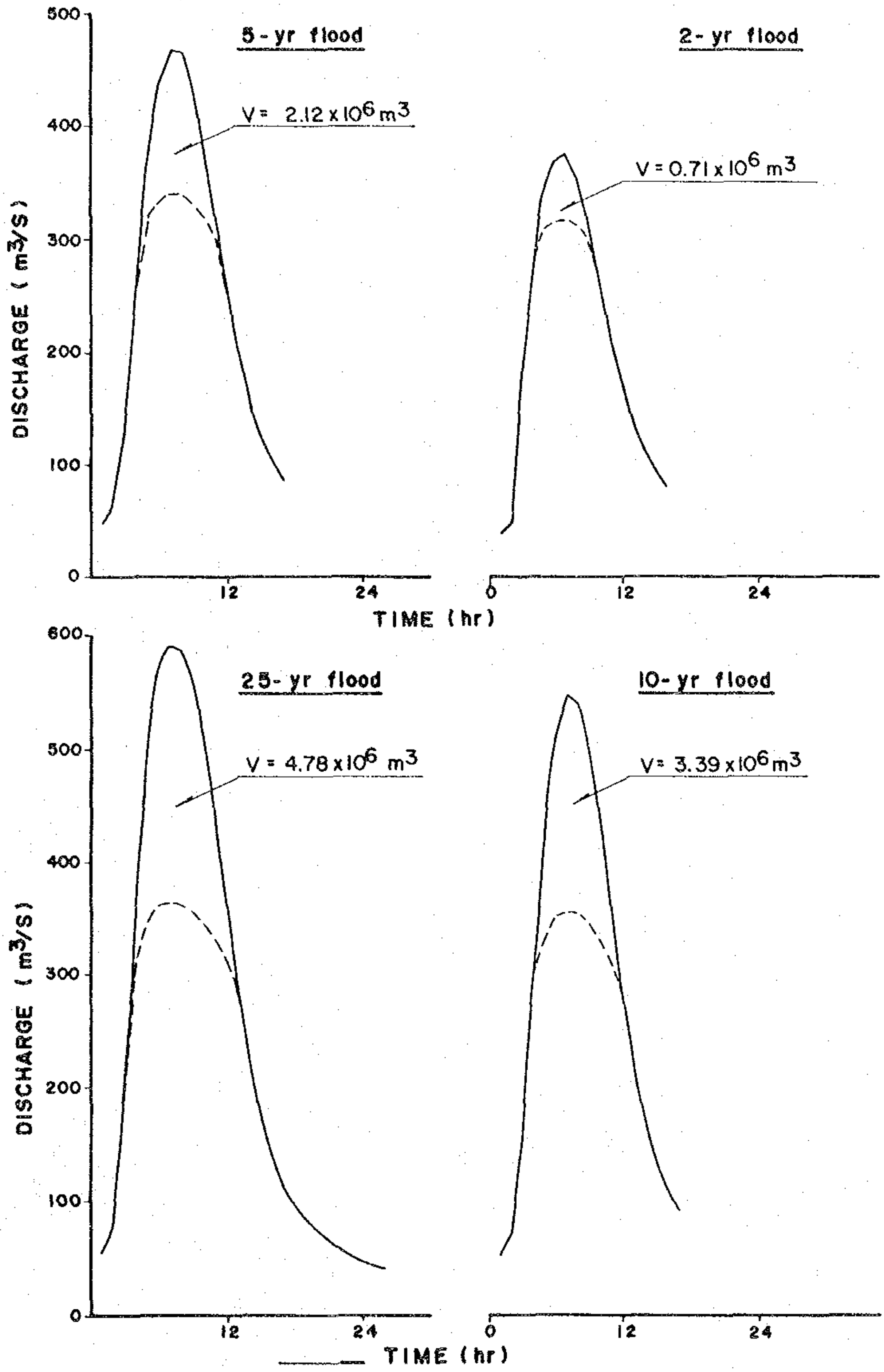


Fig. 4.3.9 REGULATING EFFECT OF ULO RETARDING BASIN
(River cross-section for 25-yr probable flood) (3/6)

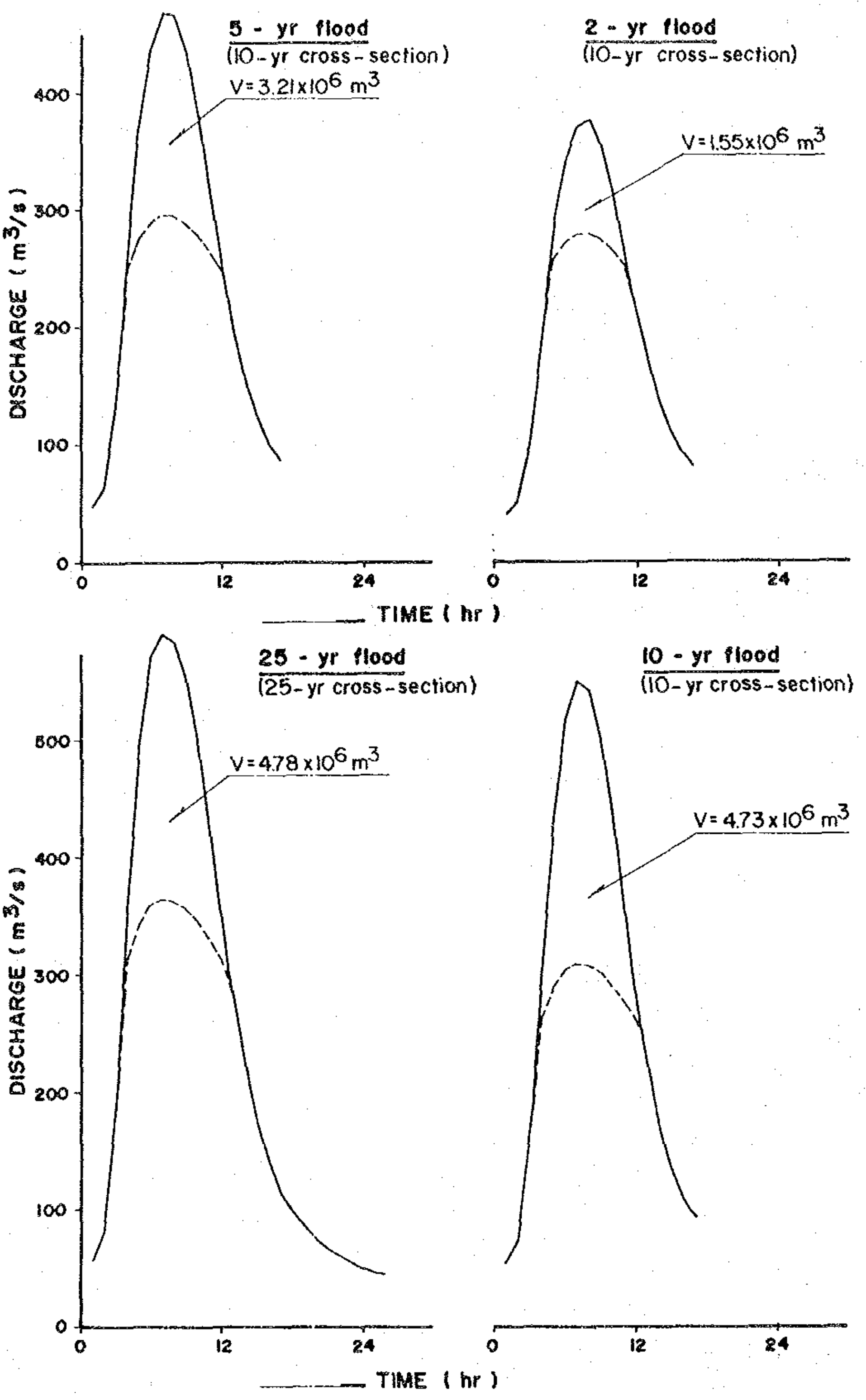


Fig. 4.3.9 REGULATING EFFECT OF ULO RETARDING BASIN
(River cross - section for 10 - yr probable flood) (4/6)

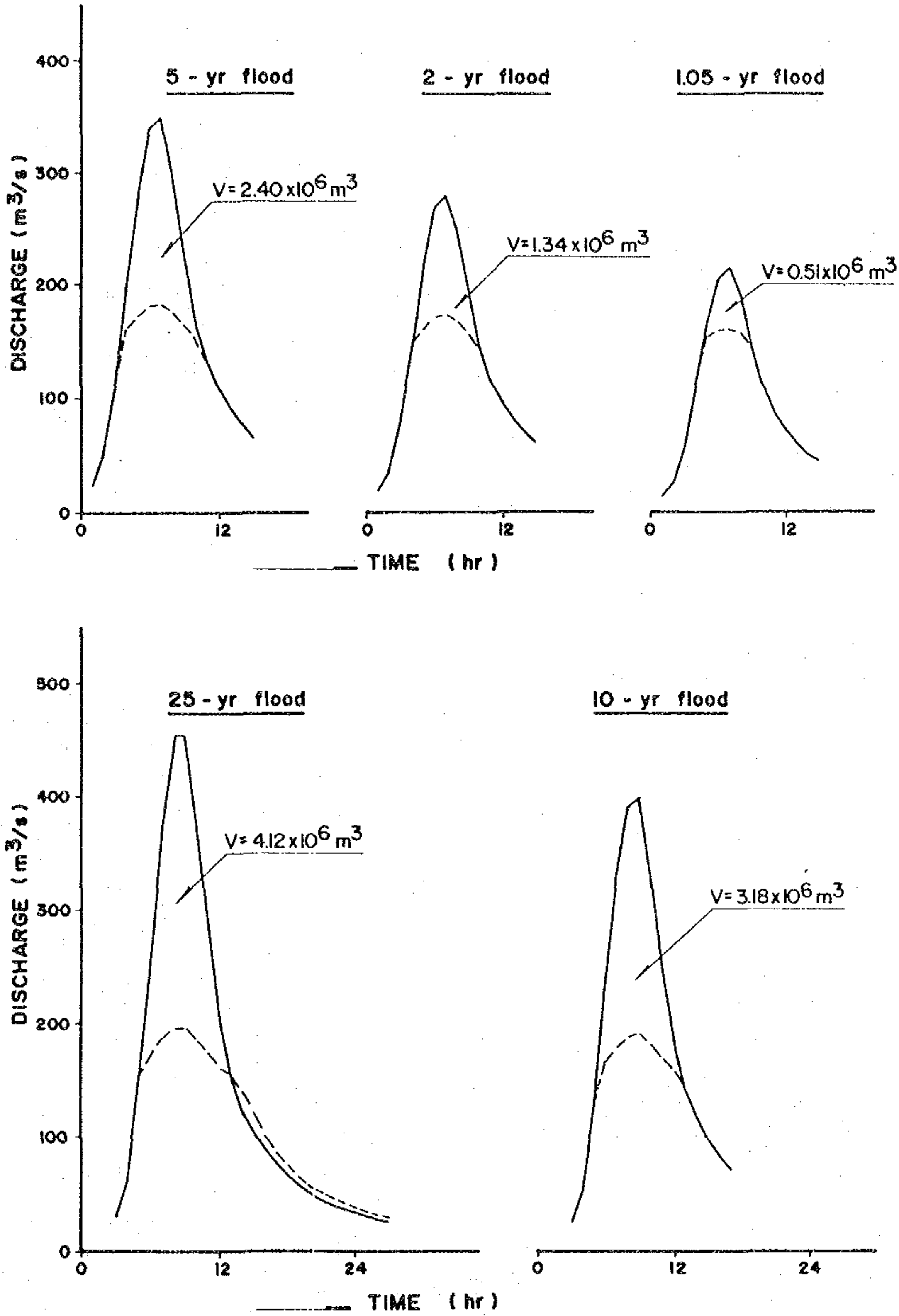
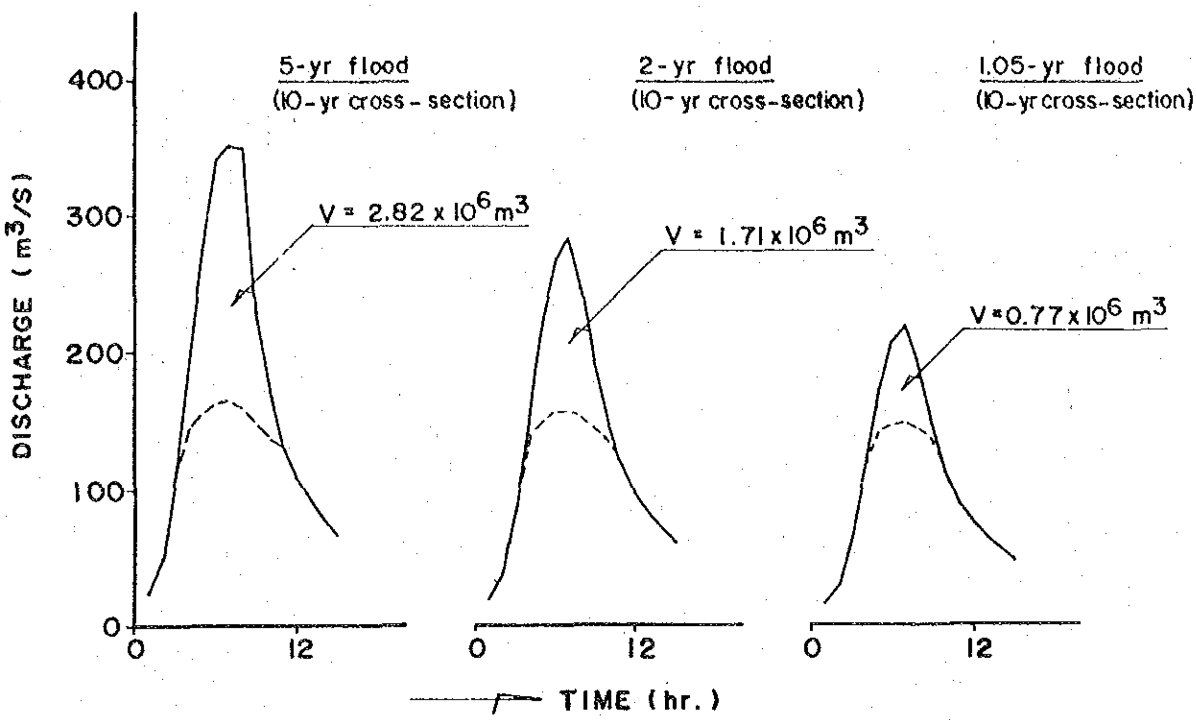


Fig. 4.3.9 REGULATING EFFECT OF KEDUNGSOKO RETARDING BASIN
(River cross - section for 25 - yr probable flood) (5/6)



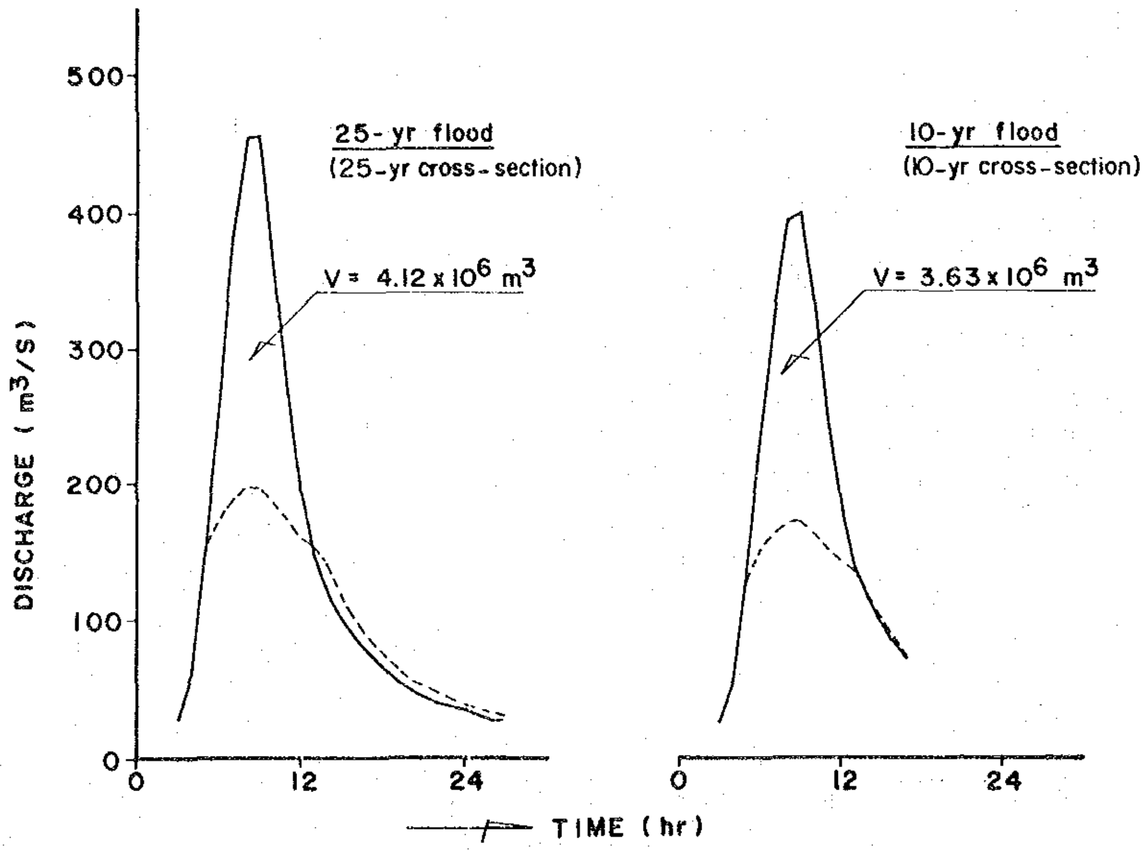


Fig. 4.3.9 REGULATING EFFECT OF KEDUNGSOKO RETARDING BASIN
(River cross - section for 10 - yr probable flood) (6/6)

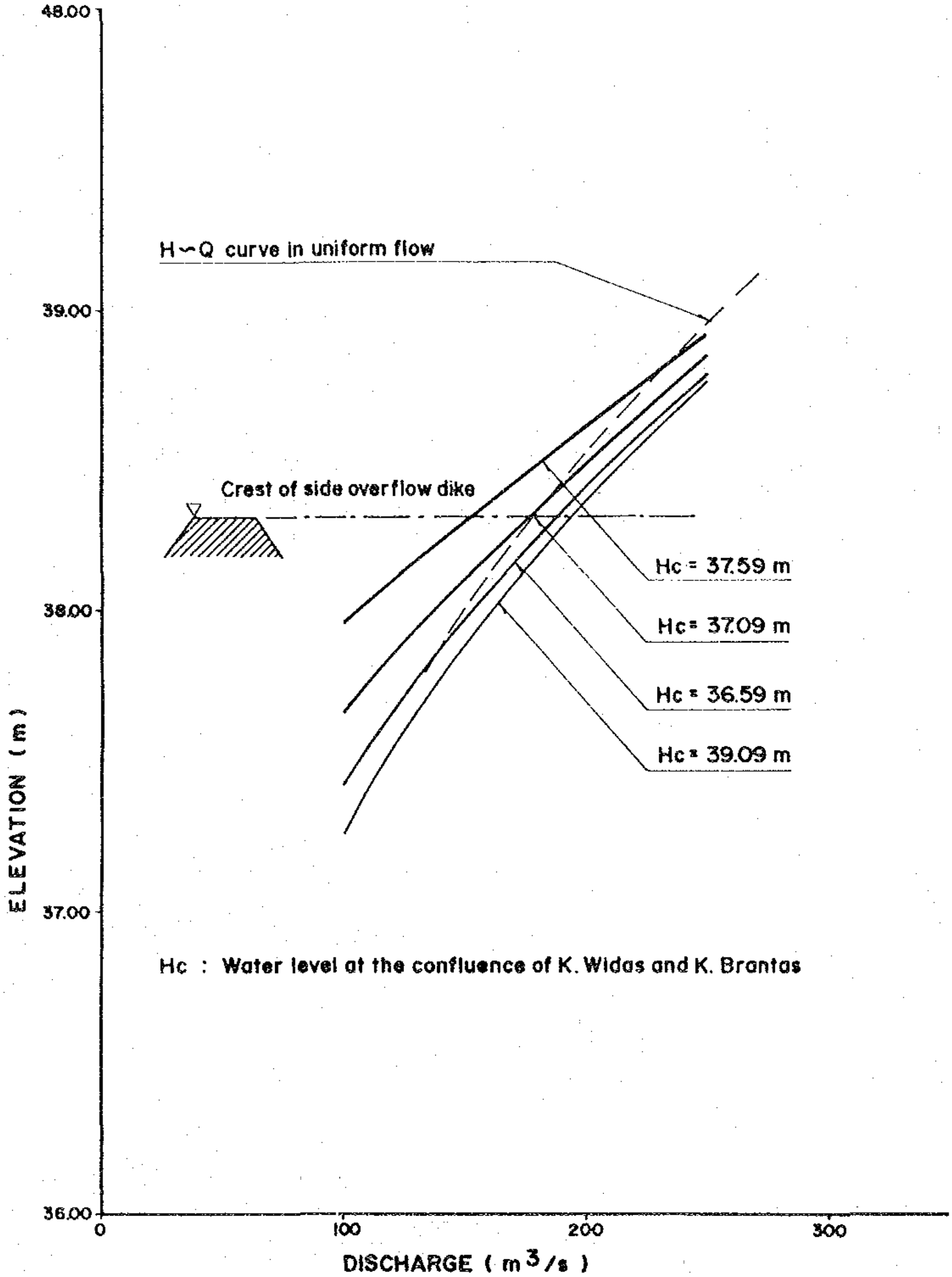


Fig. 4.3.10 STAGE DISCHARGE RELATION OF K. WIDAS AT DOWNSTREAM END OF SIDE OVERFLOW DIKE OF WIDAS RETARDING BASIN (1/3)

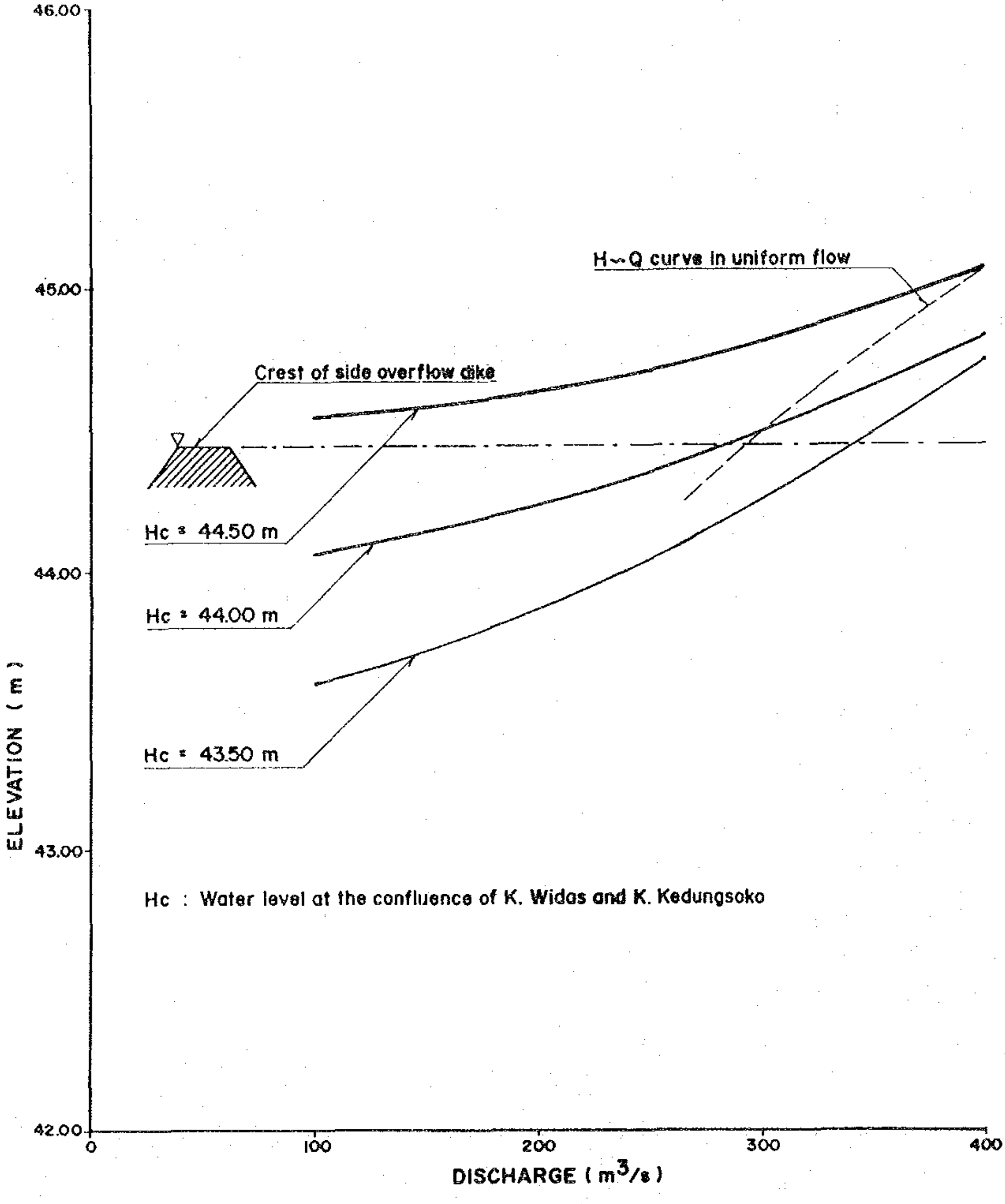


Fig. 4.3.10 STAGE DISCHARGE RELATION OF K. WIDAS AT DOWNSTREAM END OF SIDE OVERFLOW DIKE OF ULO RETARDING BASIN (2/3)

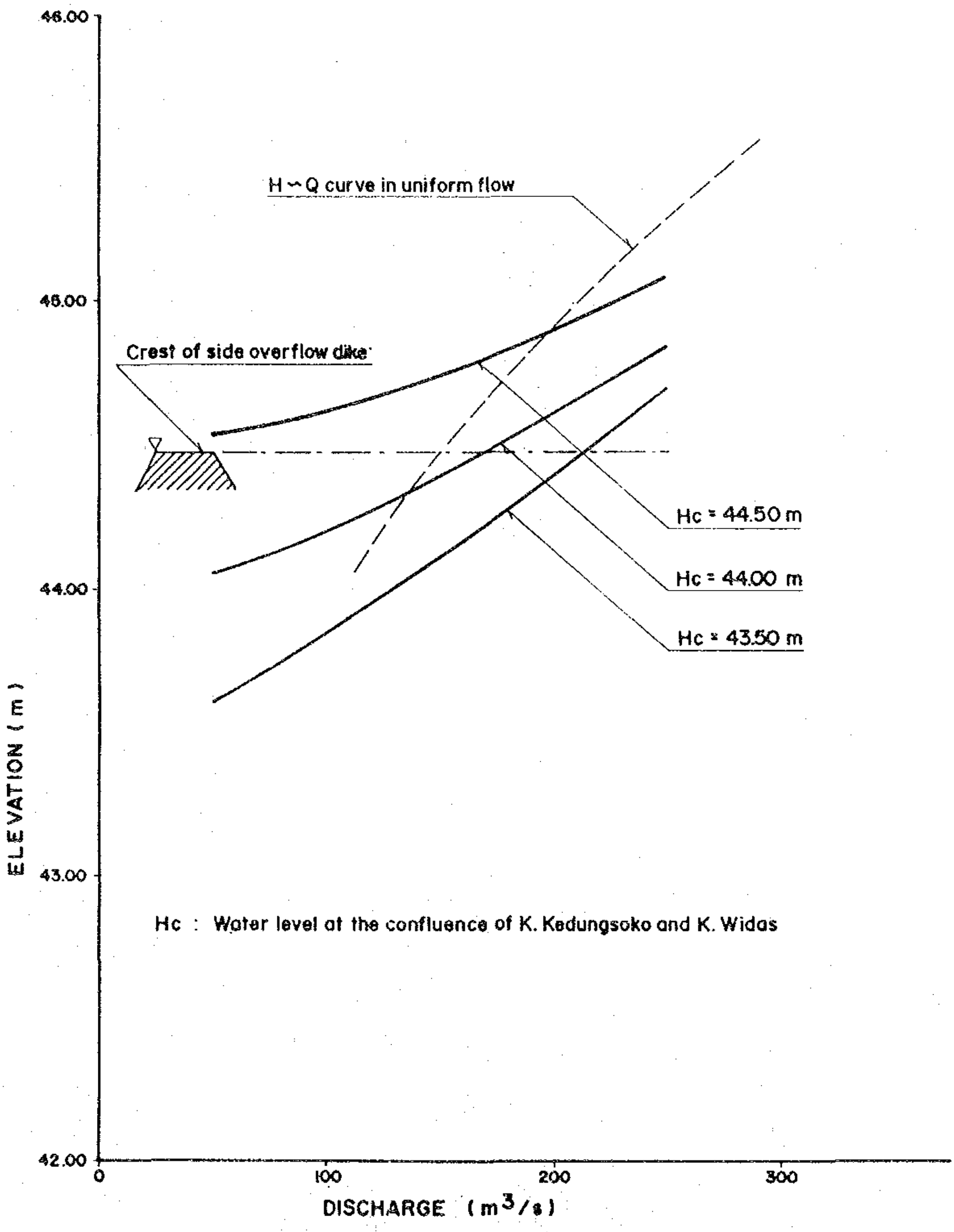


Fig. 4.3.10 STAGE DISCHARGE RELATION OF K. KEDUNGSOKO AT DOWNSTREAM END OF SIDE OVERFLOW DIKE OF KEDUNGSOKO RETARDING BASIN (3/3)

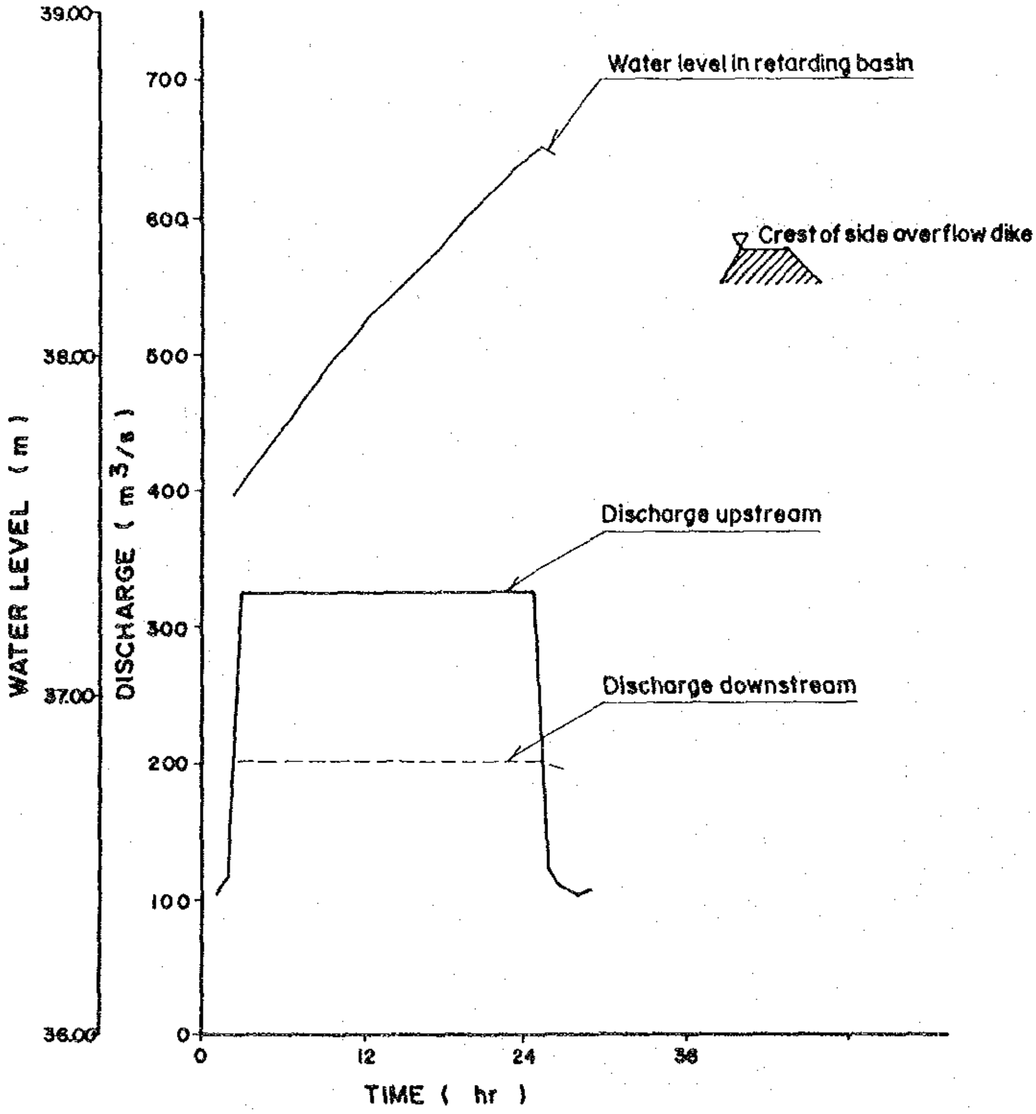


Fig. 4.3.11 FLOOD ROUTING IN THE WIDAS RETARDING BASIN (Flood hydrograph : type I) (1/6)

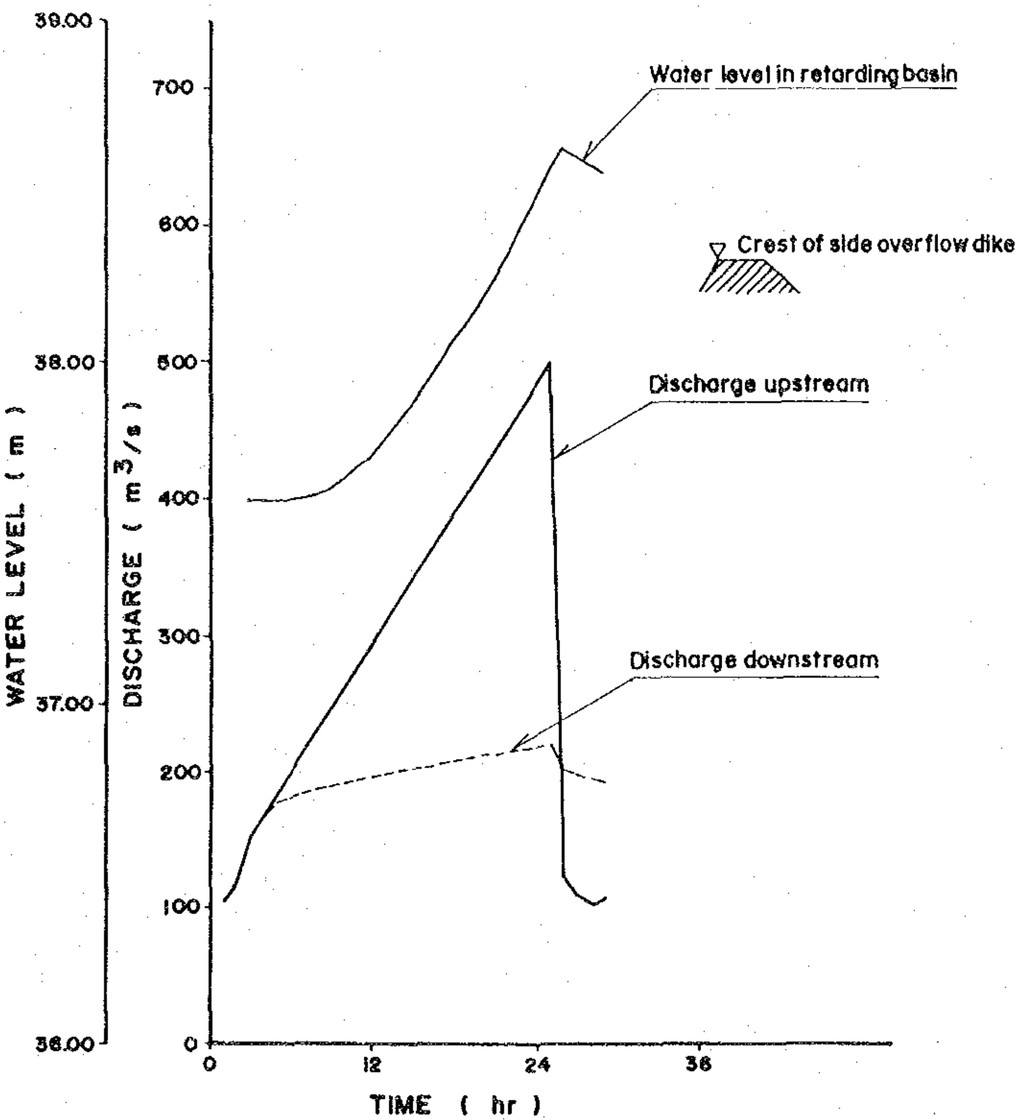


Fig. 4.3.11 FLOOD ROUTING IN THE WIDAS RETARDING BASIN (Flood hydrograph : type 2) (2/6)

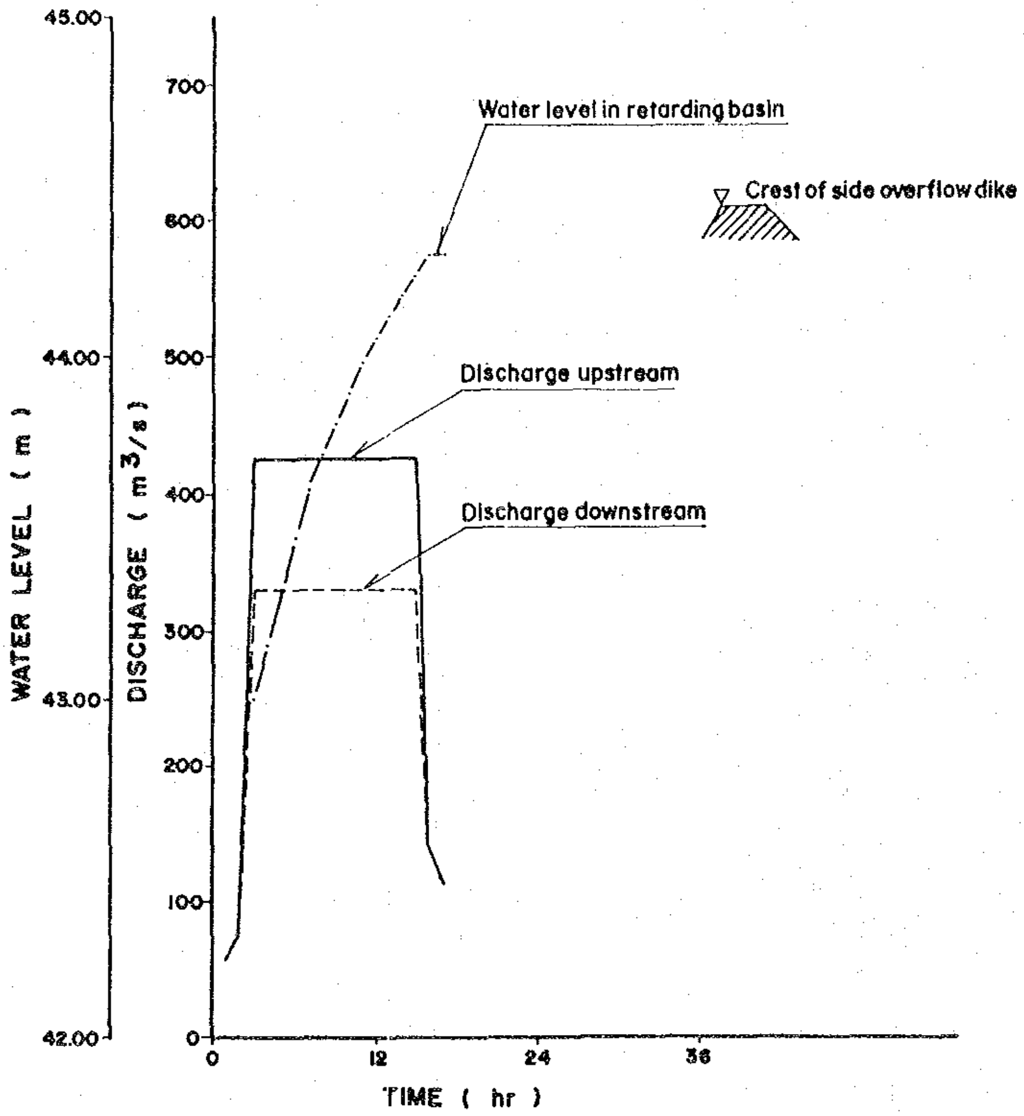


Fig. 4.3.11 FLOOD ROUTING IN THE ULO RETARDING BASIN (Flood hydrograph : type I) (3/6)

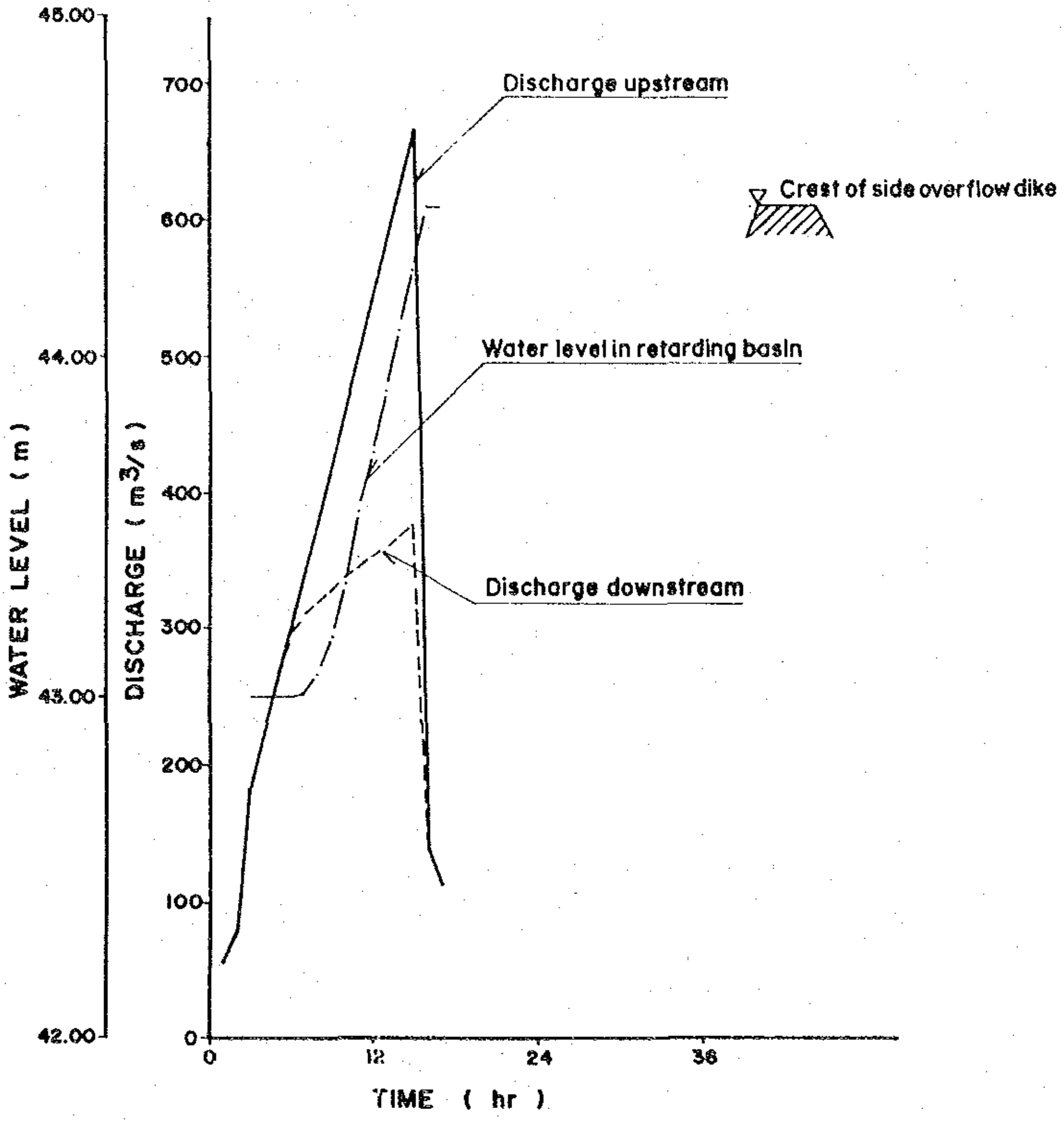


Fig. 4.3.11 FLOOD ROUTING IN THE ULO RETARDING BASIN (Flood hydrograph : type 2) (4/6)

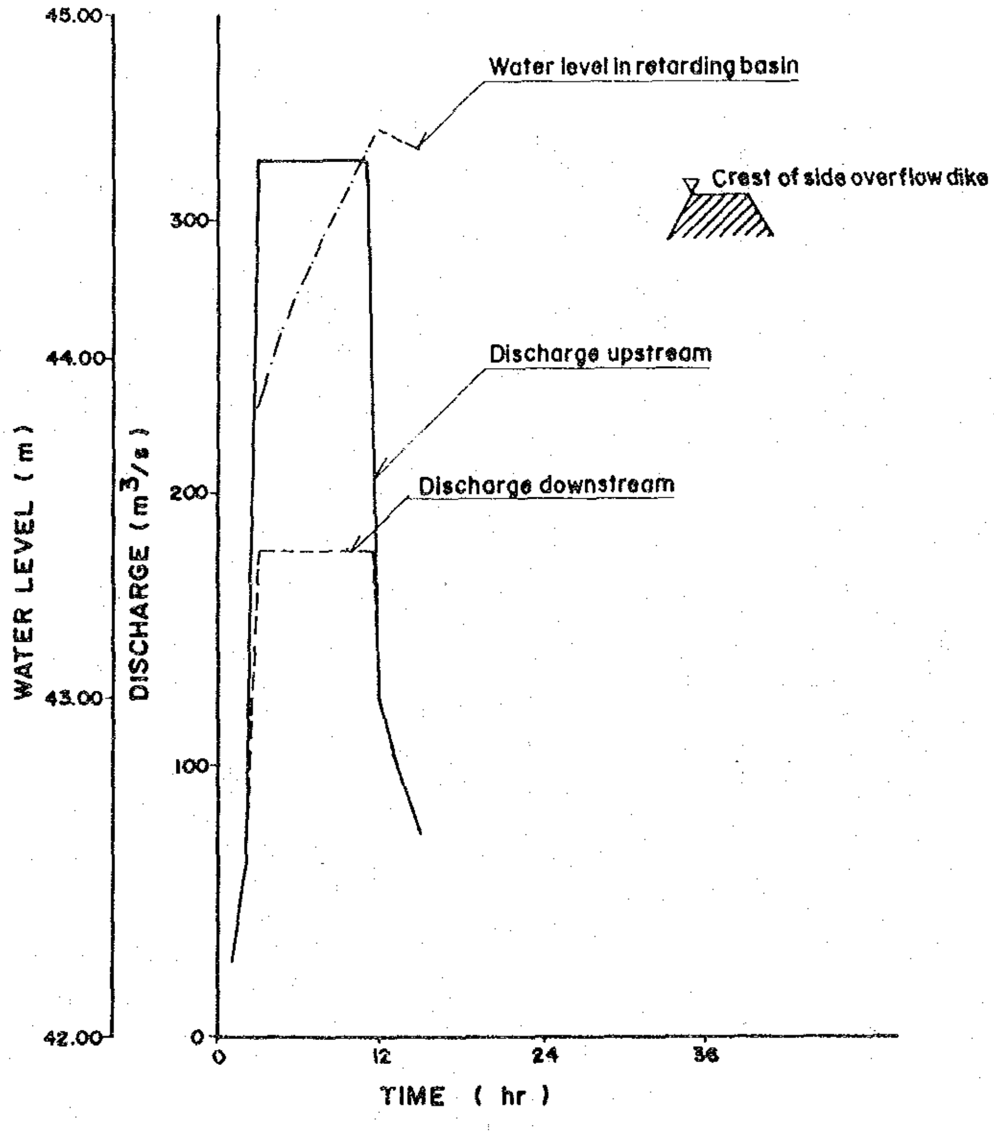


Fig. 4.3.11 FLOOD ROUTING IN THE KEDUNGSOKO RETARDING BASIN
(Flood hydrograph : type I) (5/6)

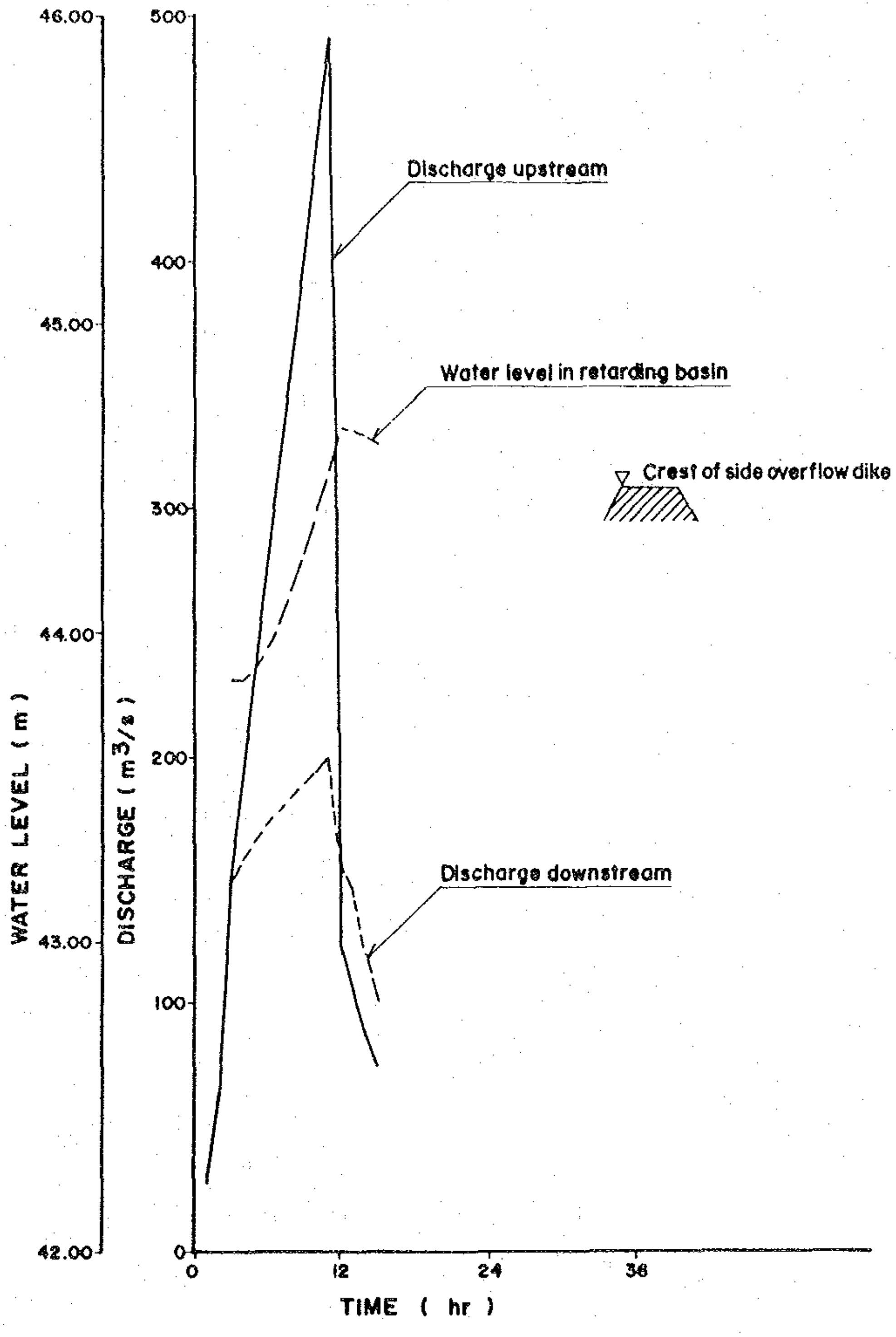


Fig. 4.3.11 FLOOD ROUTING IN THE KEDUNGSOKO RETARDING BASIN (Flood hydrograph : type 2) (6/6)

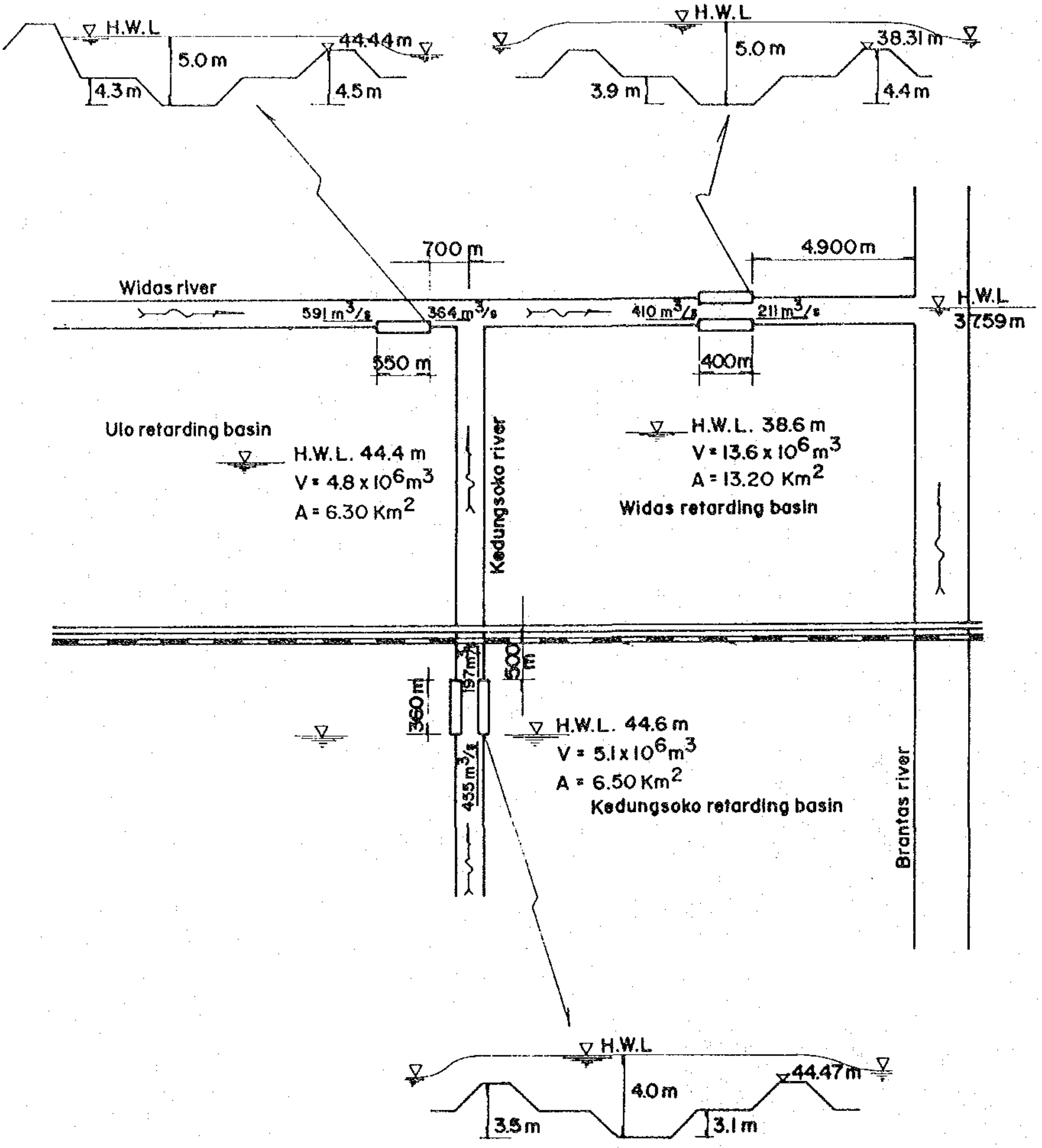


Fig. 4.3.12 LOCATION DIAGRAM OF RETARDING BASINS

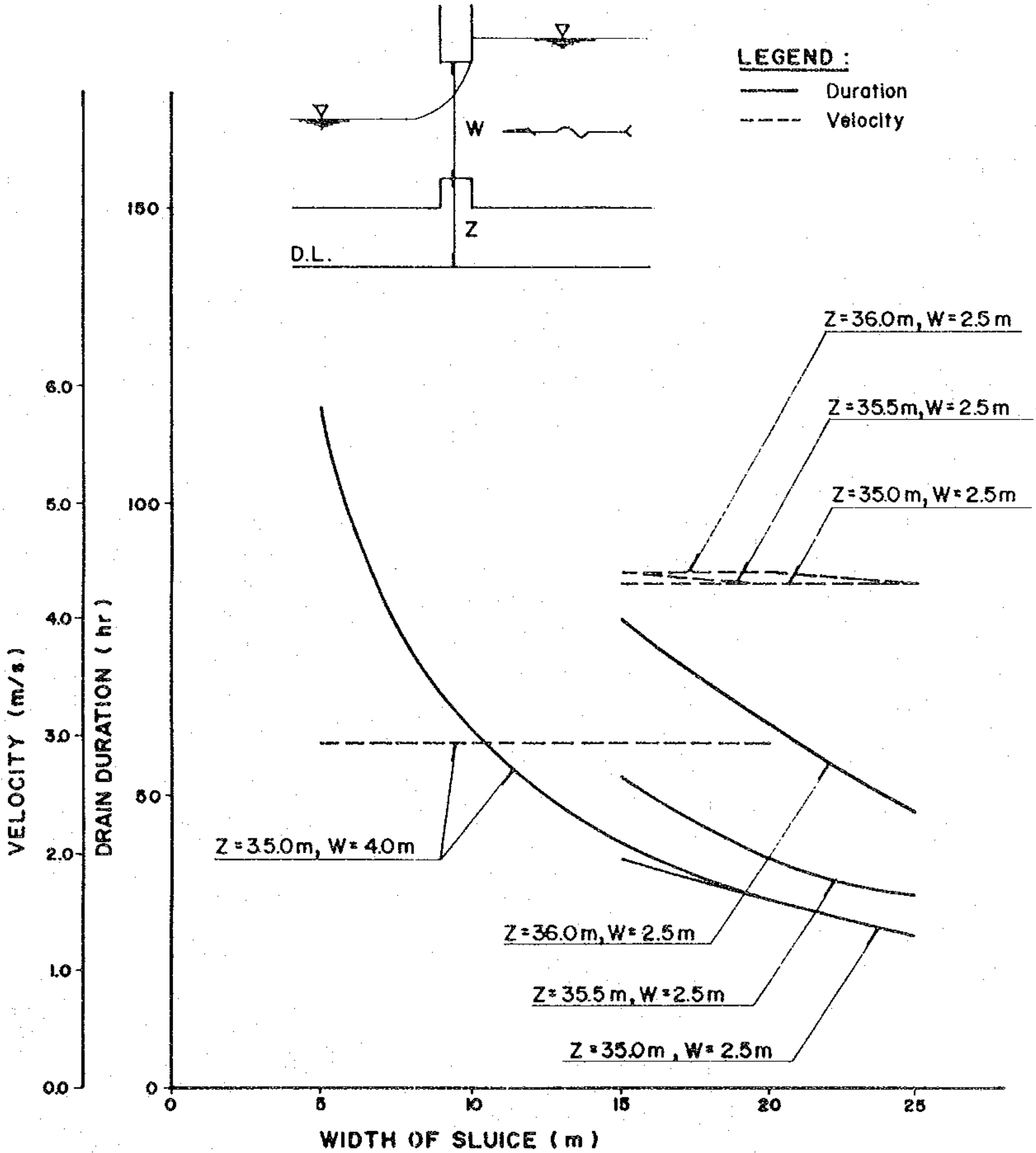


Fig. 4.3.13 DRAIN DURATION AND MAXIMUM DRAIN VELOCITY OF WIDAS RETARDING BASIN (1/3)

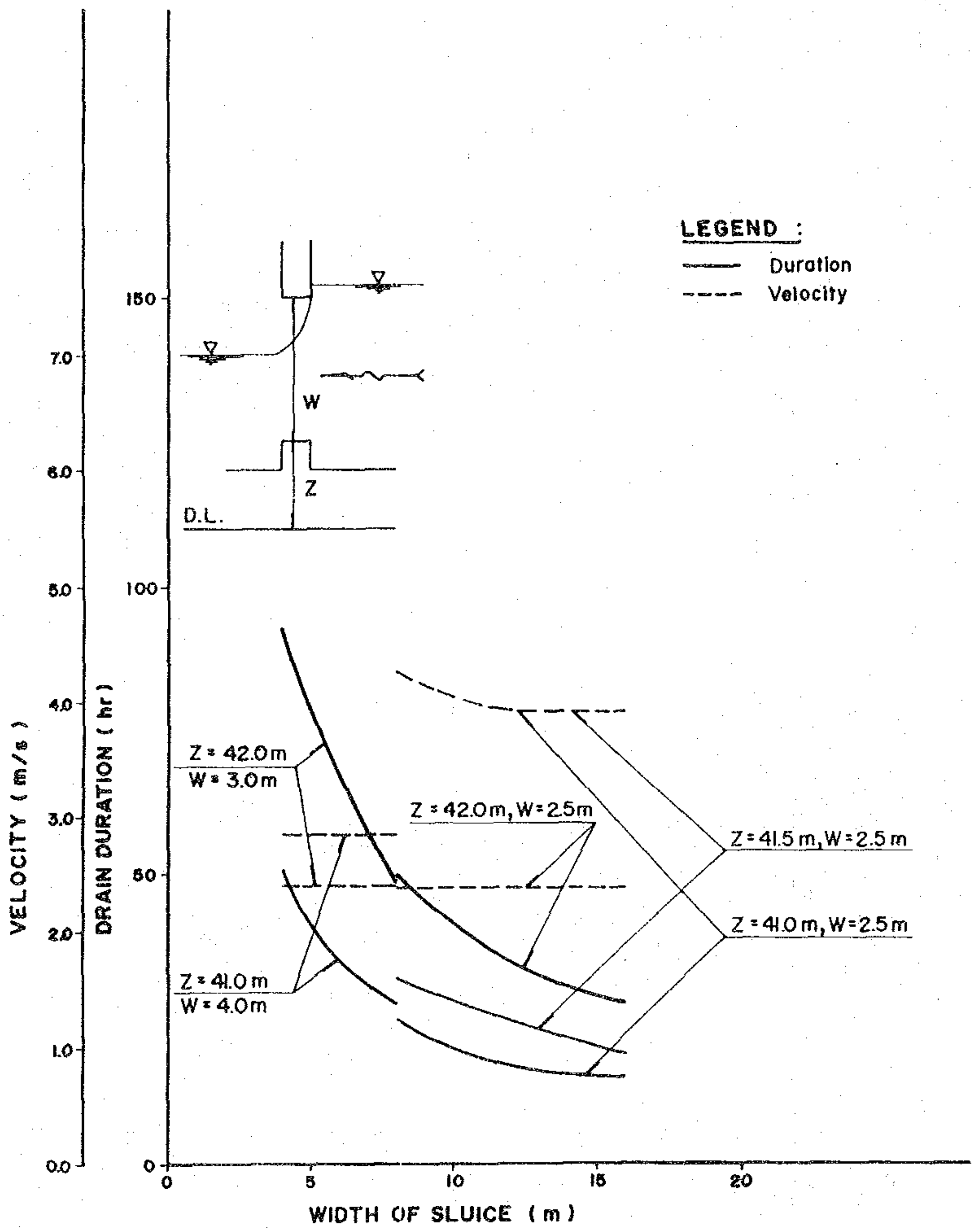


Fig. 4. 3. 13 DRAIN DURATION AND MAXIMUM DRAIN VELOCITY OF ULO RETARDING BASIN (2/3)

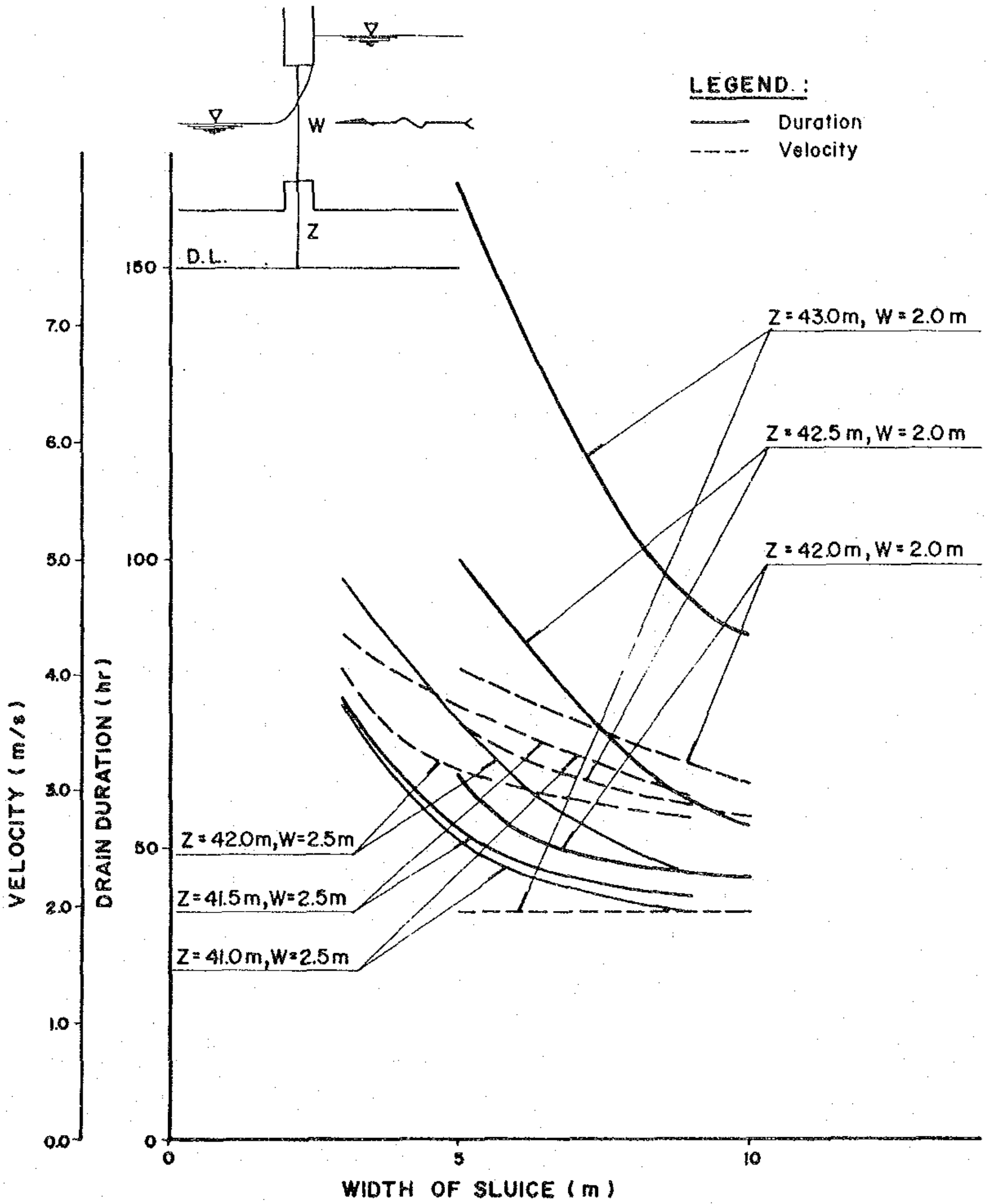


Fig. 4.3.13 DRAIN DURATION AND MAXIMUM DRAIN VELOCITY OF KEDUNGSOKO RETARDING BASIN (3/3)

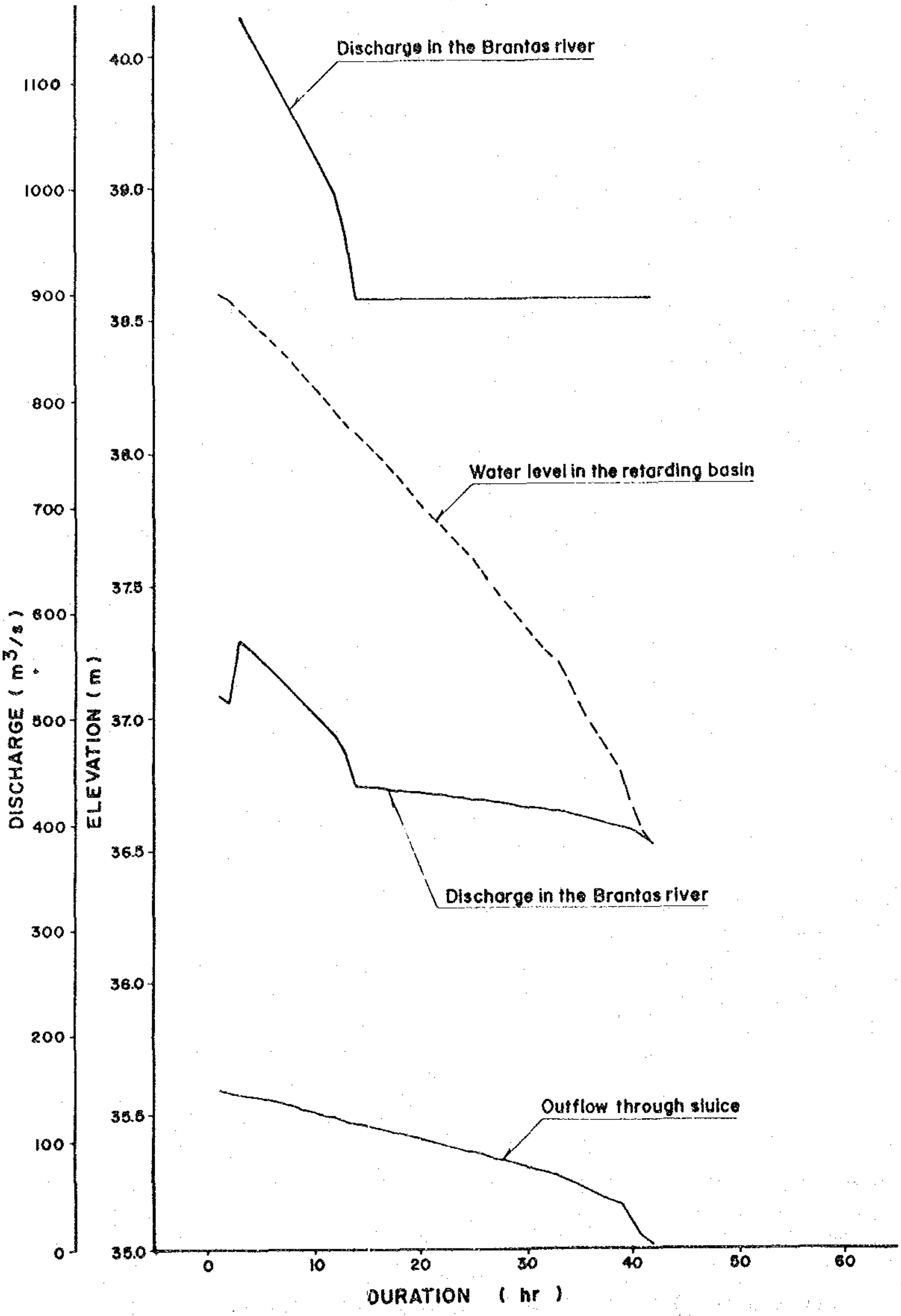


Fig. 4.3.14 FLOOD WATER DRAINAGE THROUGH SLUICE OF WIDAS RETARDING BASIN (1/3)

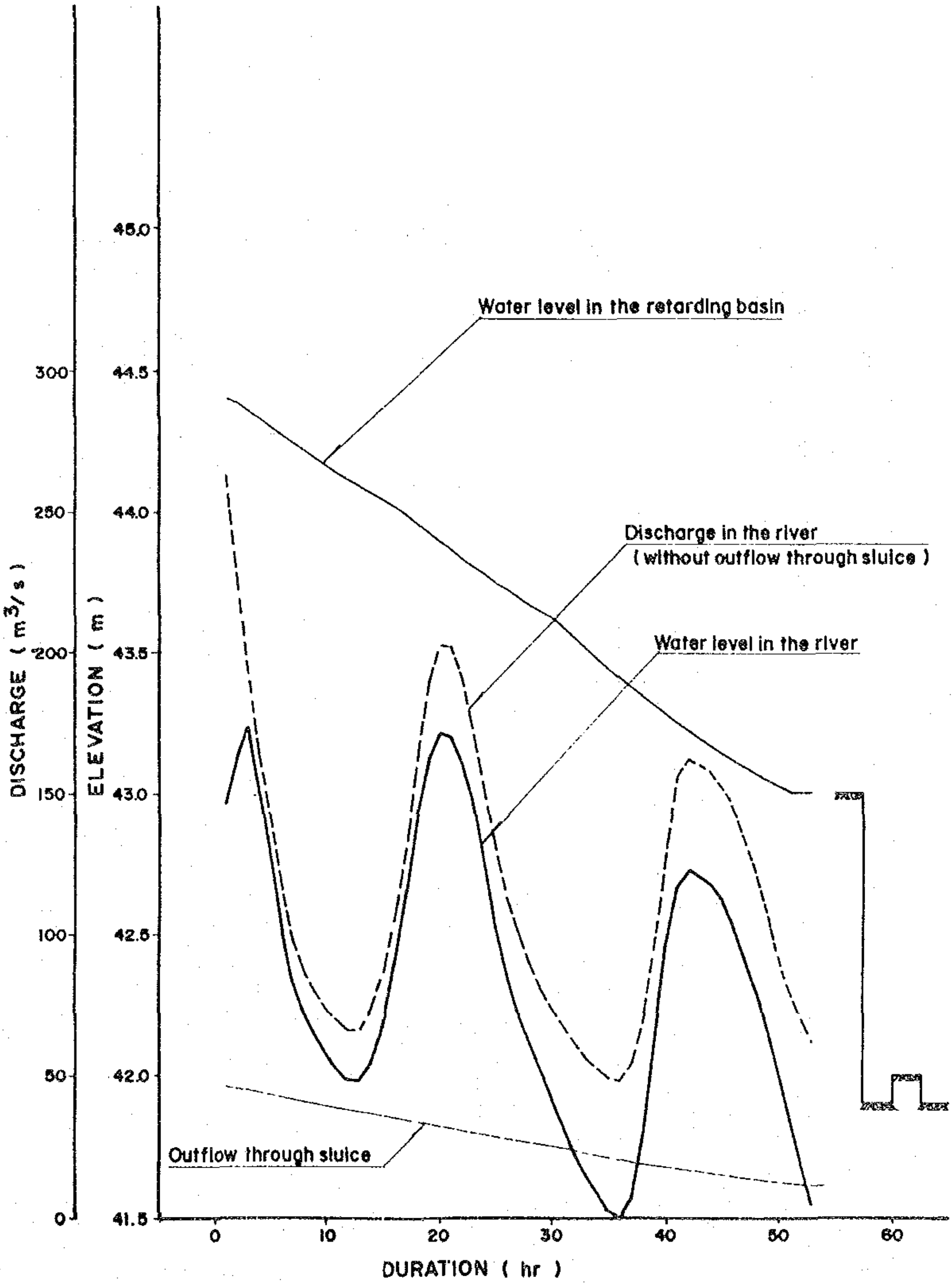


Fig. 4.3.14 FLOOD WATER DRAINAGE THROUGH SLUICE OF ULO RETARDING BASIN (2/3)

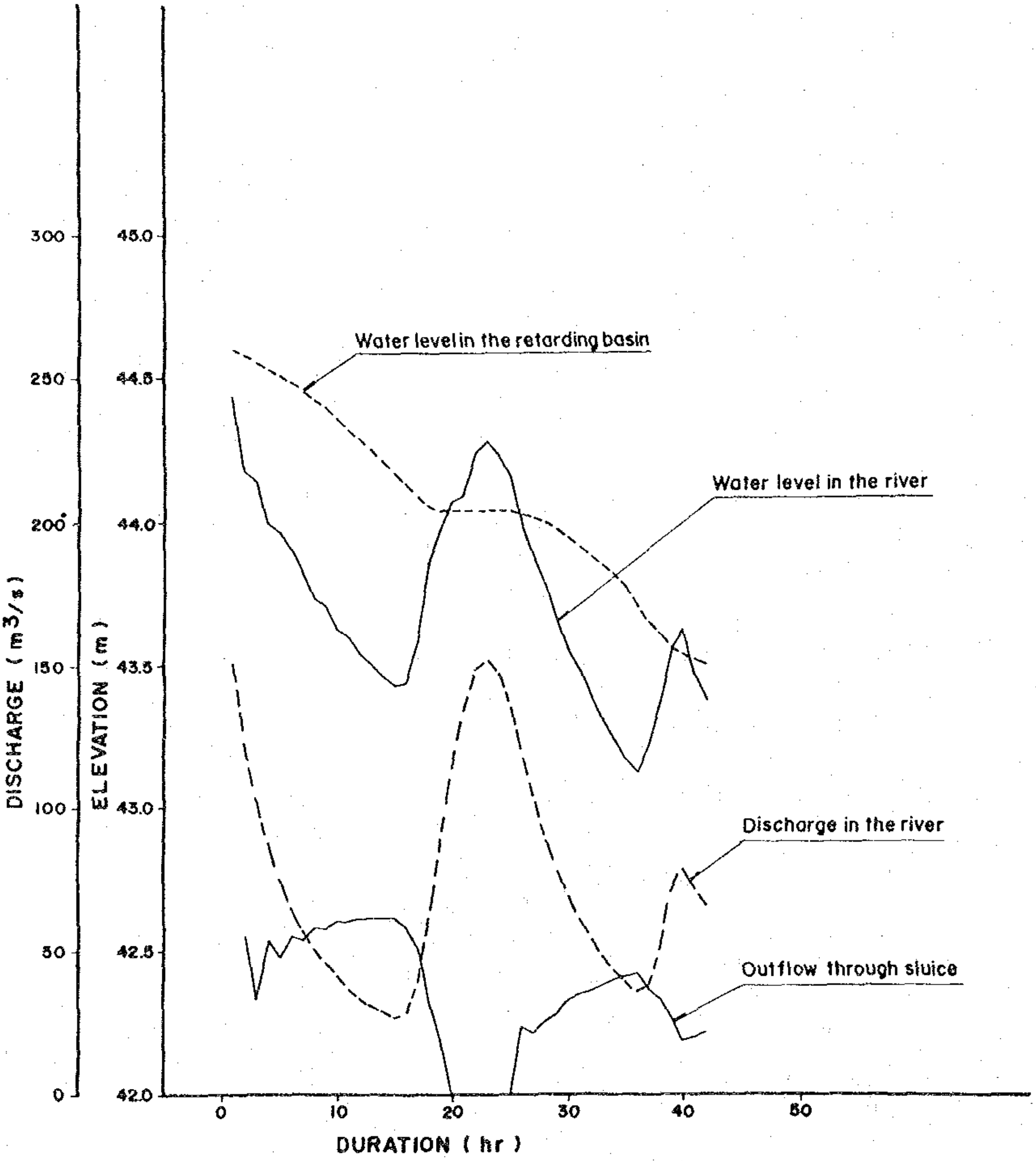


Fig. 4.3.14 FLOOD WATER DRAINAGE THROUGH SLUICE OF KEDUNGSOKO RETARDING BASIN (3/3)

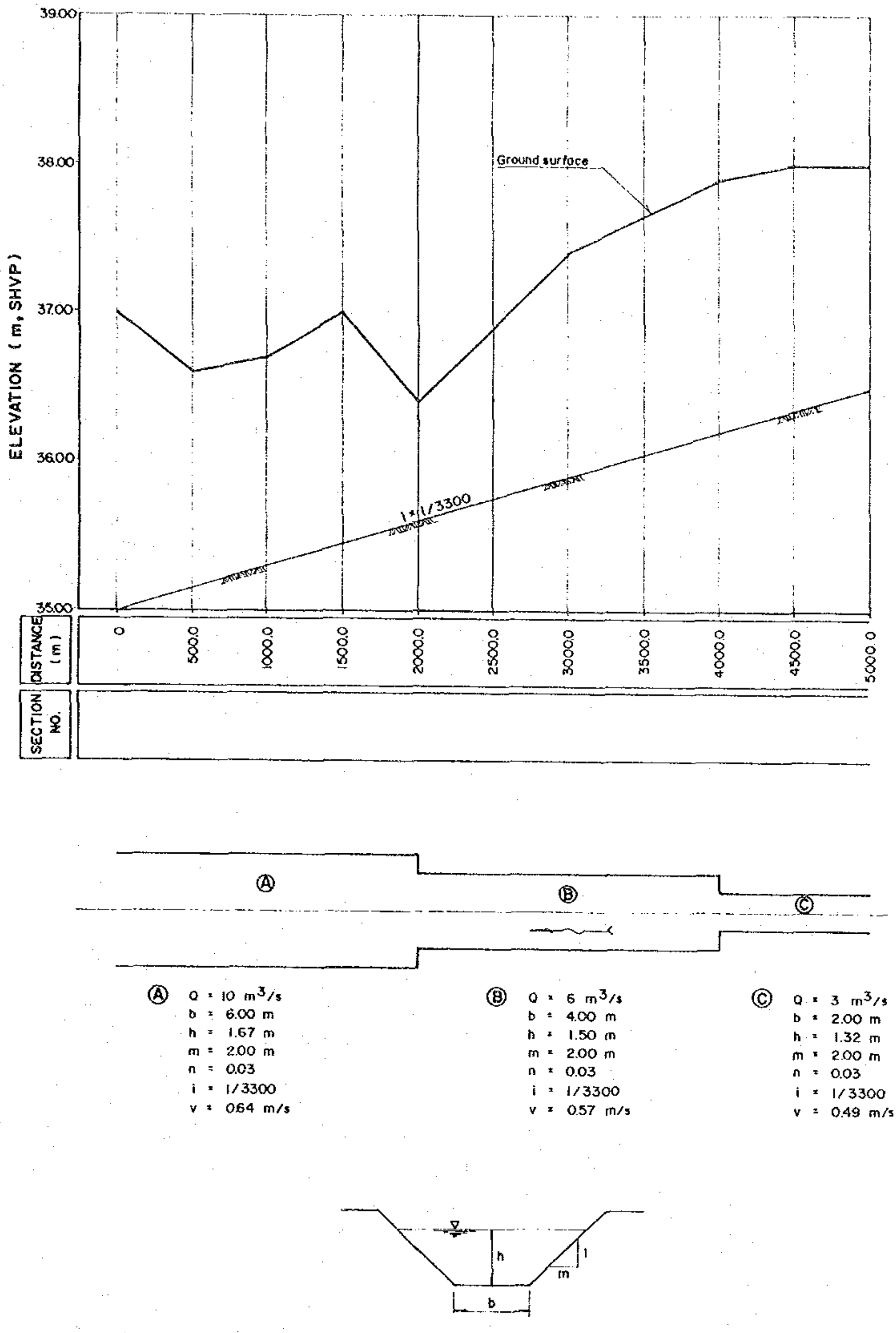
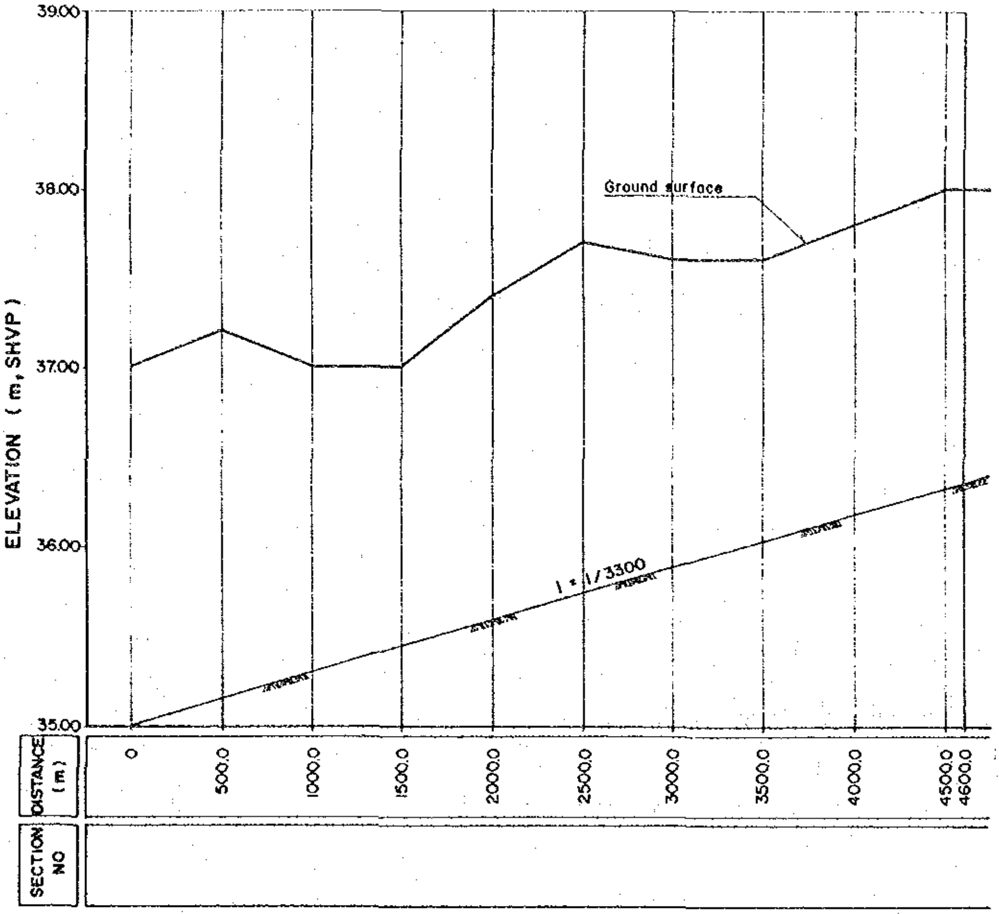
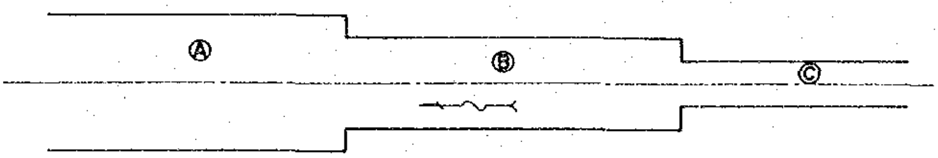


Fig. 4.3.15 LONGITUDINAL PROFILE AND STANDARD CROSS - SECTION OF DRAINAGE CANAL OF LEFT WIDAS RETARDING BASIN (1/3)





	Ⓐ	Ⓑ	Ⓒ
Q	10 m^3/s	6 m^3/s	3 m^3/s
b	6.00 m	4.00 m	2.00 m
h	1.67 m	1.50 m	1.32 m
m	2.00 m	2.00 m	2.00 m
n	0.03	0.03	0.03
i	1/3300	1/3300	1/3300
v	0.64 m/s	0.57 m/s	0.49 m/s

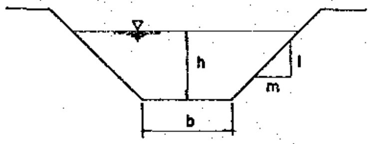


Fig. 4.3.15 LONGITUDINAL PROFILE AND STANDARD CROSS - SECTION OF DRAINAGE CANAL FROM SIDE OVERFLOW DIKE TO DRAINAGE SLUICE OF RIGHT WIDAS RETARDING BASIN (2/3)

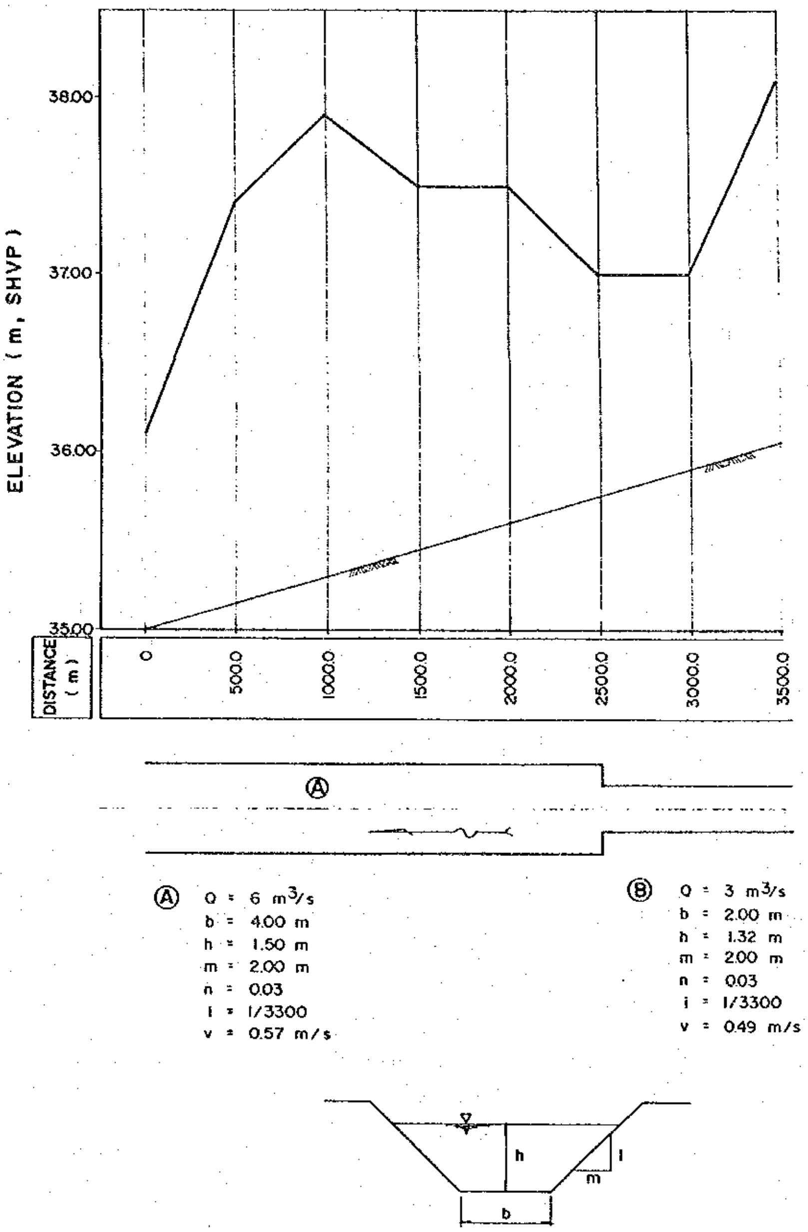


Fig. 4.3.15 LONGITUDINAL PROFILE AND STANDARD CROSS - SECTION OF DRAINAGE CANAL IN UPSTREAM REACH OF RIGHT WIDAS RETARDING BASIN (3/3)

4.4 Proposed River Channel Improvement

1. River width

In general, river width is determined based on not only scale of design discharge but also river channel profile, topography, geology, land use in the riparian area and so on.

In this plan, river width is determined considering the following aspects of design standard and present condition.

Design standard of rivers in Japan

Design standard in Japan is as follows;

Design discharge (m^3/s)	River width (m)
300	40 - 60
500	60 - 80
1000	90 - 100

On the other hand, actual river width which currently designed and/ or under construction and/or constructed is given on Fig. 4.4.1 showing relationship among river width, design discharge and basin area.

Present river width

Out of the objective rivers, the upper reach of Kedungsoko river has been improved essentially involving construction of flood dikes on the both banks. In this plan, these existing dikes are fully utilized by strengthening and heightening. For the others, the river width including high-water channel has been not yet fixed and varies depending on the scale of flood discharges.

In some rivers especially Widas river, excessive meandering, are remarkable in locations and such excessive ones are smoothened by cut-off channel considering stability of river channel. In determination of river width, it is considered to cover such large meandering of river course, that is, river width is determined considering the extent of the large meandering of the existing river course.

Under the above considerations, river width of the respective rivers is determined as shown below.

River	By basin area		By design discharge		Present average river width (m)	Proposed river width (m)
	Area (km^2)	River width (m)	Design discharge (m^3/s)	River width (m)		
Lower Widas	1350-1200	350-310	570-530	90-80	300-400	300-100
Upper Widas	690- 230	250-150	640-440	100-70	100- 50	110- 50
Diversions + Upper Ulo	230- 220	150-140	230-190	50	Upper Ulo 40	50
Kedungsoko	500	210	470-200	75-50	100	100- 90
Kuncir	60	70	95	50	30	40

2. Longitudinal profile

Design profile is determined considering profile of the existing river channel. The river bed elevation is set at the average upper line of the deepest river bed in the existing channel.

Design high-water level is determined based on the following criteria. For rivers which diking system have been employed or are to be employed, the high-water level is set not so as to heighten the existing flood water level or max. flood level in the past, in principle. For rivers which are improved by excavation of low-water channel without diking system, it is set below average existing ground height as low as possible.

The design elevations of dike crown, high-water level and river bed are shown in Table 4.4.1.

3. River cross-section and its cross-sectional area

Double section consisting of high-water channel and low-water channel is adopted to river channel section considering large fluctuation of river discharge and stability in principle. However, also single section with berm is adopted to the lower Ulo which is newly connected to the middle Widas river.

The required cross-sectional area is estimated by uniform flow method. The adopted Manning's coefficient roughness "n" is as follows;

n = 0.03 for low-water channel
n = 0.05 for high-water channel

The major proposed dimensions of typical cross-section for comprehensive plan and first stage plan are given in Table 4.4.2. Those typical cross-sections are shown on Figs. 4.4.2 and 4.4.3 respectively.

Based on the above design profile and typical cross-section, the river cross-sections at the respective surveyed cross-sections are proposed as explained later (Fig. 4.4.5). For reference, carrying capacity of the proposed river channel of the comprehensive plan is checked by non-uniform flow calculation and the results are shown in Table 4.4.3. According to the Table 4.4.3, it shows that the proposed river channel can be flown design discharge below the design HWL for almost whole stretches.

4. Bank protection works

The bank protection works consisting of wetmasonry and gabion are provided at flow attacking places and/or along densely populated areas. The right bank of the new diversion channel and Upper Ulo river is protected by wetmasonry type revetment for almost whole stretches to prevent Nganjuk urban area from breach of flood dike due to flow attacking.

Length and area of bank protection works are shown in Table 4.4.4 and locations of major bank protection works are shown on Fig. 4.4.4. Approximate 40% of total bank protection works for comprehensive plan is constructed by first stage plan considering existing condition.

5. Layout of proposed dike alignment and related river structures

Feasibility designs for comprehensive plan and first stage plan are made based on the typical cross-section and longitudinal profile. The proposed dike alignment, controllable retarding basin, related structures and river cross-sections are given on Figs. 4.4.4 and 4.4.5.

The controllable retarding basins and related river structures are described in the sections of 4.3 and 4.5 in this ANNEX-4, respectively.

6. Design discharge and river width of secondary tributaries

The secondary tributary is improved mainly by construction of back-water levee including minor excavation. The objective tributaries are 12 rivers in total. Such tributaries are improved for 5-yr flood for comprehensive plan and first stage plan.

The design discharges of the above tributaries are estimated based on the specific discharges which were calculated by hydrological study and those are summarized below.

	Net Area (km^2)	Specific discharge ($m^3/s/km^2$)	Design discharge (m^3/s)
Lower Widas			
Pohbuntu	61	1.38	85
Nglempoh	13	1.87	25
Jaan	11	1.87	25
Tributary	10	1.44	15
Tretes	31	1.44	45
Upper Widas			
Ngrembek	46	1.27	60
Tributary	6	1.27	10
Pelangkengi	72	2.49	180
Wotrangkul	44	1.63	75
Upper Ulo			
Secong	63	1.51	100
Winong	11	2.18	25
Kuncir			
Gonggang - Malang	37	0.54	20

For the above design discharges, the following proposed river width and length are provisionally adopted to tributary improvement for cost estimate considering existing river width and its carrying capacity. The "n" values of 0.035 for low-water channel and 0.05 for high-water channel are adopted.

River	Existing Condition		Design Condition			
	Average River width (m)	Average Carrying Capacity (m^3/s)	Design HWL of Conf. (m.SHVP)	Design Dike Crown of Conf. (m.SHVP)	Design River Width (m)	Length to be Improved (km)
Lower Widas						
Pohbuntu	20	-	39.13	40.13	30	0.9
Nglempoh	10	15	40.50	41.50	20	1.6
Jaan	20	35	41.39	42.39	30	1.3
Tributary	10	-	41.55	42.55	20	1.2
Tretes	25	15	42.50	43.50	35	1.5
Upper Widas						
Ngrembek	35	180	46.86	47.86	45	1.5
Tributary	25	40	47.24	48.24	35	1.5
Pelangkengi	50	180	47.80	48.80	60	2.9
Wotrangkul	45	120	50.93	51.93	55	2.5
Upper Ulo						
Secong	30	40	54.50	55.50	40	1.5
Winong	20	90	57.30	58.30	30	0.5
Kuncir						
Gonggang-Malang	10	10	45.83	46.63	20	0.8

A1 canal a main drainageway in Warujayeng irrigation area is to be improved for 5-yr flood of 70 m^3/s by Waru-Turi Project.

7. Merit and demerit of construction of surrounding dike of retarding basin

Surrounding dike of a retarding basin essentially aims protect the inland from flood water retarded in the retarding basin. But even without the surrounding dike, the inundation condition of the retarding basin would be improved with the construction of river dike and side overflow dike than in the present condition, depending on the hydrological and topographical features.

Here are the brief discussions on whether to construct surrounding dikes or not.

(1) Cost

In the case of construction of surrounding dike, the following costs are needed.

(a) Land acquisition cost
(b) Construction cost of dike
(c) Construction cost of sluices or culverts
(d) Operation and Maintenance cost