

Tables

Table 1.1 Members of the Study Team and Advisory Committee

	Name	Work Assignment
(1)	Study Team	
1	Shigeo OHNUMA /Norizo FUJITA	Team Leader
2	Masaki ITO	Deputy Team Leader/Water Resources Development and management
3	Toshikatsu IMAI	River Engineer(1)
4	Takuji KONO	River Engineer(2)
5	A.M.SUTMULLER /T.H.op ten NOORT	Hydrologist (1)
6	Akihiro MATSUDA	Hydrologist (2)
7	Hideo OHHATA	Sabo Planner
8	C.C. SEKINGTON	Disaster Prevention Planner
9	Tomoyasu KITA	Facility Design Engineer
10	Takuji KONO	Dam Design Engineer
11	Akihiro TAKATO	Construction Planner/Cost Estimate
12	Noritoshi MAEHARA	Economist
13	I.B.VAN BON / C.C. SEKINGTON	Water Use Planner
14	Takatoshi YAMAZAKI	Agronomist
15	Naoto MORIOKA	Agro-economist
16	Kuninobu NODA	Irrigation Planner (1)
17	J.S.T.FEKKES	Irrigation Planner (2)
18	Norihiko INOUE	Social Environmentalist
19	Hitoshi SAKAI	Natural Environmentalist
20	Kenichi SHIBATA	Satellite Image Analyst (1)
21	Chiyo KIGASAWA	Satellite Image Analyst (2)
22	Pucal YANG	Geologist /Geo-mechanical Engineer
23	Takaharu YAMAGUCHI	Coordinator
24	Toshio TSUKANO / Takashi HASHIMOTO	Interpreter
(2)	Advisory Committee	
1	Tsuneo UESAKA	Chairman
2	Yoshihiro ISHIBASHI / Yoshinao MORI	Member
3	Hiroshi OKUDAIRA	Member
4	Akira NIWA	Member
5	Mutsuya MORI	Member

Table 1.2 Members of the Steering Committee

	Name	Position
Chairman / Member	Nguyen Dinh Thinh	Vice Minister of MARD
Member	Pham Xuan Su	Director of Water Resources and Hydraulic Works Department, MARD
Member	To Trung Nghia	Director of Institute of Water Resources Planning, MARD
Member	Bui Nguyen Hong	Vice Director of Flood Control and Dyke Management Department, MARD
Member	Tran Dinh Hoi	Vice Director of Institute of Water Resources Research, MARD
Member	Vu Nang Dung	Director of National Institute for Agriculture Planning and Projection
Member	Nguyen Hong Toan	General Secretary of Vietnam National Mekong Committee, MARD
Member	Le Kien	Representative of Ministry of Planning and Investment

Table 2.1 Damages due to Past Floods in the Kone River Basin

Year	Month	Date	Flood Peak (m ³ /s)	Damage
1977	November	9 - 11	-	-
1978	-	-	1,475	-
1979	November	16 - 19	-	-
1980	November	15 - 17	4,280	-
1981	November	8 - 11	4,140	-
1983	October	29 - 31	-	-
1984	November	7 - 8	3,480	-
1985	November	25 - 26	-	agriculture, fisheries, hydraulic, transportation works badly damaged
1986	December	2 - 4	-	90 people lost, 1277 houses washed away, 3767 houses collapsed, 40 schools destroyed, agriculture, fisheries, hydraulic, transportation works badly damaged
1987	November	18 - 19	6,340	664 houses washed away, 3081 houses collapsed, 513 schools destroyed, agriculture, fisheries, hydraulic, transportation works badly damaged
1988	October	15 - 16	-	-
1990	October	13 - 15	-	7 people lost, 5 houses washed away, 92 houses collapsed, agriculture, fisheries, hydraulic, transportation works badly damaged
1991	October	22 - 25	-	3350 houses inundated, 18 classrooms collapsed,
1992	October	22 - 25	3,220	34 people lost, 640 houses washed away or collapsed, 40 schools destroyed, agriculture, fisheries, hydraulic, transportation works badly damaged
1994	October	20 - 21	2,330	10 people lost, 540 houses inundated, agriculture, fisheries, hydraulic, transportation works badly damaged
1995	October	26 - 27	-	3 people lost, many houses, schools, hydraulic, transportation works badly damaged
1996	December	Nov.30 - Dec.02	3,430	7 people lost, 4000 houses inundated or badly damaged, 30 classrooms and 23 health centers seriously damaged, agriculture, fisheries, hydraulic, transportation works badly damaged
1997	November	2 - 4	-	10 people lost, 6 houses destroyed, 2 ships submerged, agriculture, fisheries, hydraulic, transportation works badly damaged
1998	October	18 - 22	-	17 people lost, 7 people wounded, river dyke, sea dyke, hydraulic, transportation works badly damaged
1998	November	19 - 23	4,350	14 people lost, 1 people wounded, agriculture, fisheries, hydraulic, transportation works badly damaged
1999	October	17 - 19	-	1 people lost, 1105 houses inundated, 7 houses collapsed, thousands ha paddy and subsidiary crops damaged
1999	November	1 - 7	-	30 people lost, 8 people wounded, 11059 houses inundated, 360 houses washed away, agriculture, fisheries, hydraulic, transportation works badly damaged
1999	December	Nov.30 - Dec	3,680	22 people lost, 5 people wounded, 49000 houses inundated, 630 houses collapsed, 2300 houses badly damaged, health care, education, agriculture, fisheries, hydraulic, transportation works badly damaged
2000	October	5 - 11	-	2 children lost, 1100 ha paddy field inundated
2000	November	11 - 21	-	1 people missing, 30 houses collapsed, 19 houses badly damaged, 750 houses inundated
2001	November	11 - 12	-	6 people lost, agriculture, fisheries, hydraulic, transportation works badly damaged

Table 2.2 Flood Damage in Districts in Kone River Basin in 1999

Item	Unit	Total			Phu Cat		An Nhon		Tuy Phuoc		Tay Son		Vinh Thanh	
		Quantity	Unit price (1,000)	Value (Million VND)	Quantity	Value (Million VND)	Quantity	Value (Million VND)	Quantity	Value (Million VND)	Quantity	Value (Million VND)	Quantity	Value (Million VND)
1. Total damage value	Million	-	-	83,877	-	18,798	-	25,606	-	19,669	-	13,818	-	5,987
2. Life Damage														
-Died	person	37	-	-	7	-	12	-	12	-	5	-	1	-
-Injured	person	1	-	-	-	-	-	-	-	-	1	-	-	-
-Sick	person	264	-	-	-	-	-	264	-	-	-	-	-	-
3. Housing Damage				15,960		1,848		5,367		6,788		1,567		390
-Collapsed, blown away	count	614	12,000	7,368	107	1,284	126	1,512	360	4,320	11	132	10	120
-Broken, heavily flooded	count	243	6,000	1,458	34	204	110	660	30	180	24	144	45	270
-Flooded	count	18,939	300	5,682	1,200	360	10,650	3,195	5,400	1,620	1,689	507	-	-
-Broken well	count	3,460	400	1,384	-	-	-	-	1,500	600	1,960	784	-	-
-Broken, flooded hygiene works	count	227	300	68	-	-	-	-	227	68	-	-	-	-
4. Agricultural Damage				32,091		6,095		11,876		2,690		6,890		4,541
-Flooded winter paddy	ha	1,936	-	-	795	-	284	-	70	-	489	-	297	-
Of which: Completely lost	ha	664	6,000	3,984	185	1,110	122	729	70	420	223	1,338	65	387
Damaged	ha	1,101	3,000	3,302	610	1,830	163	488	-	-	199	597	129	387
-Flooded seeded winter-spring paddy	ha	1,829	-	-	1,690	-	-	-	120	-	-	-	19	-
Of which: Completely lost	ha	1,255	1,000	1,255	443	443	800	800	-	-	-	-	12	12
Damaged	ha	3	500	1	-	-	-	-	-	-	-	-	3	1
-Blown away seeded winter-spring paddy	ton	120	4,000	480	-	-	120	480	-	-	-	-	-	-
-Blown away, damaged slide cassava	ton	-	-	-	-	-	-	-	-	-	-	-	-	-
-Blown away coconut	fruit	-	-	-	-	-	-	-	-	-	-	-	-	-
-Flooded crop	ha	398	-	-	135	-	65	-	35	-	117	-	47	-
Of which: Completely lost	ha	169	2,000	337	20	40	40	80	35	70	27	54	47	93
Damaged above 30%	ha	230	600	138	115	69	25	15	-	-	90	54	-	-
-Flooded industrial tree	ha	919	-	-	-	-	159	-	-	-	493	-	267	-
Of which: Completely lost	ha	687	9,000	6,187	-	-	122	1,098	-	-	298	2,682	267	2,407
Damaged above 30%	ha	232	3,000	695	-	-	37	110	-	-	195	585	-	-
-Flooded fruit tree	ha	12	-	-	-	-	12	-	-	-	-	-	-	-
Of which: Completely lost	ha	12	2,000	24	-	-	12	24	-	-	-	-	-	-
Damaged above 30%	ha	-	-	-	-	-	-	-	-	-	-	-	-	-
-Livestock														
Died, blown away cattle	head	85	500	43	85	43	-	-	-	-	-	-	-	-
Died, blown away poultry	head	612	20	12	12	0	-	-	-	600	12	-	-	-
-Alluvial, flooded field	ha	782	20,000	15,634	128	2,560	403	8,052	110	2,200	78	1,568	63	1,254
5. School Damage				432		90		90		90		132		30
-Students off school	count	42,820	-	-	-	-	-	-	42,820	-	-	-	-	-
-Flooded classroom	room	66	2,000	132	-	-	-	-	-	66	132	-	-	-
-Collapsed classroom	room	7	30,000	210	3	90	-	-	3	90	-	-	1	30
-Damaged classroom (above 30%)	room	9	10,000	90	-	-	9	90	-	-	-	-	-	-
-Collapsed fence	m	-	-	-	-	-	-	-	-	-	-	-	-	-
-Damaged desk	set	-	-	-	-	-	-	-	-	-	-	-	-	-
6. Transportation Damage				11,847		2,123		3,399		4,350		1,192		782
-Eroded road:														
Length	m	263,453	-	-	24,899	-	86,314	-	96,350	-	23,370	-	32,520	-
Quatity	m ³	242,328	20	4,847	61,170	1,223	94,968	1,899	57,490	1,150	9,600	192	19,100	382
-100% broken transportation bridge, sluice	count	51	100,000	5,100	9	900	-	-	32	3,200	6	600	4	400
-Damaged transportation sluice gate, spill way	count	38	50,000	1,900	-	-	30	1,500	-	-	8	400	-	-
-Damaged flooded car	count	-	-	-	-	-	-	-	-	-	-	-	-	-
7. Irrigation Damage				16,711		7,183		2,592		2,724		4,017		195
-Broken anf eroded dike:														
Length	m	17,022	-	-	4,690	-	5,107	-	5,700	-	1,525	-	-	-
Quatity	m ³	148,675	20	2,974	74,734	1,495	36,501	730	31,000	620	6,440	129	-	-
-Broken anf eroded canal:														
Length	m	128,330	-	-	4,505	-	55,568	-	23,500	-	23,380	-	21,377	-
Quatity	m ³	148,377	20	2,968	39,410	788	52,097	1,042	33,200	664	19,930	399	3,740	75
-Eroded reservoir	count	18	450,000	8,100	9	4,050	-	-	2	900	7	3,150	-	-
-Damaged pumping station	count	-	-	-	-	-	-	-	-	-	-	-	-	-
-Damaged small irrigation works	count	79	30,000	2,370	25	750	24	720	18	540	8	240	4	120
-Damaged strengthened dam	count	-	-	-	-	-	-	-	-	-	-	-	-	-
-Damaged concrete dam	count	3	100,000	300	1	100	1	100	-	-	1	100	-	-
8. Aquacultural Damage				4,855		1,235		1,750		1,865				5
-Sunk boat and ship	count	-	-	-	-	-	-	-	-	-	-	-	-	-
-Sunk ferry-boat	count	-	-	-	-	-	-	-	-	-	-	-	-	-
-Heavily damaged fish pond	ha	965	5,000	4,825	241	1,205	350	1,750	373	1,865	-	-	1	5
-Lost fish, shrimp	ton	3	10,000	30	3	30	-	-	-	-	-	-	-	-
9. Hospital Damage				40						20		20		
-Broken, flooded clinic	count	4	10,000	40	-	-	-	-	2	20	2	20	-	-
-Collapsed clinic	room	-	-	-	-	-	-	-	-	-	-	-	-	-
-Damaged above 30% clinic	room	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Electricity, Telephone line Damage				26				4		22				
-Damaged transformer station	count	-	-	-	-	-	-	-	-	-	-	-	-	-
-Collapsed electric, telephone post	count	13	2,000	26	-	-	2	4	11	22	-	-	-	-
-Broken Electricity, Telephone wive	m	-	-	-	-	-	-	-	-	-	-	-	-	-
11. Material Damage				1,916		224		528		1,120				44
-Foodgrains	ton	27	2,000	54	-	-	27	54	-	-	-	-	-	-
-Paddy seed	ton	465	4,000	1,862	56	224	118	474	280	1,120	-	-	11	44
-Fertilizer	ton	-	-	-	-	-	-	-	-	-	-	-	-	-
-Salt	ton	-	-	-	-	-	-	-	-	-	-	-	-	-
-Damaged stored cement	ton	-	-	-	-	-	-	-	-	-	-	-	-	-
12. People's famine														
-Famine households need aid	count	7,930	-	-	1,025	-	3,305	-	3,600	-	-	-	-	-

Table 5.1 Population in Kone River Basin

District	Urban Centre	Population 2001		Population 2010		Population 2020	
		Urban	Rural	Urban	Rural	Urban	Rural
Quy Nhon	Quy Nhon City	227,300	20,200	273,637	22,096	333,749	24,400
Vinh Thanh	-	-	26,400	-	28,878	-	31,889
Phu Cat	Ngo May Town	11,200	178,500	13,483	195,254	16,445	215,610
Tay Son	Phu Phong Town	13,300	119,900	16,011	131,154	19,528	144,827
An Nhon	Binh Dinh Town	18,050	148,800	21,730	162,766	26,503	179,735
	Dap Da Town	18,050		21,730		26,503	
Tuy Phuoc	Tuy Phuoc Town	17,360	161,300	20,899	176,440	25,490	194,834
	Dieu Tri Town	7,440		8,957		10,924	
Van Canh	-	-	22,000	-	24,065	-	26,574
Phu My	Phu My Town	11,326		13,635		16,630	
Sub-Total :		324,026	677,100	390,082	740,653	475,772	817,869
Total :		1,001,126		1,130,735		1,293,641	

Source: Statistical Yearbook Binh Dinh Province 2001 and Socio-economic Framework

**Table 5.2 Probable Domestic Water Demands 2001 to 2020
To be Connected to the Water Supply System**

District	Urban Centre	Domestic Water Demand (m ³ /day)					
		2001		2010		2020	
		Urban	Rural	Urban	Rural	Urban	Rural
		<u>Urban Water Use:</u> 100 lpcd, UFW=40%, Coverage=60%, Institutional Use = 15%. <u>Rural Water Use:</u> 25 lpcd, No UFW, Coverage = 30%.		<u>Urban Water Use:</u> 120 lpcd, UFW=30%, Coverage=80%, Institutional Use = 15%. <u>Rural Water Use:</u> 80 lpcd, No UFW, Coverage = 40%.		<u>Urban Water Use:</u> 150 lpcd, UFW=25%, Coverage=95% Institutional Use = 15%. <u>Rural Water Use:</u> 100 lpcd, No UFW, Coverage = 50%.	
Quy Nhon	Quy Nhon City New Urban Area (Nhon Hoi)	21,957	152	39,272 20,000	707	68,366 20,000	1,220
Vinh Thanh	-	-	198	-	924	-	1,594
Phu Cat	Ngo May Town	1,082	1,339	1,935	6,248	3,369	10,781
Tay Son	Phu Phong Town	1,285	899	2,298	4,197	4,000	7,241
An Nhon	Binh Dinh Town	1,744	1,116	3,119	5,209	5,429	8,987
	Dap Da Town	1,744		3,119		5,429	
Tuy Phuoc	Tuy Phuoc Town	1,677	1,210	2,999	5,646	5,221	9,742
	Dieu Tri Town	719		1,286		2,238	
Van Canh	-	-	165	-	770	-	1,329
Phu My	Phu My Town	1,094		1,957		3,407	
Sub-Total :		31,301	5,078	75,985	23,701	117,459	40,894
Total :		36,379 m ³ /d (1.09 Mm ³ /m)		99,686 m ³ /d (2.99 Mm ³ /m)		158,353 m ³ /d (4.75 Mm ³ /m)	

**Table 5.3 Probable Domestic Water Demand 2001 to 2020
Including for Non-Connected People**

District	Urban Centre	Domestic Water Demand (m ³ /day)					
		2001		2010		2020	
		Urban	Rural	Urban	Rural	Urban	Rural
Quy Nhon	Quy Nhon City	24,230	505	41,360	1,768	69,851	2,440
	New Urban Area (Nhon Hoi)			20,000		20,000	
Vinh Thanh	-	-	660	-	2,310	-	3,188
Phu Cat	Ngo May Town	1,194	4,463	1,954	15,620	3,441	21,561
Tay Son	Phu Phong Town	1,418	2,998	2,320	10,492	4,087	14,482
An Nhon	Binh Dinh Town	1,924	3,720	3,149	13,021	5,546	17,973
	Dap Da Town	1,924		3,149		5,546	-
Tuy Phuoc	Tuy Phuoc Town	1,851	4,033	3,028	14,115	5,334	19,483
	Dieu Tri Town	793		1,298		2,286	
Van Canh	Van Canh Town	-	550	-	1,925	-	2,657
Phu My	Phu My Town	1,207		2,061		3,481	
Sub-Total :		34,541	16,928	78,318	59,251	119,572	81,784
Total :		51,469 m ³ /d (1.54 Mm ³ /m)		137,569 m ³ /d (4.13 Mm ³ /m)		201,356 m ³ /d (6.04 Mm ³ /m)	

Table 5.4 Probable Rural Industrial Water Demand

(Unit: m ³ /day)				
Area	Demand 2001	Demand 2010	Growth factor 2010-2020	Demand 2020
- Downstream area of Binh Thanh	11,410	19,100	9%	45,217
- Area between Van Phong and Binh Thanh	25,370	42,465	9%	100,530
- Area between Dinh Binh and Van Phong	12,520	20,960	9%	49,620
Total	49,300 (1.48 Mm ³ /m) (18.0 Mm ³ /yr.)	82,525 (2.48 Mm ³ /m) (30.12 Mm ³ /yr.)		195,367 (5.86 Mm ³ /m) (71.3 Mm ³ /yr.)

Table 5.5 Summarized Result of Salinity Measurement (Daily Average)
(From August 25 to September 8, 2002)

Station	Kone River (Dap Da River)				Kone River (Tan An River)												Ha Thanh River			
	Hung My		Chanh Huu		Quang Dien		Tan My		Huu Thanh		Go Boi		Tan Giang		Xuan Phuong		Duong Thien		Deo Son	
Date	S ‰	Q m ³ /s	S ‰	Q m ³ /s	S ‰	Q m ³ /s	S ‰	Q m ³ /s	S ‰	Q m ³ /s	S ‰	Q m ³ /s	S ‰	Q m ³ /s	S ‰	Q m ³ /s	S ‰	Q m ³ /s	S ‰	Q m ³ /s
Aug. 25	0.01	7.91	0.17	7.24	0.00	5.47	0.02	15.4	0.14	4.55	0.23	6.97	0.76	4.93	0.11	2.20	3.72	0.102	25.8	-0.242
26	0.01	10.5	0.11	7.07	0.00	5.36	0.01	16.7	0.12	4.13	0.14	6.69	0.39	4.93	0.10	2.10	2.96	1.47	26.0	0.087
27	0.01	8.02	0.10	6.75	0.00	4.93	0.00	7.37	0.08	2.62	0.10	5.75	0.19	5.27	0.07	3.06	4.25	0.065	25.9	0.514
28	0.06	6.91	0.09	7.54	0.07	4.22	0.06	4.02	0.10	1.81	0.11	5.23	0.24	5.41	0.09	2.97	4.48	-0.957	25.5	0.378
29	0.06	5.45	0.10	6.21	0.10	2.43	0.10	3.01	0.13	1.29	0.17	4.54	0.50	5.02	0.11	1.13	5.72	2.37	22.4	0.109
30	0.03	9.40	0.06	11.1	0.10	4.23	0.08	3.32	0.17	1.29	0.11	5.43	0.63	5.85	0.10	1.53	6.84	9.92	20.3	1.46
31	0.01	32.8	0.02	27.6	0.10	4.88	0.03	13.6	0.04	11.0	0.02	18.8	0.10	15.0	0.04	6.40	5.07	10.2	21.3	0.679
Sep. 01	0.01	40.2	0.02	37.7	0.11	15.7	0.06	13.6	0.07	7.69	0.02	20.5	0.10	14.4	0.00	6.10	3.14	7.84	16.4	-0.870
2	0.01	40.2	0.01	38.1	0.04	19.8	0.04	15.1	0.06	10.2	0.01	26.0	0.10	19.0	0.00	7.40	2.32	14.4	2.18	1.14
3	0.01	34.2	0.00	32.6	0.05	14.2	0.06	21.9	0.06	8.98	0.03	25.9	0.10	24.4	0.00	8.88	2.49	18.0	0.76	3.32
4	0.01	34.2	0.00	32.9	0.03	22.4	0.03	24.8	0.03	11.8	0.00	27.5	0.07	20.4	0.00	7.62	2.28	21.2	0.63	3.41
5	0.00	51.4	0.00	50.7	0.00	18.8	0.00	18.1	0.02	14.7	0.00	40.2	0.00	24.2	0.00	8.44	0.10	21.6	1.43	2.63
6	0.00	10.0	0.00	62.4	0.00	25.6	0.01	35.3	0.03	43.7	0.00	34.9	0.00	47.2	0.00	18.7	0.06	23.4	1.99	2.59
7	0.00	10.5	0.00	71.7	0.00	9.83	0.00	28.3	0.01	23.6	0.00	38.4	0.01	33.8	0.00	17.8	0.04	26.6	2.56	2.59
8	0.00	12.0	0.00	74.2	0.01	12.7	0.00	25.6	0.00	23.5	0.00	34.4	0.01	39.4	0.00	17.5	0.06	16.6	0.17	2.83

S: Salinity Q: River Flow

Source: Report on Initial Environmental Examination in Kone and Ha Thanh River Basin, CWRET, 2002

Table 5.6 Examination of Ecological Discharge of Kone and Ha Thanh River Basins

River & Selected Point	Kone River						Ha Thanh River		
	Binh Thanh (Apex of delta: 2,250km ²)			Kone River Basin (Virtual river mouth: 3,050km ²)			Ha Thanh River Basin (Virtual river mouth: 590km ²)		
	Min. Monthly Discharge MCM	Month	(Annual Total Discharge) (MCM)	Min. Monthly Discharge MCM	Month	(Annual Total Discharge) (MCM)	Min. Monthly Discharge MCM	Month	(Annual Total Discharge) (MCM)
Year 1978	36.6	Aug.	(1,406.2)	45.7	Aug.	(1,996.6)	6.9	Jun.	(427.3)
Year 1979	21.5	Sep.	(1,502.5)	23.9	Sep.	(1,995.1)	3.4	Sep.	(438.0)
Year 1980	26.0	Apr.	(3,273.3)	30.9	Apr.	(4,071.6)	7.6	Apr.	(634.0)
Year 1981	47.2	Apr.	(4,193.4)	53.6	Apr.	(5,609.8)	3.8	Jun.	(975.4)
Year 1982	27.7	Aug.	(1,156.9)	32.2	Aug.	(1,495.4)	6.1	Sep.	(362.6)
Year 1983	13.2	Apr.	(2,108.8)	16.6	Apr.	(2,874.9)	3.2	Jul.	(447.3)
Year 1984	29.2	Sep.	(2,755.0)	35.6	Sep.	(3,722.2)	4.5	Aug.	(682.5)
Year 1985	17.8	Aug.	(2,943.9)	21.8	Aug.	(3,948.1)	8.2	Aug.	(834.1)
Year 1986	20.1	Sep.	(2,910.2)	23.7	Sep.	(3,654.5)	6.7	Jul.	(668.0)
Year 1987	21.6	Aug.	(2,514.0)	25.4	Aug.	(3,345.0)	4.9	Aug.	(687.8)
Year 1988	15.1	Aug.	(2,092.1)	20.6	Aug.	(2,937.1)	5.3	Aug.	(777.4)
Year 1989	31.1	Apr.	(1,218.0)	47.6	Apr.	(1,525.6)	6.9	Aug.	(524.0)
Year 1990	18.8	Apr.	(3,273.8)	23.4	Apr.	(4,460.6)	8.5	Apr.	(759.4)
Year 1991	17.8	Aug.	(2,225.0)	22.1	Aug.	(2,846.9)	6.5	Aug.	(632.6)
Year 1992	21.2	Jul.	(2,398.5)	25.7	Jul.	(3,053.6)	4.4	Sep.	(481.3)
Year 1993	13.5	Aug.	(2,286.7)	16.5	Aug.	(3,214.1)	2.9	Aug.	(718.7)
Year 1994	22.5	Aug.	(1,684.8)	26.6	Aug.	(2,096.9)	8.5	Aug.	(466.7)
Year 1995	24.8	Aug.	(2,456.6)	27.1	Aug.	(3,081.0)	3.0	Aug.	(564.0)
Year 1996	31.1	Aug.	(4,461.3)	45.4	Aug.	(5,995.0)	6.6	Aug.	(1,127.5)
Year 1997	37.8	Aug.	(2,300.2)	43.0	Aug.	(2,893.0)	7.2	Aug.	(552.9)
Year 1998	32.3	Apr.	(4,044.8)	37.6	Aug.	(5,337.3)	4.6	Aug.	(940.0)
Year 1999	51.1	Aug.	(5,291.7)	56.5	Aug.	(6,628.9)	6.4	Sep.	(1,055.2)
Year 2000	78.4	Sep.	(3,339.2)	90.5	Sep.	(4,192.4)	8.5	Sep.	(828.3)
Year 2001	25.3	Sep.	(1,892.0)	30.1	Jul.	(2,484.6)	4.7	Sep.	(408.1)
P=90% (MCM)	17.8	Aug./'85		21.8	Aug./'85		3.4	Sep./'79	
Ecological discharge (m ³ /s)	<u>6.6</u>			<u>8.1</u>			<u>1.3</u>		

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Table 5.7 Available Data on Water Quality (BOD) in Kone and Ha Thanh River Basins

1. Water Quality Analysis Conducted by CWRET as dry season in 2002 (surface water of river systems only)

Sampling Date	Kone River (incl. La Vi River)										Ha Thanh River		
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	
2002/08/31	2002/08/31	2002/08/31	2002/08/31	2002/08/29	2002/08/29	2002/08/29	2002/08/29	2002/08/30	2002/09/02	2002/08/30	2002/08/30	2002/08/30	
BOD (mg/l)	8.6	3.3	2.4	3.5	3.6	3.7	3.7	5.0	2.7	4.6	3.0	7.9	
No.1: Downstream of Vinh Son Hydropwoer Plant						No.7: Bridge of National Route 1, An Nhon district							
No.2: Binh Dinh dam site						No.8: Tang Giang (Tan An river mouth)							
No.3: Thien An village, Tay Thuan commune, Tay Son district						No.9: Bridge of National Route 1, Phu Cat district (La Vi river)							
No.4: 1km Upstream of sugar mill, Tay Son district						No.10: Chanh Huu (near Dap Da river mouth)							
No.5: 1km Downstream of sugar mill, Tay Son district						No.11: Upstream of Ha Thanh river, Canh Thuan commune, Van Canh district							
No.6: Tay Son bridge (10km Upstream of Binh Thanh)						No.12: Downstream of Ha Thanh river, Duong Thien village							

CWRET: Center of Water Resources and Environment Technology (Sub-contractor of IEE study)

2. Existing Data of Water Quality (surface water of river systems only)

River Name	Location	Sampling Date	BOD (mg/l)	Data Source	Remark
Kone	Dinh Binh dam site, Vinh Hiep commune	1999/May	0	Environmental Impact Assessment Report of Dinh Binh Reservoir Project in Binh Dinh Province, HEC1, 1999	
Kone	Upstream of sugar mill factory	1999/May	0	- ditto -	
Kone	Bridge in Tay Son district	1999/May	6	- ditto -	
Kone	Ba Gi bridge in An Nhon dist.	1999/May	4.8	- ditto -	Route-1 bridge of Tan An river
La Vi	Kien An bridge	1999/May	4.5	- ditto -	
Kone	Upstream of sugar mill factory	1995/Dec	8.7	- ditto -	
Kone	- ditto -	1995/Dec	3.2	- ditto -	
Ha Thanh	Song Ngang bridge	??	2.4	Report on Existing Environmental Condition of Binh Dinh Province, DOSTE, 2002	Sampling date is unclear.

Table 7.1 Present Cropping Area in the Project Area of Master Plan (2001)

	Cropping Pattern A			Cropping Pattern B			Cropping Pattern C			Total		
	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total
I. Physical Area												
Farm Land	11,800 31.3%	25,900 68.7%	37,700	10,000 74.1%	3,500 25.9%	13,500	2,600 78.8%	700 21.2%	3,300	24,400 44.8%	30,100 55.2%	54,500
II. by Cropping Season												
1. Winter - Spring	11,800 31%	15,000 40%	26,800	10,000 74%	2,200 9%	12,200	2,600 79%	700 21%	3,300	24,400 45%	17,900 33%	42,300
Paddy (early)	11,800 31%	10,400 28%	22,200	1,600 12%	- 0%	1,600	- -	- -	0	13,400 25%	10,400 19%	23,800
Paddy (late)	- -	- -	0	8,400 62%	1,000 -	9,400	2,600 79%	700 21%	3,300	11,000 20%	1,700 3%	12,700
Maize	- -	4,200 11%	4,200	- -	1,200 9%	1,200	- -	- -	0	0 0%	5,400 10%	5,400
Groundnuts/ Soybeans	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
Tobacco	- -	400 1%	400	- -	- -	0	- -	- -	0	0 0%	400 1%	400
2. Summer - Autumn	11,800 31%	8,200 22%	20,000	8,300 62%	1,300 10%	9,600	2,600 79%	400 12%	3,000	22,700 42%	9,900 18%	32,600
Paddy (early)	10,200 27%	- -	10,200	1,600 12%	- -	1,600	- -	- -	0	11,800 22%	0 0%	11,800
Paddy (late)	- -	- -	0	5,600 42%	- -	5,600	2,300 70%	- -	2,300	7,900 15%	0 0%	7,900
Maize	- -	3,600 10%	3,600	800 6%	600 4%	1,400	200 6%	200 6%	400	1,000 2%	4,400 8%	5,400
Groundnuts/ Soybeans	1,600 4%	4,600 12%	6,200	300 2%	700 5%	1,000	100 3%	200 6%	300	2,000 4%	5,500 10%	7,500
Tobacco	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
3. 3rd Crop Season	6,900 18%	0 0%	6,900	1,600 12%	0 0%	1,600	0 0%	0 0%	0	8,500 16%	0 0%	8,500
Paddy (early)	6,900 18%	- -	6,900	1,600 12%	- -	1,600	- -	- -	0	8,500 16%	0 0%	8,500
Paddy (late)	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
Maize	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
Groundnuts/ Soybeans	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
Tobacco	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
4. Perennial Crops	0 0%	10,900 29%	10,900	0 0%	1,300 10%	1,300	0 0%	0 0%	0	0 0%	12,200 22%	12,200
Sugarcane	- -	5,600 15%	5,600	- -	- -	0	- -	- -	0	0 0%	5,600 10%	5,600
Pinapple	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
Cassava	- -	5,300 14%	5,300	- -	1,300 10%	1,300	- -	- -	0	0 0%	6,600 12%	6,600
5. Total (Cropping Intensity)	30,500 81% 258%	34,100 91% 132%	64,600 171%	19,900 147% 199%	4,800 36% 137%	24,700 183%	5,200 158% 200%	1,100 33% 157%	6,300 191%	55,600 102% 228%	40,000 73% 133%	95,600 175%
III. by Crops	30,500 56%	34,100 91%	64,600	19,900 37%	4,800 9%	24,700	5,200 158%	1,100 33%	6,300	55,600 102%	40,000 73%	95,600
Paddy	28,900 53%	10,400 28%	39,300	18,800 35%	1,000 2%	19,800	4,900 149%	700 21%	5,600	52,600 97%	12,100 22%	64,700
Maize	0 -	7,800 21%	7,800	800 2%	1,800 3%	2,600	200 6%	200 6%	400	1,000 2%	9,800 18%	10,800
Groundnuts/ Soybeans	1,600 3%	4,600 12%	6,200	300 1%	700 1%	1,000	100 3%	200 6%	300	2,000 4%	5,500 10%	7,500
Tobacco	0 -	400 1%	400	0 0%	0 0%	0	0 0%	0 0%	0	0 0%	400 1%	400
Sugarcane	- -	5,600 15%	5,600	- -	- 0%	0	- -	- -	0	0 0%	5,600 10%	5,600
Pinapple	- -	- -	0	- -	- 0%	0	- -	- -	0	0 0%	0 0%	0
Cassava	- -	5,300 14%	5,300	- -	1,300 2%	1,300	- -	- -	0	0 0%	6,600 12%	6,600

Table 7.2 Future Cropping Area in the Project Area of Master Plan (2020)

	Cropping Pattern A			Cropping Pattern B			Cropping Pattern C			Total						
	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total				
I. Physical Area																
Farm Land	37,700	100%	0 0%	37,700	13,500	100%	0 0%	13,500	3,300	100%	0 0%	3,300	54,500	100%	0 0%	54,500
II. by Cropping Season																
1. Winter - Spring	31,700	84%	0 0%	31,700	13,500	100%	0 0%	13,500	3,300	100%	0 0%	3,300	48,500	89%	0 0%	48,500
Paddy (early)	26,500	70%	-	26,500	2,700	20%	-	2,700	-	-	-	0	29,200	54%	-	29,200
Paddy (late)	-	-	-	0	8,200	61%	-	8,200	3,300	100%	-	3,300	11,500	21%	-	11,500
Maize	4,500	12%	-	4,500	2,600	19%	-	2,600	-	-	-	0	7,100	13%	-	7,100
Groundnuts/ Soybeans	-	-	-	0	-	-	-	0	-	-	-	0	0	0%	-	0
Tobacco	700	2%	-	700	-	-	-	0	-	-	-	0	700	1%	-	700
2. Summer - Autumn	31,700	84%	0 0%	31,700	13,500	100%	0 0%	13,500	3,300	100%	0 0%	3,300	48,500	89%	0 0%	48,500
Paddy (early)	19,000	50%	-	19,000	1,400	10%	-	1,400	-	-	-	0	20,400	37%	-	20,400
Paddy (late)	-	-	-	0	5,500	41%	-	5,500	2,000	61%	-	2,000	7,500	14%	-	7,500
Maize	7,500	20%	-	7,500	2,600	19%	-	2,600	700	21%	-	700	10,800	20%	-	10,800
Groundnuts/ Soybeans	5,200	14%	-	5,200	4,000	30%	-	4,000	600	18%	-	600	9,800	18%	-	9,800
Tobacco	-	-	-	0	-	-	-	0	-	-	-	0	0	0%	-	0
3. 3rd Crop Season	18,900	50%	0 0%	18,900	2,700	20%	0 0%	2,700	0	0%	0 0%	0	21,600	40%	0 0%	21,600
Paddy (early)	18,900	50%	-	18,900	2,700	20%	-	2,700	-	-	-	0	21,600	40%	-	21,600
Paddy (late)	-	-	-	0	-	-	-	0	-	-	-	0	0	0%	-	0
Maize	-	-	-	0	-	-	-	0	-	-	-	0	0	0%	-	0
Groundnuts/ Soybeans	-	-	-	0	-	-	-	0	-	-	-	0	0	0%	-	0
Tobacco	-	-	-	0	-	-	-	0	-	-	-	0	0	0%	-	0
4. Perennial Crops	6,000	16%	0 0%	6,000	0	0%	0 0%	0	0	0%	0 0%	0	6,000	11%	0 0%	6,000
Sugarcane	5,700	15%	-	5,700	-	-	-	0	-	-	-	0	5,700	11%	-	5,700
Pinapple	300	1%	-	300	-	-	-	0	-	-	-	0	300	1%	-	300
Cassava	-	-	-	0	-	-	-	0	-	-	-	0	0	0%	-	0
5. Total (Cropping Intensity)	88,300	234%	0 0%	88,300	29,700	220%	0 0%	29,700	6,600	200%	0 0%	6,600	124,600	229%	0 0%	124,600
III. by Crops	88,300	234%	0 0%	88,300	29,700	220%	0 0%	29,700	6,600	200%	0 0%	6,600	124,600	229%	0 0%	124,600
Paddy	64,400	171%	-	64,400	20,500	152%	-	20,500	5,300	161%	-	5,300	90,200	166%	-	90,200
Maize	12,000	32%	-	12,000	5,200	39%	-	5,200	700	21%	-	700	17,900	33%	-	17,900
Groundnuts/ Soybeans	5,200	14%	-	5,200	4,000	30%	-	4,000	600	18%	-	600	9,800	18%	-	9,800
Tobacco	700	2%	-	700	0	0%	-	0	0	0%	-	0	700	1%	-	700
Sugarcane	5,700	15%	-	5,700	-	0%	-	0	-	0%	-	0	5,700	11%	-	5,700
Pinapple	300	1%	-	300	-	0%	-	0	-	-	-	0	300	1%	-	300
Cassava	-	-	-	0	-	-	-	0	-	-	-	0	0	0%	-	0

Table 7.3 Domestic Water Supply Requirement for Water Supply Plan

(1) Urban Domestic Water Requirement for Water Supply Plan

(Unit: m³/day)

Districts	Urban center	2010			2020		
		Total demand	Existing/Committed capacity	Net requirement	Total demand	Existing/Committed capacity	Net requirement
Quy Nhon	Quy Nhon City	39,272			68,366		
	New urban area (Nhon Hoi)	20,000			20,000		
	Sub-total	59,272	45,000	14,272	88,366	45,000	43,366
Phu Cat	Ngo May town	1,935	-	1,935	3,369	-	3,369
Tay Son	Phu Phong town	2,298	-	2,298	4,000	-	4,000
An Nhon	Binh Dinh Town	3,119	-	3,119	5,429	-	5,429
	Dap Da Town	3,119	-	3,119	5,429	-	5,429
	Sub-total	6,238	-	6,238	10,858	-	10,858
Tuy Phuoc	Tuy Phuoc Town	2,999	-	2,999	5,221	-	5,221
	Dieu Tri Town	1,286	-	1,286	2,238	-	2,238
	Sub-total	4,285	-	4,285	7,459	-	7,459
Phu My	Phu My Town	1,957		1,957	3,407		3,407
Total		75,985 (2.28M m ³ /m)	45,000	30,985 (0.93M m ³ /m)	117,459 (3.52M m ³ /m)	45,000	72,459 (2.17M m ³ /m)

(2) Rural Domestic Water Requirement for Water Supply Plan

(Unit: m³/day)

District	2010			2020		
	Total Demand	Existing Capacity	Net requirement	Total Demand	Existing Capacity	Net Requirement
Quy Nhon	707	152	555	1,220	152	1,068
Vinh Thanh	924	198	726	1,594	198	1,396
Phu Cat	6,248	1,339	4,909	10,781	1,339	9,422
Tay Son	4,197	899	3,298	7,241	899	6,342
An Nhon	5,209	1,116	4,093	8,987	1,116	7,871
Tuy Phuoc	5,646	1,210	4,436	9,742	1,210	8,532
Van Canh	770	165	605	1,329	165	1,164
Total	23,701 (0.71 Mm ³ /m)	5,079	18,622 (0.56 Mm ³ /m)	40,894 (1.23 Mm ³ /m)	5,079	35,815 (1.07 Mm ³ /m)

Table 7.4 Industrial Water Supply Requirement for Water Supply Plan**(1) Rural Industrial Water Requirement for Water Supply Plan**(Unit: m³/day)

<u>Area</u>	2010			2020		
	Total Demand	Existing Capacity	Net Requirement	Total Demand	Existing Capacity	Net Requirement
- Downstream area of Binh Thanh	19,100	11,410	7,690	45,217	11,410	33,807
- Area between Van Phong and Binh Thanh	42,465	25,370	17,095	100,530	25,370	75,160
- Area between Dinh Binh and Van Phong	20,960	12,520	8,440	49,620	12,520	37,100
Total	82,525 (2.48 Mm ³ /m)		33,225 (1.0 Mm ³ /m)	195,367 (5.86 Mm ³ /m)		146,067 (4.38 Mm ³ /m)

(2) Industrial Zone Water Requirement for Water Supply Plan(Unit: m³/day)

Industrial Zone	2010			2020		
	Total Demand	Existing Capacity	Net Requirement	Total Demand	Existing Capacity	Net Requirement
- Phu Tai	8,750	0	8,750	17,500	0	17,500
- Long My	10,500	0	10,500	21,000	0	21,000
- Nhon Hoi	35,000	0	35,000	70,000	0	70,000
- Paper Mill at An Nhon	50,000	0	50,000	50,000	0	50,000
Total	54,250	0	54,250	108,500	0	108,500

Table 7.5 Causes of Past Floods in the Kone River Basin

Year	Month	Date	Flood Peak (m ³ /s)	Cause
1977	November	9 - 11	-	tropical thermal combined with cold front.
1978	-	-	1,475	-
1979	November	16 - 19	-	tropical thermal combined with cold front.
1980	November	15 - 17	4,280	tropical low pressure combined with cold front
1981	November	8 - 11	4,140	tropical low pressure combined with cold front
1983	October	29 - 31	-	tropical low pressure combined with cold front
1984	November	7 - 8	3,480	typhoon No.9 (Agnes)
1985	November	25 - 26	-	typhoon No.11 combined with cold front
1986	December	2 - 4	-	tropical low pressure combined with tropical thermal and cold front
1987	November	18 - 19	6,340	typhoon No.16 landing on Quy Nhon and cold front
1988	October	15 - 16	-	tropical low pressure
1990	October	13 - 15	-	typhoon No.8 and cold front
1991	October	22 - 25	-	tropical thermal combined with cold front.
1992	October	22 - 25	3,220	typhoon No.6 landing on Quy Nhon
1994	October	20 - 21	2,330	typhoon No.9 combined with cold front
1995	October	26 - 27	-	typhoon No.10 landing in Binh Dinh province
1996	December	Nov.30 - Dec.02	3,430	tropical low pressure and cold front
1997	November	2 - 4	-	typhoon No.5 with strong north-east wind
1998	October	18 - 22	-	tropical thermal combined with cold front.
1998	November	19 - 23	4,350	typhoon No.5 and cold front
1999	October	17 - 19	-	typhoon No.9 combined with cold front
1999	November	1 - 7	-	tropical low pressure and tropical thermal
1999	December	Nov.30 - Dec. 8	3,680	tropical low pressure and cold front
2000	October	5 - 11	-	tropical low pressure and tropical thermal
2001	November	11 - 12	-	typhoon No.8 (Ling Ling)

Table 8.1 Alternative Scales of Dinh Binh Dam

Items	Alt.I		Alt.II		Alt.III		Remarks
	Alt.I-1	Alt.I-2	Alt.II-1	Alt.II-2	Alt.III-1	Alt.III-2	
Dam Crest Level	EL.95.3	EL.95.3	EL.100.3	EL.100.3	EL.105.3	EL.105.3	
F.W.L (Gross Vol., MCM)	EL. 93.3 (242.78)	EL.93.3 (242.78)	EL.98.3	EL.98.3	EL.103.3	EL.103.3	Flood Water Level
S.W.L (Gross Vol., MCM)	EL.92.8 (237.52)	EL. 92.8 (237.52)	EL.97.8 (309.07)	EL.97.8 (309.07)	EL.102.8 (391.82)	EL.102.8 (391.82)	Surcharge Water Level
F.S.L (Gross Vol., MCM)	EL.91.9 (226.18)	EL.91.9 (226.18)	EL.96.9 (295.81)	EL.96.9 (295.81)	EL.101.9 (376.53)	EL.101.9 (376.53)	Full Supply Level
Rainy Season Limited W.L (Gross Vol., MCM)	EL.65.0 (16.3)	EL.82.0 (116.3)	EL.65.0 (16.3)	EL.82.0 (116.3)	EL.65.0 (16.3)	EL.82.0 (116.3)	Sep. to Nov.
Dead W.L (Gross Vol., MCM)	EL.65.0 (16.3)	EL.65.0 (16.3)	EL.65.0 (16.3)	EL.65.0 (16.3)	EL.65.0 (16.3)	EL.65.0 (16.3)	
F/C Vol. (MCM) -Major Flood-	221.22	121.22	292.77	192.77	375.52	275.52	Flood Control Volume
F/C Vol. (MCM) -Late Flood-	(Dec. 1-10)	200.0	200.0	200.0	200.0	200.0	Flood Control Volume
	(Dec. 11-20)	120.0	120.0	120.0	120.0	120.0	
	(Dec. 21-31)	50.0	50.0	50.0	50.0	50.0	
Effective Storage Vol. (MCM)	209.88	209.88	279.51	279.51	360.23	360.23	
D/S River Discharge at Binh Thanh for Probable Major Flood (m ³ /s)	10 % flood	5,037	5,037	4,450	4,450	3,887	3,887
	5 % flood	4,018	4,018	3,494	3,494	3,021	3,021
	2 % flood	3,264	3,264	2,807	2,807	2,277	2,277
Resettlement (by D/B Dam) - Households (Nos.)	587	587	616	616	646	646	

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Table 8.2 : Examination on Conceivable Alternative Basin Development Plans (1/2)

Alternative Basin Development Plans	Flood Control (F/C) Aspect										Water Utilization Aspect							Environmental Aspect		Economic Aspect		Overall Evaluation									
	Dinh Binh Dam				Dyke System			New Sea Dyke Spillway			F/C Requirement (1,960 m ³ /s)	Effective Storage of Dam (MCM)	Power Generation (GWh/yr)	Cost			Resettlement (Households)	W/S Requirement ² / ₃	Natural Environment Indicators: 1) Precious species 2) Impact on protected area 3) Impact on lagoon 4) Water quality	Social Environment Indicators: 5) Impact of resettlement 6) Impact on important infrastructures such as national road and railway	Total construction cost (M.US\$) ¹ / ₂		Economic Viability, EIRR(%) NPV (MR.US\$)								
	F/C Vol. of Dam (MCM)	F/C Capacity (m ³ /s) ¹ / ₂	Resettlement (Households)	Cost (M. US\$) ¹ / ₂	F/C Capacity (m ³ /s)	Resettlement (Households)	Cost (M. US\$) ¹ / ₂	Mitigation of Inundation (km ²) ² / ₃	Resettlement (Households)	Cost (M. US\$) ¹ / ₂				Dam & weir (M. US\$) ¹ / ₂	Irr.& Drainage System (M.US\$) ¹ / ₂	D&I W/S Facilities (M. US\$) ¹ / ₂															
I. Including La Tinh River Basin																															
I-1 With Dam																															
A. Without New Sea Dyke Spillway																															
I-1.1A Dam Alt.I-1	221.7	2,886	587	81.7	1,691	248	107.1	-	0	0	Satisfied	209.9	36.5	50.1	144.3	294.4	713	Not satisfied	-	-	-	-	-	-	-	-	-	-	-	-	-
I-1.2A Dam Alt.I-2	121.2	2,130	587	81.7	1,691	248	107.1	-	0	0	Satisfied	209.9	42.0	50.1	144.3	294.4	713	Not satisfied	-	-	-	-	-	-	-	-	-	-	-	-	-
I-1.3A Dam Alt.II-1	292.8	3,343	616	94.3	1,691	248	107.1	-	0	0	Satisfied	279.5	37.8	50.1	144.3	294.4	713	Satisfied	-No impact for 1) & 2) - Not clear but minor for 3) & 4); Need appropriate consideration	-Medium impact for 5) -Relatively larger for 6) Need appropriate consideration	690.2	15.0 % 91.9	Optimum with La Tinh and without new sea dyke spillway								
I-1.4A Dam Alt.II-2	192.8	2,660	616	94.3	1,691	248	107.1	-	0	0	Satisfied	279.5	44.6	50.1	144.3	294.4	713	Satisfied	- Ditto-	- Ditto-	690.2	14.7 % 84.9									
I-1.5A Dam Alt.III-1	375.5	3,711	646	107.1	1,691	248	107.1	-	0	0	Satisfied	360.2	37.2	50.1	144.3	294.4	713	Satisfied	- Ditto-	- Ditto-	703.0	14.8 % 91.3									
I-1.6A Dam Alt.III-2	275.5	3,220	646	107.1	1,691	248	107.1	-	0	0	Satisfied	360.2	44.7	50.1	144.3	294.4	713	Satisfied	- Ditto-	- Ditto-	703.0	14.6 % 87.1									
B. With New Sea Dyke Spillway																															
I-1.1B Dam Alt.I-1	221.72	2,886	587	81.7	1,691	248	107.1	17.0	0	0.3	Satisfied	209.9	36.5	50.1	144.3	294.4	713	Not satisfied	-	-	-	-	-	-	-	-	-	-	-	-	-
I-1.2B Dam Alt.I-2	121.22	2,130	587	81.7	1,691	248	107.1	17.0	0	0.3	Satisfied	209.9	42.0	50.1	144.3	294.4	713	Not satisfied	-	-	-	-	-	-	-	-	-	-	-	-	-
I-1.3B Dam Alt.II-1	292.77	3,343	616	94.3	1,691	248	107.1	17.0	0	0.3	Satisfied	279.5	37.8	50.1	144.3	294.4	713	Satisfied	-No impact for 1) & 2) - Not clear but minor for 3) & 4); Need appropriate consideration	-Medium impact for 5) -Relatively larger for 6) Need appropriate consideration	690.5	15.1 % 92.4	Optimum with La Tinh and with new sea dyke spillway								
I-1.4B Dam Alt.II-2	192.77	2,660	616	94.3	1,691	248	107.1	17.0	0	0.3	Satisfied	279.5	44.6	50.1	144.3	294.4	713	Satisfied	- Ditto-	- Ditto-	690.5	14.8 % 86.3									
I-1.5B Dam Alt.III-1	375.52	3,711	646	107.1	1,691	248	107.1	17.0	0	0.3	Satisfied	360.2	37.2	50.1	144.3	294.4	713	Satisfied	- Ditto-	- Ditto-	703.3	14.9 % 91.7									
I-1.6B Dam Alt.III-2	275.52	3,220	646	107.1	1,691	248	107.1	17.0	0	0.3	Satisfied	360.2	44.7	50.1	144.3	294.4	713	Satisfied	- Ditto-	- Ditto-	703.3	14.7 % 88.0									
I-2 Without Dam	0	0	0	0	1,691	248	107.1	17.0	0	0.3	Not Satisfied	0	0	0	0	294.4	0	Satisfied for D & I water supply	- Ditto-	- Ditto-	401.8	Negative -1,114.7	-Not feasible economically -No agricultural water supply								

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Note
 F/C: Flood Control
 Irr.: Irrigation
 D&I W/S: Domestic and Industrial Water Supply
 NPV: Net Present Value in million US\$

Remarks
¹/₂ In case of 10 % probable major flood
²/₃ Area that inundating water level lowering is expected by more than 1.0 m.
³/₄ 75 % dependability for irrigation and fishery
 90 % dependability for domestic/industrial water supply
⁴/₄ Excluding VAT.

Cost of Freshwater Production:
 =448,167
 m³/d*365d*US\$2.0/m³
 =US\$327million/year

Table 8.2 : Examination on Conceivable Alternative Basin Development Plans (2/2)

Alternative Basin Development Plans	Flood Control (F/C) Aspect											Water Utilization Aspect					Environmental Aspect		Economic Aspect		Overall Evaluation			
	Dinh Binh Dam				Dyke System			New Sea Dyke Spillway				F/C Requirement (1,960 m3/s)	Effective Storage of Dam (MCM)	Power Generation (GWh/yr)	Cost			Resettle-ment (House-holds)	W/S Requirement /2	Natural Environment Indicators: 1) Precious species 2) Impact on protected area 3) Impact on lagoon 4) Water quality		Social Environment Indicators: 5) Impact of resettlement 6) Impact on important infrastructures such as national road and railway	Total construction cost (M.US\$) /4	Economic Viability, EIRR(%) NPV (M.US\$)
	F/C Vol. of Dam (MCM)	F/C Capacity (m3/s) /1	Resettle-ment (House-holds)	Cost (M. US\$) /4	F/C Capacity (m3/s)	Resettle-ment (House-holds)	Cost (M. US\$) /4	Mitigation of Inundation (km ²) /2	Resettle-ment (House-holds)	Cost (M. US\$) /4	Dam & weir (M. US\$) /4				Irr.& Drainage System (M.US\$) /4	D&I W/S Facilities (M. US\$) /4								
II. Excluding La Tinh River Basin																								
II.-1 With Dam																								
A. Without New Sea Dyke Spillway																								
II-1.1A Dam Alt.I-1	221.7	2,886	587	81.7	1,691	248	107.1	-	0	0	Satisfied	209.9	36.5	48.5	127.4	294.4	713	Not satisfied	-	-	-	-		
II-1.2A Dam Alt.I-2	121.2	2,130	587	81.7	1,691	248	107.1	-	0	0	Satisfied	209.9	42.0	48.5	127.4	294.4	713	Not satisfied	-	-	-	-		
II-1.3A Dam Alt.II-1	292.8	3,343	616	94.3	1,691	248	107.1	-	0	0	Satisfied	279.5	37.8	48.5	127.4	294.4	713	Satisfied	-No impact for 1) & 2) -Not clear but minor for 3) & 4); Need appropriate consideration	-Medium impact for 5) -Relatively larger for 6) Need appropriate consideration	671.7	14.8 % 85.4	Optimum without La Tinh and without new sea dyke spillway	
II-1.4A Dam Alt.II-2	192.8	2,660	616	94.3	1,691	248	107.1	-	0	0	Satisfied	279.5	44.6	48.5	127.4	294.4	713	Satisfied	- Ditto-	- Ditto-	671.7	14.5 % 78.4		
II-1.5A Dam Alt.III-1	375.5	3,711	646	107.1	1,691	248	107.1	-	0	0	Satisfied	360.2	37.2	48.5	127.4	294.4	713	Satisfied	- Ditto-	- Ditto-	684.5	14.6 % 84.8		
II-1.6A Dam Alt.III-2	275.5	3,220	646	107.1	1,691	248	107.1	-	0	0	Satisfied	360.2	44.7	48.5	127.4	294.4	713	Satisfied	- Ditto-	- Ditto-	684.5	14.4 % 80.7		
B. With New Sea Dyke Spillway																								
II-1.1B Dam Alt.I-1	221.72	2,886	587	81.7	1,691	248	107.1	17.0	0	0.3	Satisfied	209.9	36.5	48.5	127.4	294.4	713	Not satisfied	-	-	-	-		
II-1.2B Dam Alt.I-2	121.22	2,130	587	81.7	1,691	248	107.1	17.0	0	0.3	Satisfied	209.9	42.0	48.5	127.4	294.4	713	Not satisfied	-	-	-	-		
II-1.3B Dam Alt.II-1	292.77	3,343	616	94.3	1,691	248	107.1	17.0	0	0.3	Satisfied	279.5	37.8	48.5	127.4	294.4	713	Satisfied	-No impact for 1) & 2) -Not clear but minor for 3) & 4); Need appropriate consideration	-Medium impact for 5) -Relatively larger for 6) Need appropriate consideration	672.0	14.9 % 85.9	Optimum without La Tinh and with new sea dyke spillway	
II-1.4B Dam Alt.II-2	192.77	2,660	616	94.3	1,691	248	107.1	17.0	0	0.3	Satisfied	279.5	44.6	48.5	127.4	294.4	713	Satisfied	- Ditto-	- Ditto-	672.0	14.6 % 79.8		
II-1.5B Dam Alt.III-1	375.52	3,711	646	107.1	1,691	248	107.1	17.0	0	0.3	Satisfied	360.2	37.2	48.5	127.4	294.4	713	Satisfied	- Ditto-	- Ditto-	684.8	14.7 % 85.2		
II-1.6B Dam Alt.III-2	275.52	3,220	646	107.1	1,691	248	107.1	17.0	0	0.3	Satisfied	360.2	44.7	48.5	127.4	294.4	713	Satisfied	- Ditto-	- Ditto-	684.4	14.5 % 81.5		
II.-2 Without Dam	0	0	0	0	1,691	248	107.1	17.0	0	0.3	Not Satisfied	0	0	0	0	294.4	0	Satisfied for D & I water supply	- Ditto-	- Ditto-	401.8	Negative -1,114.7	-Not feasible economically -No agricultural water supply	
													Cost of Freshwater Production: =48,167 m3/yr*365d*US\$2.0/m3 =US\$327million/year											

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Note

F/C: Flood Control
 Irr.: Irrigation
 D&I W/S: Domestic and Industrial Water Supply
 NPV Net Present Value in million US\$

Remarks

- /1 In case of 10 % probable major flood
- /2 Area that inundating water level lowering is expected by more than 1.0 m.
- /3 75 % dependability for irrigation and fishery
90 % dependability for domestic/industrial water supply
- /4 Excluding VAT.

Table 8.3 Future Irrigation Schemes to 2010 in JICA Study Area

No.	Name of Irrigation Scheme		Name of River Basin	Actual Irrigation Area (2001) by DARD (Net)	Rehabilitation Irrigation Area (2010)	New Development Irrigation Area(2010)	Actual Irrigation Area (2010)	Remark
A North of La Tinh River basin								
1	Cay Gay Left	W	La Tinh	1,162	0		1,162	CgaiL(56%)
2	Cay Ke Left	W	La Tinh	331	0		331	CkeL (41%)
3	Cay Ke Right North	W	La Tinh	121	0		121	CkeRN (15%)
Sub-total 1				1,614	0		1,614	
B South of La Tinh River Basin and North of Kone River Basin								
1	Hoi Son Upstream	R	La Tinh	118	0		118	HSup
2	Cay Gai Right	W	La Tinh	913	0		913	CgaiR (44%)
3	Cay Ke Right South	W	La Tinh	355	0		355	CkeRS (44%)
4	Thuan Ninh	R	Kone	1,060	0		1,060	ThuN
5	My Thuan	R	Kone	350	0		350	MyT
6	Tuong Son	R	Kone	336	0		336	Tson
7	Suoi Chay	R	Kone	250	0		250	SuoC
8	Hon Ga	R	Kone	120	30		150	HonG
9	Chanh Nhon	R	Kone	60	0		60	CNh
10	Dai An	R	Kone	65	0		65	DaiA
11	Cua Khau	R	Kone	65	0		65	CuaK
12	Dai Binh	P	Kone	40.00			40.00	DaiB
13	Thi Lua	P	Kone	206.00			206.00	ThiL
14	Ngai Chanh	P	Kone	53.00			53.00	Ngac
15	Thuan Ninh N2	R	La Tinh			1,640	1,640	ThuN
16	Minor schemes			340	782		1,122	MSB
Sub-total 2				4,331	812	1,640	6,783	
C Tan An - Dap Da								
1	Thanh Hoa	W	Kone	4,055			4,055	ThanH
2	Thach De	W	Kone	1,247			1,247	ThaD
3	Thuan Hat	W	Kone	166			166	ThuaH
4	Thap Mao	W	Kone	1,782			1,782	ThaM
5	Lao Tam	W	Kone	688			688	LaoT
6	Nha Phu	W	Kone	300			300	NhaP
7	Ha Bac	W	Kone	300			300	HaB
8	Bo Ngo	W	Kone	523			523	BoN
9	Bay Yen	P	Kone	220			220	BaY
12	Binh Thanh	P	Kone	170			170	BinT
10	Dap Cat	W	Kone	263.00			263.00	DapC
11	Van Kham	W	Kone	343.00			343.00	VanK
12	Van Moi	W	Kone	209.00			209.00	VanM
13	Nhon Phong (Ban Nui)	W	Kone	619.00			619.00	NhoP
14	Da Den	W	Kone	319.00			319.00	DaD
13	Ben Tranh	P	Kone	37.00			37.00	BenT
14	Thanh Danh	P	Kone	44.00			44.00	ThaD
15	Ben Go	P	Kone	0.00			0.00	BenG
16	Thach De	P	Kone	60.00			60.00	ThaD
17	An Loi	P	Kone	38.00			38.00	AnL
18	Trung Ly	P	Kone	13.00			13.00	TruL
19	An Hoa	P	Kone	30.00			30.00	AnH
20	An Thuan I+II	P	Kone	90.00			90.00	AnT
21	Long Quang	P	Kone	70.00			70.00	LonQ
22	Minor Schemes		Kone	827.00			827.00	MSC
Sub-total 3				12,413			12,413	
D South of Kone River Basin								
1	Loc (Kien) Giang	W	Kone	583	17		600	LocG
2	Nui Mot	R	Kone	2,920	0		2,920	NuiM
3	Lo Mon	R	Kone	50	24		74	LoM
4	Thu Thien	R	Kone	120	30		150	ThuT
5	Minor Schemes		Kone	857	2,099		2,956	MSD
Sub-total 4				4,530	2,170		6,700	
E Downstream Reaches of Ha Thanh River Basin								
1	Long My 2	R	Ha Thanh	110	0		110	LonM
2	Da Mai Downstream	R	Ha Thanh			0	0	DaMd
3	Phu tai	R	Ha Thanh			643	643	PhuT
4	Hoc (Cay) Thich	R	Ha Thanh	80.00	16.00		96.00	CayT
5	Hoc (Ho) Cay Da	R	Ha Thanh	80.00	16.00		96.00	CayD
6	Hoc (Cay) Ke	R	Ha Thanh	25.00	5.00		30.00	CayK
7	Minor Schemes		Ha Thanh	505.00	123.00		628.00	MSE
Sub-total 5				800	160	643	1,603	
F Van Canh Region								
1	Ba thien	R	Ha Thanh	50	12		62	BaTh
2	Da Mai Upstream	R	Ha Thanh			0	0	P15
3	Quang Hien	R	Ha Thanh			322	322	P18(21%)
4	Suoi Nhien	R	Ha Thanh	40.00	0.00		40.00	SuoT
5	Minor Schemes		Ha Thanh	290.00	77.00		367.00	MSF
Sub-total 6				380	89	322	791	
G Vinh Thanh Region								
1	Hon Lap	R	Kone	210	40		250	HonL
2	Minor Schemes		Kone	155	190		345	MSG
Sub-total 7				365	230		595	
Total (1-7)				24,433	3,461	2,605	30,499	

Note: W: Weir, R: Reservoir, P: Pumping Station

Table8.4 Future Irrigation Schemes to 2020 in JICA Study Area (1/2)

No.	Name of Irrigation Scheme		River Basin	Actual Irrigation Area (2010)	Rehabilitaition Irrigation Area (2020)	New Development Irrigation Area(2020)	Actual Irrigation Area (2020)	Remark
A North of La Tinh River basin								
1	Cay Gay Left	W	La Tinh	1,162			1,162	CgaiL(56%)
2	Cay Ke Left	W	La Tinh	331			331	CkeL (41%)
3	Cay Ke Right North	W	La Tinh	121			121	CkeRN (15%)
4	Van Phong	W	La Tinh			3,297	3,297	VPL
Sub-total 1				1,614		3,297	4,911	
B South of La Tinh River Basin and North of Kone River Basin								
1	Hoi Son Upstream	R	La Tinh	118			118	HSup
2	Cay Gai Right	W	La Tinh	913			913	CgaiR (44%)
3	Cay Ke Right South	W	La Tinh	355			355	CkeRS (44%)
4	Thuan Ninh	R	Kone	1,060			1,060	ThuN
5	My Thuan	R	Kone	350			350	MyT
6	Tuong Son	R	Kone	336			336	Tson
7	Suoi Chay	R	Kone	250			250	SuoC
8	Hon Ga	R	Kone	150			150	HonG
9	Chanh Nhon	R	Kone	60			60	CNh
10	Dai An	R	Kone	65			65	DaiA
11	Cua Khau	R	Kone	65			65	CuaK
12	Dai Binh	P	Kone	40	5		45	DaiB
13	Thi Lua	P	Kone	206	20		226	ThiL
14	Ngai Chanh	P	Kone	53	7		60	NgaC
15	Thuan Ninh N2	R	La Tinh	1,640			1,640	ThuN
16	Van Phong Proper	R				10,484	10,484	VPPr
17	Minor schemes			1,122			1,122	MSB
Sub-total 2				6,783	32	10,484	17,299	
C Tan An - Dap Da								
1	Thanh Hoa	W	Kone	4,055	65		4,120	ThanH
2	Thach De	W	Kone	1,247	53		1,300	ThaD
3	Thuan Hat	W	Kone	166	21		187	ThuaH
4	Thap Mao	W	Kone	1,782	18		1,800	ThaM
5	Lao Tam	W	Kone	688	14		702	LaoT
6	Nha Phu	W	Kone	300	0		300	NhaP
7	Ha Bac	W	Kone	300	0		300	HaB
8	Bo Ngo	W	Kone	523	65		588	BoN
9	Bay Yen	P	Kone	220	27		247	BaY
12	Binh Thanh	P	Kone	170			170	BinT
10	Lao Tam Downstream	W	Kone			512	512	LaoTD
11	Dap Cat	W	Kone	263	32		295	DapC
12	Van Kham	W	Kone	343	42		385	VanK
13	Van Moi	W	Kone	209	26		235	VanM
14	Nhon Phong (Ban Nui)	W	Kone	619	76		695	NhoP
15	Da Den	W	Kone	319	39		358	DaD
13	Ben Tranh	P	Kone	37	5		42	BenT
14	Thanh Danh	P	Kone	44	5		49	ThaD
15	Ben Go	P	Kone	0	0		0	BenG
16	Thach De	P	Kone	60	7		67	ThaD
17	An Loi	P	Kone	38	5		43	AnL
18	Trung Ly	P	Kone	13	2		15	TruL
19	An Hoa	P	Kone	30	4		34	AnH
20	An Thuan I+II	P	Kone	90	11		101	AnT
21	Long Quang	P	Kone	70	10		80	LonQ
22	Minor Schemes		Kone	827	1,080		1,907	MSC
Sub-total 3				12,413	1,607	512	14,532	
D South of Kone River Basin								
1	Loc (Kien) Giang	W	Kone	600			600	LocG
2	Nui Mot	R	Kone	2,920			2,920	NuiM
3	Lo Mon	R	Kone	74			74	LoM
4	Thu Thien	R	Kone	150			150	ThuT
5	Suoi Ca	R	Kone			700	700	SuoC
6	Dong Sim	R	Kone			1,060	1,060	DonS
7	Tien Long	R	Kone			154	154	TieL
8	Tien Thuan	R	Kone			43	43	TieT
9	Nui Thap	R	Kone			192	192	NuiT
10	Huu Giang	P	Kone			351	351	HuuG
11	Huong Giang	P	Kone			308	308	HuoG
12	Chi Hoa	P	Kone			353	353	ChiH
13	Binh Khe	P	Kone			708	708	BinK
14	Chuyen Nuoc	P	Kone			761	761	ChuyN
15	Hon Gach	P	Kone			176	176	NonG
16	Minor Schemes			2,956			2,956	MSD
Sub-total 4				6,700		4,806	11,506	

Note: W: Weir, R: Reservoir, P: Pumping Station

Table 8.4 Future Irrigation Schemes to 2020 in JICA Study Area (2/2)

No.	Name of Irrigation Scheme		River Basin	Actual Irrigation Area (2010)	Rehabilitation Irrigation Area (2020)	New Development Irrigation Area(2020)	Actual Irrigation Area (2020)	Remark
E Downstream Reaches of Ha Thanh River Basin								
1	Long My 2	R	Ha Thanh	110			110	LonM
2	Da Mai Downstream	R	Ha Thanh	0			0	DaMd
3	Phu tai	R	Ha Thanh	643			643	PhuT
4	Long My 1	R	Ha Thanh			0	0	LMy1
5	Ha Thanh	W	Ha Thanh			0	0	HaT
6	Phuoc My	P	Ha Thanh			0	0	PhuM
7	Ha Thanh Extention		Ha Thanh			2,039	2,039	HaT
8	Hoc (Cay) Thich	R	Ha Thanh	96.00			96.00	CayT
9	Hoc (Ho) Cay Da	R	Ha Thanh	96.00			96.00	CayD
10	Hoc (Cay) Ke	R	Ha Thanh	30.00			30.00	CayK
11	Minor Schemes		Ha Thanh	628.00			123.00	MSE
Sub-total 5				1,603		2,039	3,137	
F Van Canh Region								
1	Ba thien	R	Ha Thanh	62			62	BaTh
2	Da Mai Upstream	R	Ha Thanh	0			0	P15
3	Quang Hien	R	Ha Thanh	322			322	P18(21%)
4	Suoi Chinh	R	Ha Thanh			171	171	P16(11%)
5	Suoi But	R	Ha Thanh			186	186	P19(12%)
6	Dap Ca Sim	W	Ha Thanh			0	0	(8%)
7	Canh Thinh	W	Ha Thanh			0	0	A12(5%)
8	Canh Vinh	R	Ha Thanh			0	0	A7
9	Suoi Nhien	R	Ha Thanh	40.00			40.00	SuoT
10	Minor Schemes		Ha Thanh	367.00			367.00	MSF
Sub-total 6				791		357	1,148	
G Vinh Thanh Region								
1	Hon Lap	R	Kone	250			250	HonL
2	Vinh Phuc	R	Kone			148	148	VinP
3	Vinh Thanh	R	Kone			175	175	VinT.1
4	Ha Nhe	R	Kone			180	180	HaN
5	Vinh Thach (Dinh Binh)	R	Kone			1,017	1,017	VinTR
6	Minor Schemes		Kone	345			173	MSG
Sub-total 7				595		1,520	1,943	
Total (1~7)				30,499	1,639	23,015	54,476	

Note: W: Weir, R: Reservoir, P: Pumping Station

Table 8.5 Proposed Drainage System in Tan An - Dap Da Area

Drainage System	Location		Catchment Area		Discharge (m ³ /s)
	(Outlet)	(Commune)	(cm ²)	(ha)	
A Drainage Sluice					
1 DD1	Dap Da	Nhon My	56	348	4.0
2 DD2	-	Nhon Hau	38	238	2.8
3 DD3	-	Dap Da	64	400	4.6
4 DD4	-	Nhon Thanh	208	1,300	15.1
5 DD5L	-	Nhon Thanh	256	1,600	18.6
6 DD5R	-	Nhon Thanh	32	200	2.3
7 DD6	-	Nhon An	63	394	4.6
8 DD7	-	Cat Hung	117	731	8.5
9 DD8	-	Cat Hung	32	200	2.3
10 DD9	-	Cat Thang	64	400	4.6
11 NY1	Nam Yang	Nhon Phong	43	266	3.1
12 TD1	Tan An	Nhon Phuc	138	863	10.0
13 TD2	-	Nhon Loc	285	1,781	20.7
14 TD3	-	Nhon Loc	362	2,263	26.2
15 TD4L	-	Nhon Hoa	40	250	2.9
16 TD4R	-	Nhon Hoa	40	250	2.9
17 TD5	-	Nhon Khanh	40	250	2.9
18 TD6	-	Binh Dinh	165	1,031	12.0
19 TD7	-	Phuoc Quang	123	766	8.9
20 TD8	-	Phuoc Hoa	337	2,106	24.4
21 HD1	Ha Thanh	Tuy Phuoc	155	969	11.2
22 HD2	-	Nhon Binh	263	1,644	19.1
23 HD3	-	Nhon Binh	138	863	10.0
24 TND1	Thi Nai	Phuoc Thang	329	2,056	23.9
25 TND2	-	(Lao Dong Outlet) Phuoc Thang (Ha Gach Sluice)	516	3,225	37.4
26 TND3	-	(Tan Giang Sluice) Phuoc Hoa	70	438	5.1
27 TND4	-	(Kim Dong Sluice) Phuoc Hoa	137	856	9.9
28 TND5	-	(Cai Son Sluice) Phuoc Son	230	1,438	16.7
29 TND6	-	(Cho Dinh Sluice) Phuoc Son	62	388	4.5
30 TND7	-	(Ong Ba Sluice) Phuoc Son	38	238	2.8
31 TND8	-	(Ong Ho Sluice) Phuoc Thuan	84	525	6.1
32 TND9	-	(Cao Don Sluice) Phuoc Thuan	78	488	5.7
33 TND10	-	(Dong Dinh Sluice) Nhon Phu	202	1,263	14.6
34 TND11	-	(Hung Thanh Sluice) Phuoc Thuan	65	406	4.7
B Utilization Sluice					
			Flow Area (m ²)	River Velocity (m/s)	Discharge (m ³ /s)
1 DU1	Dap Da	Nhon Hau	30	0.5	15.0
2 TU1	Tan An	Nhon Khanh	15	0.5	7.5
3 TU2	-	Nhon Hoa	53	0.5	26.3
4 TU3	-	Phuoc Hiep	23	0.5	11.3
5 HU1	Ha Thanh	Nhon Phu	38	0.5	18.8
6 HU2	-	Nhon Phu	38	0.5	18.8

Note. Catchment areas have been measured on 1/25,000 maps.

Design unit drainage requirement has been estimated to be 11.6 l/s/ha.

Table 8.7 Water Source Facilities and Irrigation Schemes

(Unit: nos.)

No.	Area	Constructed up to 2001					Constructed 2001-2009					Constructed 2010-2019					Integrated 2010-2019					Accumulation as of 2020				
		D	W	P	Total 1	S	D	W	P	Total 2	S	D	W	P	Total 3	S	D	W	P	Total 4	S	D	W	P	Total	S
A	North of La Tinh River	0	2	0	2	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	2	3
B	South of La Tinh and North of Kone	9	0	3	12	12	0	0	0	0	1	0	0	1	1	0	0	-1	-1	-1	10	0	2	12	12	
C	Tan An - Dap Da	0	15	13	28	24	0	0	0	0	0	0	0	0	0	0	-7	-7	-14	-14	0	8	6	14	10	
D	South of Kone River	3	1	0	4	4	0	0	0	0	5	6	0	11	11	0	0	0	0	0	8	7	0	15	15	
E	Ha Thanh River	4	0	0	4	4	1	0	0	1	1	0	0	0	1	0	0	0	0	0	5	0	0	5	6	
F	Van Canh	2	0	0	2	2	1	0	0	1	1	2	0	2	2	0	0	0	0	0	5	0	0	5	5	
G	Vinh Thanh	1	0	0	1	1	0	0	0	0	4	0	0	4	4	0	0	0	0	0	5	0	0	5	5	
Total		19	18	16	53	49	2	0	0	2	2	12	6	0	18	20	0	-7	-8	-15	-15	33	17	8	58	56

Note. D: Dam, W: Weir, P: Pumping Station (booster pump in the canal network is not counted), S: Irrigation Scheme, Some schemes have both of weir and pumping station or two pumping stations.

Table 8.8 Summary of Integrated River Basin Management Plan for the Kone River Basin (1/3)

	Sub-project	Major Functions	Principal Feature	Financial Cost (including VAT)/EIRR
1.	Dinh Binh Multipurpose Reservoir	<ul style="list-style-type: none"> - Flood control of 5 % probable late flood and 1% probable early flood - Flood damage mitigation by flood regulation of the floods over the objective flood. - Water supply (including La Tinh River basin) for agricultural water, domestic&industrial water and river maintenance flow - Power generation 	<ul style="list-style-type: none"> - Dam type: Concrete gravity dam with a gated spillway - Dam height: about 55 m - Dam crest level: EL.100.3 m - Flood control volume: 292.77 MCM - Effective storage volume: 279.51 MCM - Power installed capacity: 6,600 kW - Annual average energy generation: 37.84 GWh - Resettlement: 616 households 	US\$98.0 mil.
2.	Agricultural Development Plan			US\$202.6 mil.
	2.1 Van Phong Weir	<ul style="list-style-type: none"> - Irrigation water supply for 14,100 ha of Van Phong and La Tinh , etc. 	<ul style="list-style-type: none"> - Weir type: Concrete fixed type - Weir length: 470 m - Crest level: EL.25m - Weir Height: 18 m 	
	2.2 Irrigation and Drainage Plan consisting of: <ul style="list-style-type: none"> - Improvement of the existing functional facilities, - Rehabilitation of the existing non-functional facilities, and - New development 	<ul style="list-style-type: none"> - Irrigation for 54,500 ha of Van Phong, Tan An, Dap Da, Ha Thanh and La Tinh, etc. 	<ul style="list-style-type: none"> - Improvement of the existing functional facilities: 24,400 ha - Rehabilitation of the existing non-functional facilities: 6,700 ha - New development: 23,400 ha - Weirs to be rehabilitated: 8 nos. - New weirs: 1 no. - New reservoirs: 11 nos. - Resettlement: 713 households 	
3.	Domestic and Industrial Water Supply Plan	<ul style="list-style-type: none"> - Urban and rural domestic water supply, - Industrial zones and rural industrial water supply 	<ul style="list-style-type: none"> - Urban domestic water supply: 72,459 m³/day - Rural domestic water supply: 35,815 m³/day - Industrial zones water supply: 108,500 m³/day - Rural industrial water supply: 146,067 m³/day - Water Supply for Paper Mill in An Nhon: 100,000 m³/day 	US\$307.8 mil. Remarks 1)

Note. The planned Thuan Phong irrigation scheme (700 ha) with reservoir in south La Thin is specially considered as a new development project besides the above-mentioned agricultural development plan because of serious water shortage in the area.

Table 8.8 Summary of Integrated River Basin Management Plan for the Kone River Basin (2/3)

	Sub-project	Major Functions	Principal Feature	Financial Cost (including VAT) /EIRR
4.	Flood Control and Bank Erosion Protection Plan			US\$112.2 mil.
4.1	Thi Nai Swamp Improvement Work	- Increase of discharge carrying capacity to 627 to 1,743 m ³ /s for flood control of the objective 5 % probable late flood together with the Dinh Binh Dam	- Construction/heightening of sea dyke: 7.8 km - Construction/improvement of drainage sluice: 21 nos. - Construction of sea dyke spillway: 12 sites	
4.2	Dap Da River Improvement Work	- Increase of discharge carrying capacity to 597 to 627 m ³ /s for flood control of the objective 5 % probable late flood together with the Dinh Binh Dam	- Construction/ heightening of flood control dyke: 28.9 km - Excavation of river channel: 28.9 km - Construction of side overflow weir: 2 sites - Construction of flood diversion groyne: 5 nos. - Construction/improvement of bridges: 4 nos. - Construction/improvement of drainage sluice: 21 nos. - Construction of flood diversion sluice: 1 no. - Construction/ improvement of bank protection work: 9.7 km - Resettlement: 88 households	
4.3	Nam Yang River Improvement Work	- Increase of discharge carrying capacity to 20 m ³ /s for flood control of the objective 5% probable late flood together with the Dinh Binh Dam	- Construction/heightening of flood control dyke : 15.9m - Excavation of river channel: 15.9 km - Construction/improvement of drainage sluice: 1 no - Construction/improvement of bank protection works: 5.3 km	
4.4	Go Cham River Improvement Works	- Increase of discharge carrying capacity to 209 m ³ /s for flood control of the objective 5% probable late flood together with the Dinh Binh Dam	- Construction/heightening of flood control dyke : 25.8 km - Excavation of river channel: 25.8 km - Construction of side overflow weir: 2 sites - Construction of flood diversion weir: 1 no. - Construction/improvement of bank protection works: 8.7 km - Resettlement: 58 households	
4.5	Tan An River Improvement Work	- Increase of discharge carrying capacity to 837 m ³ /s ~ 1,077 m ³ /s for flood control of the objective 5% probable late flood together with the Dinh Binh Dam	- Construction/heightening of flood control dyke : 28.6 km - Excavation of river channel: 28.6 km - Construction of side overflow weir: 3 sites - Construction/improvement of drainage sluice: 10 nos - Construction of flood diversion sluice: 1 no. - Construction/improvement of bank protection works: 9.6 km - Resettlement: 102 households	
4.6	Cay May River Improvement Works	- Increase of discharge carrying capacity to 50 m ³ /s for flood control of the objective 5% probable late flood together with the Dinh Binh Dam	- Construction/heightening of flood control dyke : km: 8.5 km - Excavation of river channel: 8.5 km - Construction/improvement of bank protection works: 2.8 km	

Table 8.8 Summary of Integrated River Basin Management Plan for the Kone River Basin (3/3)

Sub-project	Major Functions	Principal Feature	Financial Cost (including VAT) /EIRR
5. Rural development Plan			
5.1 Rural Roads Development Plan	- Inter commune and in-commune transportation	- Road length: 735 km	- Remarks 1)
5.2 Rural Electrification	- Access to the national grid or other sources	- Coverage: 95 % of households 100% of communes	- Remarks 1)
5.3 Rural domestic Water Supply	- Access to fresh water	- Coverage: 50 % connection to piped-system	- Remarks 2)
6. Water Resources Management Plan			Remarks 1)
6.1 Water Use Management Plan	- Proper management of water demand - Latest information management of water resources including river flow and reservoir's storage - Proper water allotment in drought year	- Management of current water demand and water supply - Preparation of annual water use plan prior to the dry season - Preparation of water demand restriction plan prior to the drought season	
6.2 Flood Control Management Plan	- Mitigation of flood damage - River basin conservation	- Flood warning and communication system - Reforestation for watershed conservation - Preparation and disclosure of hazard map	US\$4.0 mil. Remarks 1)
6.3 River Environment Management Plan	- Management of river maintenance flow - Water quality control - Thi Nai swamp monitoring	- Proper water distribution between respective water demands and river maintenance flow requirement. - Establishment of regular monitoring of river water quality as well as proposed reservoirs including Dinh Binh Dam and Van Phong Weir.	
6.4 Dam Operation Management	- Integrated operation of the existing and proposed dams including Vinh Son Dam, Dinh Binh Dam and Nui Mot Dam - Warning and communication system of dam water release	- Integrated reservoir operation for effective water supply including Vinh Son, Dinh Binh and Nui Mot Dams. - Warning dissemination of dam water release	US\$0.5 mil. Remarks 1)
6.5 Administrative Management Plan	- Establishment of the Kone River Basin Management Authority - Committees will act as task force under the authority to carry out activities: - Water use management - Flood control management - River environment management - Dam operation management	- Establishment of water use management committee with DARD as coordinating agency - Establishment of flood control and warning committee that will take over tasks of the existing provincial committee. DARD will act as coordinating agency. - Establishment of River Environment Management Committee with DOSTE as coordinating agency.	
TOTAL COST /EIRR			US\$720.5 million /15.1 %

Remarks 1) : This cost is not considered in the cost estimate for the Integrated River Basin Management Plan.

2) : This cost was taken into account in the rural domestic water supply plan.

Table 9.1 Proposed Major Irrigation Dams

No.	Name	River Basin	River	Storage Volume (MCM)		Catchment Area (km ²)	Dam Type	Dam Volume (m ³)	Dam Height (m)	Dam Crest Length (m)	Remarks
				Gross	Effective						
1	Dong Sim	Kone	Dong Sim	11.50	11.00	35.00	Earth	135,400	16.0	570	Crest width=6.0m
2	Phu Tai	Ha Thanh	Suoi Chinh	10.70	10.00	30.20	Earth	284,600	23.0	600	
3	Suoi Chiep	Ha Thanh	Suoi Chiep	8.00	7.40	23.00	Earth	88,400	15.0	420	
4	Nui Thap	Kone		2.15	2.00	8.00	Earth	134,300	15.5	600	
5	Ha Nhe	Kone	Ha Nhe	2.00	1.60	11.00	Earth	90,700	18.5	290	
6	Suoi Chinh	Ha Thanh		2.00	1.90	6.00	Earth	58,300	12.5	390	
7	Suoi But	Ha Thanh		3.60	3.30	16.00	Earth	108,600	14.5	550	
8	Vinh Thanh	Kone		0.80	0.70	10.00	Earth	55,400	12.0	400	
9	Tien Long	Kone				6.00	Earth	49,500	11.0	420	
10	Suoi Ca	Kone				20.00	Earth	83,200	14.0	450	
11	Tien Thuan	Kone				3.00	Earth	34,700	10.0	350	

**Table 9.2 Summary of Disbursement Schedule for Kone River Basin
Alternative II-1 & II-2**

Unit: Million VND, Million US\$

Description	Total	Year																		
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. Dinh Binh Reservoir Project																				
(1) Direct Construction Cost	722,854				38,588	38,588	142,392	103,038	113,660	145,270	141,316									
(2) Indirect Construction Cost	697,309		47,268	49,584	78,803	52,619	79,772	69,504	83,938	115,517	120,304									
Sub-total	1,420,163		47,268	49,584	117,392	91,207	222,164	172,542	197,598	260,787	261,620									
Equivalent to US\$	94.3		3.1	3.3	7.8	6.1	14.7	11.5	13.1	17.3	17.4									
(3) VAT	56,972		0	0	2,972	3,034	10,098	7,843	9,006	11,878	12,141									
Equivalent to US\$	4.0		0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0									
Total	1,477,135		47,268	49,584	120,363	94,241	232,262	180,385	206,604	272,665	273,761									
Equivalent to US\$	98.0		3.1	3.3	8.0	6.3	15.4	12.0	13.7	18.1	18.2									
2. Flood Control Project																				
(1) Direct Construction Cost	699,931											216,696	215,892	117,018	76,641	73,684				
(2) Indirect Construction Cost	918,595							16,324	16,772	36,541	28,016	209,452	229,567	147,708	114,284	119,930				
Sub-total	1,618,525							16,324	16,772	36,541	28,016	426,148	445,459	264,725	190,925	193,615				
Equivalent to US\$	107.4							1.1	1.1	2.4	1.9	28.3	29.6	17.6	12.7	12.8				
(3) VAT	71,520							183	176	1,046	984	19,370	20,248	12,033	8,678	8,801				
Equivalent to US\$	4.7							0.0	0.0	0.1	0.1	1.3	1.3	0.8	0.6	0.6				
Total	1,690,045							16,507	16,948	37,587	29,000	445,518	465,707	276,758	199,603	202,415				
Equivalent to US\$	112.2							1.1	1.1	2.5	1.9	29.6	30.9	18.4	13.2	13.4				
3. Irrigation and Drainage Facilities																				
(1) Direct Construction Cost	1,472,538						329,915	284,446	287,740	194,322	205,820	21,048	21,048	21,048	21,048	21,048	21,048	21,048	21,048	22,961
(2) Indirect Construction Cost	1,451,320		31,148	32,674	47,358	31,951	172,050	172,206	196,601	155,698	181,758	41,520	44,586	47,802	51,176	54,715	58,427	62,321	69,329	69,329
Sub-total	2,923,858		31,148	32,674	47,358	31,951	501,965	456,652	484,340	350,020	387,578	62,568	65,634	68,850	72,224	75,763	79,475	83,369	92,290	92,290
Equivalent to US\$	194.0		2.1	2.2	3.1	2.1	33.3	30.3	32.1	23.2	25.7	4.2	4.4	4.6	4.8	5.0	5.3	5.5	6.1	6.1
(3) VAT	128,263		151	158	760	798	22,817	20,757	22,015	15,910	17,617	2,844	2,983	3,130	3,283	3,444	3,612	3,790	4,195	4,195
Equivalent to US\$	8.5		0.0	0.0	0.1	0.1	1.5	1.4	1.5	1.1	1.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
Total	3,052,121		31,298	32,832	48,118	32,749	524,781	477,409	506,356	365,930	405,195	65,412	68,617	71,980	75,507	79,206	83,087	87,159	96,485	96,485
Equivalent to US\$	202.6		2.1	2.2	3.2	2.2	34.8	31.7	33.6	24.3	26.9	4.3	4.6	4.8	5.0	5.3	5.5	5.8	6.4	6.4
4. Domestic and Industrial water Supply																				
(1) Direct Construction Cost	2,001,996						69,177	385,732	385,732	39,849	39,849	39,849	39,849	39,849	39,849	39,849	109,026	385,732	387,652	387,652
(2) Indirect Construction Cost	2,433,851				14,374	27,644	61,214	237,758	268,309	27,571	30,875	34,341	37,976	41,789	68,981	94,587	195,589	620,237	672,606	672,606
Sub-total	4,435,847				14,374	27,644	130,390	623,490	654,041	67,421	70,724	74,190	77,825	81,639	108,831	134,437	304,615	1,005,968	1,060,258	1,060,258
Equivalent to US\$	294.4				1.0	1.8	8.7	41.4	43.4	4.5	4.7	4.9	5.2	5.4	7.2	8.9	20.2	66.8	70.4	70.4
(3) VAT	201,629				653	1,257	5,927	28,340	29,729	3,065	3,215	3,372	3,538	3,711	4,947	6,111	13,846	45,726	48,194	48,194
Equivalent to US\$	13.4				0.0	0.1	0.4	1.9	2.0	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.9	3.0	3.0	3.2
Total	4,637,477				15,027	28,900	136,317	651,830	683,770	70,485	73,939	77,562	81,363	85,350	113,778	140,548	318,461	1,051,694	1,108,452	1,108,452
Equivalent to US\$	307.8				1.0	1.9	9.0	43.3	45.4	4.7	4.9	5.1	5.4	5.7	7.6	9.3	21.1	69.8	73.6	73.6
5. Total																				
(1) Direct Construction Cost	4,897,319		0	0	38,588	38,588	541,484	773,216	787,132	379,441	386,985	277,593	276,789	177,915	137,538	134,581	130,074	406,780	410,613	410,613
(2) Indirect Construction Cost	5,501,075		78,416	82,258	140,535	112,214	313,036	495,792	565,620	335,327	360,953	285,313	312,129	237,299	234,441	269,232	254,016	682,558	741,935	741,935
Sub-total of 1 to 4	10,398,393		78,416	82,258	179,124	150,802	854,519	1,269,008	1,352,751	714,769	747,938	562,906	588,918	415,214	371,980	403,815	384,090	1,089,337	1,152,548	1,152,548
Equivalent to US\$	690.1		5.2	5.5	11.9	10.0	56.7	84.2	89.8	47.4	49.6	37.4	39.1	27.6	24.7	26.8	25.5	72.3	76.5	76.5
(3) VAT of 1 to 4	458,384		151	158	4,385	5,089	38,842	57,123	60,926	31,899	33,957	25,586	26,769	18,874	16,908	18,356	17,458	49,516	52,389	52,389
Equivalent to US\$	30.4		0.0	0.0	0.3	0.3	2.6	3.8	4.0	2.1	2.3	1.7	1.8	1.3	1.1	1.2	1.2	3.3	3.5	3.5
Total of 1 to 4	10,856,777		78,567	82,416	183,509	155,891	893,361	1,326,131	1,413,677	746,668	781,895	588,492	615,687	434,088	388,888	422,171	401,548	1,138,853	1,204,937	1,204,937
Equivalent to US\$	720.5		5.2	5.5	12.2	10.3	59.3	88.0	93.8	49.6	51.9	39.1	40.9	28.8	25.8	28.0	26.6	75.6	80.0	80.0

Table 10.1 Results of Economic Analysis of Alternatives

(1/3)

Alternative	Feature of Alternative	EIRR	B/C	NPV (US\$ m)	W/S requirement
I.	Including La Tinh River Basin				
I-1	With Dam				
A	Without New Sea Dyke Spillway				
I-1.1A	- Effective storage of dam: 209.9 MCM, - Hydropower generation: 36.5 GWh/year, - Flood control capacity of dam: 221.7 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely, but can not keep safety of dike up to 10 % major flood even with flood control effect of dam.	15.1%	1.52	90.1	Not satisfy
I-1.2A	- Effective storage of dam: 209.9 MCM, - Hydropower generation: 42.0 GWh/year, - Flood control capacity of dam: 121.2 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement with side overflow spillway, but safety level is lower than 5% late flood and can not keep safety of dike up to 10 % major flood even with flood control effect of dam	14.6%	1.46	80.2	Not satisfy
I-1.3A	- Effective storage of dam: 279.5 MCM, - Hydropower generation: 37.8 GWh/year, - Flood control capacity of dam: 292.8 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely and to keep safety of dike up to 10 % major flood by side overflow spillway in combination with flood control effect of the dam.	15.0%	1.51	91.9	Satisfy
I-1.4A	- Effective storage of dam: 279.5 MCM, - Hydropower generation: 44.6 GWh/year, - Flood control capacity of dam: 192.8 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement with side overflow spillway, but safety level is lower than 5% late flood and can not keep safety of dike up to 10 % major flood even with flood control effect of dam	14.7%	1.48	84.9	Satisfy
I-1.5A	- Effective storage of dam: 360.2 MCM, - Hydropower generation: 37.2 GWh/year, - Flood control capacity of dam: 375.5 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely and to keep safety of dike up to 10 % major flood by side overflow spillway in combination with flood control effect of the dam.	14.8%	1.50	91.3	Satisfy
I-1.6A	- Effective storage of dam: 360.2 MCM, - Hydropower generation: 44.7 GWh/year, - Flood control capacity of dam: 275.5 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, and - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely, but can not keep safety of dike up to 10 % major flood even with flood control effect of dam.	14.6%	1.48	87.1	Satisfy
B	With New Sea Dyke Spillway				
I-1.1B	- Effective storage of dam: 209.9 MCM, - Hydropower generation: 36.5 GWh/year, - Flood control capacity of dam: 221.7 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely, but can not keep safety of dike up to 10 % major flood even with flood control effect of dam.	15.2%	1.52	91.2	Not satisfy
I-1.2B	- Effective storage of dam: 209.9 MCM, - Hydropower generation: 42.0 GWh/year, - Flood control capacity of dam: 121.2 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement with side overflow spillway, but safety level is lower than 5% late flood and can not keep safety of dike up to 10 % major flood even with flood control effect of dam	14.7%	1.47	82.4	Not satisfy

Table 10.1 Results of Economic Analysis of Alternatives

(2/3)

Alternative	Feature of Alternative	EIRR	B/C	NPV (US\$ m)	W/S requirement
I-1.3B	- Effective storage of dam: 279.5 MCM, - Hydropower generation: 37.8 GWh/year, - Flood control capacity of dam: 292.8 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely and to keep safety of dike up to 10 % major flood by side overflow spillway in combination with flood control effect of the dam.	15.1%	1.52	92.4	Satisfy
I-1.4B	- Effective storage of dam: 279.5 MCM, - Hydropower generation: 44.6 GWh/year, - Flood control capacity of dam: 192.8 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement with side overflow spillway, but safety level is lower than 5% late flood and can not keep safety of dike up to 10 % major flood even with flood control effect of dam	14.8%	1.48	86.3	Satisfy
I-1.5B	- Effective storage of dam: 360.2 MCM, - Hydropower generation: 37.2 GWh/year, - Flood control capacity of dam: 375.5 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely and to keep safety of dike up to 10 % major flood by side overflow spillway in combination with flood control effect of the dam.	14.9%	1.50	91.7	Satisfy
I-1.6B	- Effective storage of dam: 360.2 MCM, - Hydropower generation: 44.7 GWh/year, - Flood control capacity of dam: 275.5 MCM, - Irrigation: 54,500 ha with livestock, aquaculture, and - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely, but can not keep safety of dike up to 10 % major flood even with flood control effect of dam.	14.7%	1.48	88.0	Satisfy
I-2	Without Dam				
I-2	- Domestic and industrial water supply: 448,000m3/day (2020) and - River improvement with side overflow spillway, but safety level is lower than 5% late flood and can not keep safety of dike up to 10 % major flood.	-	-	-	Satisfy for domestic & industrial water supply
II.	Excluding La Tinh River Basin				
II-1	With Dam				
A	Without New Sea Dyke Spillway				
II-1.1A	- Effective storage of dam: 209.9 MCM, - Hydropower generation: 36.5 GWh/year, - Flood control capacity of dam: 221.7 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely, but can not keep safety of dike up to 10 % major flood even with flood control effect of dam.	14.9%	1.50	83.6	Not satisfy
II-1.2A	- Effective storage of dam: 209.9 MCM, - Hydropower generation: 42.0 GWh/year, - Flood control capacity of dam: 121.2 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement with side overflow spillway, but safety level is lower than 5% late flood and can not keep safety of dike up to 10 % major flood even with flood control effect of dam	14.4%	1.44	73.7	Not satisfy
II-1.3A	- Effective storage of dam: 279.5 MCM, - Hydropower generation: 37.8 GWh/year, - Flood control capacity of dam: 292.8 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely and to keep safety of dike up to 10 % major flood by side overflow spillway in combination with flood control effect of the dam.	14.8%	1.49	85.4	Satisfy
II-1.4A	- Effective storage of dam: 279.5 MCM, - Hydropower generation: 44.6 GWh/year, - Flood control capacity of dam: 192.8 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement with side overflow spillway, but safety level is lower than 5% late flood and can not keep safety of dike up to 10 % major flood even with flood control effect of dam	14.5%	1.45	78.4	Satisfy

Table 10.1 Results of Economic Analysis of Alternatives

(3/3)

Alternative	Feature of Alternative	EIRR	B/C	NPV (US\$ m)	W/S requirement
II-1.5A	- Effective storage of dam: 360.2 MCM, - Hydropower generation: 37.2 GWh/year, - Flood control capacity of dam: 375.5 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely and to keep safety of dike up to 10 % major flood by side overflow spillway in combination with flood control effect of the dam.	14.6%	1.48	84.8	Satisfy
II-1.6A	- Effective storage of dam: 360.2 MCM, - Hydropower generation: 44.7 GWh/year, - Flood control capacity of dam: 275.5 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, and - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely, but can not keep safety of dike up to 10 % major flood even with flood control effect of dam.	14.4%	1.45	80.7	Satisfy
B	With New Sea Dyke Spillway				
II-1.1B	- Effective storage of dam: 209.9 MCM, - Hydropower generation: 36.5 GWh/year, - Flood control capacity of dam: 221.7 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely, but can not keep safety of dike up to 10 % major flood even with flood control effect of dam.	15.0%	1.50	84.8	Not satisfy
II-1.2B	- Effective storage of dam: 209.9 MCM, - Hydropower generation: 42.0 GWh/year, - Flood control capacity of dam: 121.2 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement with side overflow spillway, but safety level is lower than 5% late flood and can not keep safety of dike up to 10 % major flood even with flood control effect of dam	14.5%	1.45	75.9	Not satisfy
II-1.3B	- Effective storage of dam: 279.5 MCM, - Hydropower generation: 37.8 GWh/year, - Flood control capacity of dam: 292.8 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely and to keep safety of dike up to 10 % major flood by side overflow spillway in combination with flood control effect of the dam.	14.9%	1.50	85.9	Satisfy
II-1.4B	- Effective storage of dam: 279.5 MCM, - Hydropower generation: 44.6 GWh/year, - Flood control capacity of dam: 192.8 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement with side overflow spillway, but safety level is lower than 5% late flood and can not keep safety of dike up to 10 % major flood even with flood control effect of dam	14.6%	1.46	79.8	Satisfy
II-1.5B	- Effective storage of dam: 360.2 MCM, - Hydropower generation: 37.2 GWh/year, - Flood control capacity of dam: 375.5 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely and to keep safety of dike up to 10 % major flood by side overflow spillway in combination with flood control effect of the dam.	14.7%	1.48	85.2	Satisfy
II-1.6B	- Effective storage of dam: 360.2 MCM, - Hydropower generation: 44.7 GWh/year, - Flood control capacity of dam: 275.5 MCM, - Irrigation: 48,200 ha with livestock, aquaculture, and - Domestic and industrial water supply: 448,000m3/day (2020), and - River improvement to discharge 5% late flood safely, but can not keep safety of dike up to 10 % major flood even with flood control effect of dam.	14.5%	1.46	81.5	Satisfy
II-2	Without Dam				
II-2	- Domestic and industrial water supply: 448,000m3/day (2020) and - River improvement with side overflow spillway, but safety level is lower than 5% late flood and can not keep safety of dike up to 10 % major flood.	-	-	-	Satisfy for domestic & industrial water supply

Note: Applied discount rate for calculation of B/C ratio and NPV: 10%
NPV: Net Present Value

**Table 12.1 Work Quantity and Direct Construction Cost
for Alternative Damsites and Dam Types**

No.	Work item	Case	Work Quantity			
			(1)	(2)	(3)	(4)
			I		II	
			Concrete EL 100.3m 6gated spillway	Rockfill EL 101.3m 6gated spillway	Concrete EL 100.9m 6gated spillway	Rockfill EL 101.9m 6gated spillway
		Unit				
1.	Excavation Common Common	m3	848,670	3,341,300	789,600	2,933,750
2.	Excavation Strongly weathered Rock	m3	1,400	1,400	96,820	1,400
3.	Excavation Moderately weathered Rock	m3	68,250	921,390	29,700	1,116,330
4.	Excavation Slightly weathered Rock	m3	9,830	1,046,350	99,080	1,224,190
5.	Excavation Rock Underground excavation	m3	0	37,460	0	27,610
6.	Embankment Common	m3	24,960	147,440	57,120	114,310
7.	Embankment Selected	m3	450	0	17,240	0
8.	Core	m3	0	1,945,230	0	2,961,700
9.	Rock Coarse	m3	0	314,690	0	557,180
10.	Rock Fine	m3	0	144,790	1,330	270,570
11.	Lining concrete BTCTM300	m3	0	103,730	0	76,460
12.	Structure concrete M250	m3	6,700	94,850	6,700	114,020
13.	Structure concrete M200	m3	117,767	101,690	156,850	101,070
14.	Structure concrete M150	m3	413,069	35,160	560,270	42,810
15.	Lean concrete M100	m3	3,220	9,180	1,560	9,680
16.	Mortal concrete M100	m3	2,420	42,210	2,420	31,750
17.	Mortal concrete M75	m3	240	240	240	240
18.	Boring D63mm	m	5,710	10,190	8,700	18,050
19.	Boring D32mm	m	0	23,610	0	14,510
20.	Grouting	m	5,710	33,800	8,700	0
21.	Grouting Cement	kg	335,630	394,620	722,740	698,680
22.	Anchor bar D18mm	kg	0	47,170	0	28,990
23.	Dry riprap	m3	4,960	2,700	300	2,700
24.	Site clearance	m2	1,790	243,830	0	310,080

Direct Construction Cost

No.	Work item	unit price	Unit	(1)	(2)	(3)	(4)
				Site I		Site II	
				Concrete EL 100.3m Million VND	Rockfill EL 101.3m Million VND	Concrete EL 100.9m Million VND	Rockfill EL 101.9m Million VND
1.	Excavation Common	16,882	m3	14,327	56,408	13,330	49,528
2.	Excavation Strongly weathered Rock	20,925	m3	29	29	2,026	29
3.	Excavation Moderately weathered Rock	43,984	m3	3,002	40,526	1,306	49,101
4.	Excavation Slightly weathered Rock	108,836	m3	1,070	113,881	10,783	133,236
5.	Excavation Rock Underground excavation	1,159,663	m3	0	43,441	0	32,018
6.	Embankment Common	15,199	m3	379	2,241	868	1,737
7.	Embankment Selected	17,073	m3	8	0	294	0
8.	Core	43,673	m3	0	84,954	0	129,346
9.	Rock Coarse	19,610	m3	0	6,171	0	10,926
10.	Rock Fine	133,520	m3	0	19,332	178	36,127
11.	Lining concrete BTCTM300	2,152,266	m3	0	223,255	0	164,562
12.	Structure concrete M250	1,191,739	m3	7,985	113,036	7,985	135,882
13.	Structure concrete M200	1,105,242	m3	130,161	112,392	173,357	111,707
14.	Structure concrete M150	545,364	m3	225,273	19,175	305,551	23,347
15.	Lean concrete M100	488,177	m3	1,572	4,481	762	4,726
16.	Mortal concrete M100	340,200	m3	823	14,360	823	10,801
17.	Mortal concrete M75	352,296	m3	85	85	85	85
18.	Boring D63mm	783,379	m	4,473	7,983	6,815	14,140
19.	Boring D32mm	489,891	m	0	11,566	0	7,108
20.	Grouting	364,472	m	2,081	12,319	3,171	0
21.	Grouting Cement	930	kg	312	367	672	650
22.	Anchor bar D18mm	5,469	kg	0	258	0	159
23.	Dry riprap	152,382	m3	756	411	46	411
24.	Site clearance	3,639	m2	7	887	0	1,128
	Total			392,342	887,559	528,052	916,754

Table 12.2 Natural 10-day Runoff at Dinh Binh Dam Site (Mm3)

Natural 10-day Runoff at Dinh Binh (generated) in Mm3																									
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Jan1		56.7	26.7	23.4	46.6	60.9	10.4	30.7	53.6	52.9	78.1	39.2	24.3	16.9	41.9	44.0	29.8	60.5	22.0	48.9	99.9	30.3	127.2	90.2	62.8
Jan2		45.4	20.5	19.2	38.0	50.7	8.6	25.1	42.7	42.9	60.7	32.0	19.4	13.9	34.2	38.0	24.5	48.7	17.9	39.2	80.5	25.2	104.9	74.0	49.0
Jan3		34.1	18.2	17.4	34.2	44.9	8.0	22.5	37.8	38.1	54.0	28.6	17.4	12.7	30.8	35.2	22.0	43.1	16.1	34.4	71.3	23.5	96.4	84.7	41.9
Feb1		26.0	13.7	12.9	25.4	33.7	6.2	16.8	27.9	28.3	39.5	21.3	13.2	9.5	23.1	24.7	16.6	32.1	13.1	26.2	52.5	17.1	60.7	61.0	31.1
Feb2		21.0	11.5	10.8	21.2	27.8	5.4	14.1	23.1	23.5	32.5	17.9	11.1	8.0	19.8	20.5	14.0	26.0	10.2	21.2	43.2	14.4	49.6	48.0	26.0
Feb3		14.4	7.9	8.4	14.6	19.1	3.8	10.8	15.6	16.0	22.3	13.7	7.7	5.6	16.1	15.5	9.7	17.6	7.1	16.1	29.3	10.0	36.4	36.2	17.5
Mar1		15.5	8.6	8.1	15.8	20.6	4.3	10.3	16.7	17.2	24.6	13.1	8.4	6.1	15.7	14.7	10.6	18.8	7.7	15.3	31.3	10.9	44.7	33.8	19.1
Mar2		13.2	7.4	7.0	13.6	17.8	3.8	8.9	14.2	14.6	20.3	11.2	7.6	5.3	14.6	12.5	9.2	15.8	6.7	13.1	26.4	9.5	34.7	28.5	16.6
Mar3		12.3	7.0	6.6	12.9	16.8	3.7	8.5	13.5	13.7	18.9	10.7	7.6	5.1	14.8	11.7	8.8	16.7	6.4	12.3	24.6	9.3	31.5	26.5	16.4
Apr1		9.7	5.6	5.3	10.3	13.4	3.0	6.7	10.4	10.8	14.6	8.5	5.7	4.1	14.7	9.9	7.0	13.2	5.1	9.8	19.2	7.4	24.0	20.5	12.3
Apr2		9.4	5.0	4.7	9.0	12.1	2.8	6.0	9.0	9.5	13.1	7.5	5.1	3.6	11.5	8.9	6.3	11.7	4.7	8.5	16.8	6.5	21.5	18.8	10.7
Apr3		9.1	4.5	4.3	8.2	10.5	2.6	5.3	8.3	8.4	11.2	6.7	4.6	3.3	10.5	8.1	5.7	10.1	4.1	7.6	14.7	6.1	21.6	16.1	9.6
May1		8.9	4.6	3.9	7.8	9.6	2.7	4.8	8.1	7.5	9.9	6.0	4.8	3.0	9.5	6.8	5.1	8.7	3.8	7.0	13.1	5.6	23.9	14.1	8.6
May2		14.2	6.5	3.9	16.1	8.6	3.0	4.4	6.6	7.6	8.8	5.5	4.3	2.7	8.8	6.1	4.7	8.7	3.6	15.7	12.3	5.2	19.5	14.8	9.9
May3		13.2	12.1	23.8	28.2	8.6	2.5	5.2	6.5	8.8	8.7	5.5	5.7	9.1	9.1	6.4	5.4	16.5	5.5	22.3	22.4	7.1	20.8	18.2	8.8
Jun1		9.2	11.0	18.7	41.0	7.2	3.0	4.9	5.6	6.7	8.2	5.1	5.3	8.6	6.8	5.0	4.0	12.4	5.0	16.4	19.7	5.0	15.2	17.1	10.0
Jun2		10.4	12.3	13.2	51.6	10.9	5.2	9.7	5.2	6.0	8.8	4.5	4.8	10.1	6.2	5.2	3.7	10.1	6.1	18.3	16.0	4.5	16.6	19.7	7.5
Jun3		8.6	23.1	14.1	44.2	8.8	8.1	7.5	4.6	5.4	7.2	4.4	5.8	9.7	5.6	5.1	3.7	9.5	6.5	16.7	13.8	6.4	14.8	25.7	6.8
Jul1		13.2	14.2	9.6	25.0	8.0	5.4	8.0	4.2	4.9	6.4	3.9	5.9	7.4	5.2	4.2	4.1	8.6	10.9	16.1	12.0	18.3	13.4	23.4	6.0
Jul2		13.0	11.6	7.9	28.4	8.1	4.8	6.7	3.9	4.5	6.0	3.6	5.6	6.2	5.0	3.9	3.4	7.1	12.0	13.6	12.8	14.5	13.1	19.6	5.5
Jul3		13.7	10.7	8.9	25.9	7.1	4.2	7.1	3.9	4.8	6.1	3.6	7.3	5.7	4.7	5.8	3.9	6.8	9.3	11.0	11.9	13.0	12.9	18.9	5.4
Aug1		9.2	8.3	6.5	18.8	5.8	6.3	5.1	3.3	4.9	4.8	3.0	6.4	4.5	3.9	5.0	3.1	5.4	7.3	8.5	9.0	11.3	10.0	15.4	7.0
Aug2		7.9	6.7	5.4	16.6	5.3	7.1	4.4	3.1	4.3	4.6	2.8	10.7	4.9	3.6	5.7	2.8	4.8	5.9	7.3	8.1	8.8	9.2	13.9	11.0
Aug3		8.3	6.2	5.3	14.7	5.8	5.1	4.3	3.2	4.4	5.0	2.9	11.4	3.7	3.8	8.0	2.9	5.0	9.3	6.9	8.2	9.3	9.9	21.4	13.2
Sep1	13.1	7.3	5.2	7.5	11.5	8.1	5.9	4.2	3.3	3.8	9.2	2.5	15.4	7.7	3.4	5.7	3.4	30.1	12.3	6.0	6.8	7.5	11.2	15.9	8.3
Sep2	42.1	14.6	4.7	10.4	10.3	7.0	7.6	3.2	10.6	3.1	54.7	2.9	50.0	31.2	3.2	10.0	4.5	33.8	36.1	9.6	6.9	13.1	15.0	15.2	8.4
Sep3	227.5	18.4	7.5	34.3	15.7	11.3	11.0	4.8	47.5	4.2	35.4	16.7	38.8	18.2	6.7	15.6	6.9	21.5	17.6	17.8	88.4	33.8	18.4	14.5	11.6
Oct1	63.6	17.2	10.1	133.2	17.4	12.5	31.3	7.8	60.5	148.0	20.9	81.2	30.6	112.3	20.7	43.6	131.2	19.6	154.0	15.8	53.9	48.3	46.2	22.5	10.6
Oct2	95.8	14.2	112.7	82.6	187.1	21.5	93.2	152.4	138.3	49.6	16.9	243.0	30.3	463.4	15.5	66.3	59.7	36.8	97.3	69.2	35.9	42.1	122.9	69.6	29.0
Oct3	46.7	59.1	86.1	249.0	399.5	34.4	234.6	88.0	62.7	250.5	15.7	84.2	25.4	206.4	246.9	471.8	154.3	112.3	218.8	356.7	49.1	188.3	252.6	76.8	226.3
Nov1	249.9	149.0	34.8	339.8	325.4	58.3	160.3	199.6	172.1	120.2	196.5	122.3	22.5	113.7	70.7	144.4	48.0	41.2	243.5	280.8	256.7	96.3	473.5	34.1	99.8
Nov2	184.6	78.6	131.5	342.5	284.2	30.0	257.2	78.5	199.2	121.8	294.5	94.7	66.7	350.3	66.4	116.6	34.3	51.8	160.4	416.9	58.0	412.6	125.6	385.9	108.5
Nov3	71.8	38.8	66.1	123.4	128.0	20.4	83.4	207.6	229.8	86.8	201.5	58.9	50.9	149.8	246.8	68.5	167.8	79.9	95.9	329.6	46.2	421.3	151.8	150.7	45.9
Dec1	59.7	47.8	59.9	87.0	194.3	18.1	58.6	224.1	209.4	504.8	78.8	44.6	39.2	87.5	88.3	53.5	233.4	54.3	81.2	374.2	85.2	320.0	542.0	127.1	36.7
Dec2	46.2	39.1	39.9	79.2	139.2	15.7	49.2	78.2	83.8	110.4	61.5	40.7	27.9	66.0	138.1	41.9	231.1	43.1	84.7	225.4	53.7	295.3	246.8	101.2	84.3
Dec3	41.2	49.7	31.9	68.8	85.9	13.7	43.2	87.2	92.9	130.2	54.8	33.3	24.0	58.8	62.4	47.4	87.7	37.0	129.6	196.4	41.3	141.6	128.2	147.5	70.1

Table 12.3 (1) Summary of Dam Stability Analysis (Dam Crest Level: EL.95.3m)

Water Level Condition	Design Flood Water Level (FWL)								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Checking of Dam Stability									
1.Condition of "Middle Third"	**NG**	OK	OK	OK	OK	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σ_u)	**NG**	OK	OK	OK	OK	OK	OK	OK	OK
2)Stress at Downstream Edge(σ_d)	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Conditon of Safety for Sliding	OK	OK	OK	OK	OK	OK	OK	OK	OK

Water Level Condition	Surcharge Water Level (SWL)								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Checking of Dam Stability									
1.Condition of "Middle Third"	**NG**	**NG**	**NG**	OK	OK	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σ_u)	**NG**	**NG**	**NG**	OK	OK	OK	OK	OK	OK
2)Stress at Downstream Edge(σ_d)	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Conditon of Safety for Sliding	OK	OK	OK	OK	OK	OK	OK	OK	OK

Water Level Condition	Full Supply Level (FSL)								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Checking of Dam Stability									
1.Condition of "Middle Third"	**NG**	**NG**	**NG**	**NG**	**NG**	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σ_u)	**NG**	**NG**	**NG**	**NG**	**NG**	OK	OK	OK	OK
2)Stress at Downstream Edge(σ_d)	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Conditon of Safety for Sliding	OK	OK	OK	OK	OK	OK	OK	OK	OK

Water Level Condition	Reservoir Empty								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Checking of Dam Stability									
1.Condition of "Overturning"	OK	OK	OK	OK	OK	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σ_u)	OK	OK	OK	OK	OK	OK	OK	OK	OK
2)Stress at Downstream Edge(σ_d)	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Conditon of Safety for Sliding	OK	OK	OK	OK	OK	OK	OK	OK	OK

Note: NG: Not Satisfied

OK: Satisfied

Table 12.3 (2) Dam Stability Analysis (Dam Crest Level: EL.95.3m)

Water Level Condition	Design Flood Water Level (FWL)								
	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Down Stream Slope of Dam									
Resultant Acting Force									
Vertical $\sum V = (t)$	1,731	1,778	1,826	1,873	1,921	1,969	2,017	2,064	2,112
Horizontal $\sum H = (t)$	1,575	1,575	1,575	1,575	1,575	1,575	1,575	1,575	1,575
Moment $\sum M = (t \cdot m)$	43,820	44,877	45,963	47,080	48,227	49,404	50,611	51,849	53,116
Acting Point of Resultant Force $\sum M / \sum V (m)$	25.32	25.23	25.17	25.13	25.10	25.09	25.10	25.12	25.15
Checking of Dam Stability									
1. Condition of "Middle Third"									
1) Base Length (L(m))	36.96	38.02	39.07	40.13	41.18	42.24	43.30	44.35	45.41
2) Middle Third (L/6(m))	6.16	6.34	6.51	6.69	6.86	7.04	7.22	7.39	7.57
3) Eccentricity ($e = (L/2) - (\sum M / \sum V)(m)$)	-6.84	-6.23	-5.64	-5.07	-4.51	-3.97	-3.45	-2.94	-2.44
4) Condition of "Middle Third" ($ e < L/6$)	**NG**	OK	OK	OK	OK	OK	OK	OK	OK
2. Tensile Stress on the Foundation									
1) Stress at Upstream Edge (σ_u)	-5.14	0.81	6.28	11.32	15.99	20.30	24.31	28.03	31.50
Safety	**NG**	OK	OK	OK	OK	OK	OK	OK	OK
2) Stress at Downstream Edge (σ_d)	98.80	92.75	87.18	82.05	77.31	72.92	68.84	65.06	61.53
Safety	OK	OK	OK	OK	OK	OK	OK	OK	OK
3. Condition of Safety for Sliding									
1) Allowable Shearing Strength ($\tau (t/m^2)$)	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
2) Friction Coefficient (f)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
3) Safety for Sliding (SF > 4.0)	OK	OK	OK	OK	OK	OK	OK	OK	OK

Water Level Condition	Surcharge Water Level (SWL)								
	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Down Stream Slope of Dam									
Resultant Acting Force									
Vertical $\sum V = (t)$	1,974	2,028	2,083	2,138	2,192	2,247	2,302	2,357	2,412
Horizontal $\sum H = (t)$	1,789	1,792	1,796	1,800	1,804	1,808	1,812	1,816	1,819
Moment $\sum M = (t \cdot m)$	52,494	53,890	55,324	56,796	58,307	59,855	61,441	63,066	64,728
Acting Point of Resultant Force $\sum M / \sum V (m)$	26.60	26.57	26.56	26.57	26.60	26.64	26.69	26.76	26.84
Checking of Dam Stability									
1. Condition of "Middle Third"									
1) Base Length (L(m))	36.96	38.02	39.07	40.13	41.18	42.24	43.30	44.35	45.41
2) Middle Third (L/6(m))	6.16	6.34	6.51	6.69	6.86	7.04	7.22	7.39	7.57
3) Eccentricity ($e = (L/2) - (\sum M / \sum V)(m)$)	-8.12	-7.56	-7.02	-6.51	-6.00	-5.52	-5.04	-4.58	-4.13
4) Condition of "Middle Third" ($ e < L/6$)	**NG**	**NG**	**NG**	OK	OK	OK	OK	OK	OK
2. Tensile Stress on the Foundation									
1) Stress at Upstream Edge (σ_u)	-16.95	-10.31	-4.20	1.45	6.67	11.51	16.01	20.20	24.10
Safety	**NG**	**NG**	**NG**	OK	OK	OK	OK	OK	OK
2) Stress at Downstream Edge (σ_d)	123.76	117.02	110.82	105.09	99.79	94.88	90.32	86.08	82.13
Safety	OK	OK	OK	OK	OK	OK	OK	OK	OK
3. Condition of Safety for Sliding									
1) Allowable Shearing Strength ($\tau (t/m^2)$)	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
2) Friction Coefficient (f)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
3) Safety for Sliding (SF > 4.0)	OK	OK	OK	OK	OK	OK	OK	OK	OK

Note: NG: Not Satisfied

OK: Satisfied

Table 12.3 (3) Dam Stability Analysis (Dam Crest Level: EL.95.3m)

Water Level Condition	Full Supply Level (FSL)								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Resultant Acting Force									
Vertical $\sum V = (t)$	2,108	2,166	2,225	2,283	2,342	2,401	2,459	2,518	2,577
Horizontal $\sum H = (t)$	1,978	1,985	1,993	2,001	2,008	2,016	2,024	2,032	2,039
Moment $\sum M = (t \cdot m)$	58,371	59,982	61,635	63,331	65,070	66,851	68,675	70,541	72,449
Acting Point of Resultant Force $\sum M / \sum V (m)$	27.69	27.69	27.71	27.74	27.79	27.85	27.93	28.01	28.12
Checking of Dam Stability									
1. Condition of "Middle Third"									
1) Base Length (L(m))	36.96	38.02	39.07	40.13	41.18	42.24	43.30	44.35	45.41
2) Middle Third (L/6(m))	6.16	6.34	6.51	6.69	6.86	7.04	7.22	7.39	7.57
3) Eccentricity ($e = (L/2) - (\sum M / \sum V)(m)$)	-9.21	-8.68	-8.17	-7.67	-7.19	-6.73	-6.28	-5.84	-5.41
4) Condition of "Middle Third" ($ e < L/6$)	**NG**	**NG**	**NG**	**NG**	**NG**	OK	OK	OK	OK
2. Tensile Stress on the Foundation									
1) Stress at Upstream Edge (σ_u)	-28.27	-21.10	-14.49	-8.39	-2.73	2.51	7.39	11.93	16.17
Safety	**NG**	**NG**	**NG**	**NG**	**NG**	OK	OK	OK	OK
2) Stress at Downstream Edge (σ_d)	142.32	135.06	128.37	122.18	116.46	111.15	106.21	101.61	97.33
Safety	OK	OK	OK	OK	OK	OK	OK	OK	OK
3. Condition of Safety for Sliding									
1) Allowable Shearing Strength ($\tau (t/m^2)$)	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
2) Friction Coefficient (f)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
3) Safety for Sliding (SF > 4.0)	OK	OK	OK	OK	OK	OK	OK	OK	OK

Water Level Condition	Reservoir Empty								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Resultant Acting Force									
Vertical $\sum V = (t)$	2,344	2,408	2,472	2,536	2,601	2,665	2,729	2,794	2,858
Horizontal $\sum H = (t)$	-141	-144	-148	-152	-156	-160	-164	-168	-172
Moment $\sum M = (t \cdot m)$	25,862	27,429	29,042	30,701	32,407	34,159	35,956	37,801	39,691
Acting Point of Resultant Force $\sum M / \sum V (m)$	11.03	11.39	11.75	12.10	12.46	12.82	13.17	13.53	13.89
Checking of Dam Stability									
1. Condition of "Overturning"									
1) Base Length (L(m))	36.96	38.02	39.07	40.13	41.18	42.24	43.30	44.35	45.41
2) Middle Third (L/6(m))	6.16	6.34	6.51	6.69	6.86	7.04	7.22	7.39	7.57
3) Eccentricity ($e = (L/2) - (\sum M / \sum V)(m)$)	7.45	7.62	7.79	7.96	8.13	8.30	8.47	8.65	8.82
4) Condition of "Overturning" ($ e < L/2$)	OK	OK	OK	OK	OK	OK	OK	OK	OK
2. Tensile Stress on the Foundation									
1) Stress at Upstream Edge (σ_u)	140.06	139.48	138.94	138.43	137.95	137.50	137.08	136.68	136.30
Safety	OK	OK	OK	OK	OK	OK	OK	OK	OK
2) Stress at Downstream Edge (σ_d)	-13.24	-12.80	-12.40	-12.01	-11.65	-11.31	-10.99	-10.69	-10.40
Safety	OK	OK	OK	OK	OK	OK	OK	OK	OK
3. Condition of Safety for Sliding									
1) Allowable Shearing Strength ($\tau (t/m^2)$)	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
2) Friction Coefficient (f)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
3) Safety for Sliding (SF > 4.0)	OK	OK	OK	OK	OK	OK	OK	OK	OK

Note: NG: Not Satisfied
OK: Satisfied

Table 12.4 (1) Summary of Dam Stability Analysis (Dam Crest Level: EL.100.3m)

Water Level Condition	Design Flood Water Level (FWL)								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Checking of Dam Stability									
1.Condition of "Middle Third"	**NG**	OK	OK	OK	OK	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σ_u)	**NG**	OK	OK	OK	OK	OK	OK	OK	OK
2)Stress at Downstream Edge(σ_d)	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Conditon of Safety for Sliding	OK	OK	OK	OK	OK	OK	OK	OK	OK

Water Level Condition	Surcharge Water Level (SWL)								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Checking of Dam Stability									
1.Condition of "Middle Third"	**NG**	**NG**	**NG**	OK	OK	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σ_u)	**NG**	**NG**	**NG**	OK	OK	OK	OK	OK	OK
2)Stress at Downstream Edge(σ_d)	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Conditon of Safety for Sliding	OK	OK	OK	OK	OK	OK	OK	OK	OK

Water Level Condition	Full Supply Level (FSL)								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Checking of Dam Stability									
1.Condition of "Middle Third"	**NG**	**NG**	**NG**	**NG**	**NG**	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σ_u)	**NG**	**NG**	**NG**	**NG**	**NG**	OK	OK	OK	OK
2)Stress at Downstream Edge(σ_d)	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Conditon of Safety for Sliding	OK	OK	OK	OK	OK	OK	OK	OK	OK

Water Level Condition	Reservoir Empty								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Checking of Dam Stability									
1.Condition of "Overturning"	OK	OK	OK	OK	OK	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σ_u)	OK	OK	OK	OK	OK	OK	OK	OK	OK
2)Stress at Downstream Edge(σ_d)	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Conditon of Safety for Sliding	OK	OK	OK	OK	OK	OK	OK	OK	OK

Note: NG: Not Satisfied

OK: Satisfied

Table 12.4 (2) Dam Stability Analysis (Dam Crest Level: EL.100.3m)

Water Level Condition	Design Flood Water Level (FWL)								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Resultant Acting Force									
Vertical $\sum V = (t)$	2,107	2,165	2,223	2,282	2,340	2,399	2,457	2,516	2,575
Horizontal $\sum H = (t)$	1,848	1,848	1,848	1,848	1,848	1,848	1,848	1,848	1,848
Moment $\sum M = (t \cdot m)$	57,864	59,301	60,778	62,297	63,857	65,457	67,099	68,781	70,504
Acting Point of Resultant Force $\sum M / \sum V (m)$	27.47	27.39	27.34	27.30	27.29	27.29	27.31	27.34	27.38
Checking of Dam Stability									
1.Condition of "Middle Third"									
1)Base Length (L(m))	40.46	41.62	42.77	43.93	45.08	46.24	47.40	48.55	49.71
2)Middle Third (L/6(m))	6.74	6.94	7.13	7.32	7.51	7.71	7.90	8.09	8.28
3)Eccentricity (e=(L/2)-(ΣM/ΣM)(m))	-7.24	-6.58	-5.95	-5.34	-4.75	-4.17	-3.61	-3.06	-2.53
4)Condition of "Middle Third"(e < L/6)	**NG**	OK	OK	OK	OK	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σu)	-3.82	2.64	8.58	14.06	19.12	23.81	28.16	32.21	35.97
Safety	**NG**	OK	OK	OK	OK	OK	OK	OK	OK
2)Stress at Downstream Edge(σd)	107.95	101.40	95.38	89.82	84.69	79.94	75.53	71.43	67.62
Safety	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Condition of Safety for Sliding									
1)Allowable Shearing Strength(τ (t/m ²))	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
2)Friction Coefficient(f)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
3)Safety for Sliding(SF > 4.0)	OK	OK	OK	OK	OK	OK	OK	OK	OK

Water Level Condition	Surcharge Water Level (SWL)								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Resultant Acting Force									
Vertical $\sum V = (t)$	2,373	2,439	2,505	2,571	2,637	2,704	2,770	2,836	2,903
Horizontal $\sum H = (t)$	2,107	2,112	2,117	2,121	2,126	2,130	2,135	2,140	2,144
Moment $\sum M = (t \cdot m)$	68,784	70,636	72,538	74,491	76,494	78,548	80,652	82,806	85,011
Acting Point of Resultant Force $\sum M / \sum V (m)$	28.99	28.96	28.96	28.97	29.00	29.05	29.12	29.19	29.28
Checking of Dam Stability									
1.Condition of "Middle Third"									
1)Base Length (L(m))	40.46	41.62	42.77	43.93	45.08	46.24	47.40	48.55	49.71
2)Middle Third (L/6(m))	6.74	6.94	7.13	7.32	7.51	7.71	7.90	8.09	8.28
3)Eccentricity (e=(L/2)-(ΣM/ΣM)(m))	-8.76	-8.15	-7.57	-7.01	-6.46	-5.93	-5.42	-4.92	-4.43
4)Condition of "Middle Third"(e < L/6)	**NG**	**NG**	**NG**	OK	OK	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σu)	-17.51	-10.29	-3.63	2.51	8.20	13.47	18.36	22.92	27.17
Safety	**NG**	**NG**	**NG**	OK	OK	OK	OK	OK	OK
2)Stress at Downstream Edge(σd)	134.81	127.50	120.77	114.55	108.80	103.48	98.53	93.92	89.63
Safety	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Condition of Safety for Sliding									
1)Allowable Shearing Strength(τ (t/m ²))	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
2)Friction Coefficient(f)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
3)Safety for Sliding(SF > 4.0)	OK	OK	OK	OK	OK	OK	OK	OK	OK

Note: NG: Not Satisfied
OK: Satisfied

Table 12.4(3) Dam Stability Analysis (Dam Crest Level: EL.100.3m)

Water Level Condition	Full Supply Level (FSL)								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Resultant Acting Force									
Vertical $\sum V = (t)$	2,520	2,590	2,660	2,731	2,801	2,872	2,942	3,013	3,084
Horizontal $\sum H = (t)$	2,339	2,348	2,357	2,367	2,376	2,385	2,394	2,404	2,413
Moment $\sum M = (t \cdot m)$	76,329	78,447	80,621	82,850	85,135	87,476	89,872	92,324	94,832
Acting Point of Resultant Force $\sum M / \sum V (m)$	30.29	30.29	30.30	30.34	30.39	30.46	30.54	30.64	30.75
Checking of Dam Stability									
1.Condition of "Middle Third"									
1)Base Length (L(m))	40.46	41.62	42.77	43.93	45.08	46.24	47.40	48.55	49.71
2)Middle Third (L/6(m))	6.74	6.94	7.13	7.32	7.51	7.71	7.90	8.09	8.28
3)Eccentricity (e=(L/2)-(ΣM/ΣV)(m))	-10.06	-9.48	-8.92	-8.37	-7.85	-7.34	-6.84	-6.36	-5.90
4)Condition of "Middle Third"(e < L/6)	**NG**	**NG**	**NG**	**NG**	**NG**	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σu)	-30.65	-22.83	-15.61	-8.95	-2.77	2.96	8.29	13.25	17.88
Safety	**NG**	**NG**	**NG**	**NG**	**NG**	OK	OK	OK	OK
2)Stress at Downstream Edge(σd)	155.21	147.30	140.01	133.28	127.04	121.26	115.88	110.87	106.20
Safety	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Condition of Safety for Sliding									
1)Allowable Shearing Strength(τ (t/m ²))	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
2)Friction Coefficient(f)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
3)Safety for Sliding(SF> 4.0)	OK	OK	OK	OK	OK	OK	OK	OK	OK

Water Level Condition	Reservoir Empty								
Down Stream Slope of Dam	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86
Resultant Acting Force									
Vertical $\sum V = (t)$	2,799	2,876	2,953	3,030	3,107	3,185	3,262	3,340	3,417
Horizontal $\sum H = (t)$	-168	-173	-177	-182	-186	-191	-196	-200	-205
Moment $\sum M = (t \cdot m)$	33,901	35,957	38,074	40,252	42,490	44,789	47,148	49,567	52,048
Acting Point of Resultant Force $\sum M / \sum V (m)$	12.11	12.50	12.89	13.28	13.67	14.06	14.45	14.84	15.23
Checking of Dam Stability									
1.Condition of "Overturning"									
1)Base Length (L(m))	40.46	41.62	42.77	43.93	45.08	46.24	47.40	48.55	49.71
2)Middle Third (L/6(m))	6.74	6.94	7.13	7.32	7.51	7.71	7.90	8.09	8.28
3)Eccentricity (e=(L/2)-(ΣM/ΣV)(m))	8.12	8.30	8.49	8.68	8.87	9.06	9.25	9.43	9.62
4)Condition of "Overturning"(e < L/2)	OK	OK	OK	OK	OK	OK	OK	OK	OK
2.Tensile Stress on the Foundation									
1)Stress at Upstream Edge(σu)	152.43	151.83	151.28	150.76	150.28	149.82	149.39	148.98	148.60
Safety	OK	OK	OK	OK	OK	OK	OK	OK	OK
2)Stress at Downstream Edge(σd)	-14.09	-13.63	-13.20	-12.80	-12.42	-12.07	-11.73	-11.41	-11.11
Safety	OK	OK	OK	OK	OK	OK	OK	OK	OK
3.Condition of Safety for Sliding									
1)Allowable Shearing Strength(τ (t/m ²))	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
2)Friction Coefficient(f)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
3)Safety for Sliding(SF> 4.0)	OK	OK	OK	OK	OK	OK	OK	OK	OK

Note: NG: Not Satisfied

OK: Satisfied

Table 12.5 Result of Flood Routing (Dam crest level : EL. 95.3 m)

FWL.: EL. 93.31 m

SWL.: EL. 92.80 m

FSL. : EL. 91.93 m

Flood probability	Peak inflow discharge	Initial reservoir water level	Peak outflow discharge	Max. reservoir water level
(Year)	(m3/s)	(EL. in m)	(m3/s)	(EL. in m)
10 main	3,821	65.00	840	92.80
20 main	4,475	65.00	4,020	92.90
100 main	5,832	65.00	5,240	93.18
200 main	6,397	65.00	5,750	93.41
1,000 main	7,718	65.00	6,560	94.27
10,000 main	9,578	65.00	8,490	95.30
100 main	5,832	91.93	5,370	93.32
200 main	6,397	91.93	5,700	93.89
1,000 main	7,718	91.93	7,000	94.15
10,000 main	9,578	91.93	8,700	95.30

Table 12.6 Result of Flood Routing (Dam crest level : EL. 100.3 m)

FWL.: EL. 98.31 m

SWL.: EL. 97.80 m

FSL. : EL. 96.93 m

Flood probability	Peak inflow discharge	Initial reservoir water level	Peak outflow discharge	Max. reservoir water level
(Year)	(m3/s)	(EL. in m)	(m3/s)	(EL. in m)
10 main	3,821	65.00	450	97.80
20 main	4,475	65.00	3,613	97.98
100 main	5,832	65.00	5,240	98.19
200 main	6,397	65.00	5,750	98.40
1,000 main	7,718	65.00	6,560	98.91
10,000 main	9,578	65.00	8,140	100.21
100 main	5,832	96.93	5,380	98.32
200 main	6,397	96.93	5,820	98.59
1,000 main	7,718	96.93	6,970	99.29
10,000 main	9,578	96.93	8,640	100.30

Table12.7 Disbursement Schedule for Dinh Binh Multipurpose Reservoir
Dam Crest EL.. 100.3 m, Alternatives II-1 & II-2

Unit: Million VND, Million US\$

Description	Total(VND)			2003		2004		2005		2006		2007		2008		2009		2010		2011	
	F.C(VND)	L.C(VND)	Total(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)
1. Direct Construction Cost																					
1.1 General Items	34,881	34,465	69,346									34,881	34,465								
1.2 Main Dam Works																					
1.2.1 Overflow	61,719	60,983	122,702									15,430	15,246	15,430	15,246	15,430	15,246	15,430	15,246		
1.2.2 Non-overflow	139,436	137,773	277,209									34,859	34,443	34,859	34,443	34,859	34,443	34,859	34,443		
1.2.3 Dam Shoulder Embankment	2,318	2,290	4,608									580	573	580	573	580	573	580	573		
1.2.4 Related Works	16,716	16,516	33,232									3,343	3,303	3,343	3,303	3,343	3,303	3,343	3,303	3,343	3,303
1.2.5 Hydromechanical and Hydroelectrical Plant	16,191	15,998	32,189													5,505	5,439	5,343	5,279	5,343	5,279
Sub-total	236,380	233,561	469,941									54,212	53,565	54,212	53,565	59,717	59,004	59,555	58,844	8,686	8,583
1.3 Hydropower Plant																					
1.3.1 Main Civil Works	6,056	5,983	12,039																	3,028	2,992
1.3.2 Related Works	25,542	25,237	50,779															12,771	12,618	12,771	12,618
1.3.3 Hydropower Plant, 3,300 kw x 2	34,602	34,189	68,790																	34,602	34,189
Sub-total	66,199	65,409	131,608															15,799	15,610		
1.4 Transmission Line, 22 kv x 25 km	15,076	14,896	29,971																	15,076	14,896
1.5 Relocation Road	31,156	30,785	61,941					15,578	15,392	15,578	15,392										
Total of 1	383,692	379,115	762,808					15,578	15,392	15,578	15,392	89,093	88,030	54,212	53,565	59,717	59,004	75,353	74,454	74,162	73,277
Equivalent to US\$	25.5	25.2	50.6					1.0	1.0	1.0	1.0	5.9	5.8	3.6	3.6	4.0	3.9	5.0	4.9	4.9	4.9
2. Indirect Construction Cost																					
2.1 Resettlement Cost	0	134,656	134,656	39,050		39,050		39,050		17,505											
2.2 Engineering Cost	38,369	37,912	76,281					6,139	6,066	5,372	5,308	5,372	5,308	5,372	5,308	5,372	5,308	5,372	5,308	5,372	5,308
2.3 Administration	0	26,924	26,924		3,231		2,962		2,962		2,962		2,962		2,962		2,962		2,962		2,962
2.4 Price Escalation (F.C:1.6% , L.C:4.9%)	54,487	217,749	272,236	0	4,245	0	6,483	1,424	13,385	1,730	11,124	9,439	32,015	7,002	24,594	8,813	31,365	12,397	44,512	13,682	50,025
2.5 Physical Contingency (Civil:10%, Plant:5%)	44,361	76,381	120,743	0	4,653	0	4,850	2,314	7,685	2,268	5,229	10,390	12,831	6,659	8,643	7,115	9,592	9,045	12,460	6,571	10,439
Total of 2	137,218	493,621	630,839	0	51,179	0	53,345	9,877	69,148	9,370	42,128	25,201	53,116	19,033	41,506	21,300	49,226	26,814	65,241	25,624	68,733
Equivalent to US\$	9.1	32.8	41.9	0.0	3.4	0.0	3.5	0.7	4.6	0.6	2.8	1.7	3.5	1.3	2.8	1.4	3.3	1.8	4.3	1.7	4.6
Total of 1 & 2	520,910	872,737	1,393,647	0	51,179	0	53,345	25,455	84,540	24,948	57,520	114,294	141,146	73,244	95,071	81,016	108,231	102,167	139,695	99,786	142,010
Equivalent to US\$	34.6	57.9	92.5	0.0	3.4	0.0	3.5	1.7	5.6	1.7	3.8	7.6	9.4	4.9	6.3	5.4	7.2	6.8	9.3	6.6	9.4
3. VAT (5 %)	0	55,767	55,767		178		171		2,636		2,637		11,611		7,651		8,627		11,018		11,239
Equivalent to US\$	0.0	3.7	3.7		0.0		0.0		0.2		0.2		0.8		0.5		0.6		0.7		0.7
Total of 1 to 3	520,910	928,504	1,449,414	0	51,357	0	53,516	25,455	87,176	24,948	60,157	114,294	152,757	73,244	102,722	81,016	116,858	102,167	150,713	99,786	153,250
Equivalent to US\$	34.6	61.6	96.2	0.0	3.4	0.0	3.6	1.7	5.8	1.7	4.0	7.6	10.1	4.9	6.8	5.4	7.8	6.8	10.0	6.6	10.2

Note:
(1) Cost data sources; Feasibility study report, executive summary, Stage 2, No. 444C-05-TT2, General Explanation, No.444C-05-TM (HEC-1) and Supplementary Study, No.444C-10-T1(HEC-1)
(2) Price level; As of Year 2001
(3) Exchange rate; US\$ 1.0 = VND 15,068 = ¥ 123.39
(4) Price escalation; F.C : 1.6 % and L.C : 4.9 %

**Table 12.8 Direct Construction Cost for Dinh Binh Multipurpose Reservoir
(First Step, Dam Crest E.L95.3m)**

No.	Description	Unit	Quantity	Foreign Currency Portion		Local Currency Portion		Total
				Unit	Amount	Unit	Amount	
					Million VND		Million VND	Million VND
	Construction Cost							
1	General Items	L.S	1		32,241		31,856	64,097
2	Main Dam Works							
2.1	Dam Works							
	(1) Excavation, common	m3	816,904	8,492	6,937	8,390	6,854	13,791
	(2) Excavation, strongly weathered rock	m3	1,400	10,525	15	10,400	15	29
	(3) Excavation, moderately weathered rock	m3	63,829	22,124	1,412	21,860	1,395	2,807
	(4) Excavation, slightly weathered rock	m3	9,253	54,745	507	54,091	501	1,007
	(5) Embankment, common	m3	24,274	7,645	186	7,554	183	369
	(6) Embankment, selected	m3	411	8,588	4	8,485	3	7
	(7) Rock, fine	m3	404	67,161	27	66,359	27	54
	(8) Structure concrete, M250	m3	6,700	599,445	4,016	592,294	3,968	7,985
	(9) Structure concrete, M200	m3	107,738	555,937	59,896	549,305	59,181	119,077
	(10) Structure concrete, M150	m3	333,751	274,318	91,554	271,046	90,462	182,016
	(11) Lean concrete, M100	m3	2,895	245,553	711	242,624	702	1,413
	(12) Mortar concrete, M100	m3	2,422	171,121	414	169,079	410	824
	(13) Mortar concrete, M75	m3	240	177,205	43	175,091	42	85
	(14) Boring, D63mm	m	18,709	394,040	7,372	389,339	7,284	14,656
	(15) Grouting	m	18,709	184,335	3,449	182,137	3,408	6,856
	(16) Cement	kg	1,101,305	468	515	462	509	1,024
	(17) Dry riprap	m3	170	76,648	13	75,734	13	26
	(18) Site clearance	m2	0	1,830	0	1,809	0	0
	Sub-total				177,069		174,957	352,026
2.2	Related Works	L.S	1		16,716		16,516	33,232
	Sub-total				16,716		16,516	33,232
2.3	Hydromechanical and Hydroelectrical Plant							
	(1) Hydromechanical works	L.S	1		16,161		15,968	32,129
	(2) Hydroelectrical works	L.S	1		30		30	60
	Sub-total				16,191		15,998	32,189
	Total of 2				209,976		207,472	417,448
3	Hydropower Plant							
3.1	Main Civil Works							
	(1) Excavation, common	m3	137,275	8,492	1,166	8,390	1,152	2,317
	(2) Excavation, strongly weathered rock	m3	1,400	10,525	15	10,400	15	29
	(3) Excavation, moderately weathered rock	m3	5,000	22,124	111	21,860	109	220
	(4) Excavation, slightly weathered rock	m3	2,000	54,745	109	54,091	108	218
	(5) Embankment, common	m3	15,167	7,645	116	7,554	115	231
	(6) Embankment, selected	m3	0	8,588	0	8,485	0	0
	(7) Rock, fine	m3	75	67,161	5	66,359	5	10
	(8) Structure concrete, M250	m3	6,700	599,445	4,016	592,294	3,968	7,985
	(9) Structure concrete, M200	m3	0	555,937	0	549,305	0	0
	(10) Structure concrete, M150	m3	40	274,318	11	271,046	11	22
	(11) Lean concrete, M100	m3	150	245,553	37	242,624	36	73
	(12) Mortar concrete, M100	m3	2,422	171,121	414	169,079	410	824
	(13) Mortar concrete, M75	m3	240	177,205	43	175,091	42	85
	(14) Boring, D63mm	m	0	394,040	0	389,339	0	0
	(15) Grouting	m	0	184,335	0	182,137	0	0
	(16) Cement	kg	0	468	0	462	0	0
	(17) Dry riprap	m3	170	76,648	13	75,734	13	26
	(18) Site clearance	m2	0	1,830	0	1,809	0	0
	Sub-total				6,056		5,983	12,039
3.2	Related Works	L.S	1		25,542		25,237	50,779
	Sub-total				25,542		25,237	50,779
3.3	Hydropower Plant, 3,300 kv x 2							
	(1) Hydromechanical works	L.S	1		34,171		33,764	67,935
	(2) Hydroelectrical works	L.S	1		430		425	855
	Sub-total				34,602		34,189	68,790
	Total of 3				66,199		65,409	131,608
4	Transmission Line, 22 kv x 25 km	L.S	1		15,076		14,896	29,971
	Sub-total				15,076		14,896	29,971
5	Relocation Road, 19 km	L.S	1		31,156		30,785	61,941
	Sub-total				31,156		30,785	61,941
	Total				354,648		350,417	705,065
	Equivalent to US\$				23.5		23.3	46.8

Note:

(1) Cost data sources; Feasibility study report, executive summary, Stage 2, No. 444C-05-TT2, General Explanation, No.444C-05-TM (HEC-1) and Supplementary Study, No.444C-10-T1(HEC-1)

(2) Price level; As of Year 2001

(3) Exchange rate; US\$ 1.0 = VND 15,068 = ¥ 123.39

**Table 12.9 Disbursement Schedule and Project Cost for Dinh Binh Multipurpose Reservoir Project
(First step, Dam Crest EL.95.3m)**

Unit: Million VND, Million US\$

Description	Total(VND)			2003		2004		2005		2006		2007		2008		2009		2010		2011		
	F.C(VND)	L.C(VND)	Total(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	
1. Direct Construction Cost																						
1 General Items	32,241	31,856	64,097									32,241	31,856									
2 Main Dam Works																						
2.1 Dam Works	177,069	174,957	352,026									44,267	43,739	44,267	43,739	44,267	43,739	44,267	43,739			
2.2 Related Works	16,716	16,516	33,232									3,343	3,303	3,343	3,303	3,343	3,303	3,343	3,303	3,343	3,303	
2.3 Hydromechanical and Hydroelectrical Plant	16,191	15,998	32,189													5,505	5,439	5,343	5,279	5,343	5,279	
Sub-total	209,976	207,472	417,448									47,610	47,043	47,610	47,043	53,115	52,482	52,954	52,322	8,686	8,583	
3 Hydropower Plant																						
3.1 Main Civil Works	6,056	5,983	12,039															3,028	2,992	3,028	2,992	
3.2 Related Works	25,542	25,237	50,779															12,771	12,618	12,771	12,618	
3.3 Hydropower Plant, 3,300 kw x 2	34,602	34,189	68,790																	34,602	34,189	
Sub-total	66,199	65,409	131,608															15,799	15,610	50,400	49,799	
4 Transmission Line, 22 kv x 25 km	15,076	14,896	29,971																	15,076	14,896	
5 Relocation Road	31,156	30,785	61,941					15,578	15,392	15,578	15,392											
Total of 1	354,648	350,417	705,065					15,578	15,392	15,578	15,392	79,851	78,899	47,610	47,043	53,115	52,482	68,752	67,932	74,162	73,277	
Equivalent to US\$	23.5	23.3	46.8					1.0	1.0	1.0	1.0	5.3	5.2	3.2	3.1	3.5	3.5	4.6	4.5	4.9	4.9	
2. Indirect Construction Cost																						
2.1 Resettlement Cost	0	134,656	134,656		39,050		39,050		39,050		17,505											
2.2 Engineering Cost	35,465	35,042	70,506					5,674	5,607	4,965	4,906	4,965	4,906	4,965	4,906	4,965	4,906	4,965	4,906	4,965	4,906	4,906
2.3 Administration	0	25,192	25,192		3,023		2,771		2,771		2,771		2,771		2,771		2,771		2,771		2,771	2,771
2.4 Price Escalation (F.C:1.6% , L.C:4.9%)	50,541	203,830	254,371	0	4,224	0	6,454	1,393	13,248	1,697	10,964	8,475	28,783	6,179	21,764	7,864	28,048	11,321	40,684	13,612	49,661	
2.5 Physical Contingency (Civil:10%, Plant:5%)	40,772	71,660	112,431	0	4,630	0	4,828	2,265	7,607	2,224	5,154	9,329	11,536	5,875	7,648	6,319	8,549	8,237	11,365	6,523	10,343	
Total of 2	126,777	470,379	597,156	0	50,927	0	53,103	9,332	68,282	8,886	41,300	22,769	47,995	17,019	37,090	19,149	44,274	24,522	59,726	25,100	67,682	
Equivalent to US\$	8.4	31.2	39.6	0.0	3.4	0.0	3.5	0.6	4.5	0.6	2.7	1.5	3.2	1.1	2.5	1.3	2.9	1.6	4.0	1.7	4.5	
Total of 1 & 2	481,425	820,796	1,302,221	0	50,927	0	53,103	24,910	83,675	24,464	56,692	102,620	126,894	64,630	84,132	72,264	96,756	93,274	127,658	99,262	140,959	
Equivalent to US\$	32.0	54.5	86.4	0.0	3.4	0.0	3.5	1.7	5.6	1.6	3.8	6.8	8.4	4.3	5.6	4.8	6.4	6.2	8.5	6.6	9.4	
3. VAT (5 %)	0	51,611	51,611		166		160		2,571		2,577		10,432		6,762		7,708		10,067		11,168	
Equivalent to US\$	0.0	3.4	3.4		0.0		0.0		0.2		0.2		0.7		0.4		0.5		0.7		0.7	
Total of 1 to 3	481,425	872,407	1,353,832	0	51,093	0	53,263	24,910	86,246	24,464	59,269	102,620	137,326	64,630	90,894	72,264	104,463	93,274	137,725	99,262	152,127	
Equivalent to US\$	32.0	57.9	89.8	0.0	3.4	0.0	3.5	1.7	5.7	1.6	3.9	6.8	9.1	4.3	6.0	4.8	6.9	6.2	9.1	6.6	10.1	

Note:

- (1) Cost data sources; Feasibility study report, executive summary, Stage 2, No. 444C-05-TT2, General Explanation, No.444C-05-TM (HEC-1) and Supplementary Study, No.444C-10-T1(HEC-1)
- (2) Price level; As of Year 2001
- (3) Exchange rate; US\$ 1.0 = VND 15,068 = ¥ 123.39
- (4) Price escalation; F.C : 1.6 % and L.C : 4.9 %

**Table 12.10 Direct Construction Cost for Heightening of Dinh Binh Dam
(Second step, Heightening up to Dam Crest E.L.100.3m)**

No.	Description	Unit	Quantity	Foreign Currency Portion		Local Currency Portion		Total
				Unit	Amount	Unit	Amount	
					Million VND		Million VND	Million VND
	Construction Cost							
1	General Items	L.S	1		7,649		7,558	15,208
2	Main Dam Works							
2.1	Dam Works							
	(1) Excavation, common	m3	31,969	8,492	271	8,390	268	540
	(2) Excavation, strongly weathered rock	m3	0	10,525	0	10,400	0	0
	(3) Excavation, moderately weathered rock	m3	4,422	22,124	98	21,860	97	194
	(4) Excavation, slightly weathered rock	m3	579	99,291	57	98,107	57	114
	(5) Embankment, common	m3	685	7,645	5	7,554	5	10
	(6) Embankment, selected	m3	247	8,588	2	8,485	2	4
	(7) Rock, fine	m3	38	67,161	3	66,359	3	5
	(8) Structure concrete, M250	m3	0	599,445	0	592,294	0	0
	(9) Structure concrete, M200	m3	38,340	722,718	27,709	714,097	27,378	55,087
	(10) Structure concrete, M150	m3	94,660	356,613	33,757	352,360	33,354	67,111
	(11) Lean concrete, M100	m3	322	245,553	79	242,624	78	157
	(12) Mortar concrete, M100	m3	600	171,121	103	169,079	101	204
	(13) Mortar concrete, M75	m3	0	177,205	0	175,091	0	0
	(14) Boring, D63mm	m	1,772	394,040	698	389,339	690	1,388
	(15) Grouting	m	1,772	184,335	327	182,137	323	649
	(16) Cement	kg	104,309	468	49	462	48	97
	(17) Dry riprap	m3	0	76,648	0	75,734	0	0
	(18) Site clearance	m2	0	1,830	0	1,809	0	0
	(19) Demolishing	m3	6,540	147,041	962	145,287	950	1,912
	(20) Chipping (t=50 mm)	m2	30,000	5,011	150	4,952	149	299
	Sub-total				64,270		63,504	127,774
2.2	Related Works	L.S	1		0		0	0
	Sub-total				0		0	0
2.3	Hydromechanical and Hydroelectrical Plant							
	(1) Hydromechanical works	L.S	1		12,202		12,056	24,258
	(2) Hydroelectrical works	L.S	1		23		22	45
	Sub-total				12,224		12,079	24,303
	Total of 2				76,494		75,582	152,077
	Total of 1 & 2				84,144		83,140	167,284
	Equivalent to US\$				5.6		5.5	11.1

Note:

- (1) Cost data sources; Feasibility study report, executive summary, Stage 2, No. 444C-05-TT2, General Explanation, No.444C-05-TM (HEC-1) and Supplementary Study, No.444C-10-T1(HEC-1)
- (2) Price level; As of Year 2001
- (3) Exchange rate; US\$ 1.0 = VND 15,068 = ¥ 123.39

**Table 12.11 Disbursement Schedule and Project Cost for Heightening of Dinh Binh Dam
(Second Step, Heightening up to Dam Crest E.L. 100.3m)**

Unit: Million VND, Million US\$

Description	Total(VND)			2012		2013		2014		2015		2016		2017		2018		2019		2020	
	F.C(VND)	L.C(VND)	Total(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)
1. Direct Construction Cost																					
1 General Items	7,649	7,558	15,207													7,649	7,558				
2 Main Dam Works																					
2.1 Dam Works	64,270	63,504	127,774													21,852	21,591	42,418	41,913		
2.2 Related Works	0	0	0																		
2.3 Hydromechanical and Hydroelectrical Plant	12,224	12,079	24,303																		12,224 12,079
Sub-total	76,494	75,583	152,077													21,852	21,591	42,418	41,913	12,224	12,079
3 Hydropower Plant																					
3.1 Main Civil Works	0	0	0																		
3.2 Related Works	0	0	0																		
3.3 Hydropower Plant, 3,300 kw x 2	0	0	0																		
Sub-total	0	0	0																		
4 Transmission Line, 22 kv x 25 km	0	0	0																		
5 Relocation Road	0	0	0																		
Total of 1	84,143	83,141	167,284													29,501	29,149	42,418	41,913	12,224	12,079
Equivalent to US\$	5.6	5.5	11.1												2.0	1.9	2.8	2.8	0.8	0.8	
2. Indirect Construction Cost																					
2.1 Resettlement Cost	0	0	0																		
2.2 Engineering Cost	8,414	8,314	16,728													2,861	2,827	2,777	2,744	2,777	2,744
2.3 Administration	0	5,019	5,019														1,706		1,656		1,656
2.4 Price Escalation (F.C:1.6% , L.C:4.9%)	30,252	129,942	160,193													10,024	42,278	14,947	63,249	5,280	24,415
2.5 Physical Contingency (Civil:10%, Plant:5%)	11,670	22,038	33,707													4,239	7,596	6,014	10,956	1,417	3,485
Total of 2	50,336	165,312	215,648													17,124	54,407	23,738	78,604	9,474	32,300
Equivalent to US\$	3.3	11.0	14.3												1.1	3.6	1.6	5.2	0.6	2.1	
Total of 1 & 2	134,479	248,453	382,932													46,625	83,556	66,156	120,517	21,698	44,379
Equivalent to US\$	8.9	16.5	25.4												3.1	5.5	4.4	8.0	1.4	2.9	
3. VAT (5 %)																	4,306		6,168		2,208
Equivalent to US\$	0.0	0.8	0.8														0.3		0.4		0.1
Total of 1 to 3	134,479	261,136	395,615													46,625	87,863	66,156	126,686	21,698	46,588
Equivalent to US\$	8.9	17.3	26.3												3.1	5.8	4.4	8.4	1.4	3.1	

Note:
 (1) Cost data sources; Feasibility study report, executive summary, Stage 2, No. 444C-05-TT2, General Explanation, No.444C-05-TM (HEC-1) and Supplementary Study, No.444C-10-T1(HEC-1)
 (2) Price level: As of Year 2001
 (3) Exchange rate; US\$ 1.0 = VND 15,068 = ¥ 123.39
 (4) Price escalation; F.C : 1.6 % and L.C : 4.9 %

Table 12.12 Disbursement Schedule and Project Cost for Two-step Implementation of Dinh Binh Multipurpose Reservoir Project

Description	Total(VND)			2003		2004		2005		2006		2007		2008		2009		2010		2011	
	F.C(VND)	L.C(VND)	Total(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)
1. Dinh Binh Multipurpose Reservoir, Alt-1, EL.95.3 m																					
(1) Direct Construction Cost	354,648	350,417	705,065					15,578	15,392	15,578	15,392	79,851	78,899	47,610	47,043	53,115	52,482	68,752	67,932	74,162	73,277
(2) Indirect Construction Cost	126,777	470,379	597,156	0	50,927	0	53,103	9,332	68,282	8,886	41,300	22,769	47,995	17,019	37,090	19,149	44,274	24,522	59,726	25,100	67,682
Sub-total	481,425	820,796	1,302,221	0	50,927	0	53,103	24,910	83,675	24,464	56,692	102,620	126,894	64,630	84,132	72,264	96,756	93,274	127,658	99,262	140,959
Equivalent to USS	32.0	54.5	86.4	0.0	3.4	0.0	3.5	1.7	5.6	1.6	3.8	6.8	8.4	4.3	5.6	4.8	6.4	6.2	8.5	6.6	9.4
(3) VAT	0	51,611	51,611	166		160		2,571		2,577		10,432		6,762		7,708		10,067		11,168	
Equivalent to USS	0.0	3.4	3.4	0.0		0.0		0.2		0.2		0.7		0.4		0.5		0.7		0.7	
Total	481,425	872,407	1,353,832	0	51,093	0	53,263	24,910	86,246	24,464	59,269	102,620	137,328	64,630	90,894	72,264	104,463	93,274	137,725	99,262	152,127
Equivalent to USS	32.0	57.9	89.8	0.0	3.4	0.0	3.5	1.7	5.7	1.6	3.9	6.8	9.1	4.3	6.0	4.8	6.9	6.2	9.1	6.6	10.1
2. Dinh Binh Multipurpose Reservoir, Heightening, EL.100.3 m																					
(1) Direct Construction Cost	84,143	83,141	167,284																		
(2) Indirect Construction Cost	50,336	165,312	215,648																		
Sub-total	134,479	248,453	382,932																		
Equivalent to USS	8.9	16.5	25.4																		
(3) VAT	0	12,683	12,683																		
Equivalent to USS	0.0	0.8	0.8																		
Total	134,479	261,136	395,615																		
Equivalent to USS	8.9	17.3	26.3																		
3. Total																					
(1) Direct Construction Cost	438,791	433,558	872,349	0	0	0	0	15,578	15,392	15,578	15,392	79,851	78,899	47,610	47,043	53,115	52,482	68,752	67,932	74,162	73,277
(2) Indirect Construction Cost	177,113	635,691	812,804	0	50,927	0	53,103	9,332	68,282	8,886	41,300	22,769	47,995	17,019	37,090	19,149	44,274	24,522	59,726	25,100	67,682
Sub-total of 1 to 2	615,904	1,069,249	1,685,153	0	50,927	0	53,103	24,910	83,675	24,464	56,692	102,620	126,894	64,630	84,132	72,264	96,756	93,274	127,658	99,262	140,959
Equivalent to USS	40.9	71.0	111.8	0.0	3.4	0.0	3.5	1.7	5.6	1.6	3.8	6.8	8.4	4.3	5.6	4.8	6.4	6.2	8.5	6.6	9.4
(3) VAT of 1 to 2	0	64,294	64,294	166		160		2,571		2,577		10,432		6,762		7,708		10,067		11,168	
Equivalent to USS	0.0	4.3	4.3	0.0		0.0		0.2		0.2		0.7		0.4		0.5		0.7		0.7	
Total of 1 to 2	615,904	1,133,543	1,749,447	0	51,093	0	53,263	24,910	86,246	24,464	59,269	102,620	137,326	64,630	90,894	72,264	104,464	93,274	137,725	99,262	152,127
Equivalent to USS	40.9	75.2	116.1	0.0	3.4	0.0	3.5	1.7	5.7	1.6	3.9	6.8	9.1	4.3	6.0	4.8	6.9	6.2	9.1	6.6	10.1

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Description	2012		2013		2014		2015		2016		2017		2018		2019		2020	
	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)
1. Dinh Binh Multipurpose Reservoir, Alt-I, EL.95.3 m																		
(1) Direct Construction Cost																		
(2) Indirect Construction Cost																		
Sub-total																		
Equivalent to USS																		
(3) VAT																		
Equivalent to USS																		
Total																		
Equivalent to USS																		
2. Dinh Binh Multipurpose Reservoir, Heightening, EL.100.3 m																		
(1) Direct Construction Cost														29,501	29,149	42,418	41,913	12,224
(2) Indirect Construction Cost														17,124	54,407	23,738	78,604	9,474
Sub-total														46,625	83,556	66,156	120,517	21,698
Equivalent to USS														3.1	5.5	4.4	8.0	1.4
(3) VAT															4,306		6,168	
Equivalent to USS															0.3		0.4	
Total														46,625	87,863	66,156	126,685	21,698
Equivalent to USS														3.1	5.8	4.4	8.4	1.4
3. Total																		
(1) Direct Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	29,501	29,149	42,418	41,913	12,224
(2) Indirect Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	17,124	54,407	23,738	78,604	9,474
Sub-total of 1 to 2	0	0	0	0	0	0	0	0	0	0	0	0	0	46,625	83,556	66,156	120,517	21,698
Equivalent to USS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	5.5	4.4	8.0	1.4
(3) VAT of 1 to 2															4,306		6,168	
Equivalent to USS															0.3		0.4	
Total of 1 to 2	0	0	0	0	0	0	0	0	0	0	0	0	0	46,625	87,862	66,156	126,685	21,698
Equivalent to USS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	5.8	4.4	8.4	1.4

Note:
 (1) Cost data sources: Feasibility study report, executive summary, Stage 2, No. 444C-05-TT2, General Explanation, No.444C-05-TM (HEC-1) and Supplementary Study, No.444C-10-T1(HEC-1)
 (2) Price level: As of Year 2001
 (3) Exchange rate: US\$ 1.0 = VND 15,068 = ¥ 123.39
 (4) Price escalation, F.C : 1.6 % and L.C : 4.9 %

**Table 12.13 Financial and Economic Project Cost of Stepwise Construction
(Stepwise Construction)**

Phase-1: Dinh Binh Dam (El. 95.3m), Flood Control & Irrigation Facilities Unit: Million VND

Description	Financial Cost				Economic Cost without Price Escalation			
	Dinh Binh Reservoir (El.95.3m) incl. hydropower	Flood Control facilities with New Sea Dike Spillway	Irrigation & drainage facilities incl. La Tinh	Total	Dinh Binh Reservoir (El.95.3m) incl. hydropower	Flood Control facilities	Irrigation & drainage facilities incl. La Tinh	Total
1. Direct Construction Cost	705,065	699,931	1,074,676	2,479,672	634,559	629,938	967,208	2,231,705
(1) Civil works	574,115	699,931	1,074,676	2,348,722	516,704	629,938	967,208	2,113,850
(2) Plant works	130,950	-	-	130,950	117,855	-	-	117,855
2. Indirect Construction Cost								
(1) Resettlement Cost	134,656	27,580	79,294	241,530	121,190	24,822	71,365	217,377
(2) Engineering Cost	70,506	69,993	107,468	247,967	63,455	62,994	96,721	223,170
(3) Administration Cost	25,192	21,825	34,619	81,636	22,673	19,643	31,157	73,473
(4) Price Escalation (4.9%/year)	254,371	422,527	373,484	1,050,382	-	-	-	-
(5) Physical Contingency (Plant:5%,other:10%)	112,431	124,186	166,954	403,571	78,295	73,740	116,645	268,680
Sub-total (1)~(5)	597,156	666,111	761,819	2,025,086	285,613	181,199	315,888	782,700
Total (1.+ 2.)	1,302,221	1,366,042	1,836,495	4,504,758	920,172	811,137	1,283,096	3,014,405
3. VAT (5%)	51,611	60,043	78,838	190,492	-	-	-	-
Total (1.+ 2.+ 3.)	1,353,832	1,426,085	1,915,333	4,695,250	920,172	811,137	1,283,096	3,014,405
Equivalent Million US\$	89.85	94.64	127.11	311.60	61.07	53.83	85.15	200.05

Phase-2: Heightening of Dinh Binh Dam (El. 100.3) Unit: Million VND

Description	Financial Cost				Economic Cost without Price Escalation			
	Dinh Binh Reservoir (El.100.3m) incl. hydropower	Flood Control facilities with New Sea Dike Spillway	Irrigation & drainage facilities incl. La Tinh	Total	Dinh Binh Reservoir (El.100.3m) incl. hydropower	Flood Control facilities	Irrigation & drainage facilities incl. La Tinh	Total
1. Direct Construction Cost	167,284	-	-	167,284	150,556	-	-	150,556
(1) Civil works	142,981	-	-	142,981	128,683	-	-	128,683
(2) Plant works	24,303	-	-	24,303	21,873	-	-	21,873
2. Indirect Construction Cost								
(1) Resettlement Cost	-	-	-	-	-	-	-	-
(2) Engineering Cost	16,728	-	-	16,728	15,055	-	-	15,055
(3) Administration Cost	5,019	-	-	5,019	4,517	-	-	4,517
(4) Price Escalation (4.9%/year)	160,194	-	-	160,194	-	-	-	-
(5) Physical Contingency (Plant:5%,other:10%)	33,707	-	-	33,707	15,919	-	-	15,919
Sub-total (1)~(5)	215,648	-	-	215,648	35,491	-	-	35,491
Total (1.+ 2.)	382,932	-	-	382,932	186,047	-	-	186,047
3. VAT (5%)	12,683	-	-	12,683	-	-	-	-
Total (1.+ 2.+ 3.)	395,615	-	-	395,615	186,047	-	-	186,047
Equivalent Million US\$	26.26	-	-	26.26	12.35	-	-	12.35

Total of Phase-1 and Phase-2 Unit: Million VND

Description	Financial Cost				Economic Cost without Price Escalation			
	Dinh Binh Reservoir (El.100.3m) incl. hydropower	Flood Control facilities with New Sea Dike Spillway	Irrigation & drainage facilities incl. La Tinh	Total	Dinh Binh Reservoir (El.100.3m) incl. hydropower	Flood Control facilities	Irrigation & drainage facilities incl. La Tinh	Total
1. Direct Construction Cost	872,349	699,931	1,074,676	2,646,956	785,115	629,938	967,208	2,382,261
(1) Civil works	717,096	699,931	1,074,676	2,491,703	645,387	629,938	967,208	2,242,533
(2) Plant works	155,253	-	-	155,253	139,728	-	-	139,728
2. Indirect Construction Cost								
(1) Resettlement Cost	134,656	27,580	79,294	241,530	121,190	24,822	71,365	217,377
(2) Engineering Cost	87,234	69,993	107,468	264,695	78,510	62,994	96,721	238,225
(3) Administration Cost	30,211	21,825	34,619	86,655	27,190	19,643	31,157	77,990
(4) Price Escalation (4.9%/year)	414,565	422,527	373,484	1,210,576	-	-	-	-
(5) Physical Contingency (Plant:5%,other:10%)	146,138	124,186	166,954	437,278	94,214	73,740	116,645	284,599
Sub-total (1)~(5)	812,804	666,111	761,819	2,240,734	321,104	181,199	315,888	818,191
Total (1.+ 2.)	1,685,153	1,366,042	1,836,495	4,887,690	1,106,219	811,137	1,283,096	3,200,452
3. VAT (5%)	64,294	60,043	78,838	203,175	-	-	-	-
Total (1.+ 2.+ 3.)	1,749,447	1,426,085	1,915,333	5,090,865	1,106,219	811,137	1,283,096	3,200,452
Equivalent Million US\$	116.10	94.64	127.11	337.86	73.42	53.83	85.15	212.40

**Table 12.14 Annual Economic Project Cost
(Dinh Binh Dam: Stepwise Construction)**

Unit: Million US\$

Cost Item	Total (Million VND)	Equivalent (Million US\$)	Year																		
			2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. Dinh Binh Reservoir Phase-1 (El: 95.3m) including Hydropower																					
(1) Direct Construction Cost	634,559	42.11	-	-	-	1.85	1.85	9.50	5.66	6.32	8.18	8.76	-	-	-	-	-	-	-	-	
a. Civil works	516,704	34.29	-	-	-	1.85	1.85	9.50	5.66	5.66	7.54	2.23	-	-	-	-	-	-	-	-	
b. Plant works	117,855	7.82	-	-	-	-	-	-	-	0.66	0.63	6.53	-	-	-	-	-	-	-	-	
(2) Indirect Construction Cost																					
a. Resettlement cost	121,190	8.04	-	2.33	2.33	2.33	1.05	-	-	-	-	-	-	-	-	-	-	-	-	-	
b. Engineering cost	63,455	4.21	-	-	-	0.67	0.59	0.59	0.59	0.59	0.59	0.59	-	-	-	-	-	-	-	-	
c. Administration cost	22,673	1.50	-	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	-	-	-	-	-	-	-	-	
d. Physical contingency	78,295	5.20	-	0.25	0.25	0.50	0.37	1.03	0.64	0.67	0.86	0.62	-	-	-	-	-	-	-	-	
Subtotal of (2)	285,613	18.95	-	2.76	2.75	3.67	2.17	1.78	1.40	1.43	1.62	1.38	-	-	-	-	-	-	-	-	
Total of (1) + (2)	920,172	61.07	-	2.76	2.75	5.53	4.02	11.28	7.05	7.74	9.79	10.14	-	-	-	-	-	-	-	-	
2. Dinh Binh Reservoir Phase-2 (Heightening to El: 100.3m)																					
(1) Direct Construction Cost	150,556	9.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.48	5.06	1.45
a. Civil works	128,683	8.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.48	5.06	-
b. Plant works	21,873	1.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.45
(2) Indirect Construction Cost																					
a. Resettlement cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
b. Engineering cost	15,055	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.34	0.33	0.33
c. Administration cost	4,517	0.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10	0.10	0.10
d. Physical contingency	15,919	1.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.39	0.55	0.12
Subtotal of (2)	35,491	2.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.83	0.98	0.54
Total of (1) + (2)	186,047	12.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.32	6.03	2.00
3. Flood Control Facilities with New Sea Dike Spillways																					
(1) Direct Construction Cost	629,938	41.81	-	-	-	-	-	-	-	-	-	-	12.96	12.88	6.98	4.56	4.43	-	-	-	-
(2) Indirect Construction Cost																					
a. Resettlement cost	24,822	1.65	-	-	-	-	-	-	0.48	0.48	0.48	0.21	-	-	-	-	-	-	-	-	-
b. Engineering cost	62,994	4.18	-	-	-	-	-	-	-	-	0.67	0.59	0.59	0.59	0.59	0.59	0.59	-	-	-	-
c. Administration cost	19,643	1.30	-	-	-	-	-	-	0.16	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	-	-	-	-
d. Physical contingency	73,740	4.89	-	-	-	-	-	-	0.06	0.06	0.13	0.09	1.37	1.36	0.77	0.53	0.52	-	-	-	-
Subtotal of (2)	181,199	12.03	-	-	-	-	-	-	0.70	0.68	1.42	1.04	2.10	2.09	1.50	1.26	1.24	-	-	-	-
Total of (1) + (2)	811,137	53.83	-	-	-	-	-	-	0.70	0.68	1.42	1.04	15.06	14.97	8.48	5.81	5.68	-	-	-	-
4. Irrigation and Drainage Facilities incl. La Tinh River Basin																					
(1) Direct Construction Cost	967,208	64.19	-	-	-	-	-	13.80	13.35	12.65	12.65	11.75	-	-	-	-	-	-	-	-	-
(2) Indirect Construction Cost																					
a. Resettlement cost	71,365	4.74	-	1.37	1.37	1.37	0.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-
b. Engineering cost	96,721	6.42	-	-	-	1.03	0.90	0.90	0.90	0.90	0.90	0.90	-	-	-	-	-	-	-	-	-
c. Administration cost	31,157	2.07	-	0.25	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	-	-	-	-	-	-	-	-	-
d. Physical contingency	116,645	7.74	-	0.16	0.16	0.26	0.17	1.49	1.45	1.38	1.38	1.29	-	-	-	-	-	-	-	-	-
Subtotal of (2)	315,888	20.96	-	1.78	1.76	2.89	1.92	2.62	2.57	2.50	2.50	2.41	-	-	-	-	-	-	-	-	-
Total of (1) + (2)	1,283,096	85.15	-	1.78	1.76	2.89	1.92	16.42	15.93	15.15	15.15	14.16	-	-	-	-	-	-	-	-	-
5. Whole Projects																					
(1) Direct Construction Cost	2,382,261	158.10	-	-	-	1.85	1.85	23.30	19.01	18.96	20.82	20.51	12.96	12.88	6.98	4.56	4.43	-	3.48	5.06	1.45
(2) Indirect Construction Cost																					
a. Resettlement cost	217,377	14.43	-	3.71	3.71	3.71	1.66	-	0.48	0.48	0.48	0.21	-	-	-	-	-	-	-	-	-
b. Engineering cost	238,225	15.81	-	-	-	1.70	1.49	1.49	1.49	1.49	2.16	2.07	0.59	0.59	0.59	0.59	0.59	-	0.34	0.33	0.33
c. Administration cost	77,990	5.18	-	0.43	0.39	0.39	0.39	0.39	0.39	0.55	0.54	0.54	0.14	0.14	0.14	0.14	0.14	-	0.10	0.10	0.10
d. Physical contingency	284,599	18.89	-	0.41	0.41	0.77	0.54	2.52	2.15	2.11	2.37	2.01	1.37	1.36	0.77	0.53	0.52	-	0.39	0.55	0.12
Subtotal of (2)	818,191	54.30	-	4.55	4.51	6.56	4.08	4.40	4.67	4.62	5.54	4.83	2.10	2.09	1.50	1.26	1.24	-	0.83	0.98	0.54
Total of (1) + (2)	3,200,452	212.40	-	4.55	4.51	8.42	5.93	27.70	23.68	23.58	26.36	25.34	15.06	14.97	8.48	5.81	5.68	-	4.32	6.03	2.00

**Table 12.15 Cost-Benefit Analysis
(Stepwise Construction)**

Unit: Million US\$

Year in order	Year	Benefit				Cost											Net Cash Flow					
		Irrigation and drainage	Hydro- power	Flood control	Total Benefit	Investment					O/M				Replace- ment	Total Cost						
						Direct constr.	Resettle- ment	Engring service	Adminis- tration	Physical conti.	Sub-total	Dam	Flood control	Irrigation drainage				Hydro- power				
0	2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1	2002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	2003	-	-	-	-	-	-	3.71	-	0.43	0.41	4.55	-	-	-	-	-	-	-	-	4.55	-4.55
3	2004	-	-	-	-	-	-	3.71	-	0.39	0.41	4.51	-	-	-	-	-	-	-	-	4.51	-4.51
4	2005	-	-	-	-	1.85	-	3.71	1.70	0.39	0.77	8.42	-	-	-	-	-	-	-	-	8.42	-8.42
5	2006	-	-	-	-	1.85	1.66	1.49	0.39	0.54	5.93	-	-	-	-	-	-	-	-	-	5.93	-5.93
6	2007	-	-	-	-	23.30	-	1.49	0.39	2.52	27.70	-	-	-	-	-	-	-	-	-	27.70	-27.70
7	2008	0.50	-	-	0.50	19.01	0.48	1.49	0.55	2.15	23.68	-	-	0.01	-	-	-	-	-	-	23.69	-23.19
8	2009	2.09	-	-	2.09	18.96	0.48	1.49	0.54	2.11	23.58	-	-	0.05	-	-	-	-	-	-	23.63	-21.54
9	2010	4.58	-	-	4.58	20.82	0.48	2.16	0.54	2.37	26.36	-	-	0.12	-	-	-	-	-	-	26.48	-21.90
10	2011	6.55	-	-	6.55	20.51	0.21	2.07	0.54	2.01	25.34	-	-	0.17	-	-	-	-	-	-	25.51	-18.96
11	2012	14.36	1.82	5.30	21.49	12.96	-	0.59	0.14	1.37	15.06	0.17	0.06	0.37	0.12	-	-	-	-	-	15.78	5.71
12	2013	16.38	1.82	5.52	23.72	12.88	-	0.59	0.14	1.36	14.97	0.17	0.06	0.42	0.12	-	-	-	-	-	15.74	7.98
13	2014	17.12	1.82	7.65	26.59	6.98	-	0.59	0.14	0.77	8.48	0.17	0.09	0.44	0.12	-	-	-	-	-	9.30	17.29
14	2015	17.12	1.82	7.94	26.89	4.56	-	0.59	0.14	0.53	5.81	0.17	0.09	0.44	0.12	-	-	-	-	-	6.64	20.25
15	2016	17.12	1.82	9.26	28.21	4.43	-	0.59	0.14	0.52	5.68	0.17	0.11	0.44	0.12	-	-	-	-	-	6.51	21.69
16	2017	17.12	1.82	10.66	29.60	-	-	-	-	-	-	0.17	0.24	0.44	0.12	-	-	-	-	-	0.98	28.62
17	2018	17.12	1.82	11.02	29.96	3.48	-	0.34	0.10	0.39	4.32	0.17	0.25	0.44	0.12	-	-	-	-	-	5.30	24.66
18	2019	17.12	1.82	11.38	30.33	5.06	-	0.33	0.10	0.55	6.03	0.17	0.26	0.44	0.12	-	-	-	-	-	7.03	23.30
19	2020	17.12	1.82	11.75	30.69	1.45	-	0.33	0.10	0.12	2.00	0.17	0.27	0.44	0.12	-	-	-	-	-	3.00	27.69
20	2021	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
21	2022	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
22	2023	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
23	2024	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
24	2025	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
25	2026	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
26	2027	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	0.15	1.21	31.19
27	2028	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
28	2029	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
29	2030	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
30	2031	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
31	2032	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
32	2033	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
33	2034	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
34	2035	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
35	2036	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
36	2037	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	7.30	-	8.36	24.04
37	2038	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	7.15	-	8.21	24.19
38	2039	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
39	2040	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
40	2041	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
41	2042	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	7.78	-	8.84	23.56
42	2043	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
43	2044	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
44	2045	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	11.52	-	12.58	19.82
45	2046	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
46	2047	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	0.15	-	1.21	31.19
47	2048	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
48	2049	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
49	2050	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
50	2051	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
51	2052	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
52	2053	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
53	2054	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
54	2055	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
55	2056	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
56	2057	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	0.15	-	1.21	31.19
57	2058	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
58	2059	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
59	2060	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
60	2061	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
61	2062	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
62	2063	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
63	2064	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
64	2065	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
65	2066	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	-	-	1.06	31.34
66	2067	17.12	1.89	13.39	32.40	-	-	-	-	-	-	-	0.21	0.27	0.44	0.14	-	-	0.15	-	1.21	31.19
EIRR=		11.7%																				
B/C =		1.19 (at discount rate: 10%)																				
NPV=		19.0 (at discount rate: 10%)																				

Table 13.1 Present Cropping Area in the Project Area of Feasibility Study (2001)

	Cropping Pattern A			Cropping Pattern B			Cropping Pattern C			Total		
	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total
I. Physical Area												
Farm Land	3,000 14.6%	17,500 85.4%	20,500	10,100 74.3%	3,500 25.7%	13,600	2,600 78.8%	700 21.2%	3,300	15,700 42.0%	21,700 58.0%	37,400
II. by Cropping Season												
1. Winter - Spring	3,000 15%	10,200 50%	13,200	10,100 74%	2,200 16%	12,300	2,600 79%	700 21%	3,300	15,700 42%	13,100 35%	28,800
Paddy (early)	3,000 15%	7,300 36%	10,300	1,700 13%	- -	1,700	- -	- -	0	4,700 13%	7,300 20%	12,000
Paddy (late)	- -	- -	0	8,400 62%	1,000 7%	9,400	2,600 79%	700 21%	3,300	11,000 29%	1,700 5%	12,700
Maize	- -	2,700 13%	2,700	- -	1,200 9%	1,200	- -	- -	0	0 0%	3,900 10%	3,900
Groundnuts/ Soybeans	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
Tobacco	- -	200 1%	200	- -	- -	0	- -	- -	0	0 0%	200 1%	200
2. Summer - Autumn	3,000 15%	5,400 26%	8,400	8,300 61%	1,200 9%	9,500	2,600 79%	400 12%	3,000	13,900 37%	7,000 19%	20,900
Paddy (early)	2,600 13%	- -	2,600	1,700 13%	- -	1,700	- -	- -	0	4,300 12%	0 0%	4,300
Paddy (late)	- -	- -	0	5,500 40%	- -	5,500	2,300 70%	- -	2,300	7,800 21%	0 0%	7,800
Maize	- -	2,500 12%	2,500	800 6%	600 4%	1,400	200 6%	200 6%	400	1,000 3%	3,300 9%	4,300
Groundnuts/ Soybeans	400 2%	2,900 14%	3,300	300 2%	600 4%	900	100 3%	200 6%	300	800 2%	3,700 10%	4,500
Tobacco	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
3. 3rd Crop Season	1,800 9%	0 0%	1,800	1,700 13%	0 0%	1,700	0 0%	0 0%	0	3,500 9%	0 0%	3,500
Paddy (early)	1,800 9%	- -	1,800	1,700 13%	- -	1,700	- -	- -	0	3,500 9%	0 0%	3,500
Paddy (late)	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
Maize	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
Groundnuts/ Soybeans	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
Tobacco	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
4. Perennial Crops	0 0%	7,300 36%	7,300	0 0%	1,300 10%	1,300	0 0%	0 0%	0	0 0%	8,600 23%	8,600
Sugarcane	- -	4,000 20%	4,000	- -	- -	0	- -	- -	0	0 0%	4,000 11%	4,000
Pinapple	- -	- -	0	- -	- -	0	- -	- -	0	0 0%	0 0%	0
Cassava	- -	3,300 16%	3,300	- -	1,300 10%	1,300	- -	- -	0	0 0%	4,600 12%	4,600
5. Total (Cropping Intensity)	7,800 38% 260%	22,900 112% 131%	30,700 150%	20,100 148% 199%	4,700 35% 134%	24,800 182%	5,200 158% 200%	1,100 33% 157%	6,300 191%	33,100 89% 211%	28,700 77% 132%	61,800 165%
III. by Crops	7,800 38%	22,900 112%	30,700	20,100 148%	4,700 35%	24,800	5,200 158%	1,100 33%	6,300	33,100 89%	28,700 77%	61,800
Paddy	7,400 36%	7,300 36%	14,700	19,000 140%	1,000 7%	20,000	4,900 149%	700 21%	5,600	31,300 84%	9,000 24%	40,300
Maize	0 -	5,200 25%	5,200	800 6%	1,800 13%	2,600	200 6%	200 6%	400	1,000 3%	7,200 19%	8,200
Groundnuts/ Soybeans	400 2%	2,900 14%	3,300	300 2%	600 4%	900	100 3%	200 6%	300	800 2%	3,700 10%	4,500
Tobacco	0 -	200 1%	200	0 0%	0 0%	0	0 0%	0 0%	0	0 0%	200 1%	200
Sugarcane	- -	4,000 20%	4,000	- -	- 0%	0	- -	- -	0	0 0%	4,000 11%	4,000
Pinapple	- -	- -	0	- -	- 0%	0	- -	- -	0	0 0%	0 0%	0
Cassava	- -	3,300 16%	3,300	- -	1,300 10%	1,300	- -	- -	0	0 0%	4,600 12%	4,600

Table 13.2 Future Cropping Area in the Project Area of Feasibility Study (2020)

	Cropping Pattern A			Cropping Pattern B			Cropping Pattern C			Total										
	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total								
I. Physical Area																				
Farm Land	20,500	100%	0	0%	20,500	13,600	100%	0	0%	13,600	3,300	100%	0	0%	3,300	37,400	100%	0	0%	37,400
II. by Cropping Season																				
1. Winter - Spring	17,300	84%	0	0%	17,300	13,600	100%	0	0%	13,600	3,300	100%	0	0%	3,300	34,200	92%	0	0%	34,200
Paddy (early)	14,400	70%	-	-	14,400	2,800	21%	-	-	2,800	-	-	-	-	0	17,200	46%	-	-	17,200
Paddy (late)	-	-	-	-	0	8,100	60%	-	-	8,100	3,300	100%	-	-	3,300	11,400	31%	-	-	11,400
Maize	2,500	12%	-	-	2,500	2,700	20%	-	-	2,700	-	-	-	-	0	5,200	14%	-	-	5,200
Groundnuts/ Soybeans	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	0	0%	-	-	0
Tobacco	400	2%	-	-	400	-	-	-	-	0	-	-	-	-	0	400	1%	-	-	400
2. Summer - Autumn	17,300	84%	0	0%	17,300	13,600	100%	0	0%	13,600	3,300	100%	0	0%	3,300	34,200	92%	0	0%	34,200
Paddy (early)	10,300	50%	-	-	10,300	1,400	10%	-	-	1,400	-	-	-	-	0	11,700	31%	-	-	11,700
Paddy (late)	-	-	-	-	0	5,400	40%	-	-	5,400	2,000	61%	-	-	2,000	7,400	20%	-	-	7,400
Maize	4,100	20%	-	-	4,100	2,700	20%	-	-	2,700	700	21%	-	-	700	7,500	20%	-	-	7,500
Groundnuts/ Soybeans	2,900	14%	-	-	2,900	4,100	30%	-	-	4,100	600	18%	-	-	600	7,600	20%	-	-	7,600
Tobacco	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	0	0%	-	-	0
3. 3rd Crop Season	10,300	50%	0	0%	10,300	2,800	21%	0	0%	2,800	0	0%	0	0%	0	13,100	35%	0	0%	13,100
Paddy (early)	10,300	50%	-	-	10,300	2,800	21%	-	-	2,800	-	-	-	-	0	13,100	35%	-	-	13,100
Paddy (late)	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	0	0%	-	-	0
Maize	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	0	0%	-	-	0
Groundnuts/ Soybeans	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	0	0%	-	-	0
Tobacco	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	0	0%	-	-	0
4. Perennial Crops	3,300	16%	0	0%	3,300	0	0%	0	0%	0	0	0%	0	0%	0	3,300	9%	0	0%	3,300
Sugarcane	3,000	15%	-	-	3,000	-	-	-	-	0	-	-	-	-	0	3,000	8%	-	-	3,000
Pinapple	300	2%	-	-	300	-	-	-	-	0	-	-	-	-	0	300	1%	-	-	300
Cassava	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	0	0%	-	-	0
5. Total (Cropping Intensity)	48,200	235%	0	0%	48,200	30,000	221%	0	0%	30,000	6,600	200%	0	0%	6,600	84,800	227%	0	0%	84,800
	235%				235%	221%			221%	200%					200%	227%			227%	
III. by Crops	48,200	235%	0	0%	48,200	30,000	221%	0	0%	30,000	6,600	200%	0	0%	6,600	84,800	227%	0	0%	84,800
Paddy	35,000	171%	-	-	35,000	20,500	151%	-	-	20,500	5,300	161%	-	-	5,300	60,800	163%	-	-	60,800
Maize	6,600	32%	-	-	6,600	5,400	40%	-	-	5,400	700	21%	-	-	700	12,700	34%	-	-	12,700
Groundnuts/ Soybeans	2,900	14%	-	-	2,900	4,100	30%	-	-	4,100	600	18%	-	-	600	7,600	20%	-	-	7,600
Tobacco	400	2%	-	-	400	0	0%	-	-	0	0	0%	-	-	0	400	1%	-	-	400
Sugarcane	3,000	15%	-	-	3,000	-	0%	-	-	0	-	0%	-	-	0	3,000	8%	-	-	3,000
Pinapple	300	2%	-	-	300	-	0%	-	-	0	-	-	-	-	0	300	1%	-	-	300
Cassava	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	0	0%	-	-	0

Table 13.3 Summary of Cost Comparison of Van Phong Weir (Site-II)

Item	1A. Fixed Weir, Spread Foundation			1B. Fixed Weir, floating			2A. Rubber Weir, Spread Foundation			2B. Rubber Weir, Floating			
	(million VND)			(million VND)			(million VND)			(million VND)			
	Q'ty	Cost	Ratio	Q'ty	Cost	Ratio	Q'ty	Cost	Ratio	Q'ty	Cost	Ratio	
(a) Excavation													
Common	Exc =	268,543 m3	4,364	3.8%	292,699 m3	4,757	2.7%	269,994 m3	4,388	3.6%	293,853 m3	4,776	2.7%
Weatherd Rock	Exr =	29,838 m3	681	0.6%	32,522 m3	743	0.4%	29,999 m3	685	0.6%	32,650 m3	746	0.4%
(b) Earthfilling													
Common Filling	Efb =	14,919 m3	211	0.2%	16,261 m3	230	0.1%	15,000 m3	212	0.2%	16,325 m3	231	0.1%
Backfilling	Efc =	2,984 m3	72	0.1%	13,009 m3	315	0.2%	12,000 m3	290	0.2%	13,060 m3	316	0.2%
(c) Concrete													
Class M250	Ca =	38,693 m3	52,582	45.6%	85,798 m3	116,596	67.1%	36,582 m3	49,713	40.3%	84,193 m3	114,414	63.7%
Class M150	Cb =	28,298 m3	31,276	27.1%	4,180 m3	4,620	2.7%	27,835 m3	30,764	25.0%	1,943 m3	2,147	1.2%
Class M100	Cc =	952 m3	457	0.4%	3,606 m3	1,731	1.0%	964 m3	463	0.4%	3,624 m3	1,740	1.0%
(d) Form													
	FM =	40,194 m2	1,944	1.7%	53,987 m2	2,611	1.5%	38,650 m2	1,869	1.5%	51,681 m2	2,500	1.4%
(e) Reinforcing Bar													
	RB =	1,935 ton	10,849	9.4%	4,290 ton	24,058	13.9%	1,829 ton	10,257	8.3%	4,210 ton	23,607	13.1%
(f) Sheet Pile													
U-Shape, t=13mm	SP =	0 m2	0	0.0%	5,513 m2	8,377	4.8%	0 m2	0	0.0%	5,513 m2	8,377	4.7%
(g) Foundation Pile													
B=H=400mm	FP =	0 m	0	0.0%	3,095 m	3,746	2.2%	0 m	0	0.0%	2,785 m	3,370	1.9%
(h) Grouting													
	GR=	6,158 m	7,081	6.1%	0 m	0	0.0%	6,158 m	7,081	5.7%	0 m	0	0.0%
(i) Rubber Weir													
	RW =	0 m2	0	0.0%	0 m2	0	0.0%	1,313 m2	13,448	10.9%	1,313 m2	13,448	7.5%
(j) River Dike													
Earthfilling	Efb =	415,716 m3	5,885	5.1%	415,716 m3	5,885	3.4%	286,752 m3	4,059	3.3%	286,752 m3	4,059	2.3%
			115,402	100.0%		173,668	100.0%		123,230	100.0%		179,731	100.0%

Note. The above costs are estimated on the direct construction cost basis.

Table 13.4 Irrigation Schemes as of 2012 in F/S

No.	Name of Irrigation Scheme		Actual 2001	Irrigation Area			Irrigation Area in 2012						Hoi Son Reser. (La Tinh)	Grand Total	
				in 2012			Van Phong Weir			Other Schemes under Dinh Binh Dam					
				Rehabilitation as of 2012	New Development as of 2012	Actual 2012	Van Phong Area	Van Phong Ext. (La Tinh)	Total	Tan An Dap Da	Vinh Thanh, etc. (along Kone)	Tan An Ext. (Lower Ha Thanh)			Total
A	North of La Tinh River		1,614	0	3,297	4,911	0	3,297	3,297	0	0	0	0	1,614	4,911
1	Cay Gay Left	W La Tinh	1,162			1,162			0				0	1,162	1,162
2	Cay Ke Left	W La Tinh	331			331			0				0	331	331
3	Cay Ke Right North	W La Tinh	121			121			0				0	121	121
4	Van Phong Extension (La Tinh)	W La Tinh			3,297	3,297		3,297	3,297				0		3,297
B	South of La Tinh Riv. & North of Kone Riv.		1,685	32	10,484	12,201	10,815	0	10,815	0	0	0	0	1,386	12,201
5	Hoi Son Upstream	R La Tinh	118			118			0				0	118	118
6	Cay Gai Right	W La Tinh	913			913			0				0	913	913
7	Cay Ke Right South	W La Tinh	355			355			0				0	355	355
8	Dai Binh	P Kone	40	5		45	45		45				0		45
9	Thi Lua	P Kone	206	20		226	226		226				0		226
10	Ngai Chanh	P Kone	53	7		60	60		60				0		60
11	Van Phong Proper	R			10,484	10,484	10,484		10,484				0		10,484
C	Tan An - Dap Da		12,413	1,607	512	14,532	0	0	0	14,532	0	0	14,532	0	14,532
12	Thanh Hoa I+II	W Kone	4,055	65		4,120			0	4,120			4,120		4,120
13	Thach De	W Kone	1,247	53		1,300			0	1,300			1,300		1,300
14	Thuan Hat	W Kone	166	21		187			0	187			187		187
15	Thap Mao	W Kone	1,782	18		1,800			0	1,800			1,800		1,800
16	Lao Tam	W Kone	688	14		702	0	0	0	702	0	0	702	0	702
17	Part of Lao Tam	W Kone				0									0
18	Nha Phu	W Kone	300			300			0	300			300		300
19	Ha Bac	W Kone	300			300			0	300			300		300
20	Bo Ngo	W Kone	523	65		588			0	588			588		588
21	Bay Yen	P Kone	220	27		247			0	247			247		247
22	Binh Thanh	P Kone	170			170			0	170			170		170
23	Lao Tam Downstream	W Kone			512	512			0	512			512		512
24	Dap Cat	W Kone	263	32		295			0	295			295		295
25	Van Kham	W Kone	343	42		385			0	385			385		385
26	Van Moi	W Kone	209	26		235			0	235			235		235
27	Nhon Phong (Ban Nui)	W Kone	619	76		695			0	695			695		695
28	Da Den	W Kone	319	39		358			0	358			358		358
29	Ben Tranh	P Kone	37	5		42			0	42			42		42
30	Thanh Danh	P Kone	44	5		49			0	49			49		49
31	Ben Go	P Kone	0	0		0			0	0			0		0
32	Thach De	P Kone	60	7		67			0	67			67		67
33	An Loi	P Kone	38	5		43			0	43			43		43
34	Trung Ly	P Kone	13	2		15			0	15			15		15
35	An Hoa	P Kone	30	4		34			0	34			34		34
36	An Thuan I+II	P Kone	90	11		101			0	101			101		101
37	Long Quang	P Kone	70	10		80			0	80			80		80
38	Unknown Minor Schemes	Kone	827	1,080		1,907			0	1,907			1,907		1,907
D	South of Kone River Basin		0	0	2,657	2,657	0	0	0	0	2,657	0	2,657	0	2,657
39	Huu Giang	P Kone			351	351			0	351			351		351
40	Huong Giang	P Kone			308	308			0	308			308		308
41	Binh Hoa	P Kone			353	353			0	353			353		353
42	Binh Khe	P Kone			1,319	1,319			0	1,319			1,319		1,319
43	Hoa Lac	P Kone			150	150			0	150			150		150
44	Hon Gach	P Kone			176	176			0	176			176		176
E	Downstream Reaches of Ha Thanh River Bas		0	0	2,039	2,039	0	0	0	0	0	2,039	2,039	0	2,039
45	Tan An Extension (Lower Ha Thanh)	Ha Thanh			2,039	2,039			0			2,039	2,039		2,039
G	Vinh Thanh Region		0	0	1,017	1,017	0	0	0	0	1,017	0	1,017	0	1,017
46	Vinh Thach (Dinh Binh) IR	R Kone			1,017	1,017			0	1,017			1,017		1,017
Total of A to G			15,712	1,639	20,006	37,357	10,815	3,297	14,112	14,532	3,674	2,039	20,245	3,000	37,357

Table 13.5 Disbursement Schedule for Van Phong Weir and Irrigation and Drainage System

Unit: Million VND, Million US\$

Description	Total(VND)			2003		2004		2005		2006		2007		2008		2009		2010		2011	
	F.C(VND)	L.C(VND)	Total(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)
1. Direct Construction Cost																					
1.1 General Items	25,741	25,434	51,175									25,741	25,434								
1.2 Van Phong Weir																					
1.2.1 Weir	83,171	82,179	165,350									18,298	18,079	18,298	18,079	18,298	18,079	18,298	18,079	9,981	9,861
1.2.2 Scouring Sluice	2,021	1,997	4,018											2,021	1,997						
1.2.3 Intake Facilities	3,838	3,792	7,631											3,838	3,792						
1.2.4 Flood Dike	4,939	4,880	9,819									4,939	4,880								
Sub-total	93,969	92,848	186,817									23,236	22,959	24,157	23,869	18,298	18,079	18,298	18,079	9,981	9,861
1.3 Rehabilitation Works of Existing Weirs	36,544	36,108	72,652									5,847	5,777	7,674	7,583	7,674	7,583	7,674	7,583	7,674	7,583
1.4 New Pumping Station	14,746	14,570	29,316									2,359	2,331	3,097	3,060	3,097	3,060	3,097	3,060	3,097	3,060
1.5 Main Irrigation System	153,914	152,078	305,992									24,626	24,333	32,322	31,936	32,322	31,936	32,322	31,936	32,322	31,936
1.6 Primary and Secondary Irrigation System	142,656	140,955	283,611									22,825	22,553	29,958	29,600	29,958	29,600	29,958	29,600	29,958	29,600
1.7 Drainage System	34,177	33,769	67,946									5,468	5,403	7,177	7,092	7,177	7,092	7,177	7,092	7,177	7,092
1.8 Farm Road Network	4,147	4,097	8,244									663	656	871	860	871	860	871	860	871	860
1.9 On-farm System (Irrigation, Drainage and Farm Road Facilities)	34,668	34,254	68,923									5,547	5,481	7,280	7,193	7,280	7,193	7,280	7,193	7,280	7,193
Total of 1	540,562	534,114	1,074,676									116,314	114,926	112,536	111,193	106,677	105,404	106,677	105,404	98,359	97,186
Equivalent to US\$	35.9	35.4	71.3									7.7	7.6	7.5	7.4	7.1	7.0	7.1	7.0	6.5	6.4
2. Indirect Construction Cost																					
2.1 Resettlement Cost	0	79,294	79,294		22,995		22,995		22,995		10,308										
2.2 Engineering Cost	54,056	53,411	107,468					8,649	8,546	7,568	7,478	7,568	7,478	7,568	7,478	7,568	7,478	7,568	7,478	7,568	7,478
2.3 Administration	0	34,619	34,619		4,154		3,808		3,808		3,808		3,808		3,808		3,808		3,808		3,808
2.4 Price Escalation (F.C:1.6%, L.C:4.9%)	78,921	294,563	373,484	0	2,726	0	4,136	567	7,455	625	5,835	12,379	41,960	14,115	48,716	15,469	54,405	17,544	62,789	18,222	66,542
2.5 Physical Contingency (10%)	67,354	99,600	166,954	0	2,988	0	3,094	922	4,280	819	2,743	13,626	16,817	13,422	17,119	12,971	17,109	13,179	17,948	12,415	17,501
Total of 2	200,331	561,487	761,818	0	32,863	0	34,034	10,138	47,084	9,012	30,172	33,573	70,063	35,105	77,121	36,008	82,800	38,291	92,022	38,205	95,329
Equivalent to US\$	13.3	37.3	50.6	0.0	2.2	0.0	2.3	0.7	3.1	0.6	2.0	2.2	4.6	2.3	5.1	2.4	5.5	2.5	6.1	2.5	6.3
Total of 1 & 2	740,893	1,095,601	1,836,494	0	32,863	0	34,034	10,138	47,084	9,012	30,172	149,886	184,989	147,640	188,314	142,685	188,204	144,968	197,426	136,564	192,515
Equivalent to US\$	49.2	72.7	121.9	0.0	2.2	0.0	2.3	0.7	3.1	0.6	2.0	9.9	12.3	9.8	12.5	9.5	12.5	9.6	13.1	9.1	12.8
3. VAT (5 %)	0	78,838	78,838		229		220		1,209		1,126		15,222		15,271		15,040		15,563		14,958
Equivalent to US\$	0.0	5.2	5.2		0.0		0.0		0.1		0.1		1.0		1.0		1.0		1.0		1.0
Total of 1 to 3	740,893	1,174,439	1,915,332	0	33,091	0	34,253	10,138	48,293	9,012	31,298	149,886	200,211	147,640	203,585	142,685	203,245	144,968	212,990	136,564	207,473
Equivalent to US\$	49.2	77.9	127.1	0.0	2.2	0.0	2.3	0.7	3.2	0.6	2.1	9.9	13.3	9.8	13.5	9.5	13.5	9.6	14.1	9.1	13.8

Note:

- (1) Cost data sources: Feasibility study report, executive summary, Stage 2, No. 444C-05-TT2, General Explanation, No.444C-05-TM (HEC-1) and Supplementary Study, No.444C-10-T1(HEC-1)
- (2) Price level; As of Year 2001
- (3) Exchange rate; US\$ 1.0 = VND 15,068 = ¥ 123.39
- (4) Price escalation; F.C 1.6 % and L.C 4.9 %

Table 14.1 Disbursement Schedule for Downstream Flood Control Plan

Unit: Million VND, Million US\$

Description	Total(VND)			2008		2009		2010		2011		2012		2013		2014		2015		2016	
	F.C(VND)	L.C(VND)	Total(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)	F.C(VND)	L.C(VND)		
1. Direct Construction Cost																					
1.1 General Items	16,765	16,565	33,330									16,765	16,565								
1.2 Thi Nai Swamp																					
1.2.1 Sea Dyke	14,824	14,647	29,471									5,559	5,493	7,412	7,324	1,853	1,831				
1.2.2 Improvement of Sluice Gates	55,494	54,832	110,326									20,810	20,562	27,747	27,416	6,937	6,854				
1.2.3 Improvement of spillway	1,012	1,000	2,011									379	375	506	500	126	125				
1.2.4 New Construction of Spillway	843	833	1,677									316	313	422	417	105	104				
Sub-total	72,173	71,312	143,485									27,065	26,742	36,087	35,656	9,022	8,914				
1.3 Dap Da River																					
1.3.1 Dyke	24,445	24,154	48,599									3,911	3,865	5,133	5,072	5,133	5,072	5,133	5,072	5,133	5,072
1.3.2 Bridges	22,249	21,984	44,233									3,560	3,517	4,672	4,617	4,672	4,617	4,672	4,617	4,672	4,617
1.3.3 Side Overflow Spillway	3,446	3,405	6,852									3,446	3,405								
1.3.4 New Construction of Sluice Gates	21,880	21,619	43,499									3,501	3,459	4,595	4,540	4,595	4,540	4,595	4,540	4,595	4,540
1.3.5 Bank Protection Works	5,656	5,589	11,245									905	894	1,188	1,174	1,188	1,174	1,188	1,174	1,188	1,174
1.3.6 Reconstruction of Irrigation Weir	20,500	20,256	40,756									7,688	7,596	10,250	10,128	2,563	2,532				
Sub-total	98,178	97,007	195,184									23,011	22,736	25,839	25,530	18,151	17,935	15,589	15,403	15,589	15,403
1.4 Go Cham River																					
1.4.1 Dyke	4,296	4,244	8,540									1,074	1,061	1,418	1,401	1,418	1,401	387	382		
1.4.2 Bridges	7,198	7,112	14,311									1,800	1,778	2,375	2,347	2,375	2,347	648	640		
1.4.3 Side Overflow Spillway	960	949	1,909									960	949								
1.4.4 New Construction of Fixed Weir	6,239	6,165	12,404									2,340	2,312	3,120	3,082	780	771				
1.4.5 Reconstruction of Irrigation Weir	3,120	3,082	6,202									1,170	1,156	1,560	1,541	390	385				
1.4.6 Bank Protection Works	5,031	4,971	10,003									1,258	1,243	1,660	1,641	1,660	1,641	453	447		
Sub-total	26,845	26,524	53,369									8,601	8,499	10,133	10,012	6,623	6,544	1,487	1,470		
1.5 Tan An River																					
1.5.1 Dyke	34,532	34,120	68,651									5,525	5,459	7,252	7,165	7,252	7,165	7,252	7,165	7,252	7,165
1.5.2 Bridges	18,977	18,751	37,729									3,036	3,000	3,985	3,938	3,985	3,938	3,985	3,938	3,985	3,938
1.5.3 Side Overflow Spillway	3,440	3,399	6,839									3,440	3,399								
1.5.4 New Construction of Sluice Gate	42,391	41,885	84,277									6,783	6,702	8,902	8,796	8,902	8,796	8,902	8,796	8,902	8,796
1.5.5 Improvement of Irrigation Weir	17,826	17,614	35,440									6,685	6,605	8,913	8,807	2,228	2,202				
1.5.6 Bank Protection Works	6,360	6,284	12,644									1,018	1,005	1,336	1,320	1,336	1,320	1,336	1,320	1,336	1,320
Sub-total	123,527	122,054	245,580									26,487	26,171	30,388	30,025	23,703	23,420	21,475	21,219	21,475	21,219
1.6 Nam Yang River																					
1.6.1 Dyke	3,375	3,334	6,709									1,265	1,250	1,687	1,667	422	417				
1.6.2 Bridges	4,417	4,364	8,782									1,656	1,637	2,209	2,182	552	546				
1.6.3 New Construction of Sluice Gate	875	864	1,739									875	864								
1.6.4 Bank Protection Works	3,096	3,059	6,155									1,161	1,147	1,548	1,530	387	382				
Sub-total	11,763	11,622	23,385									4,958	4,899	5,444	5,379	1,361	1,345				
1.7 Ca My River																					
1.7.1 Dyke	522	516	1,039									392	387	131	129						
1.7.2 Bank Protection Works	1,645	1,625	3,270									1,234	1,219	411	406						
Sub-total	2,167	2,141	4,309									1,625	1,606	542	535						
1.8 Kone River																					
1.8.1 Groyne	648	640	1,288									486	480	162	160						
Sub-total	648	640	1,288									486	480	162	160						
Total of 1	352,065	347,866	699,931									108,998	107,698	108,594	107,298	58,860	58,158	38,550	38,091	37,063	36,621
Equivalent to US\$	23.4	23.1	46.5									7.2	7.1	7.2	7.1	3.9	3.9	2.6	2.5	2.5	2.4
2. Indirect Construction Cost																					
2.1 Resettlement Cost	0	27,580	27,580		7,998		7,998				3,585										
2.2 Engineering Cost	35,207	34,787	69,993					5,633	5,566	4,929	4,870	4,929	4,870	4,929	4,870	4,929	4,870	4,929	4,870	4,929	4,870
2.3 Administration	0	21,825	21,825		2,619		2,619		2,401	2,401	2,401	2,401	2,401	2,401	2,401	2,401	2,401	2,401	2,401	2,401	2,401
2.4 Price Escalation (F.C: 1.6%, L.C: 4.9%)	83,997	338,530	422,527	0	4,223	0	4,848	865	8,590	848	6,660	21,735	79,617	23,820	88,841	14,620	56,428	10,820	43,261	11,289	46,061
2.5 Physical Contingency (10%)	47,127	77,059	124,186	0	1,484	0	1,525	650	2,456	578	1,752	13,566	19,459	13,734	20,341	7,841	12,186	5,430	8,862	5,328	8,995
Total of 2	166,330	499,781	666,112	0	16,324	0	16,772	7,148	27,011	6,354	19,268	40,230	106,346	42,484	116,453	27,389	75,885	21,179	59,394	21,546	62,328
Equivalent to US\$	11.0	33.2	44.2	0.0	1.1	0.0	1.1	0.5	1.8	0.4	1.3	2.7	7.1	2.8	7.7	1.8	5.0	1.4	3.9	1.4	4.1
Total of 1 & 2	518,395	847,647	1,366,042	0	16,324	0	16,772	7,148	27,011	6,354	19,268	149,228	214,044	151,077	223,752	86,249	134,042	59,729	97,485	58,609	98,949
Equivalent to US\$	34.4	56.3	90.7	0.0	1.1	0.0	1.1	0.5	1.8	0.4	1.3	9.9	14.2	10.0	14.8	5.7	8.9	4.0	6.5	3.9	6.6
3. VAT (5 %)	0	60,043	60,043	0	183	0	176	0	938	0	875	0	16,512	0	17,038	0	10,013	0	7,146	0	7,162
Equivalent to US\$	0.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	1.1	0.0	1.1	0.0	0.7	0.0	0.5	0.0	0.5
Total of 1 to 3	518,395	907,690	1,426,085	0	16,507	0	16,948	7,148	27,949	6,354	20,143	149,228	230,556	151,077	240,789	86,249	144,056	59,729	104,631	58,609	106,111
Equivalent to US\$	34.4	60.2	94.6	0.0	1.1	0.0	1.1	0.5	1.9	0.4	1.3	9.9	15.3	10.0	16.0	5.7	9.6	4.0	6.9	3.9	7.0

Note:

- (1) Cost data sources; Feasibility study report, executive summary, Stage 2, No. 444C-05-TT2, General Explanation, No.444C-05-TM (HEC-1) and Supplementary Study, No.444C-10-T1(HEC-1)
 (2) Price level; As of Year 2001
 (3) Exchange rate; US\$ 1.0 = VND 15,068 = ¥ 123.39
 (4) Price escalation; F.C 1.6 % and L.C 4.9 %

Table 15.1 Possible Mitigation Measures for the Conceivable Negative Impacts (Natural Environment)

	Environ. Element	Conceivable negative impacts	Possible mitigation measures	Stage*¹⁾
Physical environment	1) Topography and Geology	· Soil erosion in and around construction site and its sedimentation in downstream site.	· Inevitable to some extent. Sheet covering, planting, installation of deposition pond when necessary.	C
		· Erosion at immediately below the dam site.	· Due consideration in the design of dam for the energy dissipation of overflowing water.	C
		· Reduction of sediment load and acceleration of erosion in Kone river.	· River bank protection by means of gabion and/or other structures.	O/M
		· Sedimentation in back water section in reservoir.	· Monitoring on the sedimentation and accumulation of transported material and its clearance when necessary.	O/M
		· Change of river morphology in Dap Da, Go Chem and Tan An river	· Monitoring on stability of river dikes and bank protection when necessary.	C & O/M
	2) Groundwater	· Rising of groundwater level around both Dinh Binh and Van Phong reservoirs.	· Monitoring on stability of ground near the Dinh Binh and Van Phong reservoirs and protection when necessary.	O/M
	3) Water quality	· Turbid / alkali water flow from construction site.	· Inevitable to some extent. Installation of deposition pond when necessary. · Consideration on weather in earthwork planning.	C
		· Possibility of eutrophication in reservoir.	· Clearance of existing trees, bushes, and others on the reservoir bed before the storage of water.	O/M
		· Degradation of water quality in Kone river.	· Water quality control including wastewater treatment for domestic and industrial water use. · Consideration in agricultural input based on IPM.	O/M
Ecological Environment	1) Terrestrial ecology	· Habitat loss for terrestrial wild animals and disturbance of terrestrial ecology.	· Inevitable to some extent. Further information is needed for effective countermeasure. · Reforestation in head water area for wild animals' resettlement / migration.	O/M
	2) Aquatic ecology	· Reduction of nutrients supply for aquatic biota in Kone river.	· Inevitable to some extent. Further information is needed for effective countermeasure.	O/M
		· Habitat modification of aquatic biota in Kone river.	· Due consideration in design of river improvement, especially for the creation of favorable condition for aquatic biota.	O/M
		· Habitat disturbance in and around back water area of weir.	· Inevitable to some extent. Further information is needed for effective countermeasure.	O/M
	3) Ecology in Thi Nai swamp	· Reduction of nutrients supply for fish, including cultured species.	· Inevitable to some extent. Further information is needed for effective countermeasure.	O/M
		· Reduction of flush out effect due to the decrease of flood frequency.	· Inevitable to some extent. Further information is needed for effective countermeasure.	O/M
		· Degradation of river water quality and adverse effect on aquatic ecology.	· Water quality control including wastewater treatment for domestic and industrial water use. · Consideration in agricultural input based on IPM.	O/M

*¹⁾ C: Construction stage, O/M: Operation and Maintenance stage

Table 15.2 Possible Mitigation Measures for the Conceivable Negative Impacts (Social Environment)

Env. Element	Conceivable negative impacts	Possible mitigation measures	Stage
1) Land acquisition and resettlement	· Impacts of land acquisition and resettlement by Dinh Binh dam construction.	· Due implementation of resettlement action plan prepared by PPC. · Ad hoc public consultation with stakeholders in parallel with the implementation of resettlement action plan (not only before the construction but also after completing action plan).	P, C, and O/M
	· Impacts of land acquisition and resettlement by a dam-related civil works.	· Preparation and implementation of due compensation plan for quarry development (one soil quarry site). · Detail impact evaluation on the alternative road of No. 637, and preparation of countermeasures if necessary.	P, C, and O/M
	· Impacts of land acquisition and resettlement by river improvement and irrigation system development.	· Preparation and implementation of due plans on land compensation and resettlement (set-back type shifting), in parallel with ad hoc public consultation with stakeholders in the same manner as Dinh Binh dam case. · Detail impact evaluation on the river improvement works carried out within the stretches of non-widening design.	P, C, and O/M
2) Social and communal issues	· Conflict between new comers and recipient communities of resettlers by Dinh Binh dam.	· Preparation and implementation of society development program for solution of conflict. · Due management, liaison work and consultation enhancement by the existing RRMB after completion of resettlement action.	P, C, and O/M
	· Life style change of ethnic minority (Bana group) by Dinh Binh dam.	· Support and assistance for smooth life stabilization such as stable cultivation and settlement.	P, C, and O/M
	· Difficulty of restoration of living status on socially vulnerable group.	· Support and assistance to war-affected and/or widow-headed households for their self-sustenance. · Due consideration and care, such as a specific entitlement, for illegal land occupants who use the river area.	P, C, and O/M
3) Fishery in Thi Nai swamp	· Impacts on fishery conditions and resources due to reduction of nutrient supply.	· Inevitable to some extent. Monitoring is essential.	O/M
	· Impacts on fishery conditions and resources due to increment of agricultural input.	· Inevitable to some extent. Monitoring is essential. · Due application of and compliance with IPM.	O/M
4) Cultural and historical heritage	· Impact on historical heritages by river improvement.	· Design consideration and adjustment of the alignment for river widening works.	P
5) Landscape	· Change of existing landscape due to civil work of Dinh Binh dam and river improvement.	· Design consideration including i) minimization to the extent possible of topographical change by earth work, and ii) application of sodding on the cut/embanked slope.	P

P: Pre-construction stage, C: Construction stage, O/M: Operation and Maintenance stage, RRMB: Resettlement and Relocation Management Board for Dinh Binh dam
IPM: Integrated Pest Management

Table 15.3 Environmental Monitoring Plan

	Area/Target	Locations	Monitoring parameters	Frequency	Stage* ¹⁾	Methodology		
Physical Environment	1) Topography and Geology	Construction site	Around Dinh Binh Dam site.	Erosion and sedimentation.	When necessary.	C	Ocular observation.	
		Dinh Binh reservoir	Backwater section of the reservoir.	Sedimentation of transported loads from upstream.	When necessary.	O/M	Ditto	
		Dap Da, Go Chem and Tan An rivers	Dikes of widened reaches.	Stability of dikes.	Ditto	O/M	Ditto	
	2) Groundwater	Van Phong Reservoir	Areas along protection dike of national road, route No. 19.	Groundwater level and stability of ground along the reservoir.	Ditto	O/M	Ditto	
		3) Water quality	Dinh Binh sam, Van Phong weir and quarry site	Downstream area of construction site and quarry site	Turbid / alkali water flow from construction site.	Ditto	C	Ditto
			Dinh Binh reservoir	Center of the reservoir, at vertically 3 depths.	Temperature, pH, Salinity, Turbidity, BOD, COD, DO, SS, Total-N, Total-P and others if necessary.	Two times a year (In dry season and rainy season). 10 years after completion.	O/M	Site survey, water sampling and laboratory test.
	Kone river	Same location as those selected in EIA Study (8 locations).	Ditto	Ditto	O/M	Ditto		
Ecological Environment	1) Terrestrial Ecology	Ecological change of reservoir basin	Outside of reservoir bed (area to be submerged) in Vinh Thanh district.	Inventory of terrestrial flora (higher class plants) and fauna (mammals, birds, reptiles, amphibians and others if necessary).	Two times: before and after the water storage in Dinh Binh reservoir.	Pre-C & O/M	Field investigation and laboratory identification.	
	2) Aquatic Ecology	Dap Da, Go Chem and Tan An rivers.	Widened reaches.	Inventory of aquatic biota, including phytoplankton, zooplankton, benthos, nekton, and others if necessary.	Two times every two year (In dry season and rainy season). 10 years after completion.	O/M	Field investigation and laboratory identification.	
	3) Ecology in Thi Nai swamp	Water quality of Thi Nai swamp	Three stations in the swamp: 1) North part. 2) Center. 3) Estuary mouth.	Temperature, pH, Salinity, Turbidity, BOD, COD, DO, SS, Total-N, Total-P, Pesticides and others if necessary.	Ditto	O/M	Site survey, water sampling and laboratory test.	
		Aquatic biota	Ditto	Inventory of aquatic biota, including phytoplankton, zooplankton, benthos, nekton, and others if necessary.	Ditto	O/M	Field investigation and laboratory identification.	
Social Environment	1) Land acquisition, resettlement	Effectiveness of compensation and resettlement plan	Dinh Binh dam, resettlement sites. Areas along the stretches of river improvement. Areas along new canal systems including Van Phong weir.	Actual progress of and compliance with the plan. Socio-economic conditions and requirement of stakeholders.	Once at pre-construction stage, and continuously after work starts until achievement of self-sustenance.	Pre-C, C and O/M	Field observation, interview or inquiry, consultation	
	2) Social/communal issues	Restoration of livelihood and life stabilization	Ditto.	Socio-economic conditions of vulnerable households comparing with former one.	Ditto.	Ditto	Ditto.	
	3) Fishery in Thi Nai swamp	Fishery conditions and resources	Areas in and around the swamp	Catch amount of fishing by kind. Production of aquaculture by breeding.	Two times every two year (In dry season and rainy season). 10 years after completion.	O/M	Statistic data collection and consolidation, field observation, interview or inquiry, consultation	

*¹⁾ Pre-C: Pre-Construction stage, C: Construction stage, O/M: Operation and Maintenance stage.

Table 16.1 Summary of Disbursement Schedule for Kone River Basin

Alternative II-1 & II-2, Feasibility Study

Unit: Million VND, Million US\$

Description	Total(VND)			2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		2016			
	F.C (VND)	L.C (VND)	Total (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)	F.C (VND)	L.C (VND)				
1. Dinh Binh Multipurpose Reservoir																																	
(1) Direct Construction Cost		379,115	762,808					15,578	15,392	15,578	15,392	89,093	88,030	54,212	53,565	59,717	59,004	75,353	74,454	74,162	73,277												
(2) Indirect Construction Cost	137,218	493,621	630,839	0	51,179	0	53,345	9,877	69,148	9,370	42,128	25,201	53,116	19,033	41,506	21,300	49,226	26,814	65,241	25,624	68,733												
Sub-total	520,910	872,737	1,393,647	0	51,179	0	53,345	25,455	84,540	24,948	57,520	114,294	141,146	73,244	95,071	81,016	108,231	102,167	139,695	99,786	142,010												
Equivalent to US\$	34.6	57.9	92.5	0.0	3.4	0.0	3.5	1.7	5.6	1.7	3.8	7.6	9.4	4.9	6.3	5.4	7.2	6.8	9.3	6.6	9.4												
(3) VAT	0	55,767	55,767		178		171		2,636		2,637		11,611		7,651		8,627		11,018		11,239												
Equivalent to US\$	0.0	3.7	3.7	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.8	0.0	0.5	0.0	0.6	0.0	0.7	0.0	0.7												
Total	520,910	928,504	1,449,414	0	51,357	0	53,516	25,455	87,176	24,948	60,157	114,294	152,757	73,244	102,722	81,016	116,858	102,167	150,713	99,786	153,250												
Equivalent to US\$	34.6	61.6	96.2	0.0	3.4	0.0	3.6	1.7	5.8	1.7	4.0	7.6	10.1	4.9	6.8	5.4	7.8	6.8	10.0	6.6	10.2												
2. Van Phong Weir and Irrigation and Drainage System																																	
(1) Direct Construction Cost	540,562	534,114	1,074,676									116,314	114,926	112,536	111,193	106,677	105,404	106,677	105,404	98,359	97,186												
(2) Indirect Construction Cost	200,331	561,487	761,818	0	32,863	0	34,034	10,138	47,084	9,012	30,172	33,573	70,063	35,105	77,121	36,008	82,800	38,291	92,022	38,205	95,329												
Sub-total	740,893	1,095,601	1,836,494	0	32,863	0	34,034	10,138	47,084	9,012	30,172	149,886	184,989	147,640	188,314	142,685	188,204	144,968	197,426	136,564	192,515												
Equivalent to US\$	49.2	72.7	121.9	0.0	2.2	0.0	2.3	0.7	3.1	0.6	2.0	9.9	12.3	9.8	12.5	9.5	12.5	9.6	13.1	9.1	12.8												
(3) VAT	0	78,838	78,838		229		220		1,209		1,126		15,222		15,271		15,040		15,563		14,958												
Equivalent to US\$	0.0	5.2	5.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0												
Total	740,893	1,174,439	1,915,332	0	33,091	0	34,253	10,138	48,293	9,012	31,298	149,886	200,211	147,640	203,585	142,685	203,245	144,968	212,990	136,564	207,473												
Equivalent to US\$	49.2	77.9	127.1	0.0	2.2	0.0	2.3	0.7	3.2	0.6	2.1	9.9	13.3	9.8	13.5	9.5	13.5	9.6	14.1	9.1	13.8												
3. Downstream Flood Control Plan																																	
(1) Direct Construction Cost	352,065	347,866	699,931																					108,998	107,698	108,594	107,298	58,860	58,158	38,550	38,091	37,063	36,621
(2) Indirect Construction Cost	166,330	499,781	666,112									0	16,324	0	16,772	7,148	27,011	6,354	19,268	40,230	106,346	42,484	116,453	27,389	75,885	21,179	59,394	21,546	62,328				
Sub-total	518,395	847,647	1,366,042									0	16,324	0	16,772	7,148	27,011	6,354	19,268	149,228	214,044	151,077	223,752	86,249	134,042	59,729	97,485	58,609	98,949				
Equivalent to US\$	34.4	56.3	90.7									0.0	1.1	0.0	1.1	0.5	1.8	0.4	1.3	9.9	14.2	10.0	14.8	5.7	8.9	4.0	6.5	3.9	6.6				
(3) VAT	0	60,043	60,043									0	183	0	176	0	938	0	875	0	16,512	0	17,038	0	10,013	0	7,146	0	7,162				
Equivalent to US\$	0.0	4.0	4.0									0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	1.1	0.0	1.1	0.0	0.7	0.0	0.5	0.0	0.5				
Total	518,395	907,690	1,426,085									0	16,507	0	16,948	7,148	27,949	6,354	20,143	149,228	230,556	151,077	240,789	86,249	144,056	59,729	104,631	58,609	106,111				
Equivalent to US\$	34.4	60.2	94.6									0.0	1.1	0.0	1.1	0.5	1.9	0.4	1.3	9.9	15.3	10.0	16.0	5.7	9.6	4.0	6.9	3.9	7.0				
4. Total																																	
(1) Direct Construction Cost	892,627	1,261,095	2,153,722	0	0	0	15,578	15,392	15,578	15,392	205,407	202,956	166,748	164,758	166,394	164,408	182,030	179,858	172,521	170,463	108,998	107,698	108,594	107,298	58,860	58,158	38,550	38,091	37,063	36,621			
(2) Indirect Construction Cost	503,879	1,554,889	2,058,768	0	84,042	0	87,379	20,015	116,232	18,382	72,300	58,774	123,179	54,138	134,951	57,308	148,798	72,253	184,274	70,183	183,330	40,230	106,346	42,484	116,453	27,389	75,885	21,179	59,394	21,546	62,328		
Sub-total of 1 to 3	1,780,198	2,815,985	4,596,183	0	84,042	0	87,379	35,593	131,624	33,960	87,692	264,180	326,135	220,884	299,709	223,701	313,207	254,283	364,132	242,704	353,793	149,228	214,044	151,077	223,752	86,249	134,042	59,729	97,485	58,609	98,949		
Equivalent to US\$	118.1	186.9	305.0	0.0	5.6	0.0	5.8	2.4	8.7	2.3	5.8	17.5	21.6	14.7	19.9	14.8	20.8	16.9	24.2	16.1	23.5	9.9	14.2	10.0	14.8	5.7	8.9	4.0	6.5	3.9	6.6		
(3) VAT of 1 to 3	0	194,648	194,648		407		391		3,845		3,763		26,833		23,105		23,843		27,519		27,072		16,512		17,038		10,013		7,146		7,162		
Equivalent to US\$	0.0	12.9	12.9	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	1.8	0.0	1.5	0.0	1.6	0.0	1.8	0.0	1.8	0.0	1.1	0.0	1.1	0.0	0.7	0.0	0.5	0.0	0.5		
Total of 1 to 3	1,780,198	3,010,633	4,790,831	0	84,449	0	87,770	35,593	135,469	33,960	91,455	264,180	352,968	220,884	322,814	223,701	337,050	254,283	391,651	242,704	380,865	149,228	230,556	151,077	240,790	86,249	144,055	59,729	104,631	58,609	106,111		
Equivalent to US\$	118.1	199.8	317.9	0.0	5.6	0.0	5.8	2.4	9.0	2.3	6.1	17.5	23.4	14.7	21.4	14.8	22.4	16.9	26.0	16.1	25.3	9.9	15.3	10.0	16.0	5.7	9.6	4.0	6.9	3.9	7.0		

Note:

- (1) Cost data sources; Feasibility study report, executive summary, Stage 2, No. 444C-05-TT2, General Explanation, No.444C-05-TM (HEC-1) and Supplementary Study, No.444C-10-T1(HEC-1)
- (2) Price level; As of Year 2001
- (3) Exchange rate; US\$ 1.0 = VND 15,068 = ¥ 123.39
- (4) Price escalation; F.C : 1.6 % and L.C : 4.9 %

Table 17.1 Economic Farmgate Price of Products and Inputs (1/3)

Commodity and Operation	Unit	Price per Unit	Remarks
(*1)			
I. Paddy/Rice (Export Parity)			
1. CIF Bangkok	ton	\$164.8	White rice (Thai), 5% broken, milled.
2. Quality adjustment	ton	\$156.6	Adjusted to 95% of CIF Bangkok (*2).
3. Freight and insurance	- ton	\$20.0	
4. FOB Da Nang	ton	\$136.6	
Expressed in VND	ton	D2,058,300	Exchange rate: US\$1.0 = VND15,068
5. Transport & handling	- ton	D193,200	Between Qui Nhon and Da Nang (300 km)
6. Ex-mill price at Binh Dinh	ton	D1,865,100	
7. Conversion to paddy	ton	D1,212,300	Recovery rate: 65%.
8. Value of by-product	+ ton	D576,000	Rice husk & bran for animal feed, equivalent to maize.
9. Milling Charges	- ton	D24,200	2% of paddy value at ex-mill price (item 7).
10. Mill gate price	ton	D1,764,100	
10. Transport to rice mill	- ton	D14,000	Transport cost within the area (20 km).
11. Economic farm gate price	ton	D1,750,100	
Expressed per kg	kg	D1,750	
II. Maize (Import Parity)			
1. FOB US Gulf ports	ton	\$79.3	No.2, yellow.
2. Quality adjustment	ton	\$51.5	Ajusted to 65% of FOB US (*3).
3. Freight and insurance	+ ton	\$43.0	
4. CIF Da Nang	ton	\$94.5	
Expressed in VND	ton	D1,423,900	Exchange rate: US\$1.0 = VND15,068
5. Transport & handling cost	+ ton	D193,200	Between Qui Nhon and Da Nang (300 km)
6. Wholesale price	ton	D1,617,100	at Qui Nhon
7. Inland transportation	- ton	D14,000	Transport cost within the area (20 km).
8. Economic farm gate price	ton	D1,603,100	
Expressed per kg	kg	D1,600	Competition with imported animal feed.
III. Groundnuts (Export Parity)			
1. CIF North Europe	ton	\$534.0	Groundnuts oil, Rotterdam.
2. Quality Adjustment	ton	\$507.3	Ajusted to 95% of FOB North Europe (*4).
3. Freight and insurance	- ton	\$45.0	
4. FOB Da Nang	ton	\$462.3	
Expressed in VND	ton	D6,965,900	Exchange rate: US\$1.0 = VND15,068
5. Handling cost	- ton	D58,200	at Da Nang
6. Ex-mill price at Ho Chi Minh	ton	D6,907,700	
7. Equivalent to groundnuts	ton	D2,763,100	Recovery rate: 40%.
8. Processing cost	- ton	D138,200	5% of raw nuts value at ex-mill price (item 5).
9. Value of by-product (feed)	+ ton	D665,300	Meal for anima feed, maize equivalent.
10. Mill gate price	ton	D3,290,200	at Da Nang
11. Inland transport	- ton	D193,200	Between Site and Da Nang (300 km)
12. Economic farm gate price	ton	D3,097,000	
Expressed per kg	kg	D3,100	

Note: *1: International market price in 2015 deflated to 2001 constant price by the manufacturing unit value, quoted from the Appendix 2: Grobal Commodity Price Prospects of "Global Economic Prospects and the Developing Countries, 2002".

*2: Adjustment estimated based on the past export record of Vietnam, taking into account the price differences among 5%, 25% & 35% in Bankok market.

*3: Ajustment estimated based on import substitution for animal feed.

*4: Ajustment assumed groundnut oil export quality.

Table 17.1 Economic Farmgate Price of Products and Inputs (2/3)

Commodity and Operation	Unit	Price per Unit (*1)	Remarks
IV. Soybeans (Import Parity)			
1. FOB North Europe	ton	\$164.8	based on CIF at Rotterdam from US
2. Quality Adjustment	ton	\$164.8	No adjustment applied
3. Freight and insurance	+ ton	\$45.0	
4. FOB Ho Chi Minh	ton	\$209.8	
Expressed in VND	ton	D3,161,300	Exchange rate: VND15,068 per \$1.0
5. Transport & handling	+ ton	D386,700	Between Qui Nhon and Ho Chi Minh (730 km)
6. Wholesale price	ton	D3,548,000	at Qui Nhon
7. Inland transport	- ton	D13,200	Between site and Qui Nhon (20 km)
8. Economic farm gate price	ton	D3,534,800	
Expressed per kg	kg	D3,530	
V. Tobacco (Export Parity)			
1. CIF North Europe	ton	\$2,105.2	
2. Quality Adjustment	ton	\$1,999.9	Ajusted to 95% of FOB North Europe
3. Freight and insurance	- ton	\$45.0	
4. FOB Ho Chi Minh	ton	\$1,954.9	
Expressed in VND	ton	D29,456,400	Exchange rate: VND15,068 per \$1.0
5. Handling cost	- ton	D58,200	at Saigon Port
6. Inland transportation	- ton	D132,000	Dong Nai to Ho Chi Minh (200 km)
7. Ex-factory price at Dong Nai	ton	D29,266,200	
Conversion to material	ton	D8,779,900	Raw tobacco leaf recovery: 21%
8. Processing cost	- ton	D2,791,100	
9. Factory gate price	ton	D5,988,800	
10. Inland transportation	- ton	D231,000	Site to Dong Nai factory (350 km)
11. Economic farm gate price	ton	D5,757,800	Price after preparation and curing
Expressed per kg	kg	D5,760	
VI. Sugarcane (Import Parity)			
1. FOB North Europe	ton	\$160.0	
2. Quality Adjustment	+ ton	\$140.0	Ajusted to 85% of FOB North Europe
3. Freight and insurance	+ ton	\$45.0	
4. CIF Da Nang	ton	\$185.0	
Expressed in VND	ton	D2,788,000	Exchange rate: VND15,068 per \$1.0
5. Handling cost	+ ton	D58,200	at Da Nang Port
6. Inland Transportation	+ ton	D148,500	Between Qui Nhon and Da Nang (330 km)
7. Wholesale Price		D2,994,700	at Qui Nhon
8. Inland Transportation	- ton	D19,800	Between Qui Nhon and Tay Son (30 km)
9. Ex-mill factory price	ton	D2,974,900	as sugar at Tay Son.
Value as sugarcane		D252,900	Recovery of sugar from sugarcane: 8.5%
10. Processing Cost	- ton	D35,400	
11. By-product (molasses 5.2%)	+ ton	D0	Molasses, baggase, filtered mud, etc.
12. Mill gate price	ton	D217,500	
13. Transport from farm to mill	- ton	D10,900	
14. Economic farm gate price	ton	D206,600	
Expressed per kg	kg	D210	

Note: *1: International market price in 2015 deflated to 2001 constant price by the manufacturing unit value, quoted from the Appendix 2: Global Commodity Price Prospects of "Global Economic Prospects and the Developing Countries, 2002".

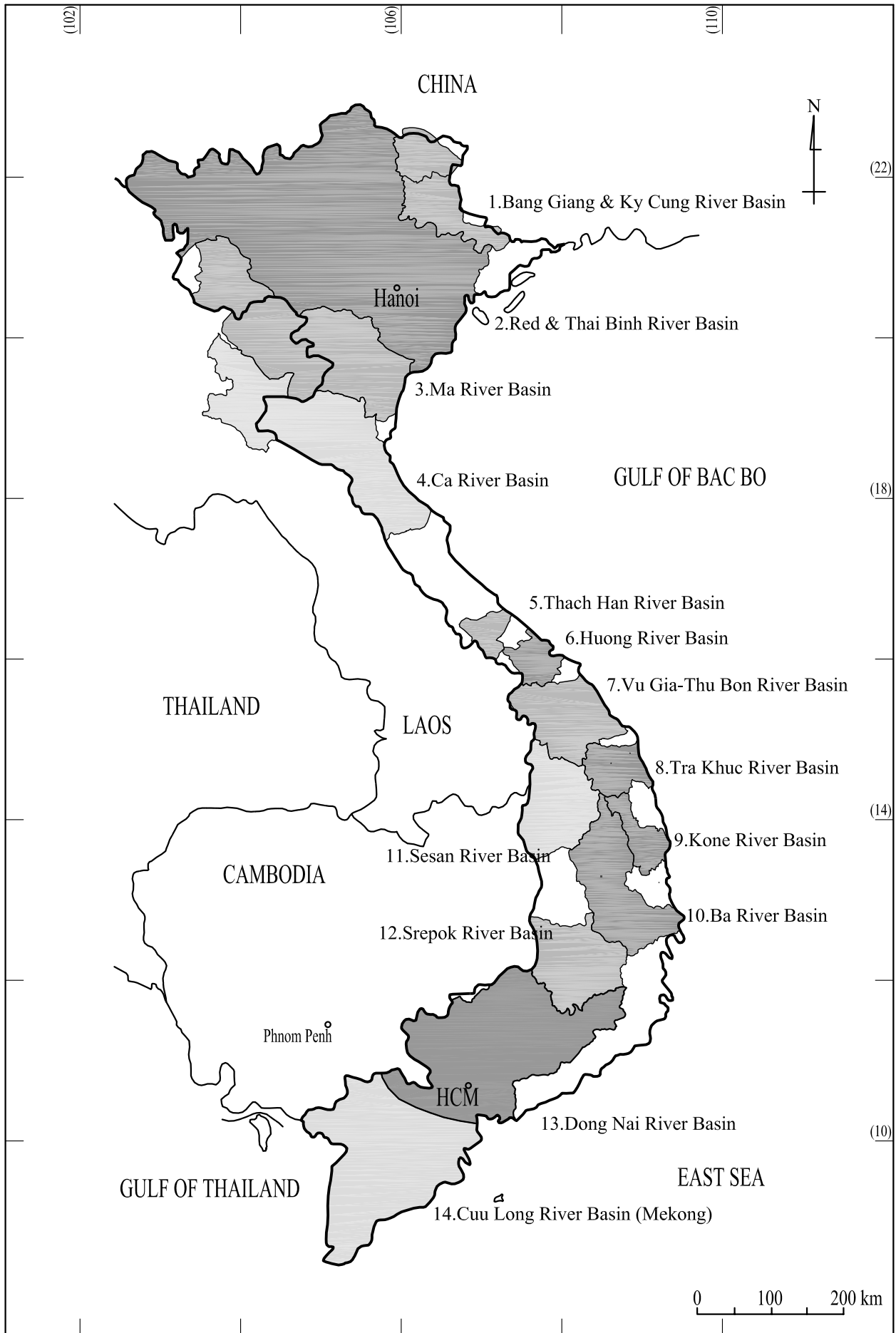
*: Inland transportation cost VND450 / ton km for short distance, and VND660 / ton km for long distance.

Table 17.1 Economic Farmgate Price of Products and Inputs (3/3)

Commodity and Operation	Unit	Price per Unit	Remarks
(*1)			
VII. <u>DAP: diammonium phosphate (Import Parity)</u>			
FOB US Gulf	ton	\$121.7	Bulk, spot.
Freight and insurance	+ ton	\$43.0	
CIF Da Nang	ton	\$164.7	
Expressed in VND	ton	D2,481,700	Exchange rate: VND15,068 per \$1.0
Transport & handling	+ ton	D58,200	at Da Nang Port
Inland transport	+ ton	D135,000	Danag - Qui Nhon (300 km)
Wholesale price	ton	D2,674,900	at Qui Nhon
Inland transport	+ ton	D14,000	Between site and Qui Nhon (average 20 km)
Economic farm gate price	ton	D2,688,900	
Expressed per kg	kg	D2,690	
Effective content N	kg	D12,810	Total N: 21%, total P2O5: 53%.
Effective content P ₂ O ₅	kg	D5,080	
VIII. <u>Potassium Chloride (Import Parity)</u>			
FOB North America	ton	\$79.3	Standard grade, spot, Vancouver
Freight and insurance	+ ton	\$43.0	
CIF Da Nang	ton	\$122.3	
Expressed in VND	ton	D1,842,800	Exchange rate: VND15,068 per \$1.0
Transport & handling	+ ton	D58,200	at Da Nang Port
Inland transport	+ ton	D135,000	Danag - Qui Nhon (300 km)
Wholesale price	ton	D2,036,000	at Qui Nhon
Inland transport	+ ton	D14,000	Between site and Qui Nhon (average 20 km)
Economic farm gate price	ton	D2,050,000	
Expressed per kg	kg	D2,050	
Effective content	kg	D3,730	Total K ₂ O: 55% on average (48% to 62%).
IX. <u>TSP: triple super-phosphate (Import Parity)</u>			
FOB US Gulf	ton	\$100.7	Bulk, spot.
Freight and insurance	+ ton	\$43.0	
CIF Da Nang	ton	\$143.7	
Expressed in VND	ton	D2,165,300	Exchange rate: VND15,068 per \$1.0
Transport & handling	+ ton	D58,200	at Da Nang Port
Inland transport	+ ton	D135,000	Danag - Qui Nhon (300 km)
Wholesale price	ton	D2,358,500	at Qui Nhon
Inland transport	+ ton	D14,000	Between site and Qui Nhon (average 20 km)
Economic farm gate price	ton	D2,372,500	
Expressed per kg	kg	D2,370	
As effective content	kg	D5,150	Total P ₂ O ₅ : 46% on average (43% to 49%).
X. <u>Urea (Import Parity)</u>			
FOB Eastern Europe	ton	\$91.5	Bulk or bagged, spot.
Freight and insurance	+ ton	\$45.0	
CIF Da Nang	ton	\$136.5	
Expressed in VND	ton	D2,056,800	Exchange rate: VND15,068 per \$1.0
Transport & handling	+ ton	D58,200	at Da Nang Port
Inland transport	+ ton	D135,000	Danag - Qui Nhon (300 km)
Wholesale price	ton	D2,250,000	at Qui Nhon
Inland transport	+ ton	D14,000	Between site and Qui Nhon (average 20 km)
Economic farm gate price	ton	D2,264,000	
Expressed per kg	kg	D2,260	
Effective content	kg	D5,380	Total N: 42%.

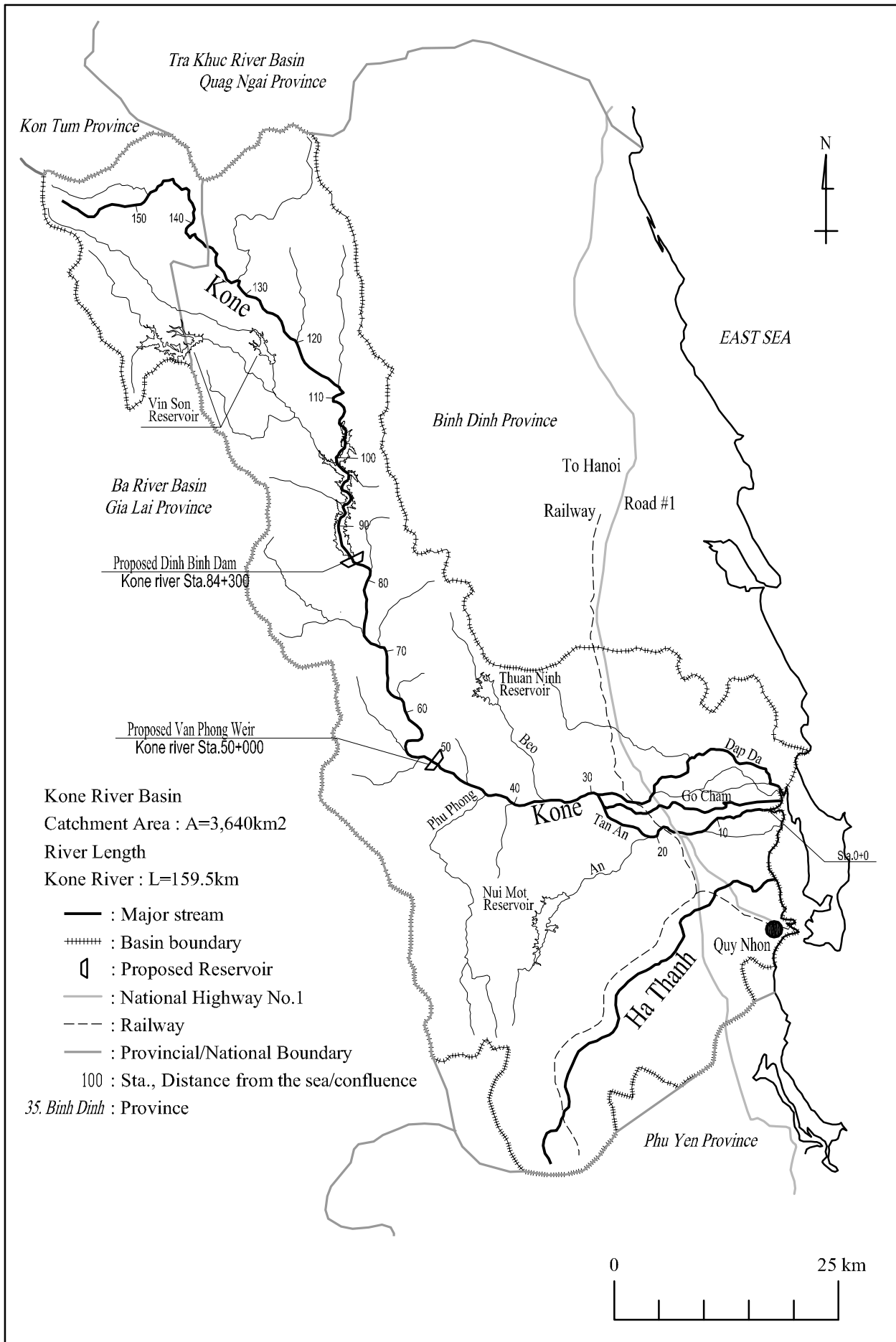
Note: *1: International market price in 2015 deflated to the 2001 constant price by the manufacturing unit value, quoted from the Appendix 2: Global Commodity Price Prospects of "Global Economic Prospects and the Developing Countries, 2002".

Figures



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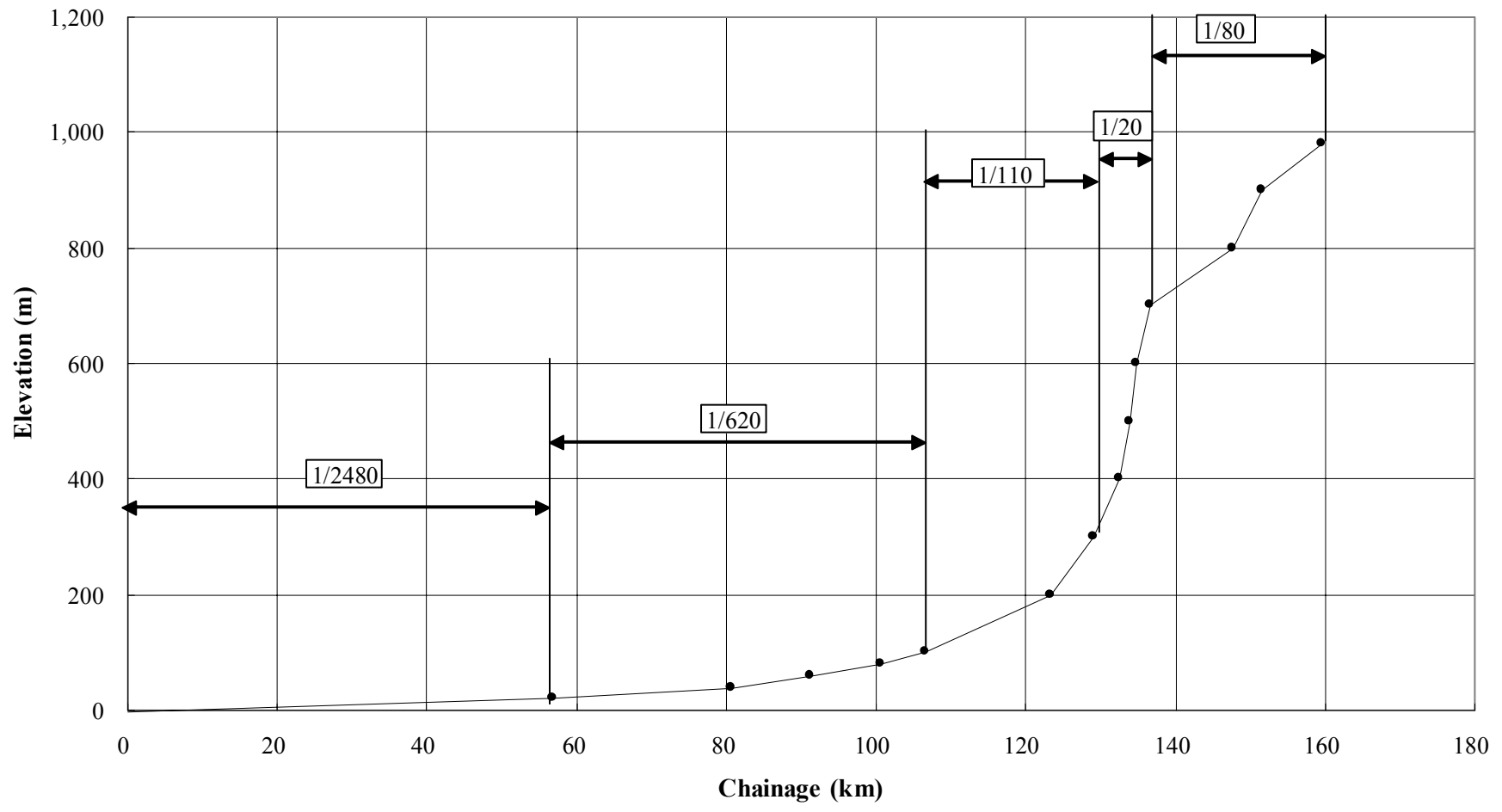
Figure 1.1
Location Map of 14 River Basins



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Figure 2.1
River System of Kone River Basin

Figure 2.2
Longitudinal Profile of Kone River



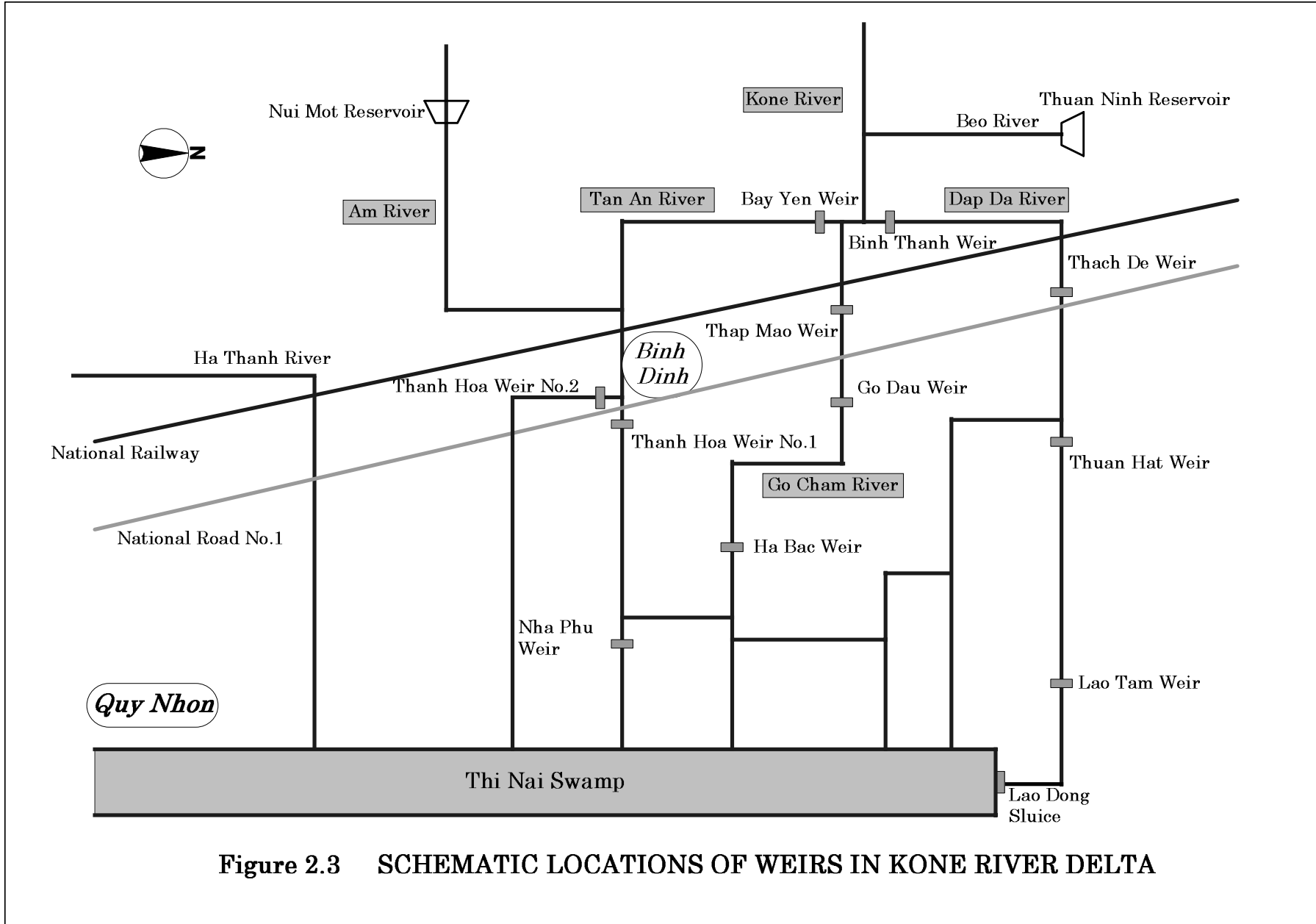
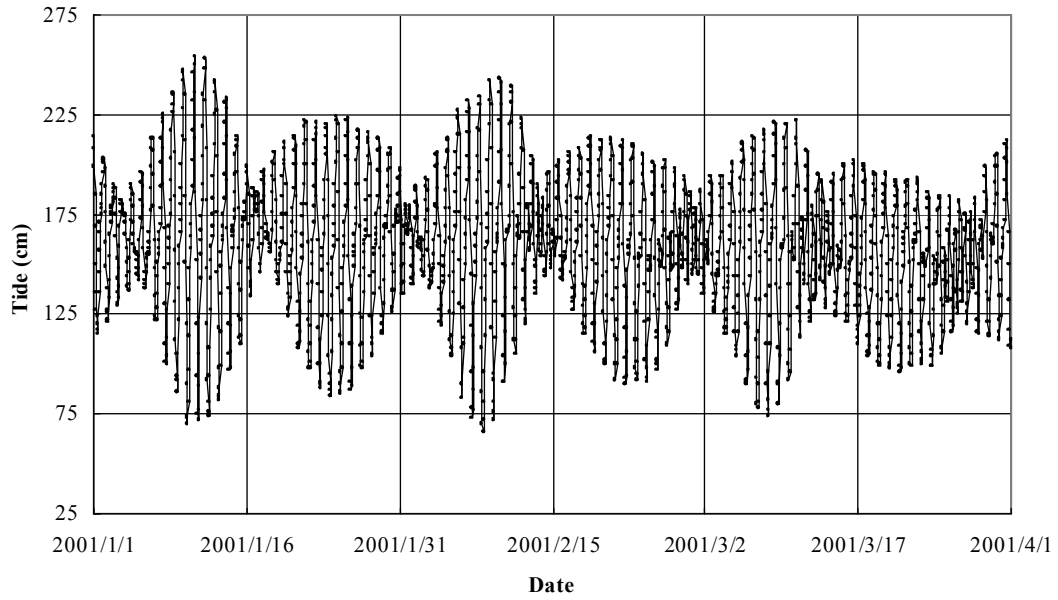


Figure 2.3 SCHEMATIC LOCATIONS OF WEIRS IN KONE RIVER DELTA

January to March



April to June

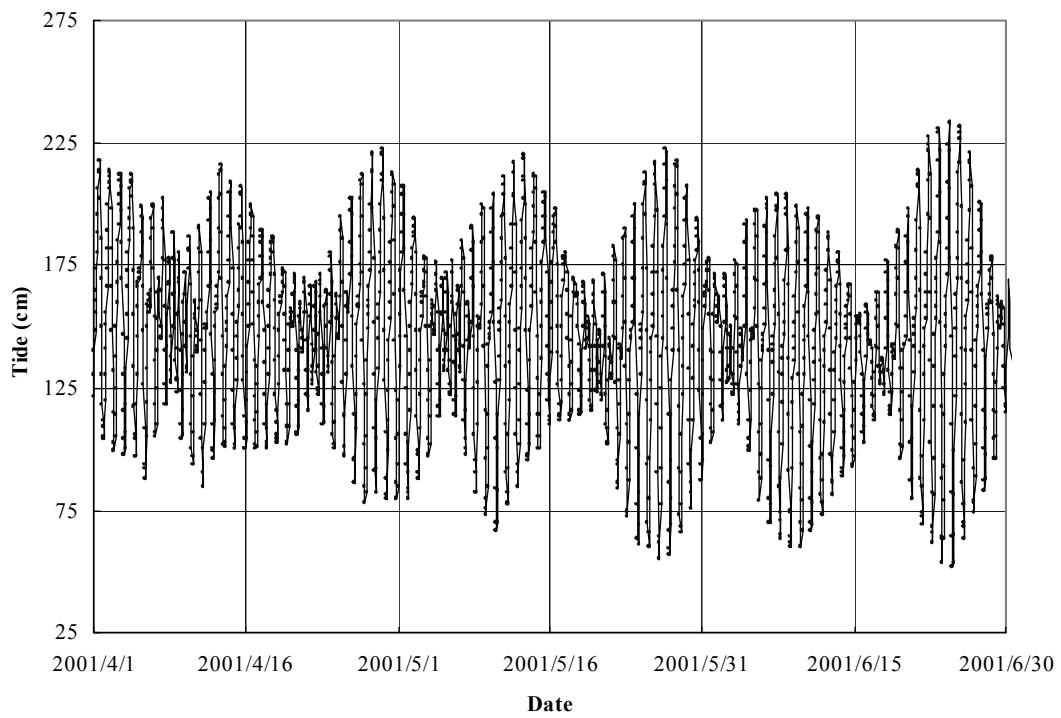
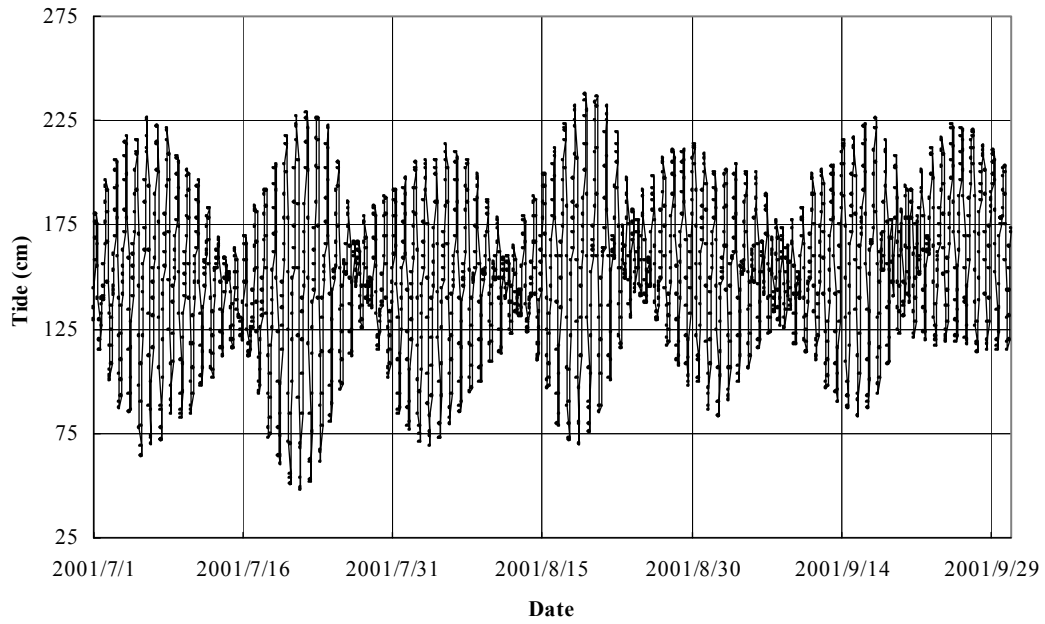


Figure 2.4 (1) Tide at Quy Nhon in 2001 January to June

July to September



**Tide at Quy Nhon in 2001
October to December**

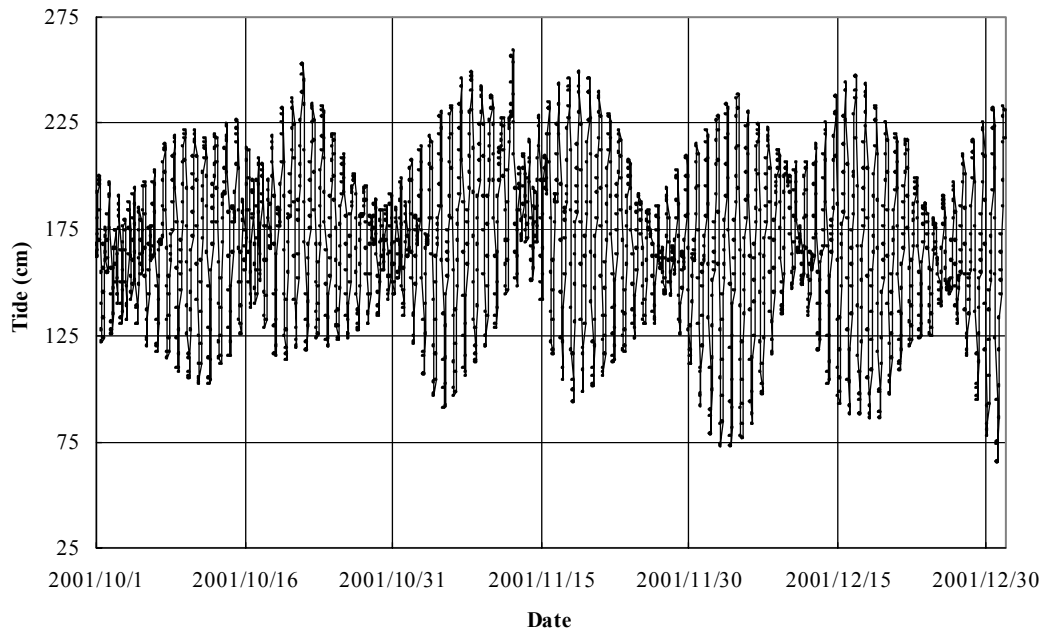


Figure 2.4 (2) Tide at Quy Nhon in 2001 July to December