

X.3 Initial Farm Investment

Initial farm investment consists of the costs for i) installation of cowshed and facilities, ii) farm machinery for fodder crop production, iii) procurement of milk cows and iv) installation of rice mill.

(See Table X.8)

These costs are summarized below:

Item	Foreign Currency (US\$10 ³)	Local Currency (FCFA 10 ⁶)	Total (US\$10 ³)
1. Installation of Cowshed and Facilities	1,446	180	1,856
2. Farm Machinery for Fodder Production	428	0	428
3. Procurement of Milk Cow (Jersey)	1,267	0	1,267
4. Installation of Rice Mill	160	8	176
Sub-total	<u>3,301</u>	<u>188</u>	<u>3,740</u>
Price Contingency	347	63	497
Total	3,648	251	4,237

The details of these costs are broken down in Tables X.9, X.10 and X.11 respectively. The disbursement schedule setup according to the project implementation schedule is shown in Table X.12.

Table X.1 SUMMARY OF CIVIL CONSTRUCTION COST

KOKBA SECTOR A=557ha							
WORKS	UPPER KOKBA A=383ha			LOWER KOKBA A=174ha			
	L/C	F/C	Total	L/C	F/C	Total	
	10*6FCFA	US\$ 10*3	US\$ 10*3	10*6FCFA	US\$ 10*3	US\$ 10*3	
I	TEMPORARY WORKS	15	47	83	11	49	75
II	MAIN IRRIGATION CANAL	239	794	1,354	763	1,269	3,060
III	SECONDARY IRRIGATION CANAL	109	379	634	42	157	255
IV	ON-FARM WORKS	119	326	605	55	150	279
V	MAIN DRAINAGE CANALS	0	0	0	0	0	0
VI	SECONDARY DRAINAGE CANALS	44	74	179	30	44	115
VII	CONNECTION ROAD	0	0	0	0	0	0
	Sub-total	526	1,620	2,855	902	1,667	3,784
IX	PHYSICAL CONTINGENCY	53	162	285	90	167	378
	Total Construction Cost	579	1,782	3,140	992	1,834	4,162
X	ENGINEERING SERVICES						
	TOTAL	579	1,782	3,140	992	1,834	4,162

BAGUINEDA SECTOR A=1979ha							
WORKS	UPPER BAGUINEDA A=555ha			LOWER BAGUINEDA A=1424ha			
	L/C	F/C	Total	L/C	F/C	Total	
	10*6FCFA	US\$ 10*3	US\$ 10*3	10*6FCFA	US\$ 10*3	US\$ 10*3	
I	TEMPORARY WORKS	33	59	137	39	119	211
II	MAIN IRRIGATION CANAL	724	880	2,579	221	690	1,209
III	SECONDARY IRRIGATION CANAL	138	500	824	311	1,134	1,864
IV	ON-FARM WORKS	165	437	824	506	1,503	2,692
V	MAIN DRAINAGE CANALS	2	5	9	147	388	731
VI	SECONDARY DRAINAGE CANALS	71	124	290	125	292	585
VII	CONNECTION ROAD	11	28	54	0	0	0
	Sub-total	1,144	2,034	4,718	1,350	4,124	7,293
IX	PHYSICAL CONTINGENCY	114	203	472	135	412	729
	Total Construction Cost	1,258	2,237	5,190	1,485	4,536	8,022
X	ENGINEERING SERVICES						
	TOTAL	1,258	2,237	5,190	1,485	4,536	8,022

TANIMA & SIENKORO TOTAL A=3000ha							
WORKS	A=464ha			A=3000ha			
	L/C	F/C	Total	L/C	F/C	Total	
	10*6FCFA	US\$ 10*3	US\$ 10*3	10*6FCFA	US\$ 10*3	US\$ 10*3	
I	TEMPORARY WORKS	14	43	75	113	317	582
II	MAIN IRRIGATION CANAL	65	188	340	2,012	3,819	8,542
III	SECONDARY IRRIGATION CANAL	161	568	946	761	2,737	4,523
IV	ON-FARM WORKS	170	510	909	1,015	2,926	5,308
V	MAIN DRAINAGE CANALS	39	114	205	187	506	946
VI	SECONDARY DRAINAGE CANALS	20	49	97	291	583	1,266
VII	CONNECTION ROAD	0	0	0	11	28	54
	Sub-total	469	1,471	2,572	4,390	10,915	21,221
IX	PHYSICAL CONTINGENCY	47	147	257	439	1,092	2,122
	Total Construction Cost	516	1,618	2,829	4,829	12,007	23,343
X	ENGINEERING SERVICES				580	1,441	2,801
	TOTAL	516	1,618	2,829	5,409	13,448	26,145

Table X.2 BREAKDOWN OF CIVIL CONSTRUCTION COST (1/8)

I CONSTRUCTION COST OF MAIN CANAL

KOBA SECTOR A=558ha

Item	Works	Unit	UPPER KOBA A=383ha		LOWER KOBA A=175ha		UPPER BAGUIINBA A=554ha							
			Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$
I EARTH WORKS														
1	Clearing	ha	52	4,223	8,315	12,538	15	523	2,417	3,645	20	697	3,223	
2	Repairing of canal bank	m2	50,000	41,500	82,000	123,500	0	0	0	0	0	0	0	0
3	Topsoil stripping	m3	0	0	0	0	0	0	0	0	0	0	0	0
4	Excavation common soil	m3	17,530	27,693	35,232	62,932	53,830	36,232	108,196	193,249	51,830	34,886	104,178	
5	Excavation soft rock	m3	0	0	0	0	0	0	0	0	0	0	0	0
6	Earthfill common soil	m3	0	0	0	0	0	0	0	0	0	0	0	0
7	Earthfill Laterite soil	m3	62,390	199,024	286,370	485,394	84,400	114,695	387,396	656,632	29,320	39,944	134,579	
8	Earthfill Excavation soil	m3	0	0	0	0	0	0	0	0	0	0	0	0
9	Laterite Pavement	m2	13,300	48,013	69,027	117,040	3,840	5,903	19,930	33,792	6,210	9,550	32,230	
10	Sod facing	m2	19,880	13,916	7,753	21,669	26,420	7,878	10,304	28,798	26,820	7,998	10,460	
	Sub Total	m3		394,373	486,700	823,073		165,233	528,245	916,116		92,975	284,670	
II CANAL LINING WORKS														
1	Concrete lining	m3	0	0	0	0	6,430	330,893	268,710	1,045,454	8,900	458,001	371,931	
2	Under drain works	m3	0	0	0	0	3,370	71,146	41,753	208,762	5,770	92,190	54,102	
3	Foundation sheet	m3	0	0	0	0	61,530	20,971	12,307	61,535	83,610	28,493	16,722	
	Sub Total			0	0	0		423,010	322,770	1,315,751		578,685	442,755	
III STRUCTURE WORKS														
1	Turnout	Nos	10	38,746	40,670	79,416	7	11,444	28,059	54,924	9	16,006	40,908	
2	Cross Drain	Nos	3	49,932	101,634	151,566	1	5,654	25,242	38,514	1	9,688	56,717	
3	Culvert for road	Nos	4	53,546	95,432	148,978	3	16,750	78,872	118,214	0	0	0	
4	Side spillway	Nos	0	0	0	0	0	0	0	0	0	0	0	
5	Check Gate	Nos	1	29,244	35,338	64,582	1	12,459	35,338	64,582	1	12,458	35,338	
6	Bridge	Nos	5	44,383	15,394	59,777	1	3,250	2,591	10,243	3	10,139	8,121	
7	Washing step	Nos	2	2,852	572	3,424	1	607	286	1,712	3	1,822	858	
8	Siphon(KOBA River)	Nos	0	0	0	0	1	121,484	229,866	515,039	0	0	0	
	Sub Total			218,703	289,040	507,743		171,667	400,254	803,228		50,113	141,942	
IV REPAIR WORKS FOR EXISTING STRUCTURE														
1	Spillway & Check gate	Nos	12	2,700	6,300	9,000	14	1,342	7,350	10,500	2	192	1,050	
2	Other structures	LS	0	4,250	10,000	14,250	0	1,010	10,000	14,250	0	1,810	10,000	
	Sub total			6,950	16,300	23,250		3,152	17,350	24,750		2,002	11,050	
	Total			55,002	794,040	1,354,066		763,062	1,266,619	3,059,845		723,775	880,417	

Table X.2 BREAKDOWN OF CIVIL CONSTRUCTION COST (2/8)

Unit: US\$1 = F CFA426

BAGUINEDA SECTOR		TANIHA & SIENKORO SECTOR A=464ha										TOTAL A=3000ha				
A=1980ha		LOWER BAGUINGUINEDA A=1426ha														
Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$
4,660	21	725	3,352	5,054	0	0	0	0	0	0	0	0	107	3,745	17,307	26,097
0	32,900	11,693	53,956	61,263	0	0	0	0	82,900	29,312	135,956	294,763	4,100	559	2,583	3,895
0	0	0	0	0	4,100	559	2,583	3,895	0	0	0	0	0	0	0	0
186,089	93,000	62,596	186,930	333,870	7,970	2,816	10,207	16,816	224,160	148,331	444,742	792,936	5,310	10,722	31,701	56,870
0	0	0	0	0	5,310	10,914	31,701	56,870	21,550	21,298	67,021	117,017	0	0	0	0
0	0	0	0	0	21,550	21,298	67,021	117,017	0	0	0	0	0	0	0	0
2,288,110	25,350	34,449	116,357	197,224	4,780	2,790	9,254	15,803	201,450	273,772	924,702	1,567,360	4,780	2,790	9,254	15,803
0	0	0	0	0	3,940	6,059	20,449	34,672	37,160	57,147	192,861	327,008	0	0	0	0
54,646	9,670	15,179	51,225	86,656	19,050	49,927	148,639	265,838	118,410	35,334	46,212	129,155	0	0	0	0
29,234	26,920	7,849	10,255	28,689	0	0	0	0	0	0	0	0	0	0	0	0
502,921	132,431	132,431	422,085	732,956	0	0	0	0	0	0	0	0	0	0	0	0
1,447,051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
270,511	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83,606	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,801,170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78,480	17	30,699	78,979	151,020	6	10,397	26,247	50,652	49	85,042	214,863	414,492	15,330	788,894	540,641	2,492,505
79,458	1	5,654	25,242	38,514	0	0	0	0	9,140	163,336	95,855	479,273	0	0	0	0
0	0	0	0	0	1	2,861	9,157	15,873	145,140	49,465	28,029	145,143	0	0	0	0
0	0	0	0	0	1	74	38	211	0	0	0	0	0	0	0	0
64,582	4	37,862	113,911	202,789	5	1608	1,665	5,440	12	76,844	221,590	401,975	1	74	38	211
31,922	3	10,859	6,817	34,308	0	0	0	0	13	43,165	34,923	136,250	0	0	0	0
5,136	3	1,822	856	5,136	1	607	286	1,712	10	6,075	2,860	17,120	0	0	0	0
0	0	0	0	0	0	0	0	0	1	121,484	229,866	515,039	0	0	0	0
0	0	85,887	227,807	431,767	0	15,547	37,393	73,868	0	417,381	1,096,436	2,076,204	0	0	0	0
1,500	0	0	0	0	0	0	0	0	28	2,684	14,700	21,000	0	0	0	0
14,250	0	1,810	10,000	14,250	0	0	0	0	0	7,242	40,000	57,000	0	0	0	0
15,750	0	1,810	10,000	14,250	0	0	0	0	0	9,926	54,700	78,000	0	0	0	0
2,579,419	221,129	659,892	1,178,973	339,726	65,474	186,032	339,726	2,012,010	3,789,000	8,512,029						

Table X.2 BREAKDOWN OF CIVIL CONSTRUCTION COST (3/8)

II CONSTRUCTION COST OF SECONDARY CANALS

Item	Works	Unit	KOKA SECTOR A=558ha						Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Quantity	L/C 10*3FCFA	F/C US\$	Quantity	L/C 10*3FCFA	F/C US\$
			UPPER KOKA A=383ha	LOWER KOKA A=175ha	UPPER BAGUINBA A=554ha													
I EARTH WORKS																		
1	Topsoil stripping	m ³	8,136	1,109	5,126	7,730	3,074	419	1,997	2,356	10,942	1,491	1,937	1,937	1,491	1,937	1,937	1,937
2	Excavation Common soil	m ³	10,296	6,930	20,490	36,758	4,133	2,782	8,225	11,007	13,602	9,155	8,225	9,155	8,225	8,225	8,225	8,225
3	Earthfill Common soil	m ³	51,998	51,391	161,714	282,349	19,835	19,603	61,667	81,290	64,353	63,601	61,667	63,601	61,667	61,667	61,667	61,667
4	Earthfill excavated soil	m ³	6,445	3,267	10,183	17,852	2,543	1,290	4,019	5,309	9,597	4,865	4,019	4,865	4,019	4,019	4,019	4,019
5	Laterite pavement	m ³	3,336	5,131	17,312	29,357	1,251	1,923	6,419	8,342	4,414	6,788	6,419	6,788	6,419	6,419	6,419	6,419
6	Sod facing	m ³	8,895	2,653	3,469	9,696	3,335	994	1,300	2,294	11,770	3,510	1,300	3,510	1,300	1,300	1,300	1,300
	Sub total			70,481	218,294	383,742		27,011	83,659	110,598		89,411		89,411		89,411		89,411
II STRUCTURE WORKS																		
1	Turnout	Nos	57	14,695	140,220	174,716	27	6,961	56,420	73,381	81	20,883	56,420	20,883	56,420	56,420	56,420	56,420
2	Check structure	Nos	48	7,429	5,323	22,761	24	3,714	2,662	6,376	73	0	2,662	0	2,662	2,662	2,662	2,662
3	Culvert	Nos	22	10,278	7,865	31,991	4	1,657	1,176	2,833	24	0	1,176	0	1,176	1,176	1,176	1,176
4	Terminal structure	Nos	9	862	338	1,893	3	221	113	334	8	0	113	0	113	113	113	113
5	Drop	Nos	11	1,951	1,911	6,491	6	993	872	1,865	13	0	872	0	872	872	872	872
5	Aquiduct	Nos		0	0	0		0	0	0		0	0	0	0	0	0	0
	Sub total			35,015	155,657	237,852		13,545	71,243	84,788		0	71,243	0	71,243	71,243	71,243	71,243
III DISMANTLE WORKS																		
1	Existing structure	LS		3,118	4,860	12,200		1,278	2,000	3,278		0	2,000	0	2,000	2,000	2,000	2,000
	Total			254,960	378,631	693,791		41,834	156,902	198,664		89,411	156,902	89,411	156,830	156,830	156,830	156,830

Table X.2 BREAKDOWN OF CIVIL CONSTRUCTION COST (4/8)

BAGUJINEDA SECTOR		TANIMA & SIENKORO SECTOR A=464ha										TOTAL A=3000ha	
A=1980ha		LOWER BAGUJINEDA A=1426ha											
Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity
10,394	25,450	3,459	16,034	24,178	13,970	1,904	8,601	10,705	61,572	8,393	38,792	58,494	61,572
46,556	30,900	20,798	61,491	110,313	16,834	11,331	33,499	44,830	75,765	50,996	150,772	251,466	75,765
349,437	145,470	143,771	452,412	63,246	78,345	77,431	243,656	321,087	360,002	355,797	1,119,612	1,824,065	360,002
26,584	22,633	11,575	36,075	63,246	12,908	6,543	20,349	26,892	54,326	27,540	85,834	139,883	54,326
38,842	10,234	15,738	53,112	90,055	5,603	8,616	29,077	37,693	24,838	38,196	128,900	204,289	24,838
10,394	27,295	8,140	10,645	29,752	14,940	110,280	5,827	116,107	66,235	125,577	25,832	168,244	66,235
486,644		203,490	629,769	1,107,446		216,106	341,254	557,315		606,499	1,549,742	2,545,745	
248,281	182	0	447,720	447,720	77	19,852	189,420	209,272	424	109,313	1,043,040	1,153,369	424
34,617	166	0	18,409	18,409	65	10,060	7,209	17,269	376	58,192	41,699	99,432	376
38,001	55	0	29,903	29,903	25	12,023	10,641	22,664	130	63,840	59,752	125,392	130
1,663	16	0	602	602	12	884	451	1,335	48	3,533	1,805	5,846	48
7,015	16	0	3,203	3,203	33	5,537	5,422	10,959	81	13,860	13,473	29,533	81
0	0	0	0	0	1	1,623	11,994	13,617	1	1,623	11,994	13,617	1
329,597		0	499,637	499,637		49,979	225,137	275,116		250,361	1,171,763	1,427,190	
2,000		0	4,200	4,200		0	1,500	1,500		0	15,520	23,178	
819,241		203,490	1,133,806	1,611,483		266,085	567,845	833,931		856,861	2,737,025	4,096,113	

Table X.2 BREAKDOWN OF CIVIL CONSTRUCTION COST (5/8)

III CONSTRUCTION COST OF ON-FARM WORKS		KOBA SECTOR A=558ha												
Item	Works	Unit	UPPER KOBA A=383ha			LOWER KOBA A=175ha			UPPER BAGUINBA A=554ha					
			Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	
I TERTIARY CANAL WORKS														
1	Topsoil stripping	km	11,293	1,491	6,888	10,389	5,186	682	3,159	16,142	3,835	2,132	3,153	
2	Excavation, common soil	m ³	8,613	5,357	11,886	24,461	3,942	2,452	5,440	12,312	7,892	7,658	5,440	
3	Earthfill, common soil	m ³	54,357	55,575	175,030	305,487	24,878	25,435	80,107	77,702	105,542	79,443	80,107	
4	Earthfill, excavated soil	m ³	8,613	4,366	13,609	23,858	3,942	1,998	5,228	12,312	8,226	6,241	6,228	
5	Farm Inlet	Nos	319	14,541	10,399	44,532	146	6,655	4,760	461	11,415	21,013	4,760	
6	Drop	Nos	6	254	333	929	4	169	222	5	391	212	222	
7	Farm Access	Nos	87	4,544	3,524	14,190	49	2,559	1,985	142	4,544	7,416	1,985	
	Sub total			86,127	221,669	423,846		39,951	101,895	141,846		124,115	101,895	
II TERTIARY DRAIN WORKS														
1	Excavation and Banking	km	12,464	21,812	18,945	40,757	5,705	9,963	6,671	17,950	18,654	13,382	8,671	
III RECLAMATION WORKS														
1	Land clearing	ha	137	9,361	18,621	27,982	63	4,305	8,563	140	18,654	4,075	8,563	
2	Rough Levelling	ha	137	27,467	54,048	81,515	63	12,631	24,854	140	18,654	11,957	24,854	
3	Farmes Boundary	ha	383	18,364	12,256	30,640	175	8,400	5,600	554	37,308	11,328	5,600	
	Sub total			55,212	84,925	140,137		25,336	39,017	74,616			39,017	
	Total			163,151	325,539	604,740		75,270	149,583	235,116		137,497	149,583	

Table X.2 BREAKDOWN OF CIVIL CONSTRUCTION COST (6/8)

BAGUINEDA SECTOR		TANIMA & SIENKORO SECTOR A=464ha										TOTAL A=3000ha				
A=1980ha		LOWER BAGUINGUINEDA A=1425ha														
Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity	L/C 10*3FCFA	F/C US\$	Total US\$
5,285	420,200	5,549	25,632	31,181	13,688	1,808	8,350	10,158	466,509	11,662	47,176	81,245				
13,098	32,049	19,933	44,228	64,161	10,440	6,493	14,407	20,900	67,356	41,893	81,401	191,292				
159,550	202,255	206,796	651,293	858,089	65,888	67,364	212,159	279,523	425,090	434,612	1,198,696	2,389,005				
12,469	32,049	16,247	50,637	66,884	10,440	5,293	16,495	21,788	67,356	34,145	93,197	186,575				
25,773	1,186	54,151	98,729	92,880	386	17,595	12,584	30,179	2,498	113,955	71,232	349,001				
434		0		0	7	284	389	673	22	918	1,166	3,378				
9,401	356	16,593	14,418	33,011	116	6,059	4,698	10,757	750	39,171	26,610	122,326				
226,010		321,270	824,937	1,146,207		104,694	269,082	373,776		676,356	1,519,478	3,322,823				
22,059	46,379	34,575	70,495	105,070	15,108	11,263	22,964	34,227	97,606	91,015	129,746	319,168				
22,053	1,060	30,855	144,075	105,070	384	11,178	52,193	63,371	1,784	59,774	232,015	335,422				
22,053	1,060	90,533	418,181	105,070	384	32,797	151,492	184,289	1,784	175,365	673,429	539,003				
44,106	1,426	29,159	45,632	210,140	454	9,488	14,648	24,336	3,002	76,759	83,936	525,776				
88,212		150,547	607,888	420,260		53,463	218,533	271,996		284,558	969,360	1,400,201				
336,274		506,392	1,503,320	1,671,557		169,620	510,579	680,199		1,051,929	2,638,604	5,042,192				

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Table X.2 BREAKDOWN OF CIVIL CONSTRUCTION COST (7/8)

IV CONSTRUCTION COST OF MAIN DRAINAGE CANALS														
KOBBA SECTOR A=558ha														
Item	Works	Unit	UPPER KOBBA A=383ha			LOWER KOBBA A=175ha			UPPER BAGUINBA A=554ha					
			Quantity 10*3FCFA	L/C US\$	F/C US\$	Total US\$	Quantity 10*3FCFA	L/C US\$	F/C US\$	Total US\$	Quantity 10*3FCFA	L/C US\$	F/C US\$	Total US\$
I EARTH WORKS														
1	Excavation and Banking	m3								2,184	4150		5,220	
II STRUCTURE WORKS														
1	Drainage Drop	Nos												
2	Drainage Junction	Nos												
3	Drainage Culvert	Nos												
Total										4150			5,220	
BAGUINEDA SECTOR A=1980ha														
LOWER BAGUINGUINEDA A=1426ha														
TANIHA & SENKORO SECTOR A=464ha														
TOTAL A=3000ha														
Total			9,369	134,800	254,600	320,260	574,860	45,400	66160	110,895	182,584	345,910	436,376	783,285
			4	66,700	48,900	115,600	Culvert				4	66,700	48,900	115,600
			10	23,590	17,020	40,610					10	23,590	17,020	40,610
							1	2455	3,532	5,987	1	2,455	3,532	5,487
Total			9,369	344,890	386,180	731,070		90615	114,428	205,043	439,655	505,828	945,487	

Table X.2 BREAKDOWN OF CIVIL CONSTRUCTION COST (8/8)

V CONSTRUCTION COST OF SECONDARY DRAINAGE CANALS

Item	Works	Unit	KOBA SECTOR A=558ha			LOWER KOBA A=175ha			UPPER BAGUINBA A=554ha				
			UPPER KOBA A=363ha	F/C US\$	Total US\$	Quantity 10*3FCFA	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity 10*3FCFA	L/C 10*3FCFA	F/C US\$	
I EARTH WORKS													
1	Excavation and Banking	m3	14,982	28,465	35,807	64,727	7,749	14,723	18,520	33,243	26,324	50,016	62,915
II STRUCTURE WORKS													
1	Drainage Drop	Nos	18	42,635	10,185	52,820	13	40,608	8,369	48,977	18	79,690	18,583
2	Drainage Culvert	Nos	27	30,181	27,769	57,950	10	14,869	16,492	31,361	23	33,285	42,330
3	Drainage Junction	Nos	3	3,115	502	3,717	1	1,038	201	1,239	3	3,115	602
	Sub total			75,931	38,556	114,487		56,535	25,062	81,597		116,090	61,515
	Total			104,396	74,363	178,759		71,258	43,582	114,840		166,106	124,430
BAGUINEDA SECTOR A=1960ha													
LOWER BAGUINGINEDA A=1426ha													
Total US\$	Quantity 10*3FCFA	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity 10*3FCFA	L/C 10*3FCFA	F/C US\$	Total US\$	Quantity 10*3FCFA	L/C 10*3FCFA	F/C US\$	Total US\$	
112,931	56,803	129,364	162,726	292,090	17,660	33,933	42,684	76,617	135,001	256,501	322,652	579,153	
96,273	17	57,084	13,231	70,315	10	3,465	902	4,367	76	223,482	51,270	274,752	
75,615	71	96,428	113,994	212,422	14	9,394	5,288	14,862	145	186,177	205,873	382,050	
3,717	8	6,307	1,506	9,913	1	1,038	201	1,239	16	16,613	3,212	19,825	
177,605		163,819	128,631	292,650		13,897	6,391	20,288		426,272	260,355	686,627	
290,536		293,163	291,557	584,740		47,830	49,075	96,905		682,773	563,007	1,265,780	
TANIMA & SIENKORO SECTOR A=464ha													
TOTAL A=3000ha													

Table X.3 INVESTIGATED COST OF BASIC CONSTRUCTION
MATERIAL AND MAN-POWER (1/3)

1) Local Construction Man-power

Description	Unit	Cost (F CFA)
1. Surveyor	day	8,800
2. Survey labour	day	2,000
3. Foreman for civil works	day	6,500
4. Carpenter	day	4,400
5. Mason	day	3,400
6. Steelman	day	3,400
7. Skilled labour	day	2,800
8. Common labour	day	1,500
9. Labour	day	1,000
10. Foreman for equipments	day	6,500
11. Mechanic	day	6,500
12. Electrician	day	4,400
13. Operator for heavy equipment	day	5,000
14. Operator for light equipment	day	4,400
15. Driver	day	4,000
16. Clerk	day	6,500
17. Storekeeper	day	4,400
18. Typist	day	3,500
19. Watchman	day	1,700

Note: The costs was calculated based on the average of local contractor's rate (working hour: 8 hr/day) in Bamako.

Table X.3 INVESTIGATED COST OF BASIC CONSTRUCTION
MATERIAL AND MAN-POWER (2/3)

2) Local Construction Materials

Description	Unit	Cost (F CFA)
1. Fuels		
Gasoline	lit.	270
Diesel oil	lit.	190
Lubricants	lit.	815
Grese	kg	1,300
2. Concrete Works		
Cement, 50 kg bag	ton	60,000
Sand, river sand	m ³	3,730
Gravel, river 5 mm - 20 mm	m ³	6,230
Crushed stone, 30 mm - 40 mm	m ³	6,030
Masonry stone, 300 mm	m ³	4,030
3. Wooden Works		
Timber for concrete form	m ³	70,000
Timber for furniture	m ³	123,000
Plywood, t = 5 mm	m ²	1,200
Plywood, t = 10 mm	m ²	2,750
Plywood, t = 15 mm	m ²	4,000
Plywood, t = 20 mm	m ²	5,200
4. Pipe Works		
Concrete pipe, 200 mm dia.	m	5,700
Concrete pipe, 300 mm dia.	m	6,700
Concrete pipe, 400 mm dia.	m	7,200
Concrete pipe, 500 mm dia.	m	7,900

Note: Cost of materials are including transportation cost
from Bamako to job site.

Table X.3 INVESTIGATED COST OF BASIC CONSTRUCTION
MATERIAL AND MAN-POWER (3/3)

3) Import Construction Materials

Description	Unit	Cost (US\$)
1. Concrete Works		
Reinforcement bars	ton	440.0
2. Gate and Steel Works		
Sluice gate, 0.70 m x 2.00 m	set	8,522.0
Sluice gate, 0.50 m x 1.80 m	set	6,544.9
Gate for 3rd canal, 300 mm dia.	set	1,740.0
Gate for 3rd canal, 400 mm dia.	set	1,957.0
Gate for 2nd canal, Type-E	set	1,243.5
Gate for 2nd canal, Type-H	set	1,834.1
Other steels	ton	637.3
3. Pipe Works		
Corrugated metal pipe		
600 mm dia., t = 1.5 mm	m	69.72
800 mm dia., t = 1.9 mm	m	114.79
1,000 mm dia., t = 2.7 mm	m	199.30
1,500 mm dia., t = 3.0 mm	m	399.53
2,000 mm dia., t = 3.0 mm	m	539.91
3,200 mm dia., t = 3.5 mm	m	944.05

Note: Costs of materials are including transportation costs from export cumulus to the job site.

Table X.4 OPERATION COST OF MAJOR EQUIPMENT

Equipment		Operation Cost (US\$/hr)			
		Depreci- ^{/2} ation Cost	Fuel and Oil Cost	Total ^{/1}	
1.	Bulldozer	21 t	37.37	11.39	48.76
	Bulldozer, w/ripper	21 t	42.11	11.39	53.50
2.	Bulldozer	15 t	24.24	7.61	31.85
	Bulldozer	11 t	20.05	5.83	25.88
3.	Backhoe	1.0 m ³	40.40	9.45	49.85
	Backhoe	0.6 m ³	29.35	5.51	34.86
	Backhoe	0.35 m ³	17.83	4.54	22.37
4.	Wheel Loader	2.3 m ³	23.98	10.64	34.67
	Wheel Loader	1.7 m ³	18.12	7.45	25.57
5.	Motor Scraper	6.1 m ³	31.59	55.69	87.28
6.	Dump Truck	11.0 t	19.63	16.85	36.48
	Dump Truck	8.0 t	13.29	13.18	26.47
	Dump Truck	6.0 t	9.99	8.64	18.63
7.	Rollers, Road roller	8.0 t	8.06	3.13	11.19
	Rollers, Vibrating	8.0 t	5.60	2.70	8.30
	Rollers, Tire	8.0 t	9.67	2.70	12.37
	Rollers, Tamping	8.0 t	1.42	-	1.42
8.	Trucks, Ordinary	6.0 t	8.36	9.18	17.54
	Trucks, Water	5.5 k lit.	10.80	9.18	19.98
	Trucks, w/3 t crane	6.0 t	9.43	9.18	18.61
	Trucks, Mixer	3.0 m ³	8.25	10.53	18.78
	Trucks, Mixer	1.7 m ³	7.16	8.37	15.53
9.	Truck Crane	7.0 t	12.74	9.45	22.19
10.	Concrete Plant	30 m ³ /hr	43.43	-	43.43
	Generator for Plant	60 kVA	3.23	5.02	8.25
	Portable Mixer	0.5 m	3.61	3.08	6.69

Remarks: ^{/1}: Excluding mechanical foreman and operator costs.

^{/2}: Depreciation costs are including the foreign and inland transportation costs.

Table X.5 ESTIMATED UNIT COST OF CIVIL
CONSTRUCTION WORKS (1/3)

Works	Unit	Unit Cost		
		Local Currency (FCFA)	Foreign Currency (US\$)	Total (US\$)
<u>A. EARTH WORKS</u>				
<u>I. Main Irrigation Canal & Road</u>				
1. Clearing of existing canal	ha	34,868	161.15	243.00
2. Repairing of existing canal bank	m ²	354	1.64	2.47
3. Topsoil stripping, t = 0.15 m	m ³	136	0.63	0.95
4. Canal excavation, common soil	m ³	354	1.28	2.11
5. Canal excavation, w/hauling distance (H.D.) of 200 m	m ³	673	2.01	3.59
6. Canal excavation, soft rock, w/H.D. of 200 m	m ³	2,019	5.97	10.71
7. Earthfill, laterite soil w/H.D. of 1,000 m	m ³	1,359	4.59	7.78
8. Earthfill by excavated soil	m ³	588	1.93	3.31
9. Laterite pavement for road w/H.D. of 1,500 m	m ³	1,538	5.19	8.80
10. Sod facing	m ²	298	0.39	1.09
<u>II. Main Drainage Canals</u>				
1. Canal excavation and banking	m ³	809	2.39	4.29
<u>III. Secondary Irrigation Canal</u>				
1. Topsoil stripping, t = 0.10 m	m ³	141	0.83	1.16
2. Canal excavation, common soil	m ³	673	1.99	3.57
3. Canal excavation, soft rock	m ³	2,019	5.97	10.71
4. Earthfill, common soil w/H.D. of 500 m	m ³	988	3.11	5.43
5. Earthfill, excavated soil	m ³	507	1.58	2.77
6. Laterite pavement for road	m ³	1,538	5.19	8.80
7. Sod facing	m ²	298	0.39	1.09

Table X.5 ESTIMATED UNIT COST OF CIVIL
CONSTRUCTION WORKS (2/3)

Works	Unit	Unit Cost		
		Local Currency (FCFA)	Foreign Currency (US\$)	Total (US\$)
<u>IV. Secondary Drainage Canal</u>				
1. Canal excavation and banking	m ³	809	2.39	4.29
<u>V. Tertiary Irrigation Canal</u>				
1. Topsoil stripping, t = 0.10 m	m ³	132	0.61	0.92
2. Canal excavation, common soil	m ³	622	1.38	2.84
3. Earthfill, common soil w/H.D. of 500 m	m ³	1,022	3.22	5.62
4. Earthfill by excavated soil	m ³	507	1.58	2.77
<u>VI. Tertiary Drainage Canal</u>				
1. Canal excavation and banking	m ³	746	1.52	3.27
<u>VII. Land Reclamation</u>				
1. Land clearing	ha	29,109	135.92	204.25
2. Rough land levelling	ha	85,409	394.51	595.00
3. Farmer's boundary	ha	20,448	32.00	80.00
<u>B. STRUCTURE WORKS</u>				
<u>I. Concrete Works</u>				
1. Concrete for structures				
- Reinforced concrete, C = 300 kg	m ³	43,708	34.80	137.40
- Unreinforced concrete, C = 250 kg	m ³	40,355	22.64	117.37
- Base concrete, C = 180 kg	m ³	30,514	15.10	86.73
2. Canal lining concrete, C = 300 kg (including form and joint works)	m ³	51,461	41.79	162.59
3. Concrete forms	m ²	3,604	2.10	10.56
4. Reinforcement bars	t	75,334	585.90	762.74

Table X.5 ESTIMATED UNIT COST OF CIVIL
CONSTRUCTION WORKS (3/3)

Works	Unit	Unit Cost		
		Local Currency (F CFA)	Foreign Currency (US\$)	Total (US\$)
<u>II. Masonry Works</u>				
1. Wet-masonry (including filling concrete and joint mortar)	m ³	33,258	15.09	93.16
<u>III. Pipe Works</u>				
1. Concrete pipes, 200 mm dia.	m	9,104	4.29	25.66
Concrete pipes, 250 mm dia.	m	9,730	4.66	27.50
Concrete pipes, 300 mm dia.	m	10,309	4.94	29.14
Concrete pipes, 400 mm dia.	m	12,933	9.08	39.44
Concrete pipes, 500 mm dia.	m	17,419	11.23	52.12
2. Corrugated metal pipes, 600 mm dia.	m	4,971	88.80	100.47
Corrugated metal pipes, 800 mm dia.	m	9,300	146.73	168.56
Corrugated metal pipes, 1,000mm dia.	m	14,480	298.22	332.21
Corrugated metal pipes, 2,000mm dia.	m	43,269	691.20	792.77
Corrugated metal pipes, 3,200mm dia.	m	71,240	1,218.96	1,386.19
<u>IV. Precast Concrete Element</u>				
1. Beam for bridge, L = 12.0 m	no.	96,272	168.85	394.84
Beam for bridge, L = 10.0 m	no.	72,727	126.46	297.18
Beam for bridge, L = 8.0 m	no.	53,212	91.97	216.88
2. Slab for bridge, L = 2.4 m	no.	30,689	48.21	120.25
Slab for bridge, L = 2.8 m	no.	33,573	52.61	131.42
Slab for bridge, L = 3.2 m	no.	35,920	56.06	130.38
Slab for bridge, L = 3.6 m	no.	38,813	60.45	151.56
3. Tertiary turnout (including gate measuring device and concrete pipes)	set	257,802	2,459.95	3,065.12
4. Farm inlet (including timber gate and pipes)	set	45,595	32.55	139.58
5. Culvert for farm access (including concret pipes and check blocks)	set	52,228	40.45	163.05
6. Drop on tertiary canal	set	42,319	55.50	154.84

Table X.6 SUMMARY OF CIVIL CONSTRUCTION COST
FOR EACH CONSTRUCTION STAGE

WORK ITEM	Total		
	F/C US\$10*3	L/C 10*6FCFAUS\$10*3	Total
STAGE - 1			
1 TEMPORARY WORKS	62	37	149
2 MAIN IRRIGATION CANALS, (7.6 km)	1,901	1,174	4,656
3 DEMONSTRATION FARM, (CSK-6 area 86.4ha)	148	51	267
4 CONNECTION ROAD, (4.3 km)	28	11	54
SUB-TOTAL (1)	2,139	1,272	5,126
STAGE - 2			
1 TEMPORARY WORKS	119	51	239
2 MAIN IRRIGATION CANAL, (29.3km)	1,731	772	3,544
3 SECONDARY IRRIGATION CANALS (22.7km)	980	272	1,619
4 ON-FARM WORKS (1,026ha)	837	311	1,568
5 FARA RIVER IMPROVEMENT (0.32km)	5	2	9
6 SECONDARY DRAINAGE CANALS (31.9 km)	226	138	551
SUB-TOTAL (2)	3,898	1,547	7,530
STAGE - 3			
1 TEMPORARY WORKS	141	46	249
2 MAIN IRRIGATION CANAL, (4.4km)	186	66	340
3 SECONDARY IRRIGATION CANALS (42.2 km)	1,702	472	2,810
4 ON-FARM WORKS (1,888km)	2,013	676	3,601
5 MAIN AND CATCH DRAIN CANALS (14.0km)	500	186	936
6 SECONDARY DRAINAGE CANALS (44.6km)	341	145	682
SUB-TOTAL (3)	4,883	1,591	8,618
TOTAL (4)=(1)+(2)+(3)	10,920	4,410	21,274
PHYSICAL CONTINGENCY (5)=(4)*10%	1,092	441	2,127
ENGINEERING SERVICES (6)=((4)+(5))*12%	1,441	582	2,808
TOTAL (7)=(4)+(5)+(6)	13,453	5,434	26,210
PRICE CONTINGENCY (8)	1,527	2,128	6,520
GRAND TOTAL (7)+(8)	14,980	7,561	32,730

Table X.7 DISBURSEMENT SCHEDULE OF CIVIL CONSTRUCTION COST

WORK ITEM	1986			1987			1988			1989			1990			Total					
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total			
	US\$10*3	10*6FCFAUS\$10*3	US\$10*3	10*6FCFAUS\$10*3	US\$10*3	10*6FCFAUS\$10*3	US\$10*3	10*6FCFAUS\$10*3	US\$10*3	10*6FCFAUS\$10*3	US\$10*3	10*6FCFAUS\$10*3	US\$10*3	10*6FCFAUS\$10*3	US\$10*3	10*6FCFAUS\$10*3	US\$10*3	10*6FCFAUS\$10*3	US\$10*3		
STAGE - 1																					
1 TEMPORARY WORKS	8	5	20	34	20	81	20	12	47												
2 MAIN IRRIGATION CANALS, (7.6 km)	181	112	443	1,086	671	2,661	634	391	1,552												
3 DEMONSTRATION FARM (CSK-6area 86.4ha)	0	0	0	74	25	134	74	25	134												
4 CONNECTION ROAD, (4.3 km)	19	7	36	9	4	18	0	0	0												
SUB-TOTAL (1)	208	124	500	1,203	720	2,893	727	428	1,733												
STAGE - 2																					
1 TEMPORARY WORKS				22	9	43	65	28	130												
2 MAIN IRRIGATION CANAL, (29.3km)				260	116	532	1,039	463	2,126												
3 SECONDARY IRRIGATION CANALS (22.7km)				0	0	0	445	124	736												
4 ON-FARM WORKS (1,026ha)				0	0	0	556	206	1,045												
5 FARA RIVER IMPROVEMENT (0.32km)				5	2	9	0	0	0												
6 SECONDARY DRAINAGE CANALS (31.9 km)				30	18	73	90	55	220												
SUB-TOTAL (2)				316	146	656	2,197	878	4,258												
STAGE - 3																					
1 TEMPORARY WORKS							77	25	136												
2 MAIN IRRIGATION CANAL, (4.4km)							186	66	340												
3 SECONDARY IRRIGATION CANALS (42.2 km)							901	250	1,488												
4 ON-FARM WORKS (1,888km)							1,054	354	1,886												
5 MAIN AND CATCH DRAIN CANALS (14.0km)							83	31	156												
6 SECONDARY DRAINAGE CANALS (44.6km)							129	55	259												
SUB-TOTAL (3)							2,431	781	4,264												
TOTAL (4)=(1)+(2)+(3)	208	124	500	1,520	865	3,551	2,925	1,306	5,991												
PHYSICAL CONTINGENCY (S)=(4)*10%	21	12	50	152	87	355	292	131	599												
ENGINEERING SERVICES (6)=[(4)+(5)]*12%	27	16	66	201	114	459	386	172	791												
TOTAL (7)=(4)+(5)+(6)	256	153	616	1,872	1,066	4,375	3,603	1,609	7,381												
PRIDE CONTINGENCY (8)	8	15	44	114	224	640	334	533	1,584												
GRAND TOTAL (7)+(8)	264	168	659	1,986	1,290	5,015	3,937	2,142	8,965												

Remark: Price escalation rates F/C=3% and L/C=10%

Table X.8 SUMMARY OF INITIAL FARM INVESTMENT

Item	Unit	Q'ty	Cost		Total (US\$10 ³)
			Foreign Currency (US\$10 ³)	Local Currency (10 ³ F CFA)	
I) Installation of Cowshed and Facilities					
1) Building			<u>98</u>	<u>165,200</u>	<u>1,374</u>
- Cowshed	m ²	7,360	825	139,500	1,152
- antiparasitic bath			27	8,600	47
- office	m ²	240	45	2,100	50
- physical contingency (10%)			90	15,000	125
2) Equipment and facilities			<u>458</u>	<u>14,700</u>	<u>493</u>
- Milk cooler			81	3,300	89
- water tank			124	5,300	136
- artificial insemination			150	-	150
- pasture fence	m	3,000	61	4,800	73
- physical contingency (10%)			42	1,300	45
II) Procurement of Farm Machinery			<u>428</u>	<u>-</u>	<u>428</u>
- tractor			277	-	277
- equipment			112	-	112
- spare parts (10%)			39	-	39
III) Procurement of Milking Cow heads			<u>1,267</u>	<u>-</u>	<u>1,267</u>
IV) Installation of Rice Mill			<u>160</u>	<u>7,500</u>	<u>176</u>
- rice mill	(no.)	13	111	-	111
- building	(m ²)	650	35	6,800	50
- physical contingency (10%)			14	700	15
Total			<u>3,301</u>	<u>188,000</u>	<u>3,740</u>
V) Price Contingency			347	63,000	497
Total			<u>3,648</u>	<u>251,000</u>	<u>4,237</u>

Table X.9 INSTALLATION OF COWSHED AND FACILITIES (1/2)

Item	Unit	Q'ty	Cost		Total (US\$10 ³)
			Foreign Currency (US\$10 ³)	Local Currency (10 ³ F CFA)	
I. Building			<u>987</u>	<u>165,200</u>	<u>1,374</u>
1) Cowshed			<u>825</u>	<u>139,500</u>	<u>1,152</u>
- Construction material			786	15,200	
. concrete	(m ³)	1,026	(287)	-	-
. steel material	(t)	149	(294)	-	-
. timber	(m ³)	57	-	(15,200)	-
. stone masonry	(m ³)	9,720	(205)	-	-
- Labour			-	63,900	-
- Construction cost			-	53,800	-
- Others			39	6,600	-
2) Antiparasitic Bath			<u>27</u>	<u>8,600</u>	<u>47</u>
- Construction material			26	-	-
. concrete	(m ³)	63	18	-	-
. fence	(m)	145	8	-	-
- Labour			-	5,800	-
- Construction cost			-	2,400	-
- Others			1	400	-
3) Office			<u>45</u>	<u>2,100</u>	<u>50</u>
- Construction material			43	-	-
- Construction cost			-	2,000	-
- Others			2	100	-
4) Physical Contingency (10%)			<u>90</u>	<u>15,000</u>	<u>125</u>
II. Equipments and Facilities			<u>458</u>	<u>14,700</u>	<u>493</u>
1) Milk Cooler			<u>81</u>	<u>3,300</u>	<u>89</u>
- Refrigerator (2,800 lit.)	(no.)	3	67	-	-
- Electric generator (5 kV)	(no.)	3	10	-	-
- Installation cost			-	3,100	-
- Others			4	200	-

Table X.9 INSTALLATION OF COWSHED AND FACILITIES (2/2)

Item	Unit	Q'ty	Cost		Total (US\$10 ³)
			Foreign Currency (US\$10 ³)	Local Currency (10 ³ F CFA)	
2) Water Tank			<u>124</u>	<u>5,300</u>	<u>136</u>
- Water bowl		1,890	58	-	-
- Pump (240 lit./min)		3	3	-	-
- Electric generator (2 kW)		3	12	-	-
- Tank (20 m ³)		3	39	-	-
- Pipe (50 mm dia.)	(m)	2,400	6	-	-
- Construction cost				5,100	-
- Others			6	200	-
3) Artificial Insemination			<u>150</u>	<u>-</u>	<u>150</u>
4) Pasture Fence			<u>61</u>	<u>4,800</u>	<u>73</u>
- Construction material			55	-	-
. steel material	(t)	4.1	12	-	-
. fence	(m)	9,000	43	-	-
- Construction cost			-	4,400	-
- Others			6	400	-
5) Physical Contingency (10%)			<u>42</u>	<u>1,300</u>	<u>45</u>
III. Price Contingency			<u>133</u>	<u>60</u>	<u>274</u>
Total			1,579	240	2,143

Table X.10 FARM MACHINERY FOR FODDER PRODUCTION

Item	Q'ty	Unit Price (US\$10 ³)	Total (US\$10 ³)
I. Tractor			<u>277.1</u>
- Wheeled type 60 ps	2	25.8	51.6
- Wheeled type 45 ps	11	20.5	225.5
II. Equipment			<u>112.1</u>
- Manure spreader (22 m ³)	1	3.3	3.3
- Disc-plough (26" x 3 ranges)	1	3.3	3.3
- Disc-harrow (18" x 24 ranges)	1	3.0	3.0
- Broad caster (16 ranges)	1	2.0	2.0
- Cambridge roller (2.4 m)	1	5.9	5.9
- Harvester (1.5 m)	3	8.0	24.0
- Fodder trailer (3 t)	6	10.9	65.4
- Seeder (400 lit.)	2	2.6	5.2
III. Spare Parts (10% of I + II)			<u>38.9</u>
Total			<u>428.1</u>
IV. Price Contingency			<u>36.0</u>
Total			<u>464.1</u>

Table X.11 INSTALLATION OF RICE MILL

Item	Q'ty	Cost		Total (US\$10 ³)
		Foreign Currency (US\$10 ³)	Local Currency (10 ³ F CFA)	
I) Rice Mill		<u>111</u>	-	<u>111</u>
- Rice mill	13	85	-	85
- Diesel generator (18 CV)	13	16	-	16
- Spare parts		10	-	10
II) Construction Cost (m)	650	<u>35</u>	<u>6,800</u>	<u>50</u>
III) Physical Contingency (10%)		<u>14</u>	<u>700</u>	<u>15</u>
Total		<u>160</u>	<u>7,500</u>	<u>176</u>
IV) Price Contingency		18	3,000	25
Total		178	10,500	201

Table X.12 DISBURSEMENT SCHEDULE OF INITIAL FARM INVESTMENT

WORK ITEM	1986			1987			1988			1989			1990			Total		
	F/C US\$10*3	L/C 10*6FCFAUS\$10*3	Total US\$10*3	F/C US\$10*3	L/C 10*6FCFAUS\$10*3	Total US\$10*3	F/C US\$10*3	L/C 10*6FCFAUS\$10*3	Total US\$10*3	F/C US\$10*3	L/C 10*6FCFAUS\$10*3	Total US\$10*3	F/C US\$10*3	L/C 10*6FCFAUS\$10*3	Total US\$10*3	F/C US\$10*3	L/C 10*6FCFAUS\$10*3	Total US\$10*3
1 INSTALLATION OF COWSHED AND FACILITIES	482	50	532	482	50	532	482	50	532	482	50	532	482	50	532	1,446	180	1,626
2 FARM MACHINERY FOR FODDER PRODUCTION	214	0	214	107	0	107	107	0	107	107	0	107	422	0	422	428	0	428
3 PROCUREMENT OF MILK COW (JERSEY)	16	1	17	423	2	425	422	0	422	422	0	422	422	0	422	1,267	0	1,267
4 INSTALLATION OF RICE MILL	712	61	773	64	2	66	80	4	84	89	4	93	160	8	168	160	8	168
SUB-TOTAL	43	13	56	855	62	917	1,091	64	1,155	1,241	64	1,305	422	0	422	3,301	188	3,489
PRICE CONTINGENCY				72	21	93	137	30	167	208	67	275	67	0	67	347	53	400
TOTAL	755	73	828	927	63	990	1,228	94	1,322	1,449	489	1,938	489	0	489	3,648	251	4,237

Remark: Price escalation rates F/D=3% and L/C=10%

ANNEX XI

PROJECT EVALUATION

ANNEX XI

PROJECT EVALUATION

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ANNEX XI

PROJECT EVALUATION

XI.1 General

The project evaluation is carried out in order to sound the feasibility of the Project from economic, financial and socio-economic viewpoints.

The *economic feasibility of the Project* is firstly evaluated by calculating the economic internal rate of return (hereinafter referred to as the "IRR"). Further, sensitivity analysis of IRR is made with respect to change in the economic project cost, market price of farm products and crop productivity. In the calculation, the economic costs and benefits are estimated based on the study results in Annex III, V and X.

Secondly, the financial feasibility is evaluated by estimating the capacity to pay of the farmers and by analysing the loan repayment capacity of the project executive agency. The calculation of the capacity to pay the water charge is to confirm the soundness of the Project from the farmers' viewpoint. The repayment schedule is made to estimate the annual subsidy by the Government based on the estimated fund requirements with the assumed financial terms of the conceivable loan and the expected revenue from the Project.

Finally, intangible socio-economic impacts of the Project are briefly studied in due consideration of the effect of the Project on the regional development.

XI.2 Economic Evaluation

XI.2.1 Basic assumptions

For the economic evaluation of the Project, the following basic assumptions are established.

- i) The project implementation period is five years from 1986 to 1990 as mentioned in Annex IX.
- ii) Only direct benefit is counted in the evaluation and any indirect or intangible benefits are not taken into account.
- iii) The current prices as of October, 1985 are used in the evaluation.
- iv) The exchange rate of the CFA Franc to US Dollar is taken to be 426 F CFA = US\$1
- v) The economic useful life of the Project is 50 years from 1986 to 2035.

XI.2.2 Economic prices

As stated in Annex V, economic farm gate prices of crops and farm inputs are estimated on the basis of the international market price forecasted by IBRD in the long term range for 1995 based on 1983 constant US Dollars.

The economic prices of the construction materials and equipment to be imported are estimated based on the CIF prices in Abidjan. They are preliminary converted from the present FOB prices in Japan, adding cost and prices related to the inland transportation between Abidjan and Bamako.

As for the local materials, labour wages, etc. related to the construction and farming practices, the present market prices are directly applied.

XI.2.3 Project cost

The project cost is broadly categorized into the costs for:

- i) Temporary works,
- ii) Rehabilitation and installation of irrigation and drainage facilities,
- iii) On-farm development,
- iv) Connection road to the project site,
- v) Initial farm investment,
- vi) Engineering services,
- vii) Physical contingency, and
- viii) Price contingency.

All the cost except price contingency are counted as the economic cost. The total economic cost and its annual disbursement are summarized in Tables XI.1 and XI.2.

Referring to the previous study, the annual operation and maintenance costs are estimated at 2% of the total capital cost. In addition, the replacement of the structures such as gate of turnout would be required at the interval of their economic useful lives. However they are not counted in the present evaluation since their replacement costs are negligibly small and the interval of replacement is rather long, i.e. more than 20 years.

XI.2.4 Project benefit

The direct project benefit is evaluated as the difference of net income from farm products in future between without project and with project. The project benefits under with project condition are derived from crop production, i.e. cereals and vegetables, and dairy production, milk and meat.

The benefit of crop production will come out in 1988 immediately after the implementation of rehabilitation of the severe leakage portion of the Sotuba main canal as main work at Stage-1.

For the estimation, the crop budgets under "with" and "without" Project are prepared as shown in Tables XI.3 and XI.4. Besides, the unit benefits per hectare are also calculated for the rainy season crops and dry season crops respectively. As shown in Table XI.5, the annual benefit of crops at full stage is $2,319 \times 10^6$ F CFA which is corresponding to 892×10^3 F CFA/ha or US\$2,095/ha. Since the crop production makes 316×10^6 F CFA in the area under "without" Project condition, the incremental benefit can be anticipated to be $2,003 \times 10^6$ F CFA or $US\$4,702 \times 10^3$ at full stage. The incremental benefit is expected to take linear increase and attain its maximum level in 1995 as shown in Table XI.6.

The benefit of dairy production will come out in 1990 after the completion of Stage-2. It is expected that the benefit of dairy production will attain its maximum level of $US\$1,604 \times 10^3$ at full stage. Deducting the production cost $US\$670 \times 10^3$, the annual net benefit of dairy production is anticipated to be $US\$934 \times 10^3$ at full stage as shown in Table XI.7.

The details of cost and benefit in dairy production is presented in Table XI.8. The total production cost covers all the facilities for cow raising.

Based on economic benefit of crop and dairy products presented in Tables XI.6 and XI.7, the flow of the total annual incremental benefit is set up as shown in Table XI.9.

XI.2.5 Internal rate of return (IRR)

For calculation of IRR, the cost and benefit flow is prepared as shown in Table XI.10. From this table, the IRR is calculated at 13.5% which indicates the economic viability of the Project.

In view of the large fund requirement for the package of the entire Project, the economic feasibility is examined in the sense of the stepwise development according to the following conditions:

Stepwise Development	IRR (%)
Only Stage-1	13.0
Stage-1 and -2	13.4
Whole Project	13.5

The project works in Stage-1 consist of the rehabilitation of severe leakage portion (11 km) of Sotuba canal and on-farm development of 86 ha of demonstration farm. Since the full irrigated area consolidated in Stage-1 is limited, the IRR is lower, i.e. 13.0% than ones in other cases. However, the execution of Stage-1 enables to expand the irrigation water supply to additional 1,800 ha of semi-irrigated area in both Upper and Lower Baguineda. Besides, the demonstration farm would give a good effect on the following on-farm development and on the introduction of proposed farming practices.

By the execution of Stage-2 following Stage-1, 1,112 ha in Koba and Upper Baguineda would be fully irrigated and the proposed cropping pattern could be applied in the areas. Besides the dairy farming would be started in this stage. The fodder crop would be planted on 270 ha of the left bank of Fara river and 1,890 k lit./year of milk would be produced. In addition, 1,336 ha of Lower Baguineda would be semi-irrigated. In this case, the IRR is calculated to be 13.4%.

Showing rather high IRR, the Project is economically justified even in case of the partial development as shown above. Taking the size of available fund into consideration, the Project can be implemented stage by stage according to the proposed stepwise development schedule.

XI.2.6 Sensitivity analysis

In addition to the calculation of IRR, a sensitivity analysis is carried out on the following critical situation in order to examine eventual fluctuation of IRR.

- (1) In case the project costs exceed the provisions for physical contingency and price escalation.
- (2) In case the project benefits diminish for certain reasons, such as the fall in market prices of crop and dairy products, decrease in yields of these products, etc.
- (3) In case the project execution period is extended.

The results of sensitivity analysis are summarized below:

Internal Rate of Return			
(Unit: %)			
Cost Increase	Benefit Decrease		1 Year Delay
	0%	20%	
0%	13.5	11.0	12.1
10%	12.4	10.0	11.2

As seen above, the IRR would not substantially fluctuate from 10.0% in the worst case, characterized by a 20% decrease of benefit and a 10% increase of cost, to 13.5% in a normal case as foreseen.

XI.3 Financial Evaluation

Financial feasibility of the Project was analyzed taking into account the farm budget and the project budget. A study was made on the possibilities of repayment of investment cost by estimating the farmers' capacity of bearing operation and maintenance expenses and the general balance of the project account.

XI.3.1 Payment capacity

Details of the budget of a typical farm, consisting of gross income, production cost, net income, living expenses, etc. estimated based on financial prices, are shown in Table XI.11.

According to the forecast of expenditures and income, the net income per household would be around 1,231,000 F CFA or US\$2,800, which represents an increase of 1.9 times the income obtained in the present situation (662,000 F CFA).

Living cost was estimated to be 950,000 F CFA or US\$2,230 on the basis of foodstuffs requirement. The payment capacity of a farm unit would be obtained by deducting this living cost from the above-mentioned main income amount. The estimated payment capacity would be 281,000 F CFA or US\$660 at full production stage.

At the present, the farmers have to pay a land rent of 25,000 F CFA or 52,500 F CFA per hectare, according to the terms and conditions of contracts signed with the Baguineda Operation. After realization of the project, the water charge which will be considered as operation and maintenance would amount to around 89,460 F CFA or US\$210 equivalent per farm unit with an area of 1.2 ha per year. This sum corresponds to 32% of the capacity to pay. In order to encourage farmers to increase their agricultural production, the water charge to be collected from farmers should remain within the limit of their payment capacity. As such, it can be anticipated that farmers will be capable enough to pay annual O & M costs.

XI.3.2 Cash flow statement

Capacity of repayment of investment fund is studied by means of cash flow which would be discounted on the basis of anticipated income and fund requirement of the Project. The net revenue would comprise water charge (or, in other words, O & M and replacement costs) and net income from milk production.

For the purpose of analysis of repayment capacity, it is assumed that the investment fund required for project realization be provided under the following conditions:

- (1) The foreign currency component will be financed by a bilateral or international agency in the form of a loan with the following conditions: Service charge will be 0.75% per annum and repayment period will be 50 years including a 10-year grace period.
- (2) The local currency component will be allocated from the national budget.

As shown in Table XI.12, the large portion of loan amount would be repaid by the Baguineda Operation in and after 1990. Only the service fee during the initial 5 years, when the milk cow raising would have not started yet, have to be bore by the Government. Since the annual income of dairy products is estimated to be US\$934,000 at the full developed stage in 1997, the Baguineda Operation could make the annual net reserve of US\$240,000 to US\$578,000. Therefore the Project can also have the repayment capacity to cover all the local currency component.

XI.4 Socio-economic Impact

In addition to the direct benefit stipulated in the economic evaluation, favourable but intangible socio-economic impacts are expected from the implementation of the Project.

XI.4.1 Expansion of home trade and foreign trade

Considerable increase in production of rice and other cereals as a result of the project realization would not only enable the Baguineda Perimeter to be self-sufficient in cereal products but also partly meet the regional food crops demand. Consequently, trade of cereal products in the country would be developed and expenses in foreign currency for import of these products could be saved.

On the other hand, increase in production of vegetables and milk upon completion of the Project would help expand both home trade and foreign trade and would also stimulate agro-industrial development in the project area as well as in its vicinity.

XI.4.2 Socio economic impact

Owing to increase in agricultural production, the net income of farm households would augment considerably, enabling them to improve their living standard. Moreover, this fact would have favourable effects on agricultural activities, and stabilize the rural economy and general welfare as a whole.

Development of road network under the Project would improve domestic transportation and communication means, thus facilitating agro-economic and rural development activities.

The realization of the Project would create a large number of employment opportunities both in construction works and in O & M of project facilities. Employment opportunities would also increase in agro-industrial sector, in particular in farm products processing plants such as SOCAM, ULB, etc.

It should be mentioned also that in participating in construction and operation and maintenance of the Project, local inhabitants would gain more experience, technical knowledges and capability in undertaking the works in various sectors. They would constitute an experienced and skillful manpower which will be useful for development of Mali in future.

Table XI.1 SUMMARY OF PROJECT COST

1. CIVIL WORKS

Work Item	Total		
	Foreign Currency (US\$10 ³)	Local Currency (10 ⁶ F CFA)	Total (US\$10 ³)
<u>Stage-1</u>			
1. Temporary works	62	37	149
2. Main irrigation canals (7.6 km)	1,901	1,174	4,656
3. Demonstration farm (DSK-5 area 86.4 ha)	148	51	267
4. Connection road (4.3 km)	28	11	54
Sub-total (1)	<u>2,139</u>	<u>1,272</u>	<u>5,126</u>
<u>Stage-2</u>			
1. Temporary works	119	51	239
2. Main irrigation canal (29.3 km)	1,731	772	3,544
3. Secondary irrigation canals (22.7 km)	980	272	1,619
4. On-farm works (1,026 ha)	837	311	1,568
5. Fara river improvement (0.32 km)	5	2	0
6. Secondary drainage canals (31.9 km)	226	138	551
Sub-total (2)	<u>3,898</u>	<u>1,547</u>	<u>7,530</u>
<u>Stage-3</u>			
1. Temporary works	141	46	249
2. Main irrigation canal (4.4 km)	186	66	340
3. Secondary irrigation canals (42.2 km)	1,702	472	2,810
4. On-farm works (1,888 ha)	2,013	676	3,601
5. Main and catch drain canals (14.0 km)	500	186	936
6. Secondary drainage canals (44.6 km)	341	145	682
Sub-total (3)	<u>4,883</u>	<u>1,591</u>	<u>8,618</u>
Total (4) = (1)+(2)+(3)	10,920	4,410	21,274
Physical Contingency (5) = (4) x 10%	1,092	441	2,127
Engineering Services (6) = ((4)+(5)) x 12%	1,441	582	2,808
Total (7) = (4)+(5)+(6)	<u>13,453</u>	<u>5,434</u>	<u>26,210</u>

2. INITIAL FARM INVESTMENT

Work Item	Total		
	Foreign Currency (US\$10 ³)	Local Currency (10 ⁶ F CFA)	Total (US\$10 ³)
1. Installation of Cowshed and Facilities	1,446	180	1,856
2. Farm Machinery for Fodder Production	428	0	428
3. Procurement of Milk Cow (Jersey)	1,267	0	1,267
4. Installation of Rice Mill	160	8	216
Sub-total	<u>3,301</u>	<u>188</u>	<u>3,767</u>
Price Contingency	347	63	470
Total	<u>3,648</u>	<u>251</u>	<u>4,237</u>

Table XI.2 ANNUAL DISBURSEMENT SCHEDULE OF ECONOMIC COST

Item	(Unit: US\$10 ³)					Total
	1986	1987	1988	1989	1990	
I. Civil Works						
Stage-1	500	2,893	1,733	-	-	5,126
Stage-2	-	658	4,258	2,614	-	7,530
Stage-3	-	-	-	4,264	4,354	6,618
Physical contingency	50	355	599	688	435	2,127
Engineering services	66	469	791	908	575	2,808
Sub-total	616	4,375	7,381	8,474	5,364	26,210
II. Initial Farm Investment						
Procurement of milk cow	-	-	423	422	422	1,267
Total	616	4,375	7,804	8,896	5,786	27,387

Table XI.3 CROP BUDGET UNDER WITH PROJECT

I. Yield and Farm Input											
Item	Unit	Rice	Maize	Sorghum and Millet	French Beans	Tomato	Water-melon	Onion	Potato	Okra	Ground-nuts
1. Yield	ton	2.5	3.0	3.0	2.0	25.0	20.0	25.0	8.0	4.0	1.5
2. Farm Input											
1) Seed	kg	30	25	8	40	0	2	5	1,200	4	60
2) Fertilizer											
- Urea	kg	260	230	110	240	400	480	105	100	115	0
- TSP	kg	130	200	50	240	260	330	75	100	60	40
- KCl	kg	100	100	40	147	350	320	135	150	70	80
3) Agrochemical											
- Insecticide	lit.	3	1	1	1	2	2	2	2	2	1
- Fungicide	lit.	1	1	1	1	2	2	2	2	2	1
4) Labour	man/day	165	105	85	140	500	300	420	360	160	115
II. Production Cost and Benefit											
Item		Rice	Maize	Sorghum and Millet	French Beans	Tomato	Water-melon	Onion	Potato	Okra	Ground-nuts
(Unit: 10 ³ F CFA/ha)											
1. Gross Production Value		530.4	372.0	369.0	1,410.0	1,875.0	1,200.0	2,150.0	1,000.0	668.0	345.0
2. Production Cost											
1) Seed		4.2	3.1	1.0	80.0	4.8	12.0	48.0	168.0	24.0	5.4
2) Fertilizer											
- Urea		33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3
- TSP		12.0	18.4	4.6	22.1	23.9	30.4	6.9	9.2	5.5	3.7
- KCl		7.4	7.4	3.0	10.9	25.9	23.7	10.0	11.1	5.2	5.9
3) Agrochemical											
- Insecticide		4.4	1.5	1.5	1.5	3.0	3.0	3.0	3.0	3.0	1.5
- Fungicide		2.1	2.1	2.1	2.1	4.2	4.2	4.2	4.2	4.2	2.1
4) Labour		82.5	52.5	42.5	70.0	250.0	150.0	210.0	180.0	80.0	57.5
5) Farm equipment		33.8	19.4	22.9	20.2	19.3	16.8	21.0	21.0	21.0	21.0
6) Milling charge		12.0	-	-	-	-	-	-	-	-	-
7) Others (5%)		4.9	4.3	3.4	8.5	5.7	6.2	6.3	12.5	4.8	3.6
Total		196.6	141.9	114.2	248.5	370.1	279.4	342.6	442.2	180.9	134.0
Net Production Value		333.8	230.1	254.8	1,161.5	1,504.9	920.6	1,807.4	557.8	487.1	211.0

Table XI.4 CROP BUDGET UNDER WITHOUT PROJECT CONDITION

I. Yield and Farm Input									
Item	Unit	Paddy	Maize	Sorghum	Tomato	Onion	Ground-nuts	Others	
1. Yield	ton	1.4	1.1	0.7	11.8	21.4	0.6	10.0	
2. Farm Input									
1) Seed	kg	120	25	8	0	5	60	2	
2) Fertilizer									
- Urea	kg	36	36	-	36	36	-	-	
- Ammonium Phosphate	kg	25	25	-	25	25	-	-	
3) Agrochemical									
- Insecticide	lit.	-	-	-	-	-	-	-	
- Fungicide	lit.	-	-	-	-	-	-	-	
4) Labour	man/day	48	40	40	330	230	40	230	
II. Production Cost and Benefit									
Item	Unit	Paddy	Maize	Sorghum	Tomato	Onion	Ground-nuts	Others	
(Unit: 103 F CFA/ha)									
1. Gross Production Value		203.0	136.4	86.1	885.0	1,840.4	138.0	600.0	
2. Production Cost									
1) Seed		16.9	3.1	1.0	4.8	48.0	5.4	12.0	
2) Fertilizer									
- Urea		4.6	4.6	0.0	4.6	4.6	0.0	0.0	
- Ammonium Phosphate		2.9	2.9	0.0	2.9	2.9	0.0	0.0	
3) Agrochemical									
- Insecticide		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
- Fungicide		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
4) Labour		24.0	20.0	20.0	165.0	115.0	24.0	115.0	
5) Farm Machinery		5.4	5.4	5.4	5.4	5.4	5.4	5.4	
6) Milling charge		-	-	-	-	-	-	-	
7) Others (5%)		1.5	0.8	0.3	0.9	3.0	0.5	0.9	
Total		55.3	36.8	26.7	183.6	179.0	35.3	133.3	
Net Production Value		147.7	99.6	59.4	701.4	1,661.4	102.7	466.7	

Table XI.5 ANNUAL BENEFIT OF CROP PRODUCTION
AT FULL-DEVELOPED STAGE

Crops	Planted Area (ha)	Net Production Value (10 ³ F CFA)	
		per Ha	Total (2,600 ha)
Rainy Season Crop			
Paddy	2,400	333.8	801,120
Potato	50	557.8	27,890
Watermelon	50	920.6	46,030
Okra	50	487.1	24,355
Groundnuts	50	211.0	10,550
			909,945
			(350,000 F CFA/ha = US\$822/ha)
Dry Season Crop			
Maize	1,600	230.1	368,160
Sorghum & Millet	200	254.8	50,960
French beans	150	1,161.5	174,225
Tomato	350	1,504.9	526,715
Onion	100	1,807.4	180,740
Potato	50	557.8	27,890
Watermelon	50	920.6	46,030
Okra	50	487.1	24,355
Groundnuts	50	211.0	10,550
			1,409,625
			(542,000 F CFA/ha = US\$1,273/ha)
Total			2,319,570
			892,000 F CFA/ha = US\$2,095/ha

Table XI.6 ANNUAL INCREMENTAL BENEFIT OF CROP PRODUCTION

Year	STAGE-1				STAGE-2				STAGE-3			
	Rainy S. Crops		Dry S. Crops		Rainy S. Crops		Dry S. Crops		Rainy S. Crops		Dry S. Crops	
	Planted Area(ha)	Benefit 10*3FCFA	Planted Area(ha)	Benefit 10*3FCFA	Planted Area(ha)	Benefit 10*3FCFA	Planted Area(ha)	Benefit 10*3FCFA	Planted Area(ha)	Benefit 10*3FCFA	Planted Area(ha)	Benefit 10*3FCFA
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
1986												
1987												
1988	86	15,050	86	23,306								
1989	86	21,070	86	32,628	756	132,300	756	204,876				
1990	86	24,080	86	37,290	756	185,220	756	286,826			1,758	476,418
1991	86	27,090	86	41,951	756	211,680	756	327,802	1,758	307,650	1,758	666,985
1992	86	30,100	86	46,612	756	238,140	756	368,777	1,758	430,710	1,758	762,269
1993	86	30,100	86	46,612	756	264,600	756	409,752	1,758	492,240	1,758	857,552
1994	86	30,100	86	46,612	756	264,600	756	409,752	1,758	553,770	1,758	952,836
1995	86	30,100	86	46,612	756	264,600	756	409,752	1,758	615,300	1,758	952,836
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2035	86	30,100	86	46,612	756	264,600	756	409,752	1,758	615,300	1,758	952,836

Year	TOTAL				BENEFIT				
	Rainy S. Crops		Dry S. Crops		Under Project	With Project	Under Project	Without Project	Increment
	Planted Area(ha)	Benefit 10*3FCFA	Planted Area(ha)	Benefit 10*3FCFA	10*3FCFA	10*3FCFA	10*3FCFA	10*3FCFA	US\$10*3
(13)=(1+5+9)	(14)=(2+6+10)	(15)=(3+7+11)	(16)=(4+8+12)	(17)=(14+17)	(18)	(19)=(17-18)	(20)		
1986									
1987									
1988	86	15,050	86	23,306	38,356	316,222	-277,866	-652	
1989	842	153,370	842	237,504	390,874	316,222	74,652	175	
1990	842	209,300	2,600	800,534	1,009,834	316,222	693,612	1,628	
1991	2,600	546,420	2,600	1,036,738	1,583,158	316,222	1,266,936	2,974	
1992	2,600	698,950	2,600	1,177,658	1,876,608	316,222	1,560,386	3,663	
1993	2,600	786,940	2,600	1,313,916	2,100,856	316,222	1,784,634	4,189	
1994	2,600	848,470	2,600	1,409,200	2,257,670	316,222	1,941,448	4,557	
1995	2,600	910,000	2,600	1,409,200	2,319,200	316,222	2,002,978	4,702	
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2035	2,600	910,000	2,600	1,409,200	2,319,200	316,222	2,002,978	4,702	

Table XI.7 ANNUAL NET BENEFIT OF DAIRY PRODUCTS

YEAR	PASTURE (ha)		MILK Kl	MEAT head	GROSS BENEFIT 10*3FCFA	MILK COW head	PRODUCTION COST 10*3FCFA	NET BENEFIT 10*3FCFA	NET BENEFIT US\$10*3
	ST-2	ST-3								TOTAL
1986	.	.	.	.	.	.	.	.	.
1987	.	.	.	.	.	.	.	.	.
1988	.	.	.	.	.	.	.	.	.
1989	.	.	.	.	.	.	.	.	.
1990	270		390	0	0	220	29,340	63,480	149
1991	270	130	790	0	0	530	70,682	117,338	275
1992	270	130	1,170	0	0	910	121,359	157,101	369
1993	270	130	1,310	0	0	1,270	159,369	142,411	334
1994	270	130	1,660	10	770	1,650	220,047	175,803	413
1995	270	130	2,180	10	770	1,980	264,056	255,554	600
1996	270	130	2,800	20	1,540	2,140	285,394	382,546	898
1997	270	130	2,800	220	16,940	2,140	285,394	397,946	934
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2035	270	130	2,800	220	16,940	2,140	285,394	397,946	934

Table XI.8 ECONOMIC COST AND BENEFIT OF MILK PRODUCTION

Item	Q'ty	Unit Price 10 ³ F CFA	Total 10 ³ F CFA
I. Gross Benefit			
- Milk (k lit.)	2,800	238	666,400
- Meat (head)	220	77	16,940
Total (I)			<u>683,340</u>
II. Production Cost			
1) Building, Facilities and Equipment			
- Labour wage (man-day)	10,800	1	10,800
- Maintenance cost			8,164
- Annual depreciation cost			44,415
- Others (5%)			3,169
2) Forrage production cost			
- Seed (t)	1.8	1,500	2,700
- Fertilizer			
Urea (t)	240	128	30,720
TSP (t)	200	92	18,400
KCl (t)	112	74	8,288
- Labour wage (man-day)	5,360	1	5,360
- Fuel and lubricant			
Diesel oil (k lit.)	96.2	190	18,278
Lubricant ^{/2}			3,656
- Depreciation cost of farm machinery ^{/3}			26,737
- Others (5%)			5,707
3) Salary, etc.			
- Salary of staff			91,010
- Administrative expense			7,990
Total (II)			<u>285,394</u>
Net Benefit (I) - (II)			397,946

(US\$934 x 10³)

Remarks: ^{/1}: Annual depreciation cost of building, equipment and facilities are:

Item	Total Cost (10 ³ F CFA)	Lifetime (year)	Annual Depreciation (10 ³ F CFA)
Building	585,324	25	23,413
Equipment and facilities	210,018	10	21,002
Total			44,415

^{/2}: 20% of the total cost of diesel oil

^{/3}: Annual depreciation cost of farm machinery are:

Item	Total Cost* (10 ³ F CFA)	Lifetime (year)	Annual Depreciation (10 ³ F CFA)
Tractor	129,850	8	16,231
Other equipment	52,530	5	10,506
Total			26,737

*: including 10% of spare parts

Table XI.9 PROJECT BENEFIT FLOW

Year	CROP PRODUCTION (I)										LIVESTOCK PRODUCTION (II)					TOTAL PROJECT BENEFIT US\$10*3 (16)
	Rainy S. Crops		Dry S. Crops		With		Without		Increment		Milk Benefit 10*6FCFA head (10)	Heat Benefit 10*6FCFA head (11)	Product. Cost 10*6FCFA (13)	Total Benefit 10*6FCFA (14)=(10+12-13)	Total Benefit US\$10*3 (15)	
	Planted Area(ha) 10*6FCFA (1)	Benefit 10*6FCFA (2)	Planted Area(ha) 10*6FCFA (3)	Benefit 10*6FCFA (4)	Project 10*6FCFA (5)=(2+4)	Project 10*6FCFA (6)	Project 10*6FCFA (7)=(5-6)	Project 10*6FCFA (8)	Project 10*6FCFA (9)	Project 10*6FCFA (10)						
1985	86	15.1	86	23.3	38.4	316.2	-277.9	(652)								
1987	842	153.4	842	237.5	390.9	316.2	74.7	175								(652)
1988	842	209.3	2600	800.5	1009.8	316.2	693.6	1,628	390	92.8	0	0.0	29.34	63.5	149	1,777
1989	2600	545.4	2600	1035.7	1583.2	316.2	1266.9	2,974	790	188.0	0	0.0	70.68	117.3	275	3,249
1990	2600	699.0	2600	1177.7	1876.6	316.2	1560.4	3,663	1170	278.5	0	0.0	121.359	157.1	369	4,032
1991	2600	786.9	2600	1313.9	2100.9	316.2	1784.6	4,189	1310	311.8	0	0.0	169.369	142.4	394	4,524
1992	2600	848.5	2600	1409.2	2257.7	316.2	1941.4	4,557	1660	395.1	10	.8	220.047	175.8	413	4,970
1993	2600	910.0	2600	1409.2	2319.2	316.2	2003.0	4,702	2180	518.8	10	.8	264.056	255.6	600	5,302
1994	2600	910.0	2600	1409.2	2319.2	316.2	2003.0	4,702	2800	666.4	20	1.5	265.394	382.5	898	5,600
1995	2600	910.0	2600	1409.2	2319.2	316.2	2003.0	4,702	2800	666.4	220	16.9	265.394	397.9	934	5,636
2035	2600	910.0	2600	1409.2	2319.2	316.2	2003.0	4,702	2800	666.4	220	16.9	265.394	397.9	934	5,636

Table XI.10 COST AND BENEFIT FLOW

Unit: US\$10*3

Year in Order	Calendar Year	Project Cost				Project Benefit		
		Civil Works	Farm Invest.	O & M Cost	Total	Crop Product.	Milk & Meat	Total
1	1986	616		0	616	0	0	0
2	1987	4,375		0	4,387	0	0	0
3	1988	7,381		423	7,904	(652)	0	(652)
4	1989	8,474		422	9,143	175	0	175
5	1990	5,354		422	6,203	1,638	149	1,787
6	1991	.		.	524	2,974	275	3,249
7	1992	.		.	524	3,663	369	4,032
8	1993	.		.	524	4,189	334	4,523
9	1994	.		.	524	4,557	413	4,970
10	1995	.		.	524	4,702	600	5,302
11	1996	.		.	524	4,702	898	5,600
12	1997	.		.	524	4,702	934	5,636
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50	2035	.		.	524	4,702	934	5,636

Table XI.11 TYPICAL FARM BUDGET UNDER
WITH PROJECT CONDITION

Item	Planted Area (ha)	Unit Yield (t/ha)	Produc- tion (t)	Price (F CFA/t)	Total (10 ³ F CFA)
(1) <u>Income</u>					
1) Agricultural production					
- Rice	1.11	2.6	2.89	170	491
- Maize	0.74	3.0	2.22	55	111
- Sorghum & Millet	0.09	2.0	0.18	55	10
- French beans	0.05	2.0	0.10	190	19
- Tomato	0.16	25.0	4.00	75	300
- Watermelon	0.04	20.0	0.80	110	88
- Onion	0.06	25.0	1.50	168	252
- Potato	0.06	8.0	0.48	150	72
- Okra	0.06	4.0	0.24	70	17
- Groundnuts	0.04	1.5	0.06	100	60
- Mango	0.37	3.0	1.11	70	78
- Meat (kg)			80 kg	220	18
<u>Total</u>					<u>1,516</u>
2. <u>Outgo</u>					
1) Crop production cost					
- Seed					27
- Fertilizer					
• Urea	610 kg				79
• TSP	440 kg				51
• KCl	310 kg				27
- Agro-chemicals					
• Insecticide	5.0 lit.				7
• Fungicide	2.8 lit.				6
- Farm machinery					62
- Milling charge of paddy (4.44 t x F CFA3,000)					13
- Others (5% of direct cost)					13
2) Living expense					950
<u>Total</u>					<u>1,235</u>
3. <u>Net Reserve</u>					
					281

Table XI.12 FINANCIAL CASHFLOW STATEMENT

(Unit: US\$10³)

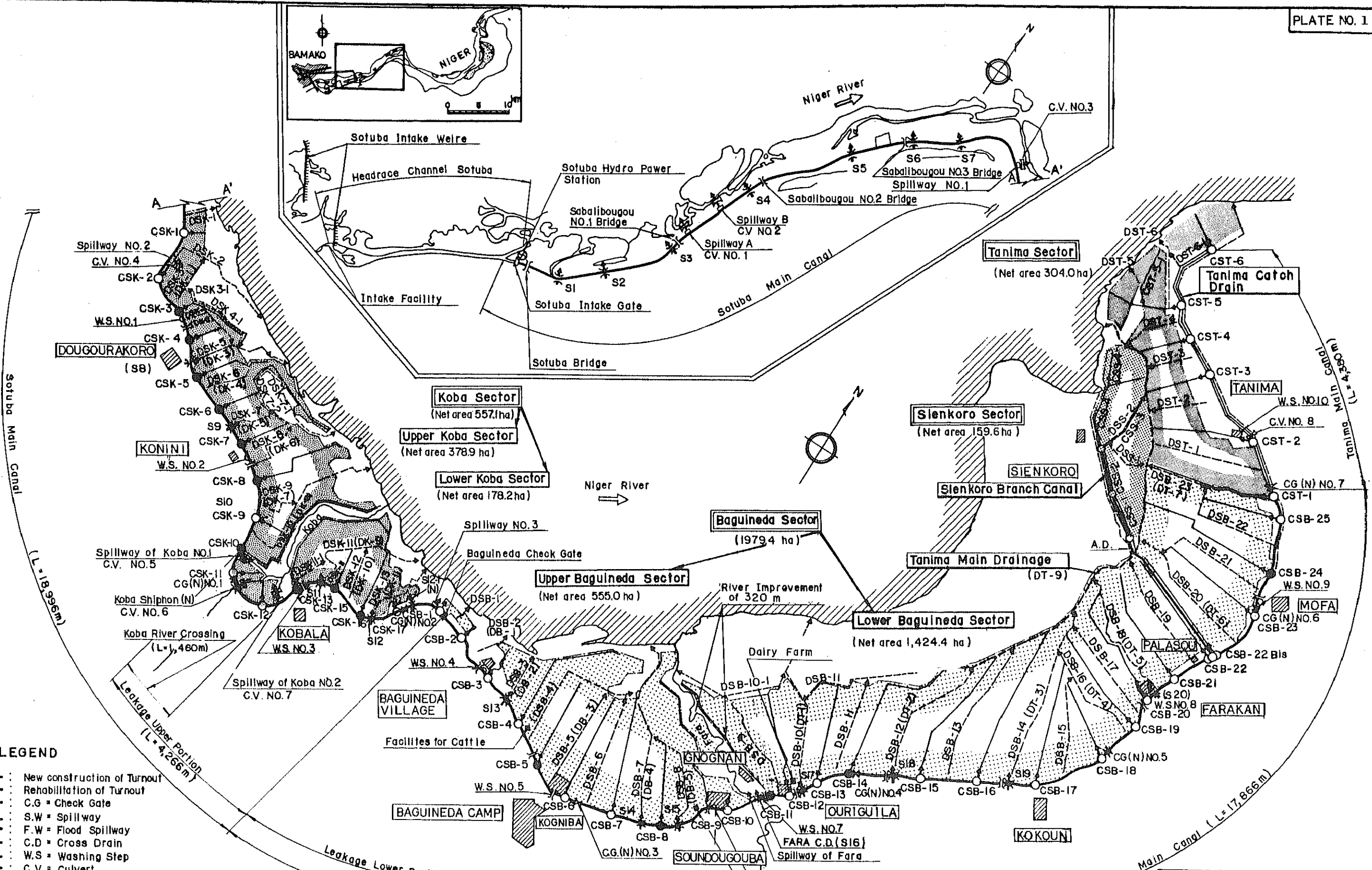
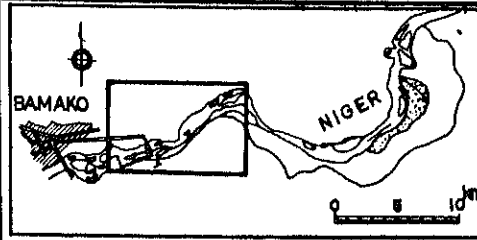
Year	Year in Order	Cash Outflow						Cash Inflow					Bal- ance	
		Capital Cost		Loan Repayment/ ¹				Project Revenue			Govern- ment Subsidy	Total		
		Civil Works	Farm Invest- ment	Sub- total	Princi- pal	Service Fee	O&M Cost	Total	Loan	Farm- ers				Baguineda Operation
1986	1	256	-	256	-	2	-	258	256	-	-	2	258	-
1987	2	1,872	755	2,627	-	22	12	2,661	2,627	10	-	23	2,660	-
1988	3	3,603	1,176	4,779	-	57	100	4,936	4,779	87	-	71	4,937	-
1989	4	4,700	1,228	5,928	-	102	247	6,277	5,928	214	-	135	6,277	-
1990	5	3,021	489	3,510	-	128	417	4,055	3,510	361	149	35	4,055	-
1991	6	-	-	-	-	128	524	652	-	454	275	-	729	77
1992	7	-	-	-	-	128	524	652	-	454	369	-	823	171
1993	8	-	-	-	-	128	524	652	-	454	334	-	788	136
1994	9	-	-	-	-	128	524	652	-	454	413	-	867	215
1995	10	-	-	-	-	128	524	652	-	454	600	-	1,054	402
1996	11	-	-	-	171	127	524	822	-	454	898	-	1,352	530
1997	12	-	-	-	171	126	524	821	-	454	934	-	1,388	567
1998	13	-	-	-	171	124	524	819	-	454	934	-	1,388	569
1999	14	-	-	-	171	123	524	818	-	454	934	-	1,388	570
2000	15	-	-	-	171	122	524	817	-	454	923	-	1,388	571
2001	16	-	-	-	171	121	524	816	-	454	934	-	1,388	573
2002	17	-	-	-	171	119	524	814	-	454	934	-	1,388	574
2003	18	-	-	-	171	118	524	813	-	454	934	-	1,388	575
2004	19	-	-	-	171	117	524	812	-	454	934	-	1,388	576
2005	20	-	-	-	171	115	524	810	-	454	934	-	1,388	578
2006	21	-	-	-	513	112	524	1,149	-	454	934	-	1,388	240
2007	22	-	-	-	513	108	524	1,145	-	454	934	-	1,388	243
2008	23	-	-	-	513	104	524	1,141	-	454	934	-	1,388	247
2009	24	-	-	-	513	100	524	1,137	-	454	934	-	1,388	251
2010	25	-	-	-	513	96	524	1,133	-	454	934	-	1,388	255
2011	26	-	-	-	513	92	524	1,129	-	454	934	-	1,388	259
2012	27	-	-	-	513	88	524	1,125	-	454	934	-	1,388	263
2013	28	-	-	-	513	85	524	1,122	-	454	934	-	1,388	266
2014	29	-	-	-	513	81	524	1,118	-	454	934	-	1,388	270
2015	30	-	-	-	513	77	524	1,114	-	454	934	-	1,388	274
2016	31	-	-	-	513	73	524	1,110	-	454	934	-	1,388	278
2017	32	-	-	-	513	69	524	1,106	-	454	934	-	1,388	282
2018	33	-	-	-	513	65	524	1,102	-	454	934	-	1,388	286
2019	34	-	-	-	513	62	524	1,099	-	454	934	-	1,388	290
2020	35	-	-	-	513	58	524	1,095	-	454	934	-	1,388	293
2021	36	-	-	-	513	54	524	1,091	-	454	934	-	1,388	297
2022	37	-	-	-	513	50	524	1,087	-	454	934	-	1,388	301
2023	38	-	-	-	513	46	524	1,083	-	454	934	-	1,388	305
2024	39	-	-	-	513	42	524	1,079	-	454	934	-	1,388	309
2025	40	-	-	-	513	38	524	1,075	-	454	934	-	1,388	313
2026	41	-	-	-	513	35	524	1,072	-	454	934	-	1,388	317
2027	42	-	-	-	513	31	524	1,068	-	454	934	-	1,388	320
2028	43	-	-	-	513	27	524	1,064	-	454	934	-	1,388	324
2029	44	-	-	-	513	23	524	1,060	-	454	934	-	1,388	328
2030	45	-	-	-	513	19	524	1,056	-	454	934	-	1,388	332
2031	46	-	-	-	513	15	524	1,052	-	454	934	-	1,388	336
2032	47	-	-	-	513	12	524	1,049	-	454	934	-	1,388	340
2033	48	-	-	-	513	8	524	1,045	-	454	934	-	1,388	343
2034	49	-	-	-	513	4	524	1,041	-	454	934	-	1,388	347
2035	50	-	-	-	513	-	524	1,037	-	454	934	-	1,388	351

Remarks: ¹: Service Fee; 0.75% of loan amount
 Repayment Period; 50 years including 10 years of grace period
 Repayment Schedule; 1% of the total loan amount per year during first 10 years
 and 3% during last 30 years

DRAWINGS

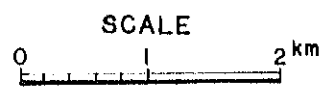
LIST OF DRAWINGS

<u>PLATE NO.</u>	<u>TITLE OF DRAWINGS</u>
1	GENERAL PLAN (PROJECT CONDITION)
2	TYPICAL LOT (KOBA AREA)
3	TYPICAL CANAL PROFILE (MAIN CANAL)
4	TYPICAL CANAL PROFILE (SECONDARY CANAL)
5	TYPICAL FACILITY ON MAIN CANAL (1/5)
6	TYPICAL FACILITY ON MAIN CANAL (2/5)
7	TYPICAL FACILITY ON MAIN CANAL (3/5)
8	TYPICAL FACILITY ON MAIN CANAL (4/5)
9	TYPICAL FACILITY ON MAIN CANAL (5/5)
10	TYPICAL FACILITY ON SECONDARY CANAL (1/2)
11	TYPICAL FACILITY ON SECONDARY CANAL (2/2)
12	TYPICAL FACILITY ON DRAINAGE CANAL
13	TYPICAL ON-FARM FACILITY

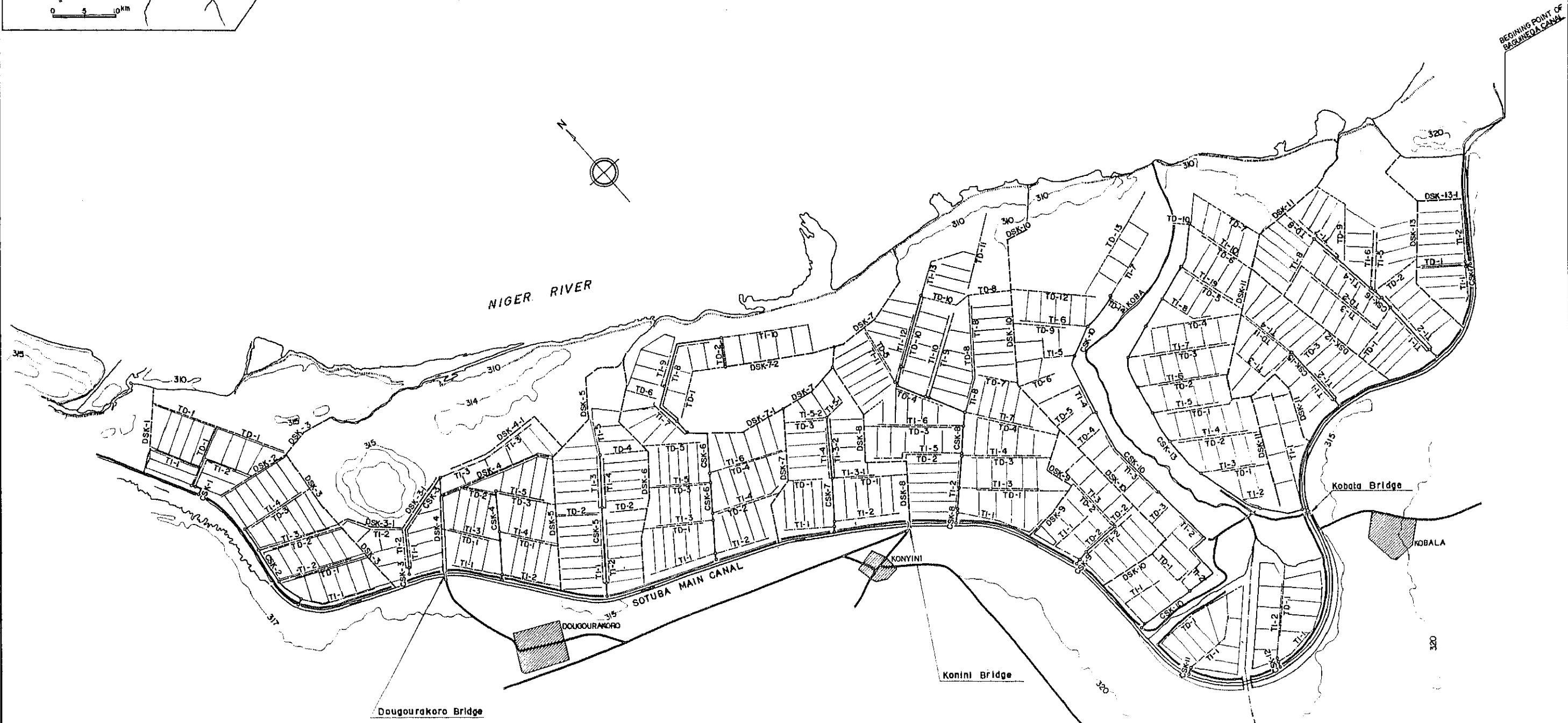
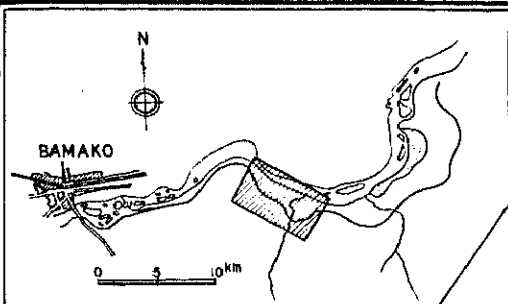


LEGEND

- New construction of Turnout
- Rehabilitation of Turnout
- C.G = Check Gate
- S.W = Spillway
- F.W = Flood Spillway
- C.D = Cross Drain
- W.S = Washing Step
- C.V = Culvert
- A.D = Aqueduct
- Existing Main Canal
- Main Canal to be Constructed
- Secondary Canal
- Main Drain
- Secondary Drain
- Bridge
- Facilities for Stock Farming
- (N) Structures to be Constructed
- (Re) Structures to be rehabilitated



BAGUINEDA AGRICULTURAL DEVELOPMENT PROJECT
THE REPUBLIC OF MALI
MINISTRY OF AGRICULTURE
GENERAL
GENERAL PLAN
(PROJECT CONDITION)
JAPAN INTERNATIONAL COOPERATION AGENCY



LEGEND

- MAIN CANAL
- SECONDARY CANAL
- TERTIARY CANAL
- SECONDARY DRAIN
- TERTIARY DRAIN
- TURNOUT
- BRIDGE
- PLOTTING (1.2 ha)
- CONTOUR
- ROAD
- RIVER

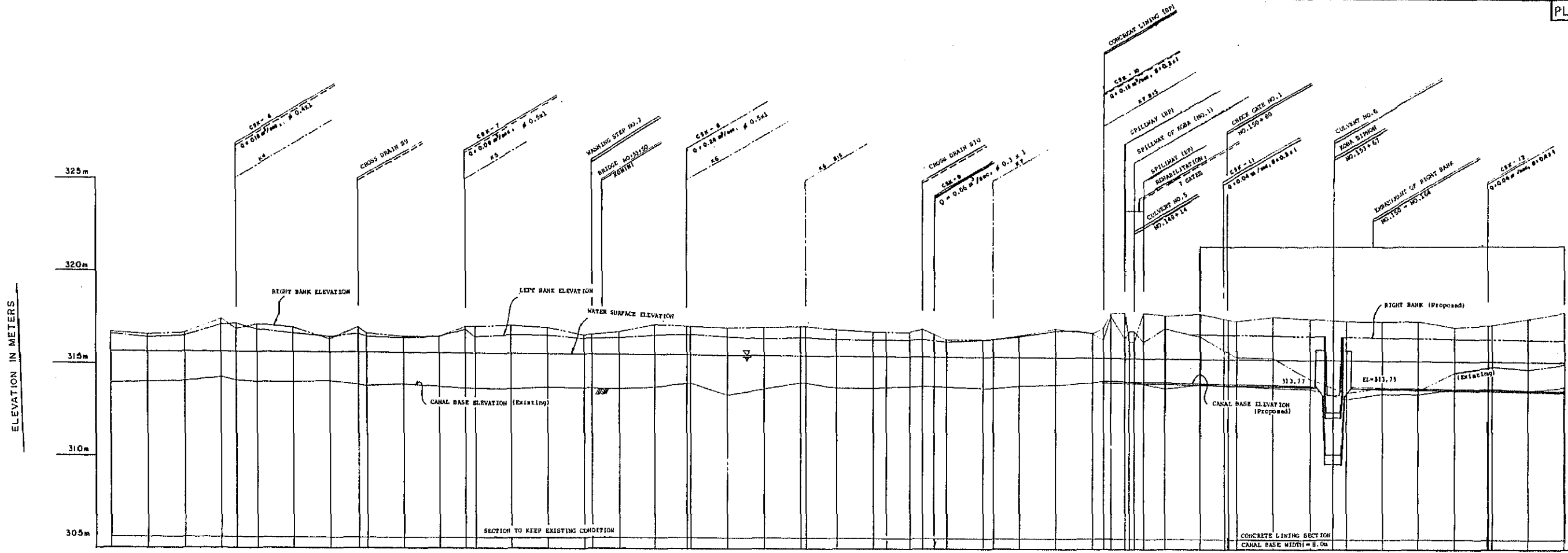


BAGUINEDA AGRICULTURAL
DEVELOPMENT PROJECT

THE REPUBLIC OF MALI
MINISTRY OF AGRICULTURE

GENERAL
TYPICAL LOT
(KOBAL AREA)

JAPAN INTERNATIONAL COOPERATION AGENCY



STATION	PROPOSED CONDITION										EXISTING CONDITION						
	DISCHARGE	VELOCITY	GRADIENT	WATER SURFACE ELEVATION	CANAL BASE ELEVATION	CANAL BASE ELEVATION	RIGHT BANK ELEVATION	LEFT BANK ELEVATION	REDUCED DISTANCE	DISTANCE	DISTANCE	DISTANCE	DISTANCE	DISTANCE	DISTANCE	DISTANCE	
NO 120	0.90 m³/s	0.36 ~ 0.33 m/s		315.87	314.28	313.34	316.08	316.34	12.000	100	100	100	100	100	100	100	
NO 121									12.000	100	100	100	100	100	100	100	
NO 122									12.000	100	100	100	100	100	100	100	
NO 123									12.000	100	100	100	100	100	100	100	
NO 124									12.000	100	100	100	100	100	100	100	
NO 125									12.000	100	100	100	100	100	100	100	
NO 126									12.000	100	100	100	100	100	100	100	
NO 127									12.000	100	100	100	100	100	100	100	
NO 128									12.000	100	100	100	100	100	100	100	
NO 129									12.000	100	100	100	100	100	100	100	
NO 130									12.000	100	100	100	100	100	100	100	
NO 131									12.000	100	100	100	100	100	100	100	
NO 132									12.000	100	100	100	100	100	100	100	
NO 133									12.000	100	100	100	100	100	100	100	
NO 134									12.000	100	100	100	100	100	100	100	
NO 135									12.000	100	100	100	100	100	100	100	
NO 136									12.000	100	100	100	100	100	100	100	
NO 137									12.000	100	100	100	100	100	100	100	
NO 138									12.000	100	100	100	100	100	100	100	
NO 139									12.000	100	100	100	100	100	100	100	
NO 140									12.000	100	100	100	100	100	100	100	
NO 141									12.000	100	100	100	100	100	100	100	
NO 142									12.000	100	100	100	100	100	100	100	
NO 143									12.000	100	100	100	100	100	100	100	
NO 144									12.000	100	100	100	100	100	100	100	
NO 145									12.000	100	100	100	100	100	100	100	
NO 146									12.000	100	100	100	100	100	100	100	
NO 147									12.000	100	100	100	100	100	100	100	
NO 148									12.000	100	100	100	100	100	100	100	
NO 149									12.000	100	100	100	100	100	100	100	
NO 150									12.000	100	100	100	100	100	100	100	
NO 151									12.000	100	100	100	100	100	100	100	
NO 152									12.000	100	100	100	100	100	100	100	
NO 153									12.000	100	100	100	100	100	100	100	
NO 154									12.000	100	100	100	100	100	100	100	
NO 155									12.000	100	100	100	100	100	100	100	
NO 156									12.000	100	100	100	100	100	100	100	
NO 157									12.000	100	100	100	100	100	100	100	
NO 158									12.000	100	100	100	100	100	100	100	
NO 159									12.000	100	100	100	100	100	100	100	
NO 160									12.000	100	100	100	100	100	100	100	

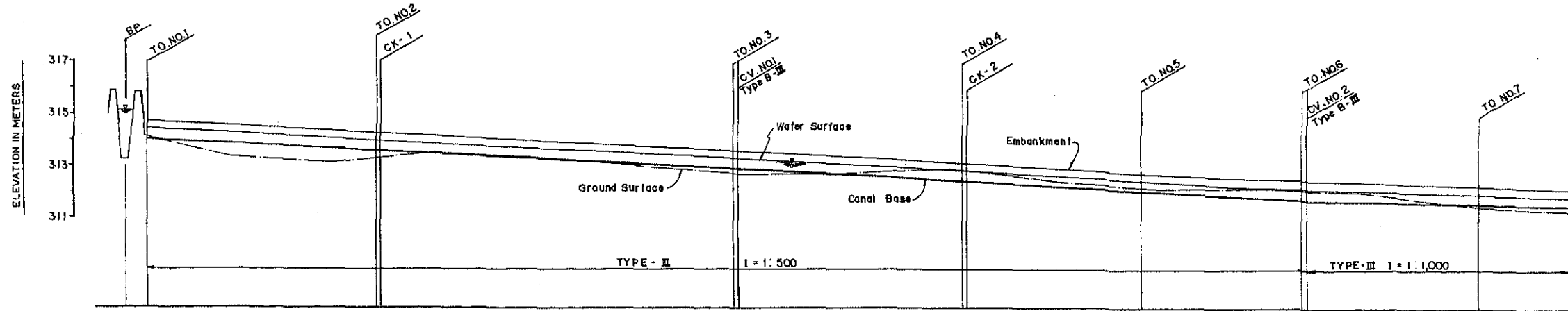
SOTUBA MAIN CANAL

- DEMOLITION OF EXISTING FACILITY
- UTILIZATION OF EXISTING FACILITY
- - - REHABILITATION
- NEWLY CONSTRUCTION

BAGUINEDA AGRICULTURAL DEVELOPMENT PROJECT
THE REPUBLIC OF MALI
MINISTRY OF AGRICULTURE

TYPICAL CANAL PROFILE (MAIN CANAL)

JAPAN INTERNATIONAL COOPERATION AGENCY



STATION	DISTANCE	REDUCED DISTANCE	GROUND SURFACE ELEVATION	WATER SURFACE ELEVATION	CANAL BASE ELEVATION
No. 0	0.00	0.00	314.30	314.89	314.00
+ 20	20.00	20.00	314.10	314.40	314.00
No. 1	80.00	100.00	313.35	314.24	313.84
No. 2	100.00	200.00	313.10	314.04	313.64
+ 30	30.00	230.00	313.50	313.99	313.59
+ 50	50.00	250.00	313.30	313.91	313.51
No. 3	65.00	300.00	313.65	313.84	313.44
No. 4	100.00	400.00	313.30	313.64	313.24
No. 5	100.00	500.00	312.90	313.44	313.04
+ 87	87.00	587.00	312.70	313.24	312.84
No. 6	85.00	600.00	312.50	313.04	312.64
No. 7	100.00	700.00	312.70	313.04	312.64
No. 8	100.00	800.00	312.90	312.84	312.44
+ 100	100.00	810.00	312.80	312.82	312.42
+ 500	500.00	815.00	312.80	312.81	312.41
No. 9	85.00	900.00	312.45	312.64	312.24
+ 85	85.00	985.00	312.25	312.47	312.07
No. 10	150.00	1,000.00	312.20	312.44	312.04
No. 11	100.00	1,100.00	312.20	312.24	311.84
+ 40	40.00	1,140.00	312.15	312.16	311.76
+ 6.25	6.25	1,146.25	312.15	312.15	311.75
No. 12	53.75	1,200.00	312.05	312.10	311.70
No. 13	100.00	1,300.00	311.55	312.00	311.60
+ 10	10.00	1,310.00	311.50	311.99	311.59
No. 14	90.00	1,400.00	311.35	311.90	311.50

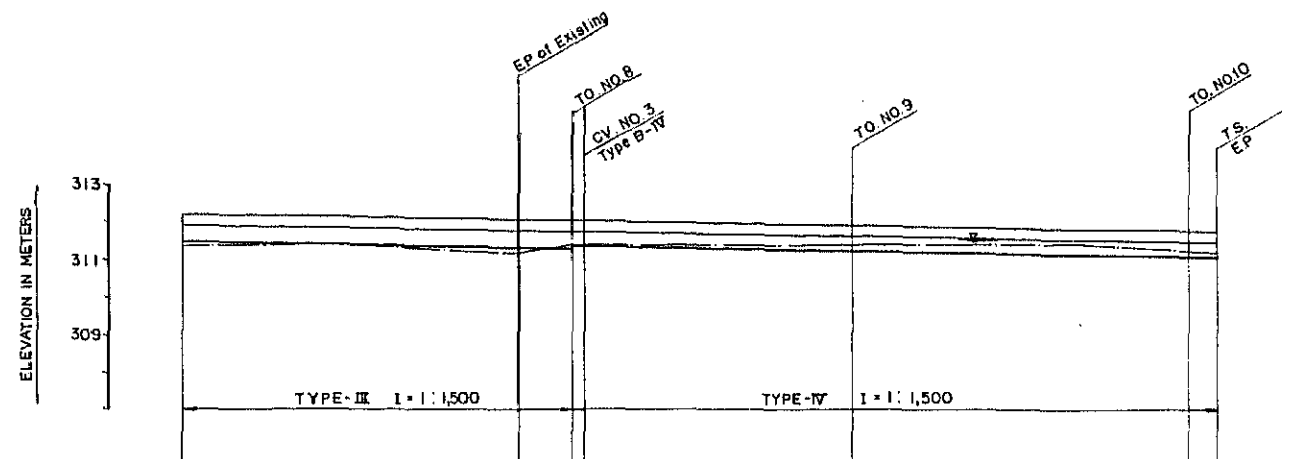
LEGEND
 CV : Culvert
 CK : Check
 TO : Turnout
 TS : Terminal Structure
 EP : End Point
 BP : BEGINNING POINT

TABLE OF CANAL (mm)

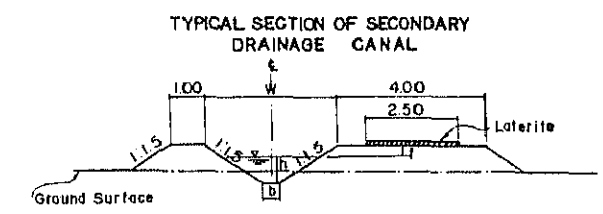
TYPE	b	h	l	w
III	400	400	200	2,200
IV	300	300	200	2,000

TABLE OF DISCHARGE

TYPE	I	1/500	1/1,000	1/1,500
III	Qmax. m ³ /s	0.215	0.152	0.124
	Vmax. m/s	0.539	0.381	0.311
IV	Qmax. m ³ /s	0.100	0.071	0.058
	Vmax. m/s	0.445	0.314	0.257

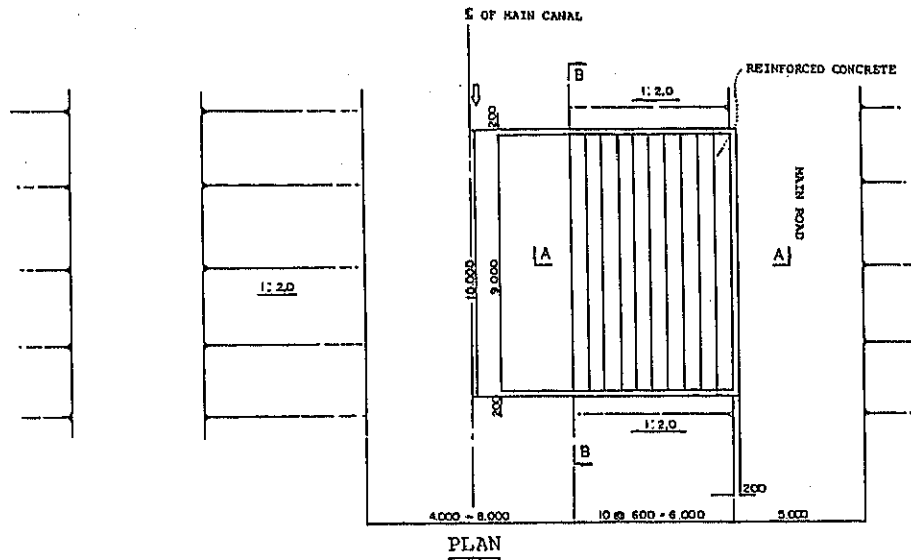


STATION	DISTANCE	REDUCED DISTANCE	GROUND SURFACE ELEVATION	WATER SURFACE ELEVATION	CANAL BASE ELEVATION
No. 14	90.00	1,400.00	311.35	311.90	311.50
No. 15	100.00	1,500.00	311.40	311.85	311.45
No. 16	100.00	1,600.00	311.20	311.77	311.37
+ 25	25.00	1,625.00	311.20	311.75	311.35
+ 60	35.00	1,660.00	311.40	311.72	311.32
+ 6.25	6.25	1,666.25	311.40	311.73	311.43
No. 17	33.75	1,700.00	311.40	311.70	311.40
No. 18	100.00	1,800.00	311.40	311.63	311.33
+ 50	50.00	1,850.00	311.40	311.60	311.30
No. 19	50.00	1,900.00	311.40	311.57	311.27
No. 20	100.00	2,000.00	311.40	311.50	311.20
+ 80	80.00	2,080.00	311.20	311.45	311.15
No. 21	20.00	21,000.00	311.15	311.43	311.13

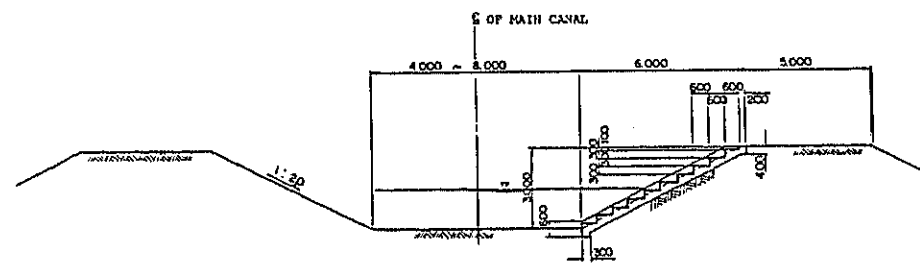


BAGUINEDA AGRICULTURAL DEVELOPMENT PROJECT
 THE REPUBLIC OF MALI
 MINISTRY OF AGRICULTURE
 TYPICAL CANAL PROFILE (SECONDARY CANAL)
 JAPAN INTERNATIONAL COOPERATION AGENCY

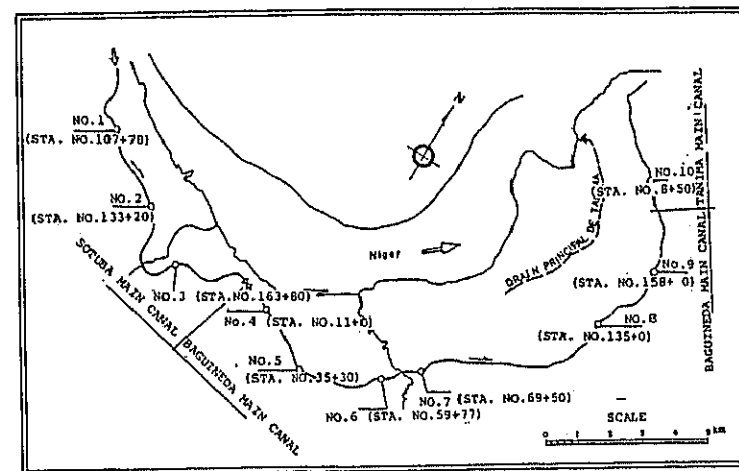
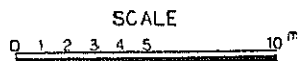
WASHING STEP



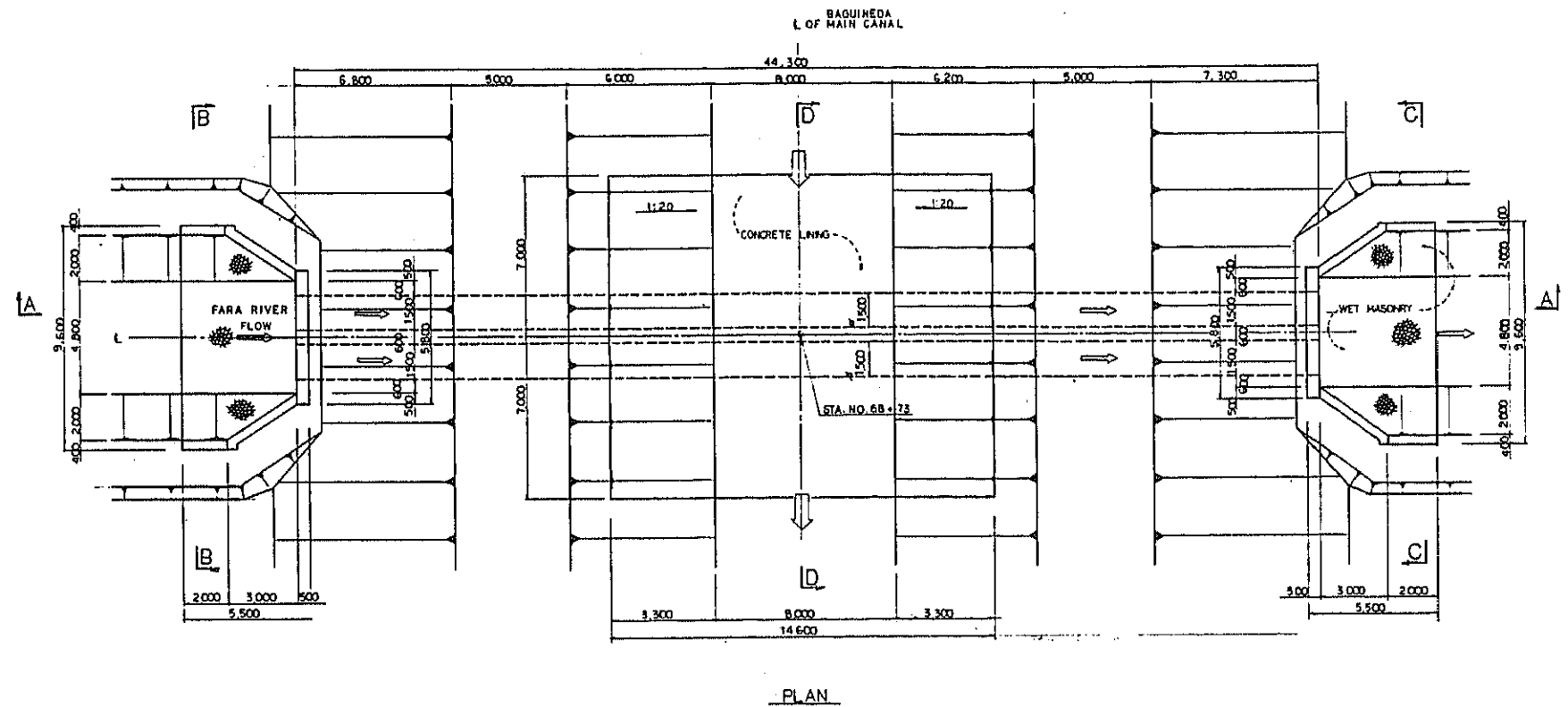
PLAN



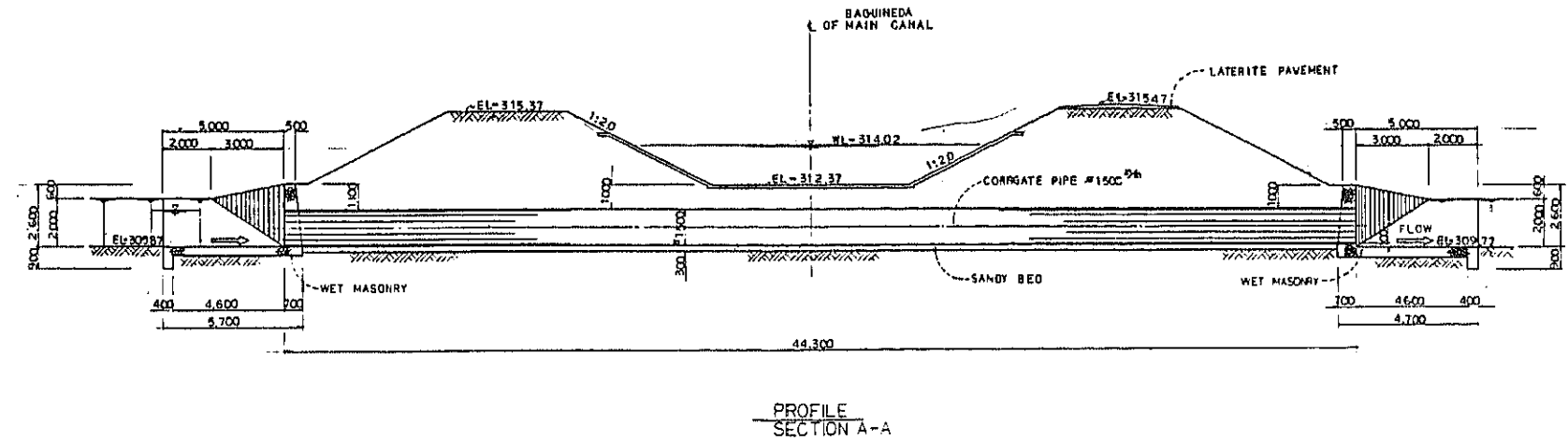
SECTION A-A



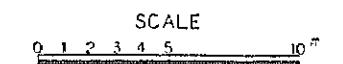
FARA CROSS DRAIN (S-16)



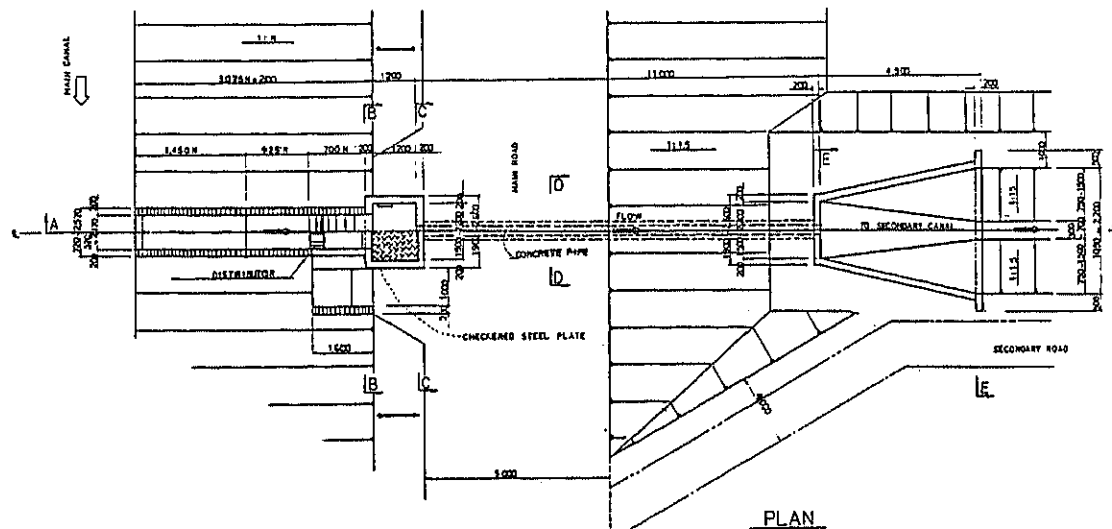
PLAN



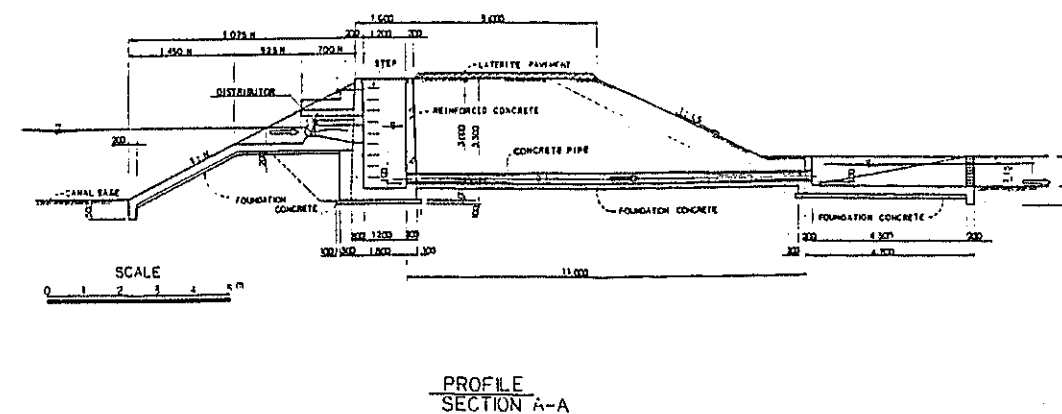
PROFILE SECTION A-A



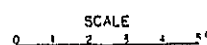
TURNOUT



PLAN



PROFILE SECTION A-A



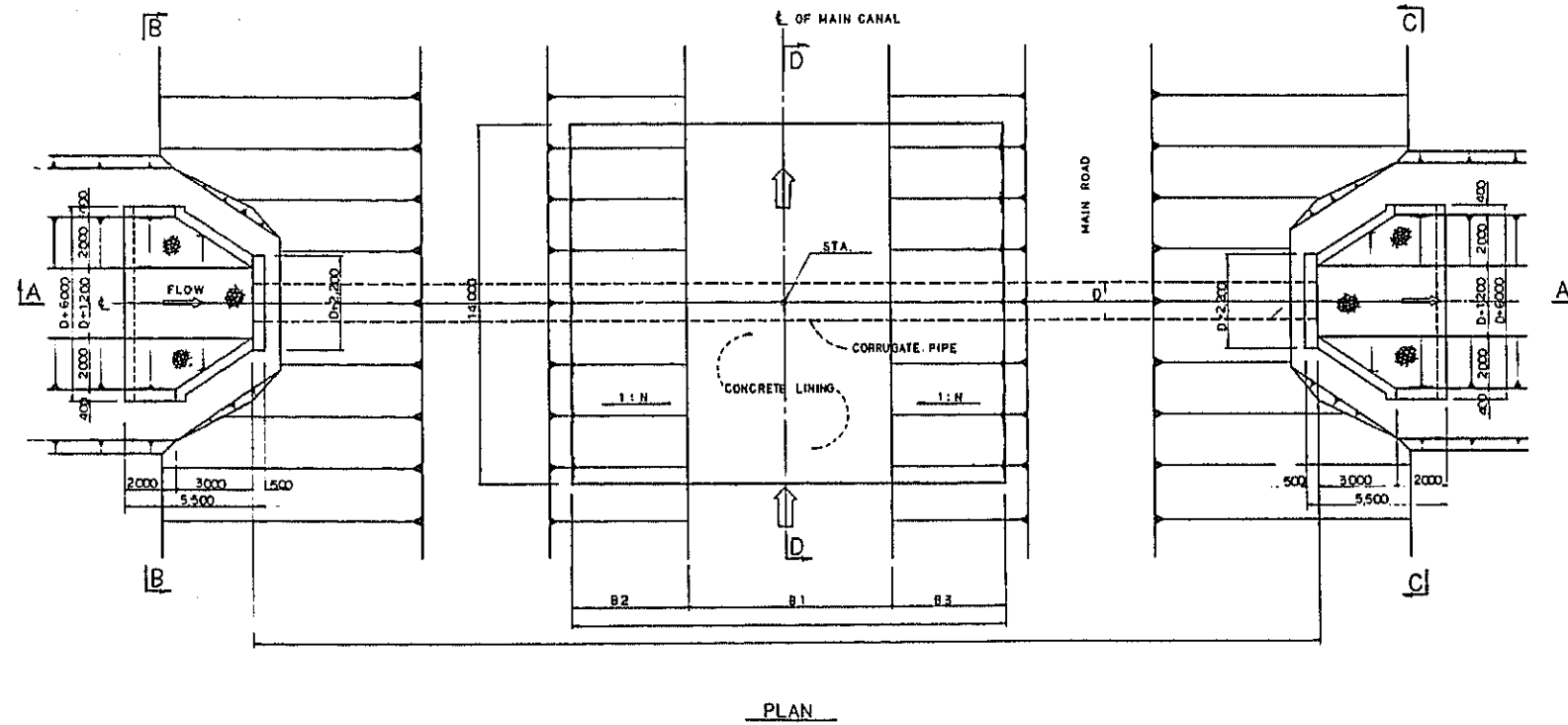
BAGUINEDA AGRICULTURAL DEVELOPMENT PROJECT

THE REPUBLIC OF MALI
MINISTRY OF AGRICULTURE

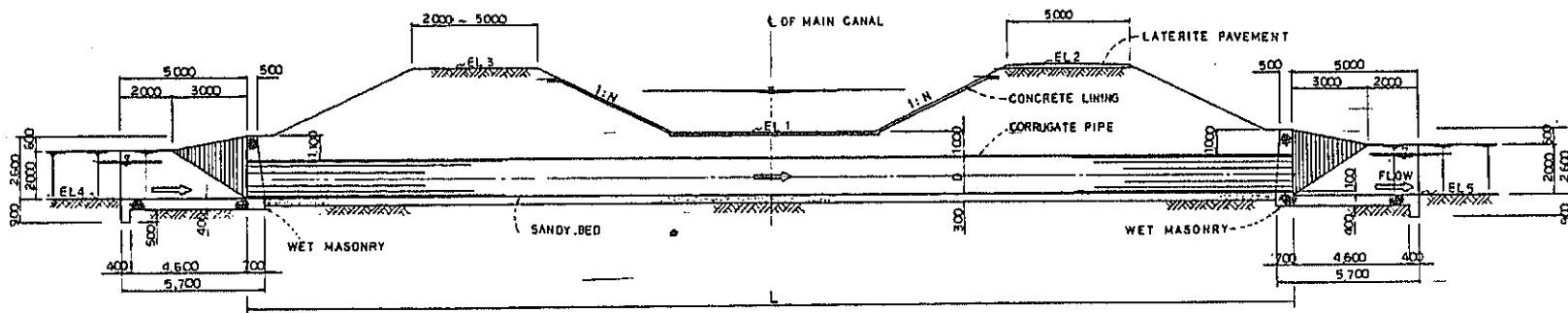
TYPICAL FACILITY ON MAIN CANAL (1/5)

JAPAN INTERNATIONAL COOPERATION AGENCY

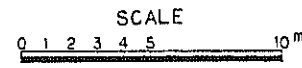
CROSS DRAIN (S-8 S-12-1 AND S-20)



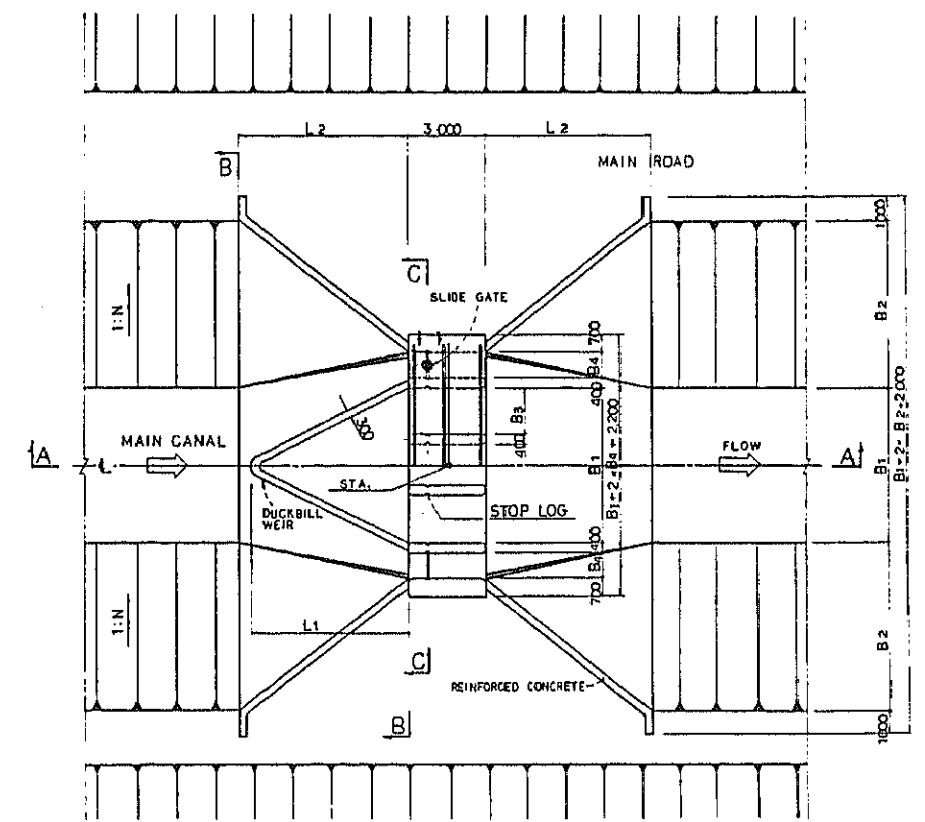
PLAN



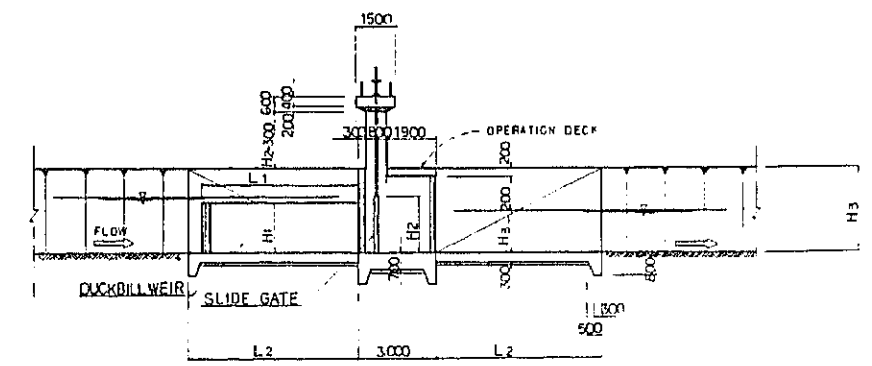
PROFILE SECTION A-A



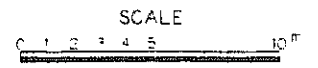
CHECK GATE



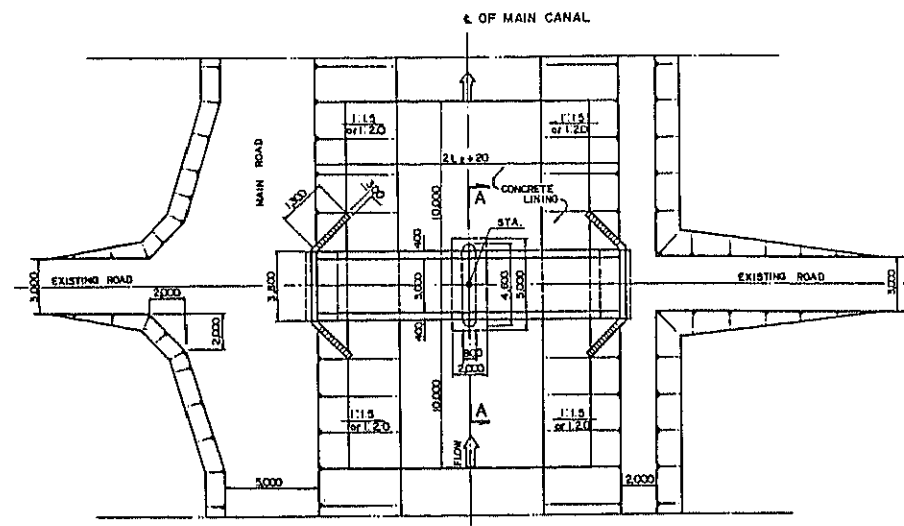
PLAN



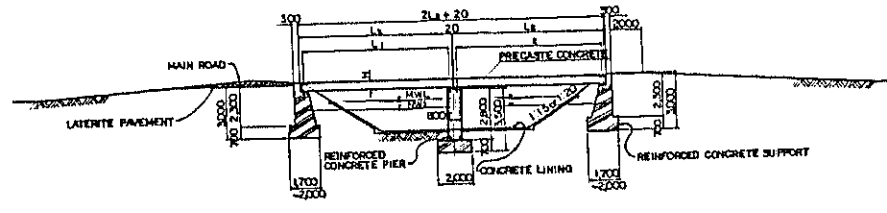
PROFILE SECTION A-A



BRIDGE TYPE - A



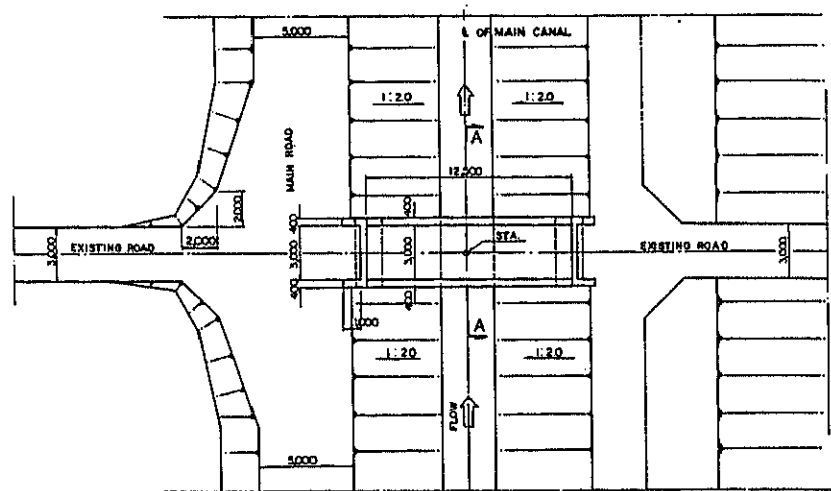
PLAN



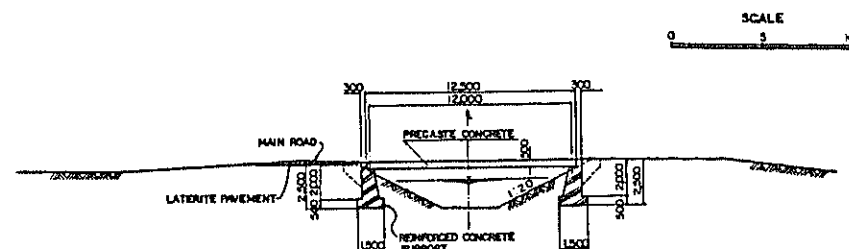
PROFILE

BAGUINEDA AGRICULTURAL DEVELOPMENT PROJECT
 THE REPUBLIC OF MALI
 MINISTRY OF AGRICULTURE
 TYPICAL FACILITY ON MAIN CANAL (2/5)
 JAPAN INTERNATIONAL COOPERATION AGENCY

BRIDGE
TYPE - B

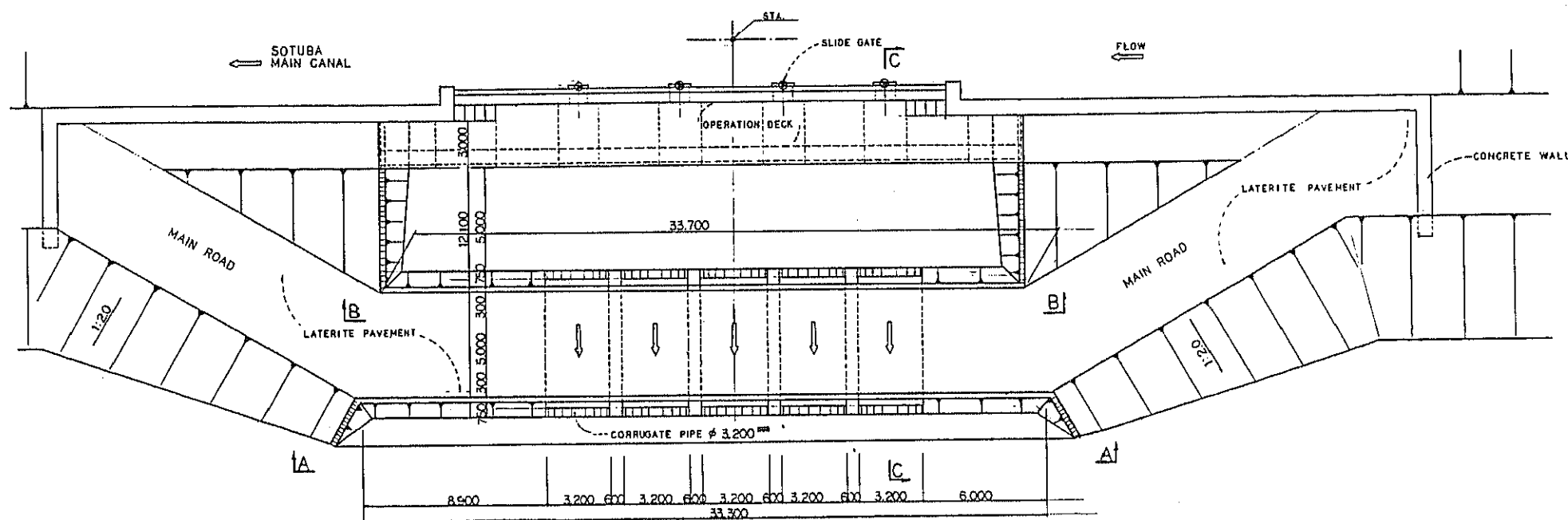


PLAN
SCALE-A

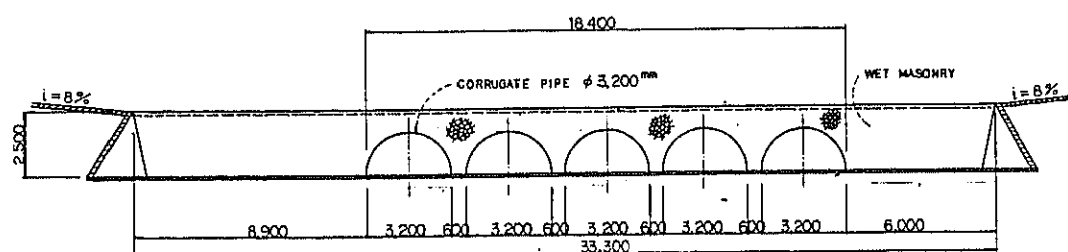


PROFILE
SCALE-A

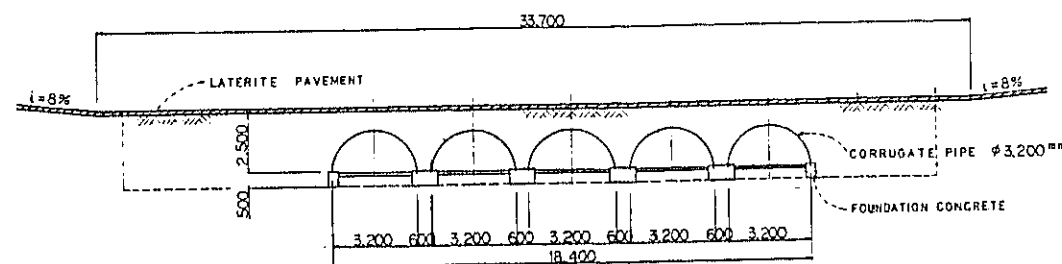
SPILLWAY A & B WITH CULVERT NO.1 & NO.2



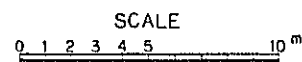
PLAN



SECTION A-A

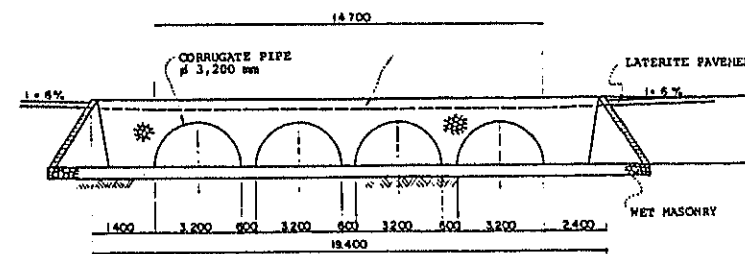
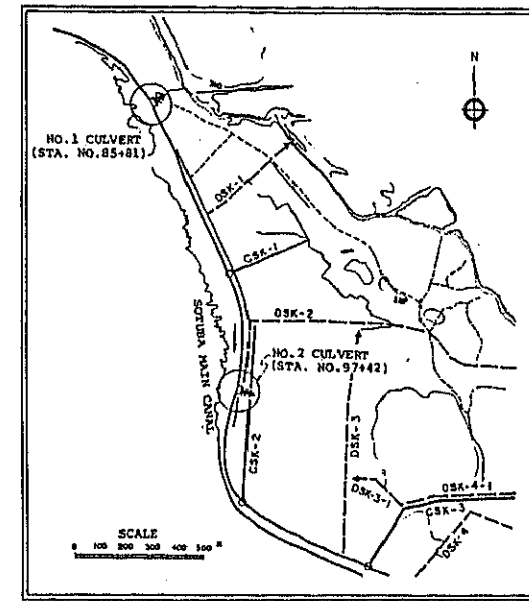
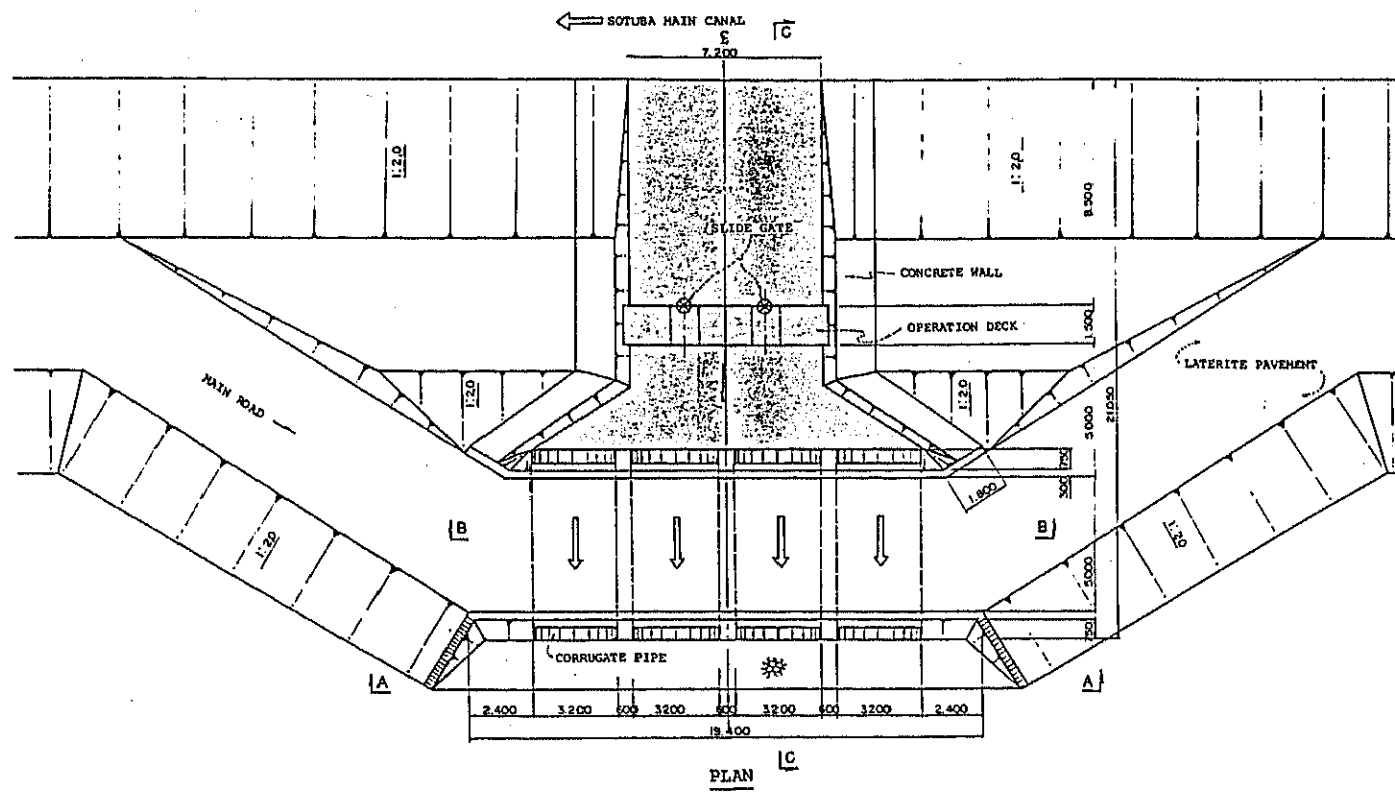


SECTION B-B

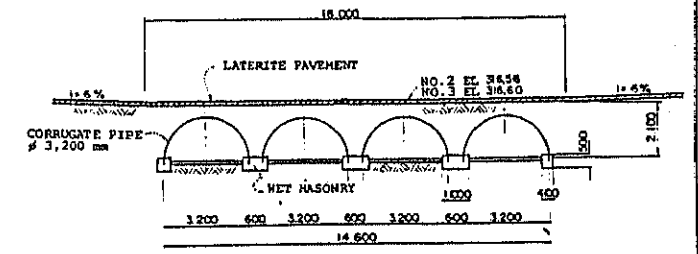


BAGUINEDA AGRICULTURAL DEVELOPMENT PROJECT
THE REPUBLIC OF MALI MINISTRY OF AGRICULTURE
TYPICAL FACILITY ON MAIN CANAL (3/5)
JAPAN INTERNATIONAL COOPERATION AGENCY

SPILLWAY No.1 & No.2 WITH CULVERT No.3 & No.4

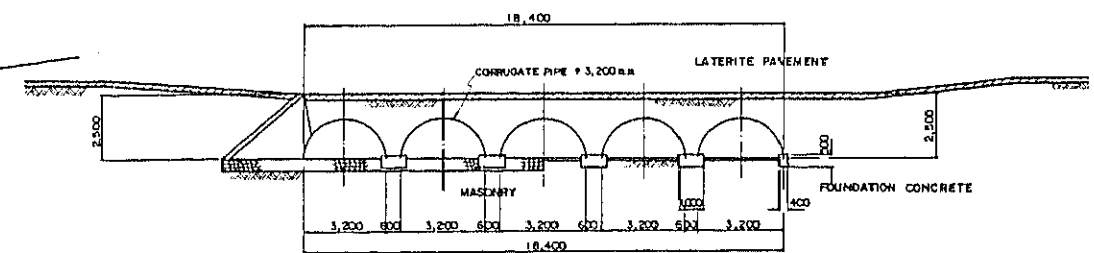
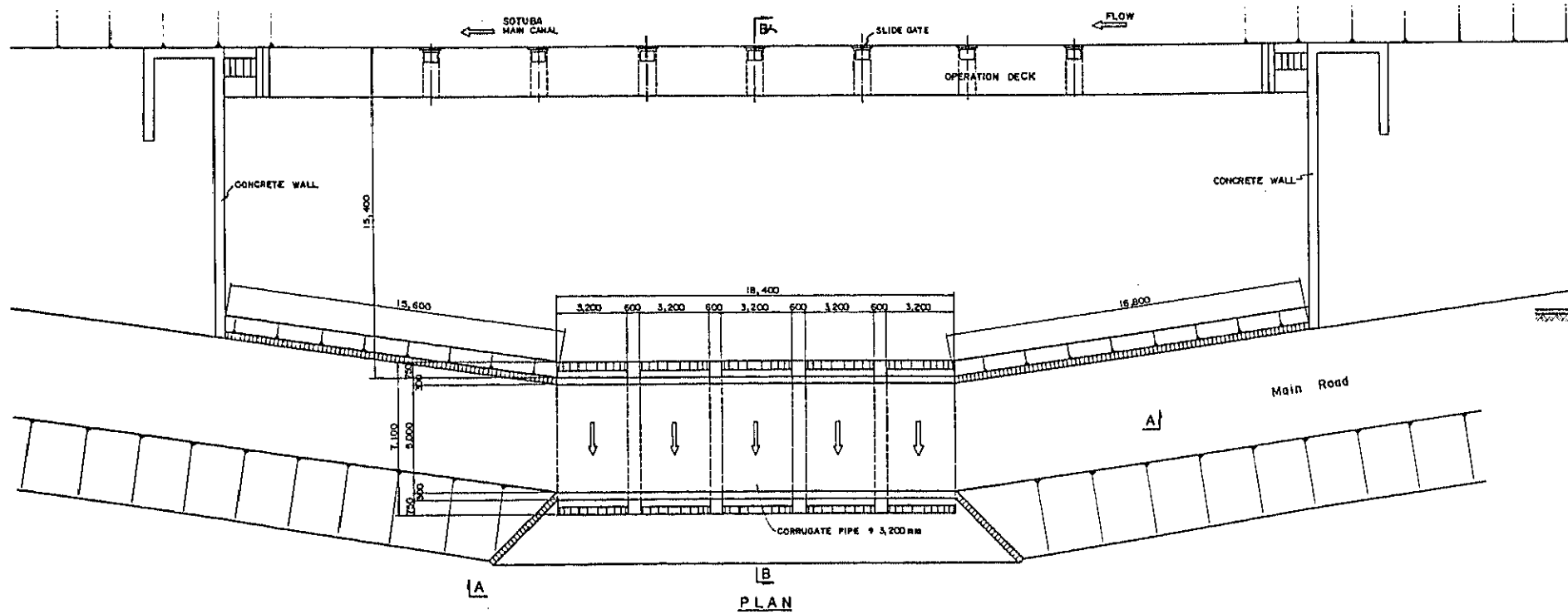


SECTION A-A

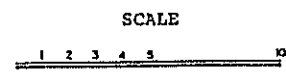


SECTION B-B

KOBA SPILLWAY NO.1 & NO.2 WITH CULVERT NO.5 & NO.7

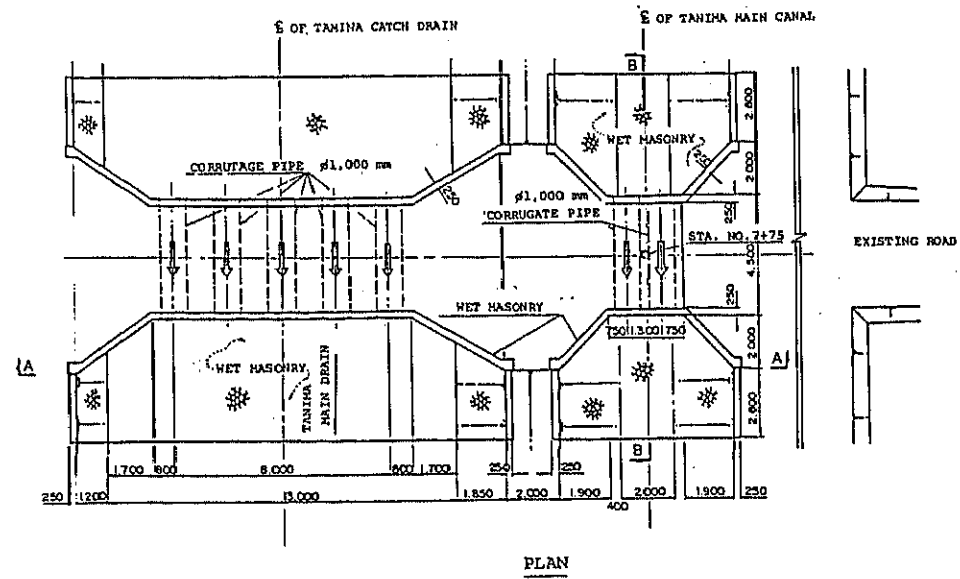


SECTION A-A

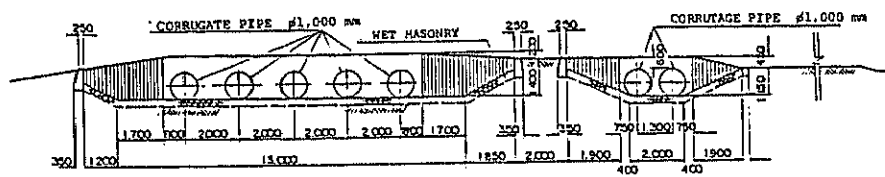


BAGUINEDA AGRICULTURAL
DEVELOPMENT PROJECT
THE REPUBLIC OF MALI
MINISTRY OF AGRICULTURE
TYPICAL FACILITY ON
MAIN CANAL (4/5)
JAPAN INTERNATIONAL COOPERATION AGENCY

CULVERT No. 8

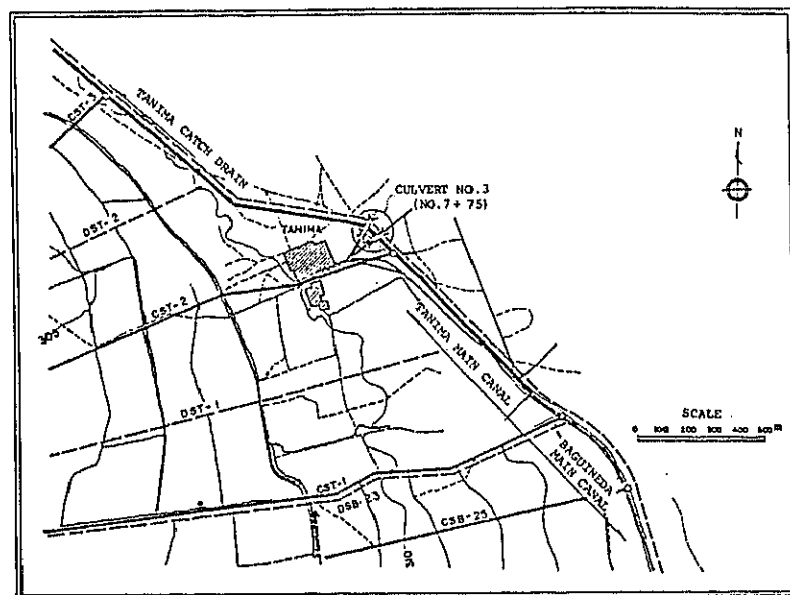


PLAN



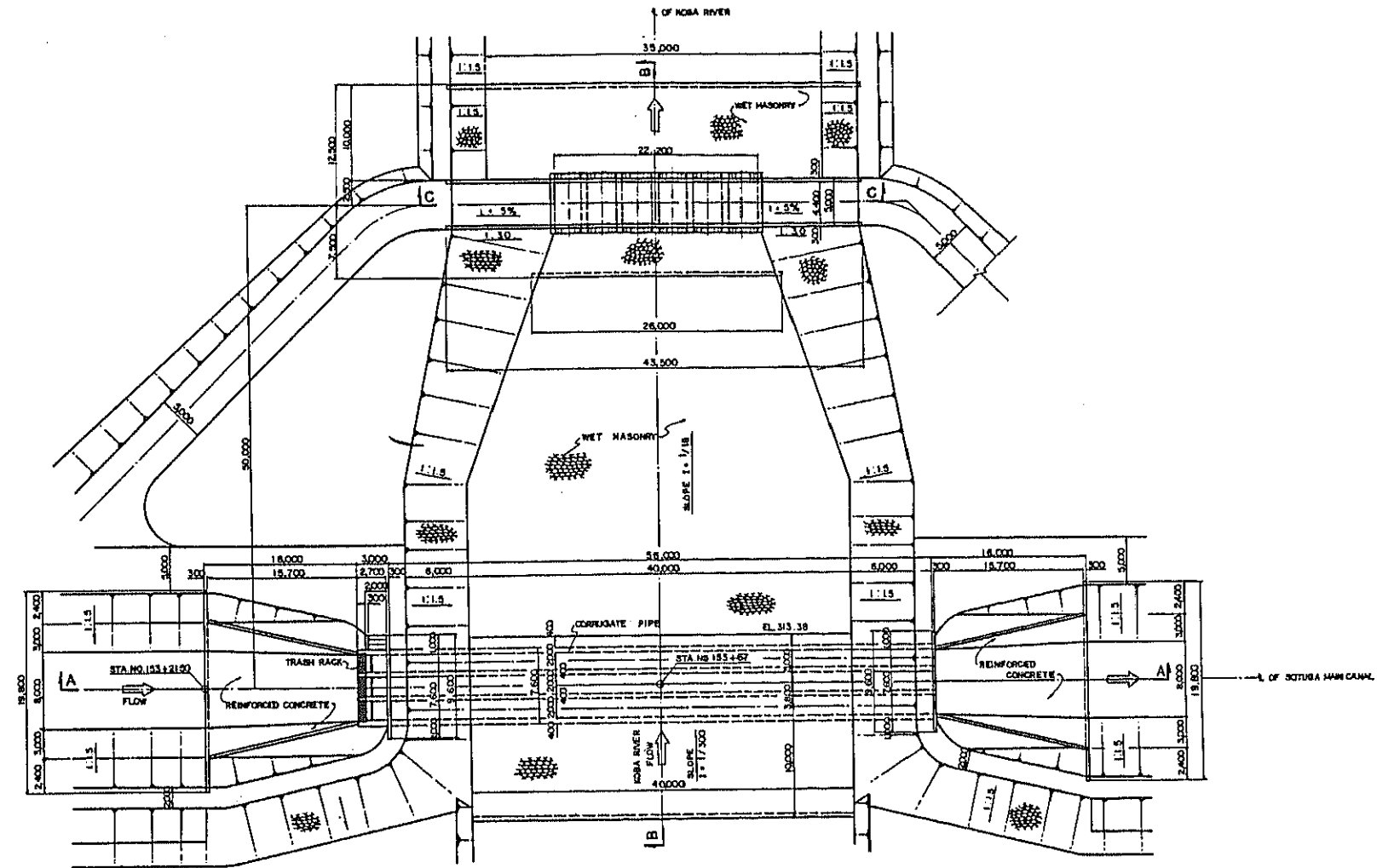
SECTION A-A

SCALE

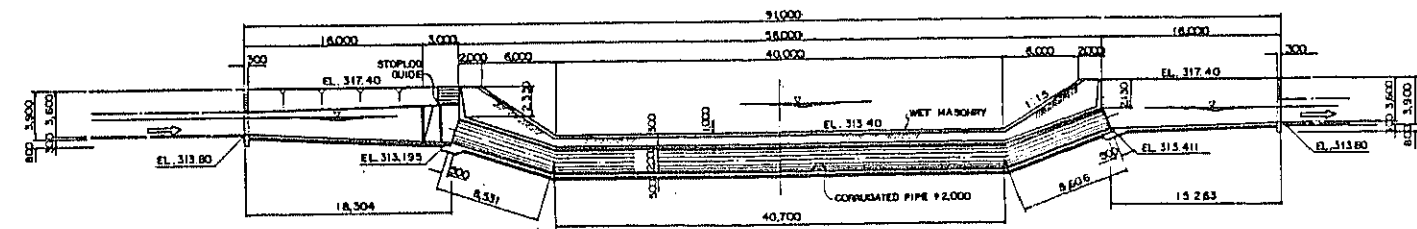


SCALE

KOBA SIPHON WITH CULVERT NO. 6

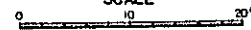


PLAN



PROFILE

SCALE



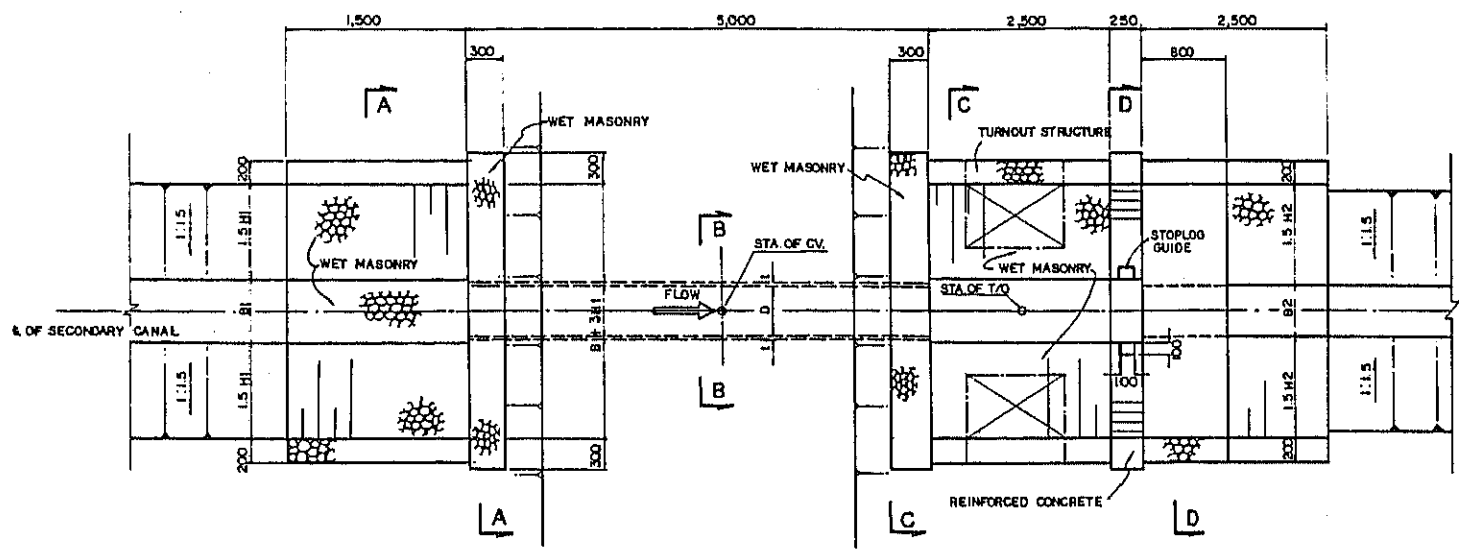
BAGUINEDA AGRICULTURAL
DEVELOPMENT PROJECT

THE REPUBLIC OF MALI
MINISTRY OF AGRICULTURE

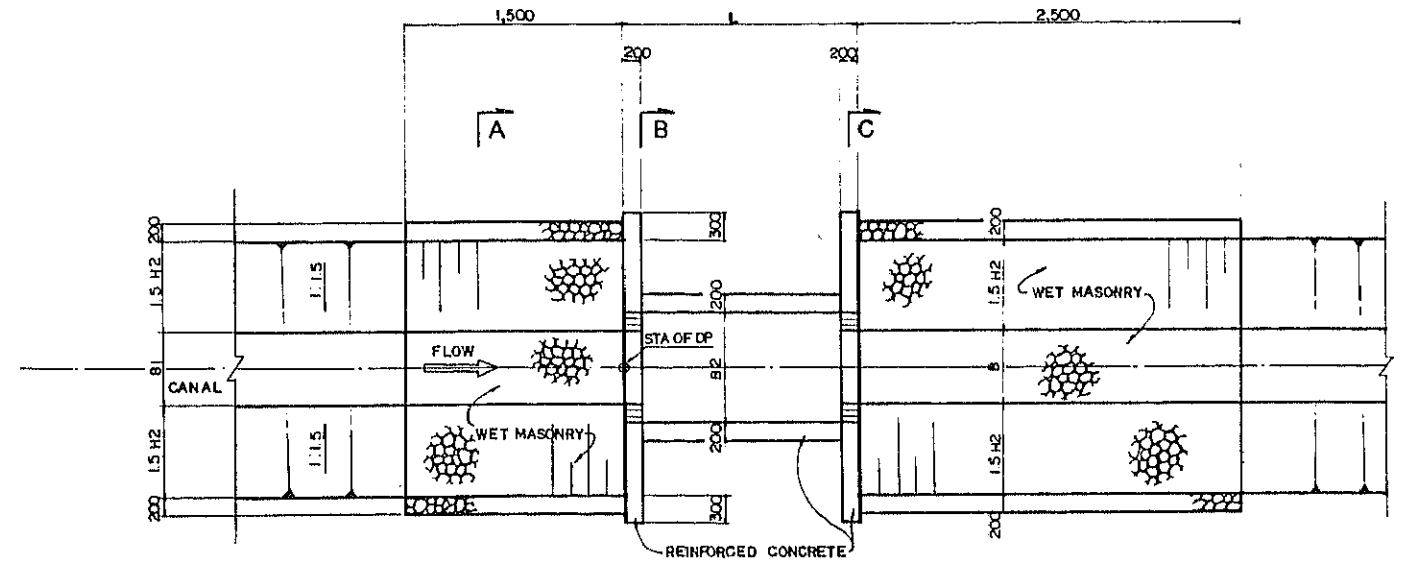
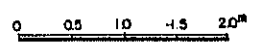
TYPICAL FACILITY ON
MAIN CANAL (5/5)

JAPAN INTERNATIONAL COOPERATION AGENCY

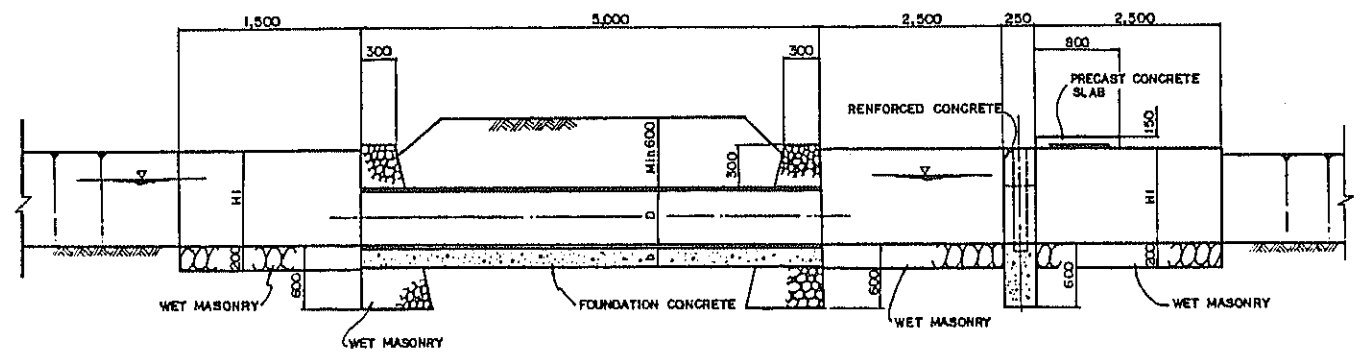
CULVERT WITH CHECK



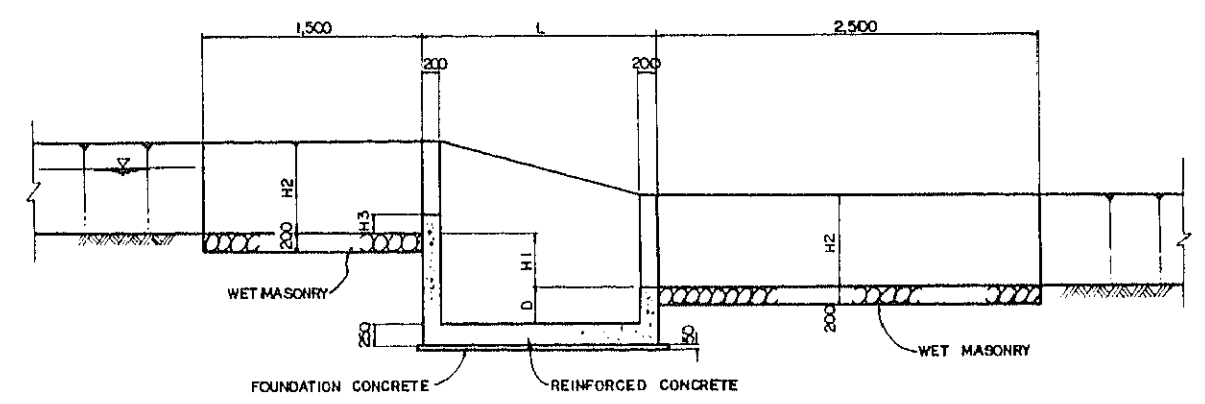
PLAN
SCALE-A



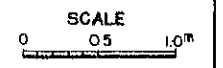
PLAN



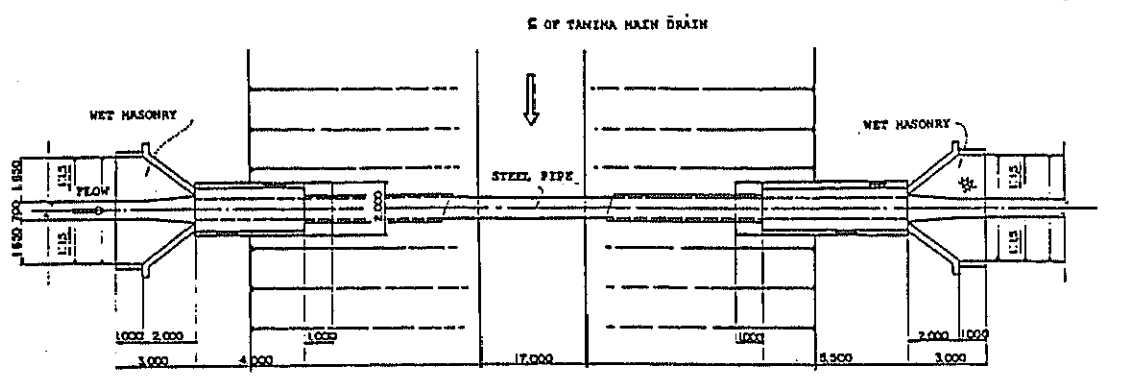
PROFILE
SCALE-A



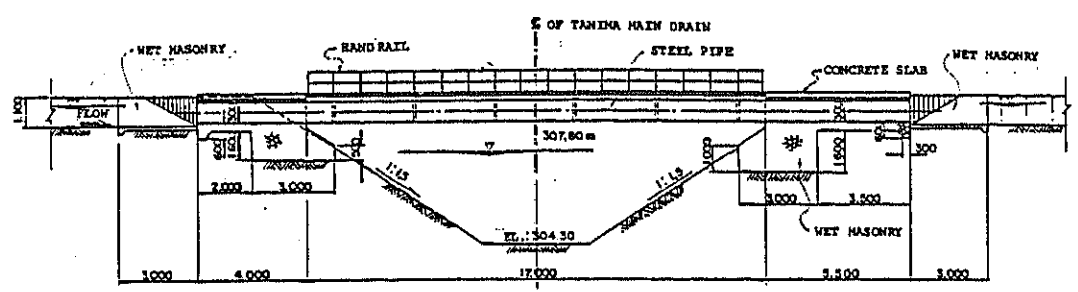
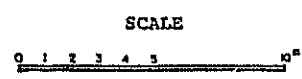
PROFILE



AQUEDUCT

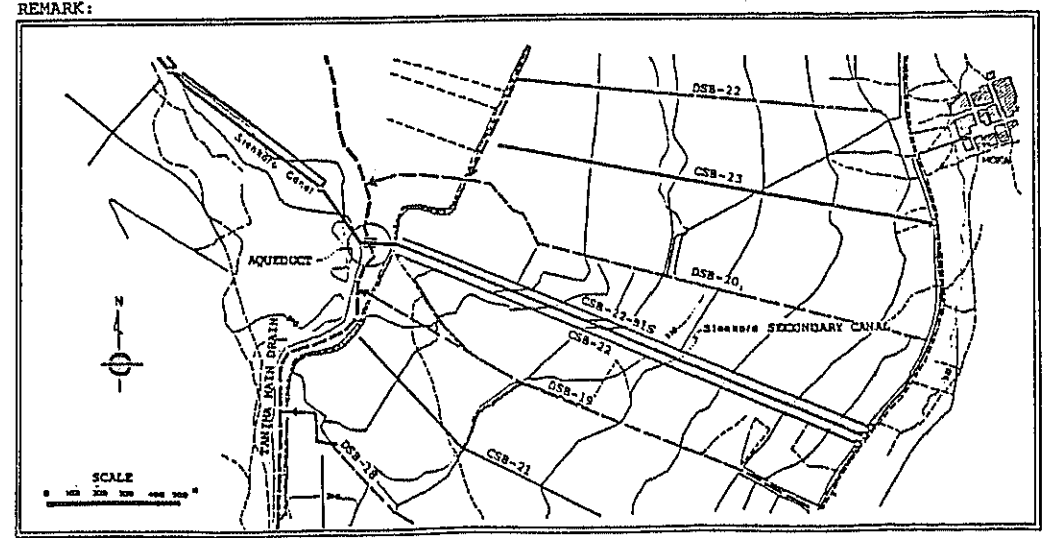


PLAN



PROFILE

REMARK:



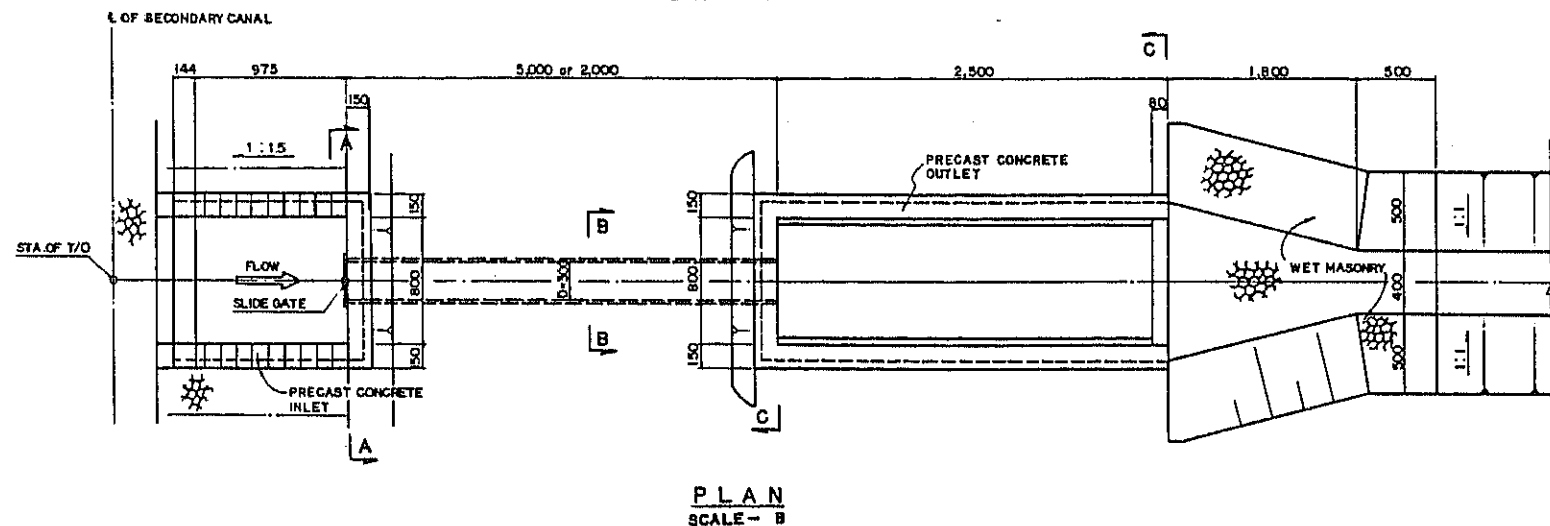
BAGUINEDA AGRICULTURAL
DEVELOPMENT PROJECT

THE REPUBLIC OF MALI
MINISTRY OF AGRICULTURE

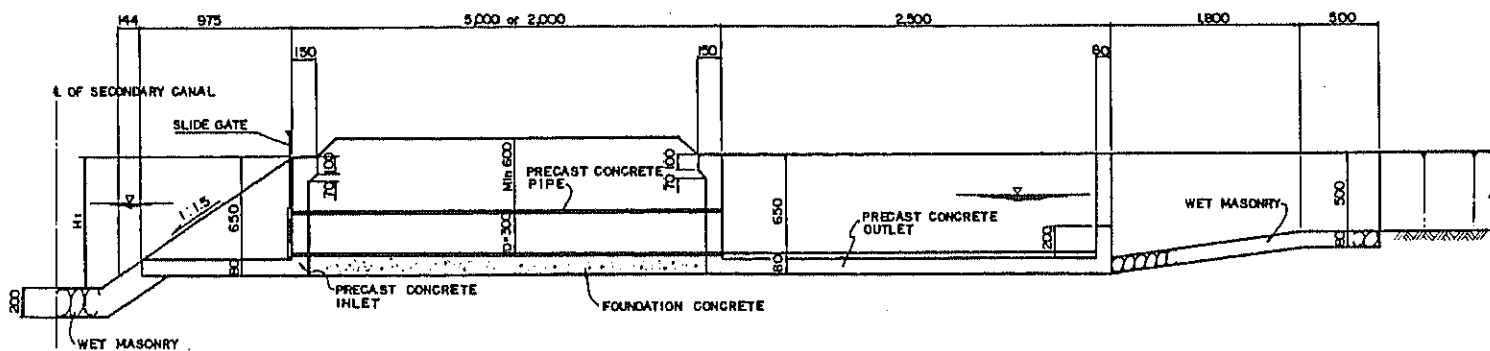
TYPICAL FACILITY ON
SECONDARY CANAL (1/2)

JAPAN INTERNATIONAL COOPERATION AGENCY

TURNOUT

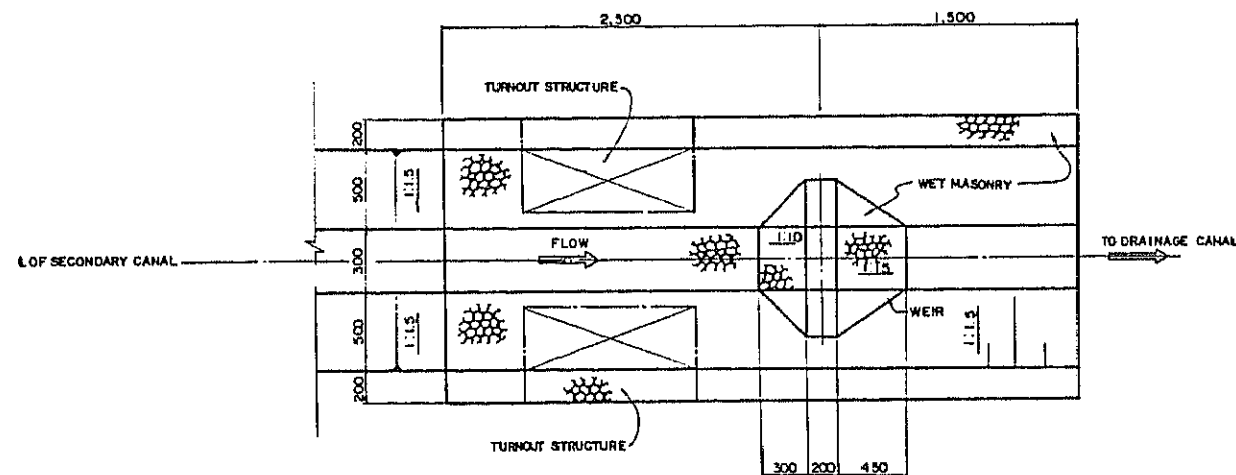


PLAN
SCALE - B

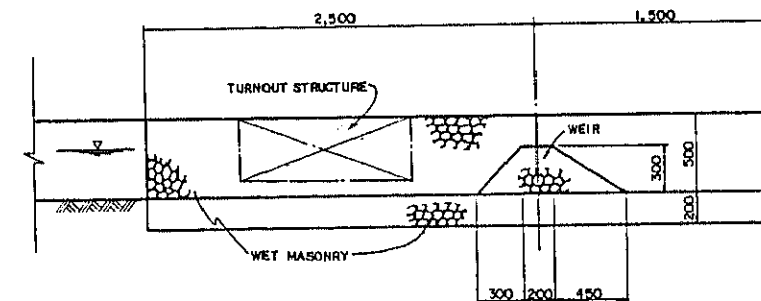


PROFILE
SCALE - B

TERMINAL STRUCTURE

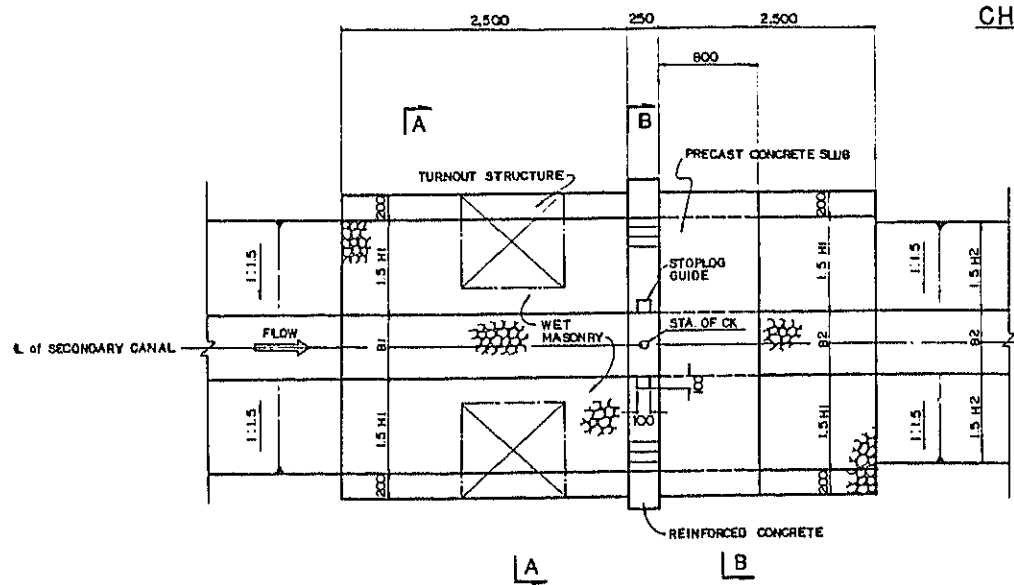


PLAN
SCALE - B

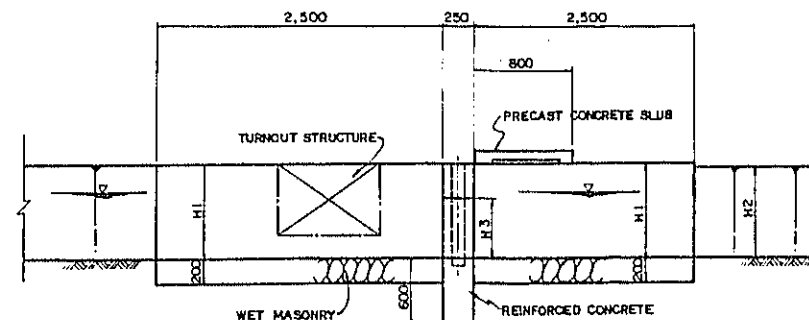


PROFILE
SCALE - B

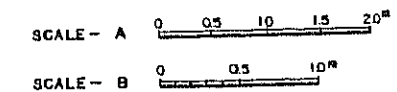
CHECK STRUCTURE



PLAN
SCALE - A



PROFILE
SCALE - A

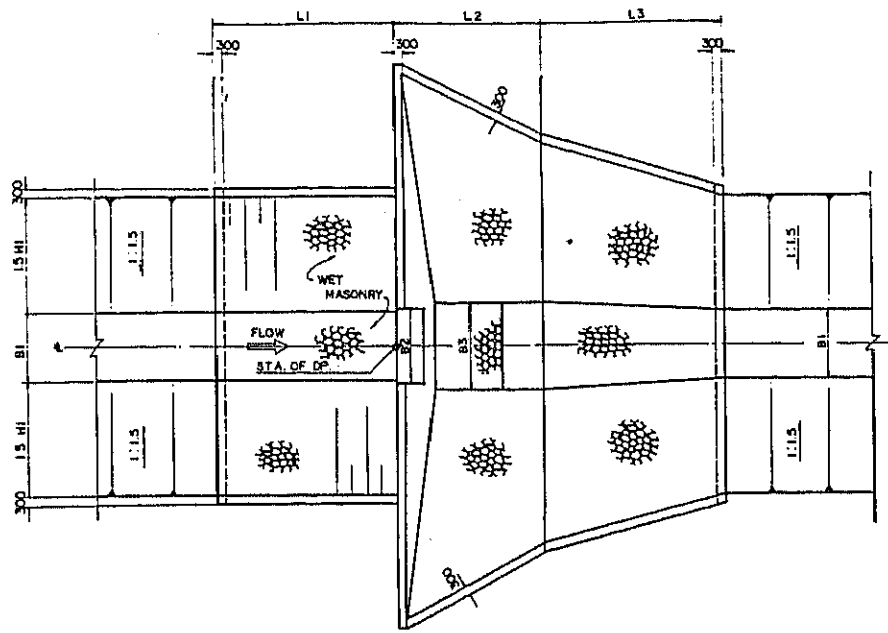


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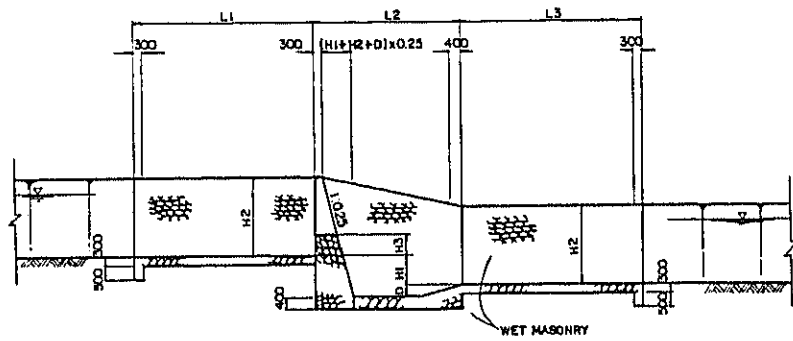
TYPICAL FACILITY ON
SECONDARY CANAL (2/2)

JAPAN INTERNATIONAL COOPERATION AGENCY

DRAINAGE DROP (TYPE-A)

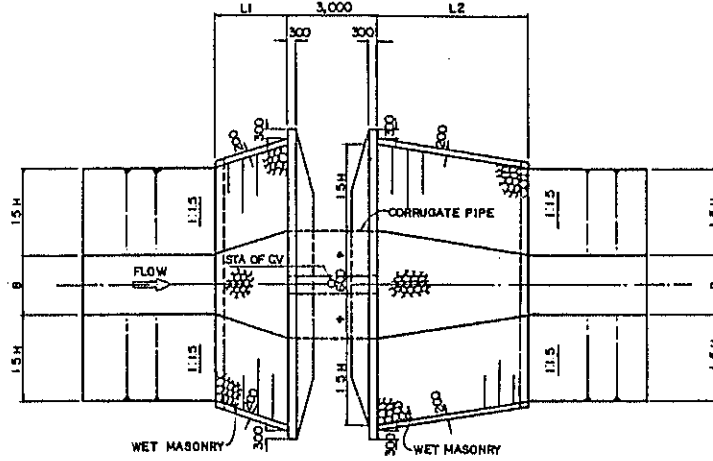


PLAN
SCALE-A

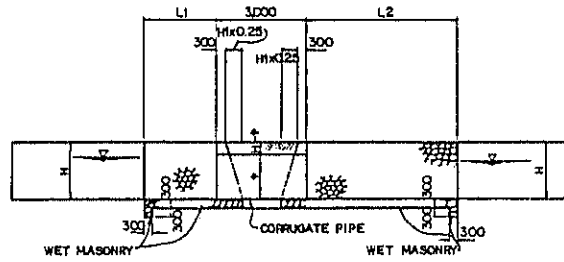


PROFILE
SCALE-A

DRAINAGE CULVERT (TYPE I, II)

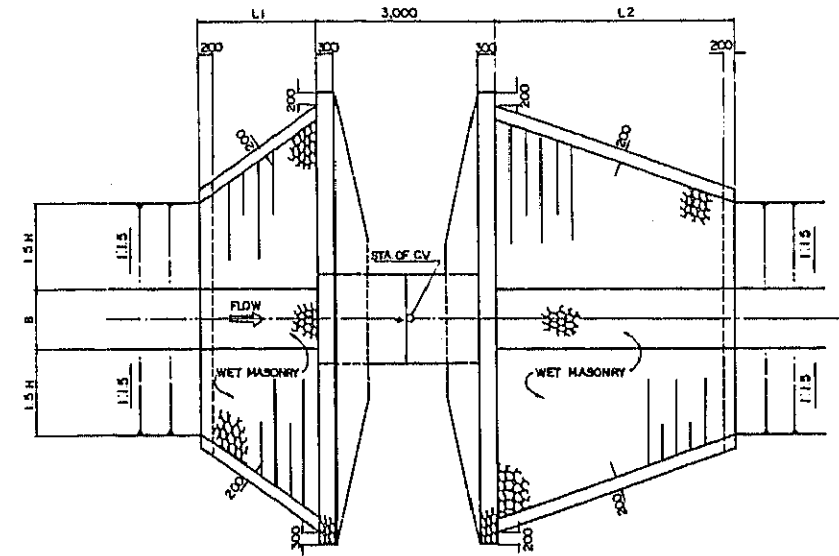


PLAN
SCALE-A

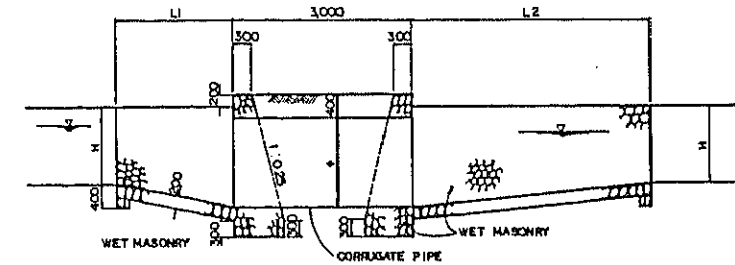


PROFILE
SCALE-A

DRAINAGE CULVERT (TYPE III ~ VII)

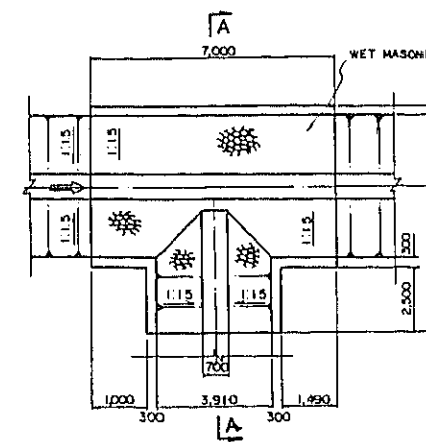


PLAN
SCALE-B

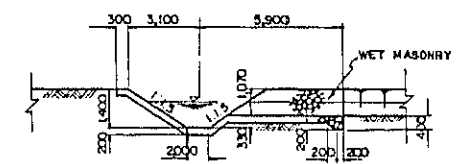


PROFILE
SCALE-B

DRAINAGE JUNCTION (TYPICAL)

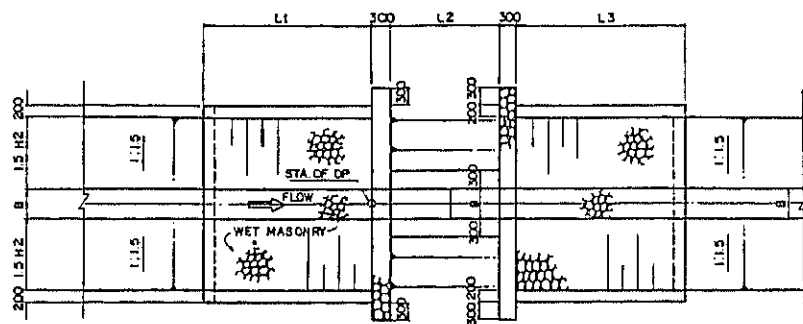


PLAN

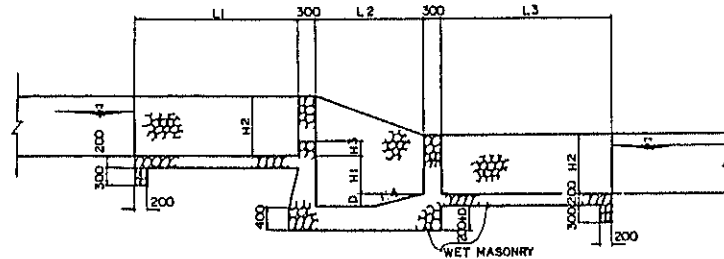


SECTION A-A

DRAINAGE DROP (TYPE-B)



PLAN
SCALE-B



PROFILE
SCALE-B

SCALE - A 0 10 20 30 40 50^m

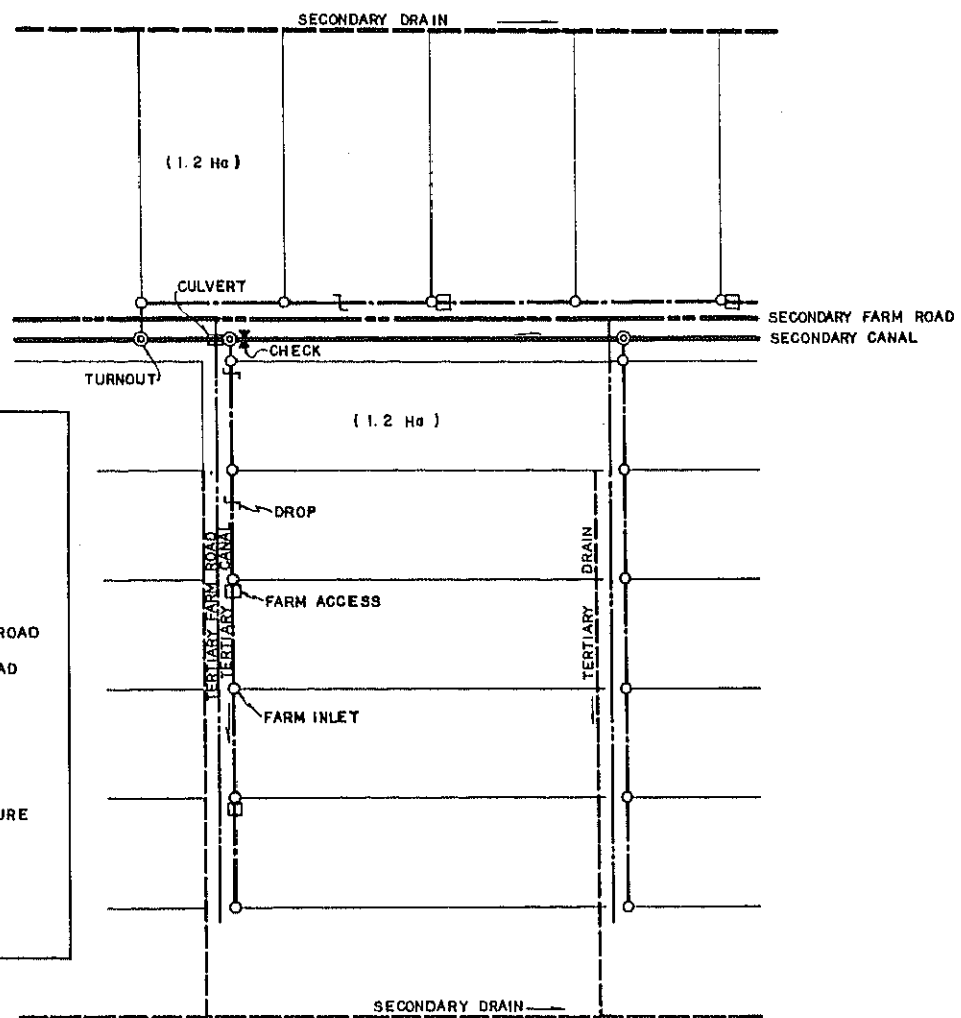
SCALE - B 0 0.5 1.0 1.5 2.0 2.5^m

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TYPICAL FACILITY ON
DRAINAGE CANAL

JAPAN INTERNATIONAL COOPERATION AGENCY

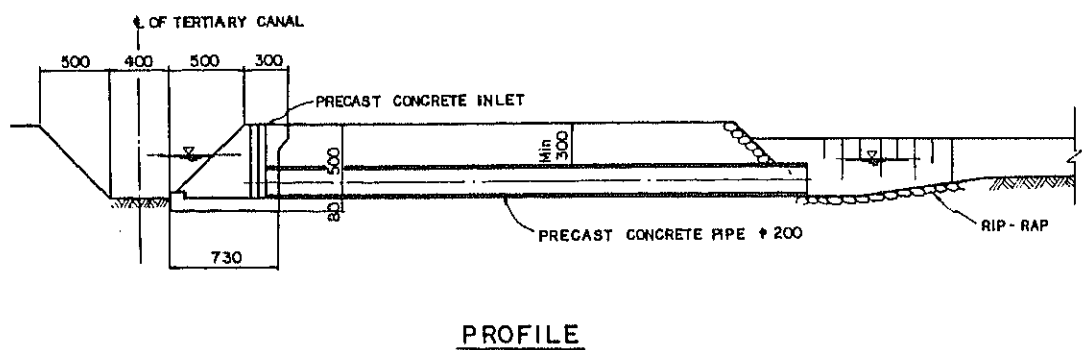
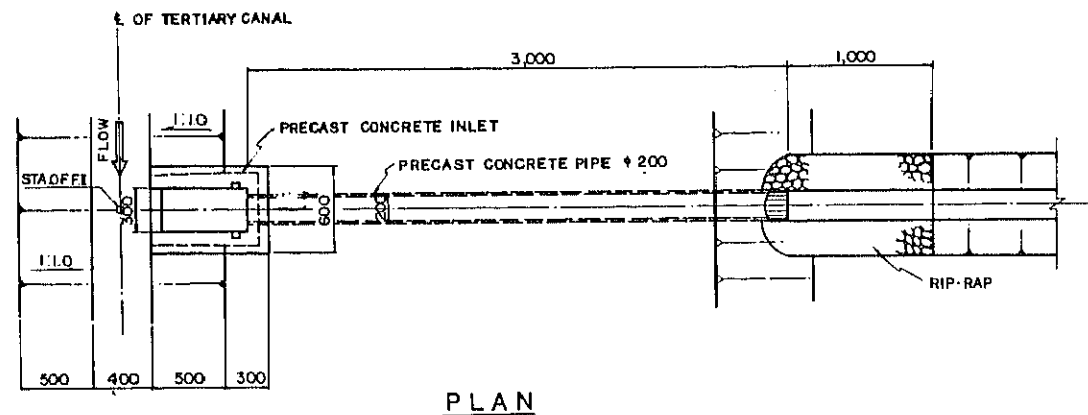
TYPICAL LAYOUT



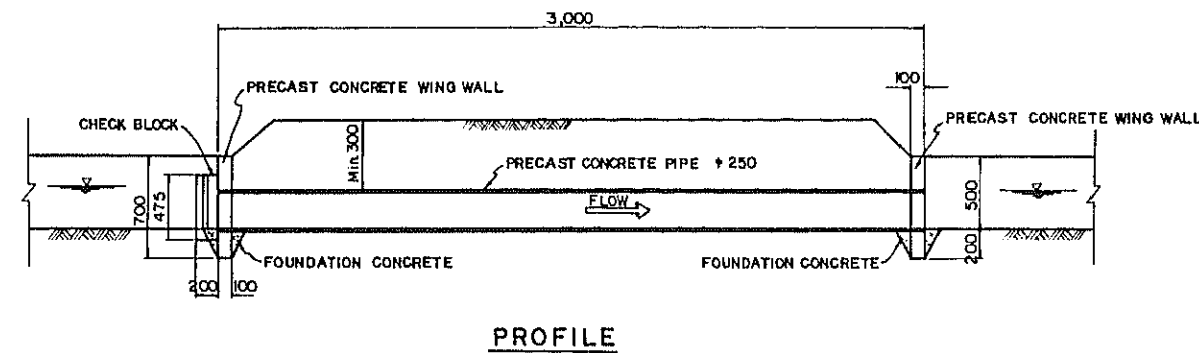
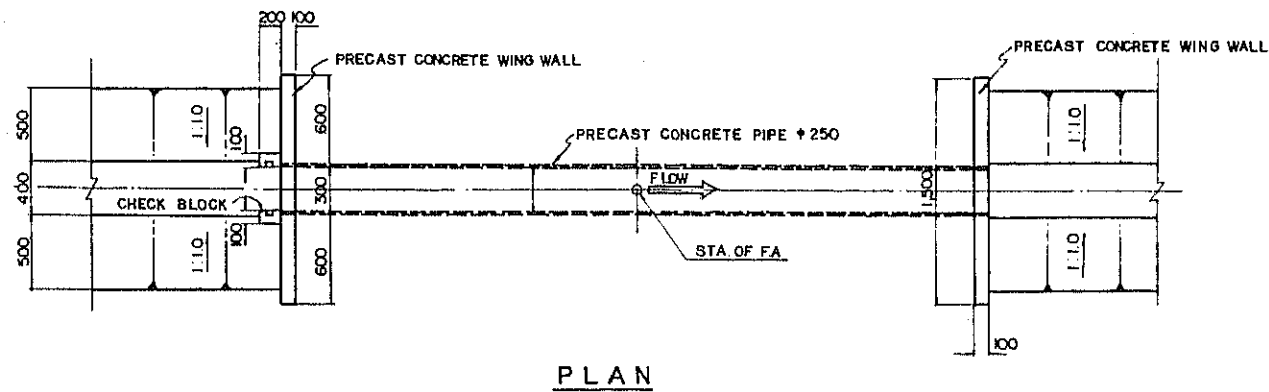
LEGEND

- SECONDARY CANAL
- TERTIARY CANAL
- SECONDARY DRAIN
- TERTIARY DRAIN
- SECONDARY FARM ROAD
- TERTIARY FARM ROAD
- ⊙ TURNOUT
- ⊕ CHECK
- ⊖ CULVERT
- ⊗ TERMINAL STRUCTURE
- FARM INLET
- FARM ACCESS
- ⊥ DROP

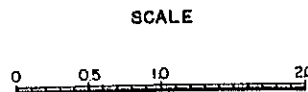
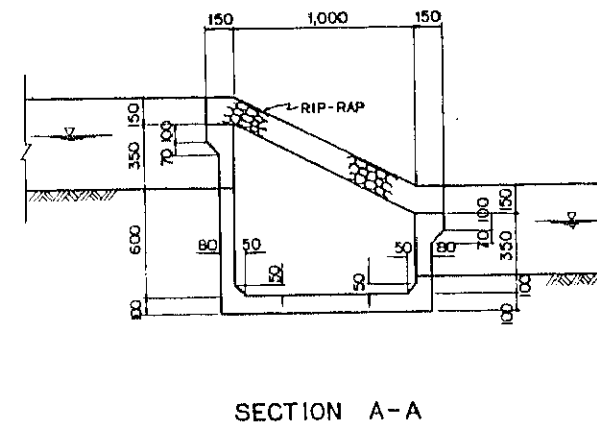
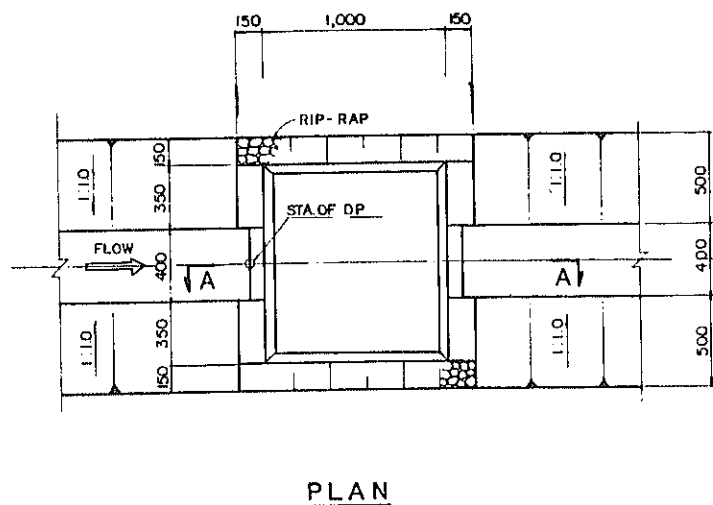
FARM INLET



FARM ACCESS



DROP



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TYPICAL ON-FARM
FACILITY

JAPAN INTERNATIONAL COOPERATION AGENCY

JICA