Appendix F

Agricultural Development

Appendix F
Agricultural Development

Table of Contents

List of Tables

Page

List of Figures

Page

Appendix F Agricultural Development

1 NATIONAL AND PROVINCIAL AGRICULTURE DEVELOPMENT POLICY

1.1 Direction of Agricultural Development in South Central Coast Region

The Kone River Basin is located in the South Central Coastal Region. According to the agricultural development policy and strategy of the government, the direction given to this region is summarized in the following table:

Direction and Strategy for Agriculture and Rural Development for 2001-2010 in South Central Coastal Zone by MARD

Commodity	Direction and Strategy	Target in 2010
- Food	- Intensification to meet local demand of food	- Rice: 2.70 million ton in 516,800 ha - Maize: 257,600 ton in 70,000 ha - Total production: 3.26 million ton
- Sugarcane	- Stable supply of material to sugarcane mills with reduction of production cost to increase competitiveness	
- Perennial Industrial Crop	- Cashew export in 80% to 90% of production - Rubber tree - Fruit tree	- Cashew: 80,000 ton in 90,000 ha - 31,500 ha of rubber plantation - 74,300 ha of fruit tree (banana, mango, dragon fruit, grape)
- Animal Husbandry	- Cattle herding - Goat for semi-mountainous area - Duck for coastal area	- Beef: 76,300 ton by 1.5 million heads
- Fishery	- Intensified shrimp aquaculture, to produce 50% of the national production	- Shrimp: 56,800 ton in 29,800 ha of aquaculture pond

Based on the above, the general direction for agricultural development in the Kone River Basin is assumed to be the following points:

i) Intensification of food production for local demand,
ii) Increase and stabilization of annual industrial crop production including sugarcane for import substitution and export,
iii) Expansion of perennial industrial trees and fruits trees,
iv) Promotion of livestock production focusing beef and other meat, and
v) Intensification of shrimp aquaculture for export.

1.2 Socio-Economic Development Plan of Binh Dinh Province

After reviewing the performance of economic development during the period from 1991 to 2000, the socio-economic development plan in Binh Dinh province was formulated for the next 10 years from 2001 to 2010, taking into account the national and regional economic situation as well as physical development potential.

In the development plan, the average GRDP growth rate target is 9.5% per annum through transformation of economy, in which target of GDP sector-wise share is expected at 26% to 28% by agriculture sector, 32% to 34% by industries and construction, and 38% to 40% by service sector. Agriculture sector will gradually decrease its position from current 47% of share in GRDP, mainly due to relatively low growth potential compared with the industrial and commercial sectors.

Priority in infrastructure development is given to water resources, transport, industries and tourism to enable each of economic sectors to develop smoothly. Private sector and foreign investment will be promoted to raise efficiency along with restructuring of cooperative sector. Enhancement of education and vocational training are emphasized to increase quality of labor force. Population is expected to be less than 1.7 million within 2010. Development direction of agriculture sector in the plan is summarized below:

Development Direction of Agriculture Sector

Sub-Sector	Direction	
Food Crops	Paddy:	Shifting of low-productive paddy area to shrimp aquaculture and other suitable crops.
		Expansion of irrigation area to introduce new crop varieties and advanced cultivation technology.
	Maize:	Expansion of production through increase of unit yield.
	Cassava:	Stabilization of planted area and increase of unit yield.
Industrial Crops	Expansion of planted area and increase of unit yield of sugarcane, coconut, cashew and fruit trees.	
Livestock	Increase of cattle (beef and dairy), pig and poultry though introduction of livestock farm models to increase production and quality.	
Forestry	Zoning of forest regeneration, application of agro-forestry development on bare lands, increase of forest cover.	
Fishery	Expansion of shrimp culture by conversion of saline paddy field to aquaculture land, development of cage culture in coastal and marine area, promotion of sustainable development taking into account of ecological environment and production potential,	

In addition to the above direction, high priority in the industrial sector is given to processing industry for agriculture, forestry and fishery products.

1.3 Agriculture and Rural Development Plan of Binh Dinh Province

Based on the national development plan and the socio-economic development plan of the

province, the agriculture and rural development plan in Binh Dinh province was formulated covering the period of 10 years from 2001 to 2010. In this plan, the following points are focused for development:

1) Sustainable development in view of land, water and biological resources,
2) Increase of crop production through crop diversification to meet local food demand and to support processing industry based on the crop suitability in locations,
3) Raising of living standard in the rural area along with social development.

GRDP growth in agriculture sector is expected at 5.0% to 5.5% during the period from 2001 to 2005 and 4.0% to 4.5% in the period of 2006 to 2010. GRDP per capita will increase from the present level of US$320 to US$750 - US$800 in 2010 at the same level of the country. In order to attain the target, high priority is given to the water resource development to supply irrigation water for annual crops to facilitate diversification of crops along with improved farming technologies.

2 IRRIGATION DEVELOPMENT PLAN IN THE KONE RIVER BASIN

2.1 Project Area for Irrigation Development in the Study Area

The project area for irrigation development under the present study is demarcated through the water balance study from the existing development plan of DARD taking into account the such previous studies conducted by HEC1. The project area is 54,500 ha in net, consisting of 24,400 ha of the present irrigation area and 30,100 ha of the rainfed and other area including unused land. The project area is characterized

Irrigation Condition in the Project Area

	Dinh Binh Reservoir			Other Water Sources	Total
	Van Phong	Other Schemes	Subtotal		
Irrigation Area	3,300 ha	12,400 ha	**15,700 ha**	8,700 ha	**24,400 ha**
Rainfed	13,800 ha	7,900 ha	**21,700 ha**	8,400 ha	**30,100 ha**
Total Land	17,100 ha	20,300 ha	**37,400 ha**	17,100 ha	**54,500 ha**

Note: Van Phong includes (i) Van Phone proper area (10,800 ha), (ii) Extension in La Tinh (3,300 ha), and (iii) the command area of Hoi Son Reservoir (3,000 ha).

Other schemes includes such command area of Dinh Binh Reservoir as (i) Tan An – Dap Da (14,500 ha), (ii) Tan An Extension in the lower reach of the Ha Thanh River (2,000 ha), and (ii) Vinh Thanh area etc. (3,700 ha).

Other water sources are command area of tributaries and other rivers like, (i) upstream of the Ha Thanh River, (ii) command areas of Nui Mot, Thuan Ninh, etc.

Source: Estimation by the JICA Study Team based on the DARD information.

2.2 Present Cropped Area in the Project Area

The flood condition is one of the serious constraints for crop cultivation in the project area. In some communes, particularly located in the most lowest area of the Tan An –Dap Da Delta along the Thi Nai Swamp, paddy cropping for the 3rd crop is severely hampered in the rainy season due to the major flood (refer to Table F.1 for cropped area by communes). The serious communes, in which paddy cropped area in 3rd crop season is less than 50% of paddy field during the past 3 years from 1999 to 2001, are listed as below.

Cropped Area of Paddy by Season (average during 1999 to 2001)

Commune	District	Paddy Area	Win.-Spr.	Sum.-Aut.	3rd Crop (Intensity)
Nhon Binh*	Qui Nhon	489 ha	473 ha	449 ha	91 ha (19%)
Cat Tien	Phu Cat	485 ha	460 ha	430 ha	1 ha (0%)
Cat Thang	Phu Cat	567 ha	560 ha	562 ha	50 ha (9%)
Dap Da	An Nhon	234 ha	227 ha	222 ha	6 ha (3%)
Phuoc Thang*	Tuy Phuoc	889 ha	850 ha	826 ha	148 ha (17%)
Phuoc Hoa*	Tuy Phuoc	547 ha	525 ha	527 ha	57 ha (10%)
Phuoc Son*	Tuy Phuoc	1,208 ha	1,179 ha	1,227 ha	477 ha (39%)
Phuoc Thuan*	Tuy Phuoc	619 ha	587 ha	586 ha	267 ha (43%)
Total		**5,038 ha**	**4,861 ha**	**4,829 ha**	**1,097 ha (22%)**

Remark *: Communes located along the Thi Nai Swamp.

Source: 1) Statistical Yearbook 2001 in each district, Binh Dinh Province.
2) Data Set of Binh Dinh Land Use General Inventory, Land Office, Binh Dinh Province.

Accordingly, in order to consider the flood condition on the cultivation, the project area is classified into three categories according to the land position suffering from the floods, namely higher, middle and lower position, as shown in Table F.2 and summarized below:

Land Position and Flood Condition in the Project Area

Position	Higher	Middle	Lower	Total
Area	**37,700 ha**	**13,500 ha**	**3,300 ha**	**54,500 ha**
Irrigated	11,800 ha	10,000 ha	2,600 ha	24,400 ha
Rainfed	25,900 ha	3,500 ha	700 ha	30,100 ha
Minor Flood	Not severe	Partially affected	Severely affected	-
Early Flood	Not severe	Partially affected	Severely affected	-
Major Flood	Not Severe	Severely affected	Severely affected	-
Late Flood	Not severe	Partially affected	Severely affected	-

Taking into account (1) the above flood condition, (2) the agro-climatic condition as shown in Figure F.1, (3) the statistical data at districts/ communes levels, and (4) the previous studies regarding cropping area and production, the present cropping patterns for each land position above are estimated, as below.

Flood Condition and Cropping Pattern in the Project Area

Position	Higher	Meddle	Lower	Total
Cropping Pattern	**A**	**B**	**C**	**-**
Van Phone Area	16,800 ha	300 ha	0 ha	17,100 ha
Other Schemes under Dinh Binh Dam	3,800 ha	13,200 ha	3,300 ha	20,300 ha
Other Water Resources	17,100 ha	0 ha	0 ha	17,100 ha
Total	**37,700 ha**	**13,500 ha**	**3,300 ha**	**54,500 ha**

Remark Figure F.2 is presented in the Section 2.4 together with proposed cropping pattern.

The present cropped area is shown in Table F.3 and summarized below:

Present Cropped Area in the Project Area

Land Position	**Higher**	**Middle**	**Lower**	**Total**
Cropping Pattern	**A**	**B**	**C**	**Combined**
Total Land	37,700 ha	13,500 ha	3,300 ha	54,500 ha
Irrigation Area	11,800 ha	10,000 ha	2,600 ha	24,400 ha
Paddy	39,400 ha	20,000 ha	5,600 ha	65,000 ha
Other Annual Crops	7,800 ha	2,700 ha	200 ha	10,900 ha
Groundnuts/ Soybeans	6,100 ha	1,700 ha	200 ha	7,300 ha
Tobacco	400 ha	0 ha	0 ha	400 ha
Sugarcane	5,700 ha	0 ha	0 ha	5,700 ha
Cassava	4,900 ha	1,400 ha	0 ha	6,300 ha
Total Cropped Area	64,300 ha	25,100 ha	6,300 ha	95,700 ha
Cropping Intensity	**172%**	**182%**	**191%**	**176%**

Source: Estimation by the JICA Study Team based on the Statistics and previous studies.

In the project area, the present cropped area is estimated at about 95,700 ha in total. This corresponds to the average cropping intensity of 176%, consisting of 211% in 24,400 ha of the irrigation area and 133% in 30,100 ha of the rainfed and other land. The low cropping intensity in the rainfed area is mainly due to short supply of irrigation water, and irrigation and drainage improvement will improve crop production through expansion of cropped area and unit yield.

2.3 Basic Concept for Agriculture Development

The agriculture development plan in the project area is formulated based on the irrigation and drainage development, taking into account the agricultural development policies at national and provincial levels, socio-economic scenario in 2020 assumed in this study. The policies include the agricultural development direction in the South Central Coast Region, the socio-economic development plan of the province, and agriculture and rural development plan of DARD. It is assumed that the future agriculture land will be provided with the following conditions under the project works:

(1) Irrigation water will be adequately supplied within the available water resources.

(2) Cultivated land will be protected from the minor, early and late floods except major floods.

(3) Drainage condition will be improved to remove internal excessive water from the cultivated land.

(4) Agricultural land in the lower land near coast will not suffer from salinity.

Under the above condition, it is expected to expand the cropped area. The conditions will also enable to introduce technical improvement of farming practices, including introduction of improved varieties, efficient farming practices, proper input dosage, etc. to be extended through the DARD extension channels.

Regarding the crops to be cultivated under the project, the following conditions are taken into account:

Crops	Conditions to be take into account
- Paddy	- Paddy will be the main crop in order to secure stable farmers' income. - The present proportion of paddy against total cropped area is more than 80% in the irrigation area. The future proportion will not exceed this level in order to maintain the provincial policy of crop diversification.
- Maize	- Maize is expanded to meet the feed requirement in the province. - Demand is also taking into account for supply to the feed processing factories to be established in the province according to the development plan of the province.
- Sweet Potatoes, Cassava and Sesame	- These crops will not be cropped under irrigation, since these crops are rainfed crops in their nature. Their profitability will not compensate the cost for irrigation and drainage development.
- Groundnuts and Soybeans	- Groundnuts and soybeans are expanded under the irrigation condition, as the main annual subsidiary crops. - These crops are rotated with other crops like maize, sugarcane and paddy.
- Tobacco	- Tobacco is expanded, however, cropped area is limited to small area due to the marketing situation.
- Sugarcane	- Milling capacity is the limiting factor for sugarcane production. - Present capacity of the milling factory in Tay Son is 324,000 ton per annum, and expected for expansion to 450,000 ton. The future production is assumed to be 70% of the future capacity taking the present condition into account.

Although such other crops as vegetables and fruits trees are expected to be high profitability and high value added, the demand outside the province needs to be developed in terms of marketability. Under the present condition, severe competition and higher risk is expected for those high profit crops. Therefore, these crops are excluded from the project under the present situation.

The crops are conservatively selected in order to assure the project benefits. Since the paddy requires the largest irrigation water per ha, other promising crops can be substituted with paddy in terms of water resource availability in future.

2.4 Proposed Cropped Area under the Project

Through irrigation and drainage development, the condition of farmland will improved as mentioned above. This will enable to introduce the improved varieties of crops with efficient farming practices and proper input dosage. This will expand the cropped area and increase unit yield with quality improvement. Based on these conditions, the future cropping pattern and cropped area is formulated as shown in Figure F.2 and Table F.4, and summarized below:

Proposed Cropped Area in the Project Area

Land Position	Higher	Middle	Lower	Total
Cropping Pattern	**A**	**B**	**C**	**Combined**
Future Irrigation Area	37,700 ha	13,500 ha	3,300 ha	54,500 ha
Paddy	63,900 ha	20,800 ha	5,300 ha	90,000 ha
Maize	12,000 ha	5,500 ha	700 ha	18,200 ha
Groundnuts/ Soybeans	5,200 ha	4,1000 ha	6000 ha	9,900 ha
Tobacco	700 ha	0 ha	0 ha	700 ha
Sugarcane	5,600 ha	0 ha	0 ha	5,600 ha
Pineapple	300 ha	0 ha	0 ha	300 ha
Total Cropped Area	87,700 ha	30,400 ha	6,600 ha	124,700 ha
Cropping Intensity	**234%**	**220%**	**200%**	**229%**

2.5 Incremental Production under the Project

Incremental cropped area by the project from the present condition is shown as summarized below:

Increment of Cropped Area

	Present	Project	Increment	Increase Rate
Irrigation Area	24,400 ha	54,500 ha	30,100 ha	123%
Non-Irrigation Area	30,100 ha	0 ha	-30,100 ha	-100%
Total	54,500 ha	54,500 ha	0 ha	0%
Paddy	65,000 ha	90,000 ha	+25,000 ha	+38%
Maize	10,900 ha	18,200 ha	+7,300 ha	+67%
Groundnuts/ Soybeans	7,300 ha	9,900 ha	+12,600 ha	+36%
Tobacco	400 ha	700 ha	+300 ha	+75%
Sugarcane	5,700 ha	5,600 ha	-100 ha	-2%
Pineapple	0 ha	300 ha	+300 ha	-100%
Cassava	6,300 ha	0 ha	-6,300 ha	-100%
Total Cropped Area	95,700 ha	124,700 ha	29,000 ha	+30%
Cropping Intensity	**176%**	**229%**	+53%	+30%

As shown in the above table, the future cropped area increase by 29,000 ha to 124,700 ha from the present cropped area of 95,700 ha. Improvement of drainage condition will

cause the expansion of paddy crops in the rainy season, but not for other subsidiary crop due to high soil moisture condition.

The anticipated yield of crops is estimated based on the present unit yield and the conditions improved under the project such sufficient irrigation water supply, proper drainage, improved farming practices, and adequate input dosage. Based on the future cropping area and the anticipated unit yields, the crop production is estimated as shown in Table F.5 and summarized below:

Production Increment in the Project Area

	Present			Project under Project			Increment (ton)
	Area (ha)	Unit Yield (ton/ha)	Production (ton)	Area (ha)	Unit Yield (ton/ha)	Production (ton)	
Paddy	64,700	2.2-4.3	245,700	90,200	4.7	427,500	181,800
Maize	10,800	1.4-3.3	17,000	17,900	4.5	80,600	63,600
Groundnuts/Soybeans	7,500	0.7-1.5	6,900	9,800	1.9	18,600	11,700
Tobacco	400	0.9-1.5	400	700	1.7	1,200	800
Sugarcane	5,600	34.1-49.7	191,000	5,700	60.0	342,000	151,000
Pineapple	0	-	0	300	20.0	6,000	6,000
Cassava	6,600	6.5	42,900	0	-	0	-42,900
Total Cropped Area	95,600		503,900	124,600		875,900	372,000

Total crop production will increase by 372,000 ton to 875,900 ton from the present production of 503,900 ton by 72%.

Table F.1 Paddy Production in the Kone River Basin (Average in 1999 to 2001) (1/2)

District/ City	Ward/ Subtown/ Commune	Average of 3 Years (1999 to 2001)											
		Total			Winter-Spring			Sum-Aut			Third crop		
		Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
		ha	ton	ton/ha	ha	ton	ton/ha	ha	ton	ton/ha	ha	ton	ton/ha
1 Qui Nhon		2,747	11,180	4.07	1,132	4,964	4.39	1,068	4,342	4.07	547	1,874	3.42
2 An Lao		39	112	2.85	0	0	-	37	107	2.88	2	5	2.33
3 Hoai Nhon		-	-	-	-	-	-	-	-	-	-	-	-
4 Hoai An		-	-	-	-	-	-	-	-	-	-	-	-
5 Phu My		7,880	31,900	4.05	2,776	12,039	4.34	2,193	9,948	4.54	2,911	9,913	3.40
6 Vinh Thanh		1,878	6,496	3.46	634	2,418	3.81	494	1,935	3.91	750	2,143	2.86
7 Phu Cat		16,315	63,378	3.88	6,313	27,978	4.43	4,678	20,377	4.36	5,324	15,023	2.82
8 Tay Son		13,387	57,487	4.29	4,573	22,202	4.86	3,887	17,436	4.49	4,927	17,848	3.62
9 An Nhon		20,983	94,103	4.48	7,344	38,597	5.26	7,094	30,688	4.33	6,545	24,818	3.79
10 Tuy Phuoc		19,745	92,725	4.70	7,637	43,844	5.74	7,560	31,804	4.21	4,548	17,077	3.75
11 Van Canh		1,835	3,983	2.17	538	1,716	3.19	261	783	3.00	1,036	1,485	1.43
Total of Data		84,810	361,364	4.26	30,946	153,758	4.97	27,274	117,421	4.31	26,591	90,186	3.39
Whole Province		127,259	524,745	4.12	46,660	219,949	4.71	40,610	172,730	4.25	39,990	132,066	3.30
1 Qui Nhon	Tran Quang Dieu	301	1,130	3.75	127	507	3.99	101	382	3.79	73	241	3.29
2 Qui Nhon	Bui Thi Xuan	332	1,207	3.64	114	444	3.90	143	523	3.67	76	240	3.18
3 Qui Nhon	Dong Da	0	0	-			-			-			-
4 Qui Nhon	Thi Nai	0	0	-			-			-			-
5 Qui Nhon	Quang Trung	34	111	3.29	20	74	3.67	13	36	2.73			-
6 Qui Nhon	Ghenh Rang	53	161	3.02	30	102	3.36	10	32	3.10	13	27	2.12
7 Qui Nhon	Ngo May	0	0	-			-			-			-
8 Qui Nhon	Nguyen Van Cu	0	0	-			-			-			-
9 Qui Nhon	Tran Hung Dao	0	0	-			-			-			-
10 Qui Nhon	Le Hong Phong	0	0	-			-			-			-
11 Qui Nhon	Ly Thuong Kiet	0	0	-			-			-			-
12 Qui Nhon	Tran Phu	0	0	-			-			-			-
13 Qui Nhon	Le Loi	0	0	-			-			-			-
14 Qui Nhon	Hai Cang	0	0	-			-			-			-
15 Qui Nhon	Nhon Binh	1,013	4,540	4.48	473	2,234	4.72	449	1,965	4.38	91	340	3.74
16 Qui Nhon	Nhon Phu	879	3,640	4.14	315	1,438	4.57	298	1,245	4.17	265	957	3.61
17 Qui Nhon	Nhon Ly	0	0	-			-			-			-
18 Qui Nhon	Nhon Hai	0	0	-			-			-			-
19 Qui Nhon	Nhon Hoi	135	392	2.90	53	165	3.14	53	159	2.98	29	68	2.32
Total of Qui Nhon City		2,747	11,180	4.07	1,132	4,964	4.39	1,068	4,342	4.07	547	1,874	3.42
5 An Lao	An Toan	39	112	2.85			-	37	107	2.88	2	5	2.33
Total of An Lao District		39	112	2.85	0	0	-	37	107	2.88	2	5	2.33
1 Phu My	Phu My	843	3,469	4.11	272	1,197	4.41	270	1,230	4.55	301	1,041	3.46
14 Phu My	My Chanh	1,404	5,389	3.84	588	2,462	4.19	315	1,395	4.43	502	1,531	3.05
16 Phu My	My Quang	886	3,573	4.03	273	1,184	4.33	241	1,088	4.52	372	1,301	3.50
17 Phu My	My Hiep	2,712	11,235	4.14	943	4,169	4.42	805	3,665	4.55	964	3,402	3.53
18 Phu My	My Tai	1,199	4,431	3.69	421	1,722	4.09	285	1,173	4.12	493	1,537	3.11
19 Phu My	My Cat	835	3,804	4.56	278	1,306	4.70	279	1,398	5.02	278	1,101	3.95
Total of Phu My District		7,880	31,900	4.05	2,776	12,039	4.34	2,193	9,948	4.54	2,911	9,913	3.40
1 Vinh Thanh	Vinh Son	178	502	2.82	93	296	3.20	28	83	3.00	58	123	2.12
2 Vinh Thanh	Vinh Kim	21	60	2.83	8	25	3.00	10	28	2.94	3	7	2.09
3 Vinh Thanh	Vinh Hoa	26	70	2.70	10	29	2.90	8	23	3.00	9	19	2.19
4 Vinh Thanh	Vinh Hiep	306	1,097	3.58	95	366	3.85	95	394	4.15	116	337	2.90
5 Vinh Thanh	Vinh Hao	76	259	3.41	23	84	3.66	25	95	3.80	28	80	2.86
6 Vinh Thanh	Vinh Quang	434	1,325	3.06	117	425	3.65	81	305	3.76	236	596	2.52
7 Vinh Thanh	Vinh Thinh	838	3,182	3.80	289	1,193	4.14	249	1,008	4.05	300	982	3.27
Total of Vinh Thanh District		1,878	6,496	3.46	634	2,418	3.81	494	1,935	3.91	750	2,143	2.86
1 Phu Cat	Ngo May	317	681	2.14	103	270	2.63	35	87	2.51	180	323	1.80
2 Phu Cat	Cat Son	567	1,888	3.33	202	813	4.03	121	511	4.23	245	564	2.30
3 Phu Cat	Cat Minh	1,557	6,697	4.30	555	2,490	4.48	483	2,030	4.20	518	2,177	4.20
4 Phu Cat	Cat Tai	1,819	7,219	3.97	651	2,791	4.29	509	2,201	4.33	660	2,228	3.38
6 Phu Cat	Cat Lam	652	1,869	2.87	213	812	3.81	123	395	3.20	315	662	2.10
7 Phu Cat	Cat Hanh	2,298	9,268	4.03	777	3,510	4.52	654	2,815	4.30	866	2,943	3.40
10 Phu Cat	Cat Hiep	600	1,205	2.01	114	305	2.67	70	151	2.16	416	749	1.80
11 Phu Cat	Cat Trinh	1,250	3,750	3.00	453	1,676	3.70	150	555	3.71	648	1,519	2.34
12 Phu Cat	Cat Nhon	1,540	6,444	4.18	630	2,985	4.74	521	2,206	4.24	389	1,253	3.22
13 Phu Cat	Cat Hung	950	4,202	4.42	435	2,095	4.82	330	1,503	4.56	185	604	3.26
14 Phu Cat	Cat Tuong	1,511	5,559	3.68	683	2,982	4.37	433	1,792	4.14	394	784	1.99
15 Phu Cat	Cat Tan	1,190	3,850	3.24	476	1,827	3.83	257	943	3.68	457	1,080	2.36
16 Phu Cat	Cat Tien	891	4,550	5.11	460	2,454	5.33	430	2,093	4.86	1	3	4.00
17 Phu Cat	Cat Thang	1,173	6,198	5.29	560	2,967	5.30	563	3,095	5.50	50	136	2.71

Table F.1 Paddy Production in the Kone River Basin (Average in 1999 to 2001) (2/2)

District/ City	Ward/ Subtown/ Commune	Average of 3 Years (1999 to 2001)											
		Total			Winter-Spring			Sum-Aut			Third crop		
		Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Total of Phu Cat District		16,315	63,378	3.88	6,313	27,978	4.43	4,678	20,377	4.36	5,324	15,023	2.82
1 Tay Son	Phu Phong	663	2,477	3.73	309	930	3.00	172	780	4.53	182	767	4.21
2 Tay Son	Binh Tan	730	2,973	4.07	234	1,052	4.50	240	947	3.94	256	974	3.81
3 Tay Son	Tay Thuan	544	1,913	3.52	162	721	4.44	73	285	3.88	308	907	2.94
4 Tay Son	Binh Thuan	829	2,325	2.81	209	828	3.96	123	448	3.65	497	1,049	2.11
5 Tay Son	Tay Giang	675	2,610	3.87	264	1,226	4.65	136	586	4.32	275	799	2.90
6 Tay Son	Binh Thanh	1,184	5,326	4.50	387	1,847	4.77	395	1,841	4.66	402	1,638	4.08
7 Tay Son	Tay An	1,111	5,170	4.66	426	2,136	5.02	337	1,558	4.63	348	1,477	4.24
8 Tay Son	Binh Hoa	1,472	7,383	5.02	491	2,709	5.52	491	2,435	4.96	491	2,239	4.56
9 Tay Son	Binh Tuong	1,067	4,041	3.79	389	1,791	4.60	227	982	4.33	451	1,268	2.81
10 Tay Son	Tay Vinh	1,056	4,781	4.53	345	1,785	5.17	344	1,601	4.66	367	1,395	3.80
11 Tay Son	Tay Binh	840	3,680	4.38	284	1,412	4.97	260	1,192	4.59	296	1,076	3.63
12 Tay Son	Vinh An	64	175	2.73	31	96	3.11	16	45	2.90	18	35	1.94
13 Tay Son	Tay Xuan	683	3,178	4.65	215	1,144	5.32	239	1,073	4.50	229	961	4.19
14 Tay Son	Tay Phu	957	4,218	4.41	348	1,634	4.70	299	1,335	4.46	310	1,249	4.03
15 Tay Son	Binh Nghi	1,512	7,236	4.78	478	2,892	6.05	538	2,330	4.33	497	2,015	4.06
Total of Tay Son District		13,387	57,487	4.29	4,573	22,202	4.86	3,887	17,436	4.49	4,927	17,848	3.62
1 An Nhon	Binh Dinh	807	4,126	5.11	278	1,706	6.13	269	1,321	4.90	259	1,099	4.24
2 An Nhon	Dap Da	455	2,738	6.02	227	1,473	6.48	222	1,243	5.60	6	23	4.10
3 An Nhon	Nhon Thanh	1,157	5,128	4.43	442	2,228	5.04	422	1,802	4.27	293	1,098	3.75
4 An Nhon	Nhon My	1,919	8,677	4.52	667	3,525	5.28	591	2,554	4.32	661	2,598	3.93
5 An Nhon	Nhon Hanh	2,224	10,507	4.72	795	4,644	5.84	772	3,289	4.26	657	2,574	3.92
6 An Nhon	Nhon Phong	1,275	6,311	4.95	514	2,904	5.65	457	2,098	4.59	303	1,309	4.32
7 An Nhon	Nhon Hau	1,068	4,729	4.43	370	1,981	5.35	347	1,513	4.36	351	1,235	3.52
8 An Nhon	Nhon An	1,591	7,601	4.78	550	3,140	5.71	508	2,291	4.51	533	2,170	4.07
9 An Nhon	Nhon Hung	1,189	5,298	4.46	400	2,180	5.46	391	1,664	4.26	398	1,454	3.65
10 An Nhon	Nhon Phuc	1,420	6,518	4.59	475	2,522	5.31	472	2,102	4.46	473	1,894	4.00
11 An Nhon	Nhon Khanh	1,128	5,138	4.55	377	2,055	5.46	370	1,568	4.24	382	1,514	3.97
12 An Nhon	Nhon Loc	1,798	7,299	4.06	602	2,731	4.54	602	2,431	4.04	594	2,137	3.60
13 An Nhon	Nhon Hoa	2,103	9,317	4.43	716	3,646	5.10	698	3,064	4.39	690	2,607	3.78
14 An Nhon	Nhon Tho	1,740	7,378	4.24	550	2,553	4.64	606	2,625	4.33	583	2,200	3.77
15 An Nhon	Nhon Tan	1,111	3,338	3.00	381	1,309	3.44	368	1,124	3.06	363	906	2.50
Total of An Nhon District		20,983	94,103	4.48	7,344	38,597	5.26	7,094	30,688	4.33	6,545	24,818	3.79
1 Tuy Phuoc	Tuy Phuoc	891	3,970	4.46	309	1,708	5.53	326	1,291	3.97	257	971	3.78
2 Tuy Phuoc	Dieu Tri	595	2,776	4.67	219	1,248	5.70	219	920	4.20	157	608	3.88
3 Tuy Phuoc	Phuoc Thang	1,824	9,390	5.15	850	5,186	6.10	826	3,657	4.43	148	546	3.68
4 Tuy Phuoc	Phuoc Hung	2,010	9,732	4.84	677	4,127	6.10	675	3,058	4.53	658	2,547	3.87
5 Tuy Phuoc	Phuoc Hoa	1,110	5,394	4.86	525	3,046	5.80	527	2,143	4.07	57	205	3.58
6 Tuy Phuoc	Phuoc Quang	1,831	8,843	4.83	664	3,940	5.93	665	2,925	4.40	502	1,978	3.94
7 Tuy Phuoc	Phuoc Son	2,883	14,580	5.06	1,179	7,312	6.20	1,227	5,481	4.47	477	1,787	3.75
8 Tuy Phuoc	Phuoc Hiep	1,997	9,259	4.64	699	4,055	5.80	678	2,847	4.20	620	2,357	3.80
9 Tuy Phuoc	Phuoc Loc	1,501	6,800	4.53	499	2,810	5.63	502	2,059	4.10	499	1,931	3.87
10 Tuy Phuoc	Phuoc Thuan	1,440	6,718	4.67	587	3,424	5.83	586	2,384	4.07	267	910	3.41
11 Tuy Phuoc	Phuoc Nghia	725	3,395	4.68	281	1,620	5.77	280	1,149	4.10	164	626	3.82
12 Tuy Phuoc	Phuoc An	1,850	7,938	4.29	715	3,573	5.00	686	2,656	3.87	449	1,709	3.80
13 Tuy Phuoc	Phuoc Thanh	715	2,591	3.62	268	1,134	4.23	224	771	3.43	223	687	3.08
14 Tuy Phuoc	Phuoc My	374	1,337	3.57	165	660	4.00	140	461	3.30	70	217	3.11
Total of Tuy Phuoc District		19,745	92,725	4.70	7,637	43,844	5.74	7,560	31,804	4.21	4,548	17,077	3.75
1 Van Canh	Van Canh	0	0	-			-			-			-
2 Van Canh	Canh Hiep	171	364	2.13	41	134	3.28	28	77	2.77	102	153	1.50
3 Van Canh	Canh Lien	277	664	2.40	171	466	2.72	79	163	2.07	27	35	1.30
4 Van Canh	Canh Vinh	706	1,854	2.63	235	830	3.53	115	427	3.72	356	596	1.67
5 Van Canh	Canh Hien	122	304	2.48	45	156	3.47	24	77	3.19	53	71	1.33
6 Van Canh	Canh Thuan	385	574	1.49	26	85	3.26	13	37	2.83	346	452	1.31
7 Van Canh	Canh Hoa	175	224	1.28	20	45	2.23	3	2	0.63	152	178	1.17
Total of Van Canh District		1,835	3,983	2.17	538	1,716	3.19	261	783	3.00	1,036	1,485	1.43

Source: Data Set of Binh Dinh Land Use General Inventory in 2000, Land Office of Binh Dinh Province.

Table F.2 Land Position and Irrigation Condition of the Project Area

(unit: ha)

Irrigation Schemes	Land Position and Irrigation Condition (Present)											
	Higher Position			Middle Position			Lower Position			Total		
	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total
1. Van Phong Weir												
- Van Phong Area	40	10,489	10,529	259	27	286	-	-	0	299	10,516	10,815
- Van Phong Extension (La Tinh Baisn)	0	3,297	3,297	-	-	0	-	-	0	0	3,297	3,297
- Command Area ofHoi Son Reservoir	3,000	0	3,000	-	-	0	-	-	0	3,000	0	3,000
Sub-Total of 1	3,040	13,786	16,826	259	27	286	0	0	0	3,299	13,813	17,112
	17.8%	80.6%	98.3%	1.5%	0.2%	1.7%	0.0%	0.0%	0.0%	19.3%	80.7%	100.0%
2. Other Schemes under Dinh Binh Dam												
- Tan An - Dap Da	-	-	0	9,787	1,428	11,215	2,626	691	3,317	12,413	2,119	14,532
- Vinh Thanh etc.	0	3,674	3,674	-	-	0	-	-	0	0	3,674	3,674
- Tan An Extension (Lower Ha Thanh)	-	-	0	0	2,039	2,039	-	-	0	0	2,039	2,039
Sub-Total of 2	0	3,674	3,674	9,787	3,467	13,254	2,626	691	3,317	12,413	7,832	20,245
	0.0%	18.1%	18.1%	48.3%	17.1%	65.5%	13.0%	3.4%	16.4%	61.3%	38.7%	100.0%
Sub-Total of 1+2	3,040	17,460	20,500	10,046	3,494	13,540	2,626	691	3,317	15,712	21,645	37,357
	8.1%	46.7%	54.9%	26.9%	9.4%	36.2%	7.0%	1.8%	8.9%	42.1%	57.9%	100.0%
3. Other Water Reources												
- Kone Tributaries & Ha Thanh	8,721	8,398	17,119	-	-	0	-	-	0	8,721	8,398	17,119
- Kone Tributaries (Middle Reach)	3,196	5,131	8,327	-	-	0	-	-	0	3,196	5,131	8,327
- Thuan Ninh	1,060	1,640	2,700	-	-	0	-	-	0	1,060	1,640	2,700
- Nui Mot	2,920	0	2,920	-	-	0	-	-	0	2,920	0	2,920
- Kone Tributaries (Vinh Thanh Area)	365	561	926	-	-	0	-	-	0	365	561	926
- Ha Thanh Basins (Upstream)	1,180	1,066	2,246	-	-	0	-	-	0	1,180	1,066	2,246
Sub-Total of 3	8,721	8,398	17,119	0	0	0	0	0	0	8,721	8,398	17,119
	50.9%	49.1%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.9%	49.1%	100.0%
4. Grand Total of 1 + 2 + 3	11,761	25,858	37,619	10,046	3,494	13,540	2,626	691	3,317	24,433	30,043	54,476
	21.6%	47.5%	69.1%	18.4%	6.4%	24.9%	4.8%	1.3%	6.1%	44.9%	55.1%	100.0%

Table F.3 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**
Sugarecane	-	-	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	**30,500**	81%	**34,100**	91%	**64,600**	**19,900**	147%	**4,800**	36%	**24,700**	**5,200**	158%	**1,100**	33%	**6,300**	**55,600**	102%	**40,000**	73%	**95,600**
(Cropping Intensity)	258%		132%		171%	199%		137%		183%	200%		157%		191%	228%		133%		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
Sugarecane	-	-	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 F.4 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**
Sugarecane	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	**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**
(Cropping Intensity)	234%				234%	220%				220%	200%				200%	229%				229%
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
Sugarecane	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 F.5 Increment of Production under the Project

Crop	Present			Future under the Project			Increment				
	Area (ha)	Unit Yield (ton/ha)	Production (ton)	Area (ha)	Unit Yield (ton/ha)	Production (ton)	Area (ha)		Unit Yield (ton/ha)	Production (ton)	
Paddy											
Winter-Spring Season	36,500	2.9 - 4.3	140,000	40,700	5.00	203,500	4,200	12%	1.16	63,500	45%
Summer-Autum Season	19,700	2.6 - 3.9	76,800	27,900	4.70	131,100	8,200	42%	0.80	54,300	71%
3rd Crop Season	8,500	2.2 - 3.4	28,900	21,600	4.30	92,900	13,100	154%	0.90	64,000	221%
Sub-total	64,700	2.2 - 4.3	245,700	90,200	4.70	427,500	25,500	39%	0.94	181,800	74%
Maize	10,800	1.4 - 3.3	17,000	17,900	4.50	80,600	7,100	66%	2.93	63,600	374%
Groundnuts & Soybeans	7,500	0.7 - 1.5	6,900	9,800	1.90	18,600	2,300	31%	0.98	11,700	170%
Tobacco	400	0.9 - 1.5	400	700	1.70	1,200	300	75%	0.71	800	200%
Sugarcane	5,600	34.1 - 49.7	191,000	5,700	60.00	342,000	100	2%	25.89	151,000	79%
Pineapple	0	-	0	300	20.00	6,000	300	100%	20.00	6,000	100%
Cassava	6,600	6.50	42,900	0	-	0	-6,600	-	-	-42,900	-
Total	**95,600**	**-**	**503,900**	**124,600**	**-**	**875,900**	**29,000**	**30%**	**-**	**372,000**	**74%**

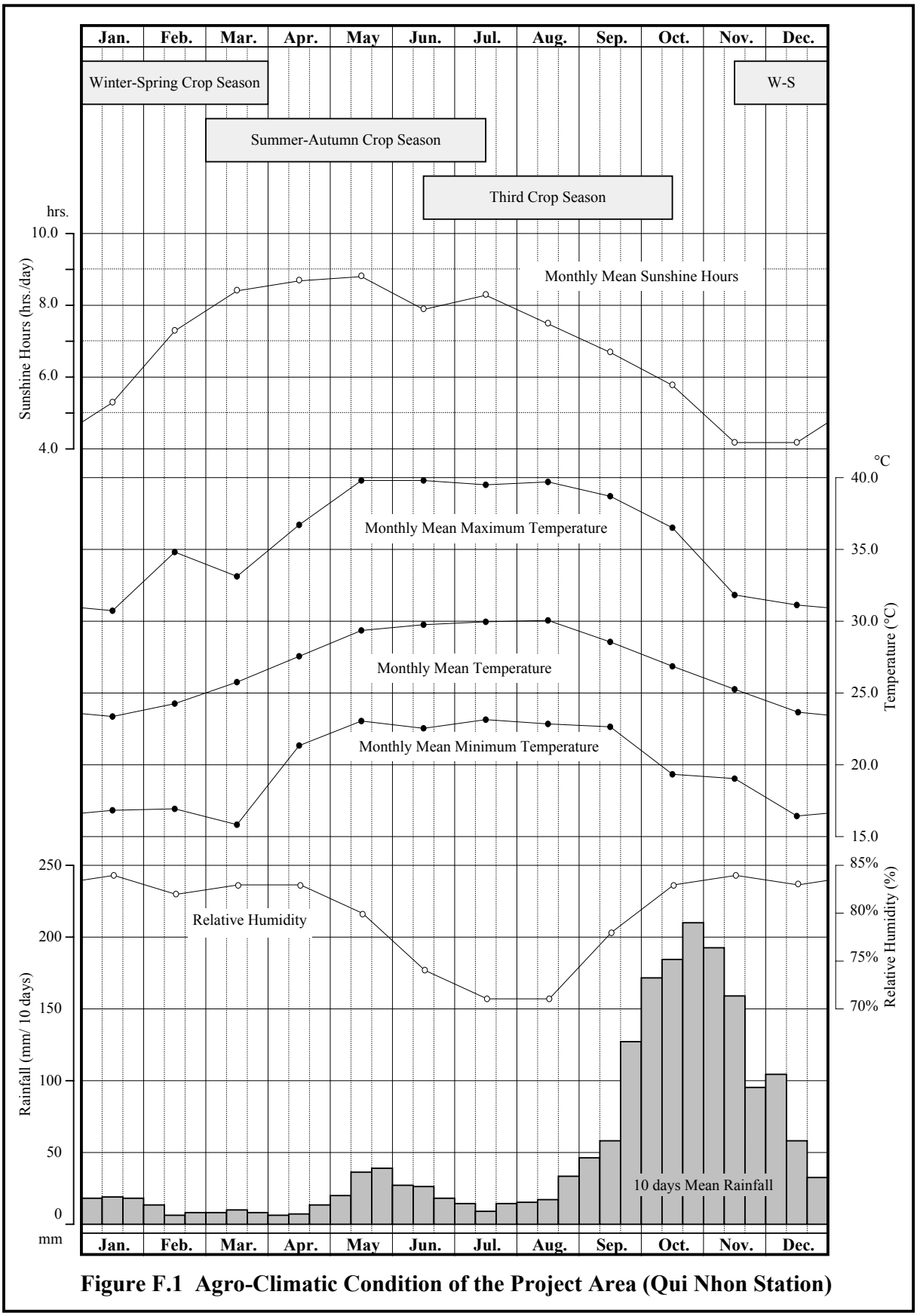


Figure F.1 Agro-Climatic Condition of the Project Area (Qui Nhon Station)

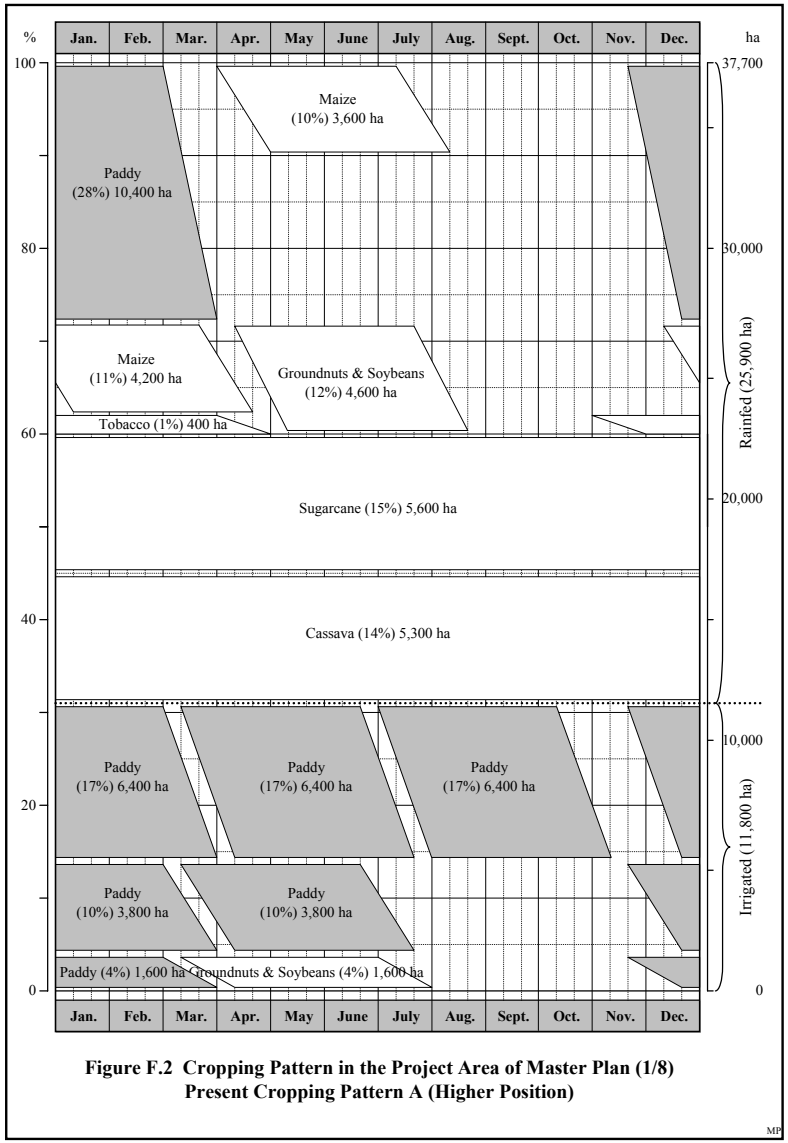


Figure F.2 Cropping Pattern in the Project Area of Master Plan (1/8)
Present Cropping Pattern A (Higher Position)

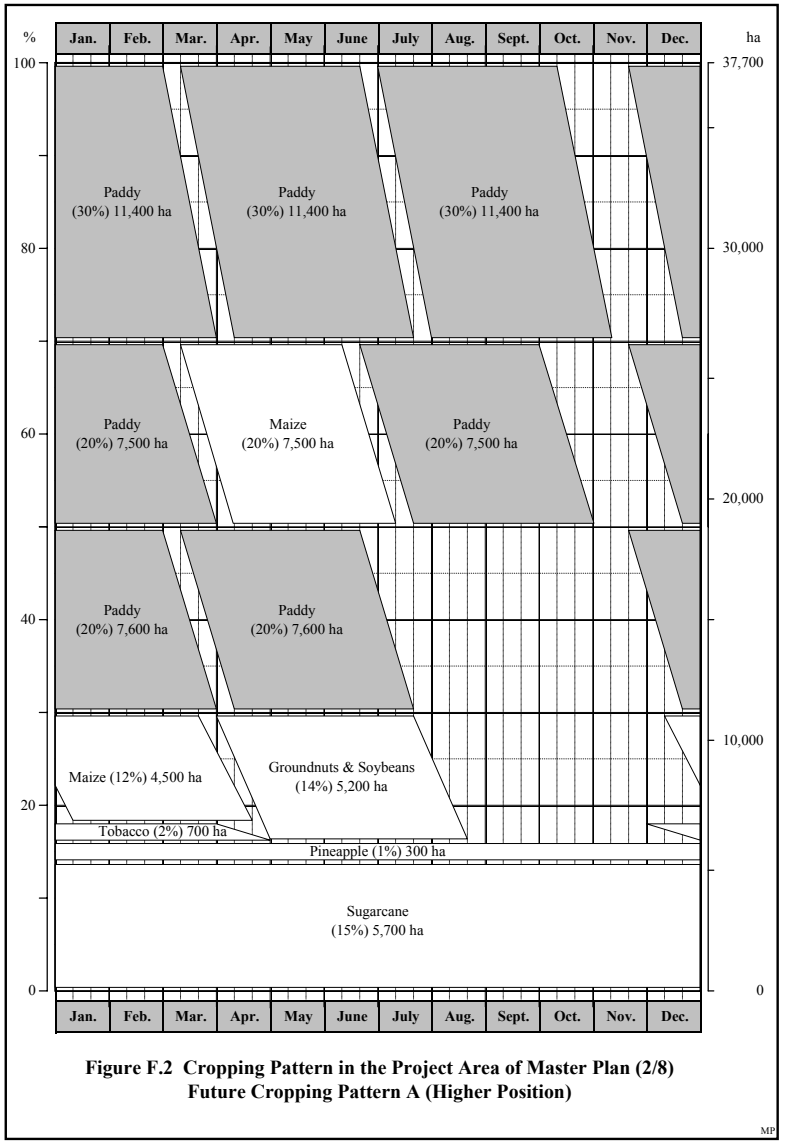


Figure F.2 Cropping Pattern in the Project Area of Master Plan (2/8)
Future Cropping Pattern A (Higher Position)

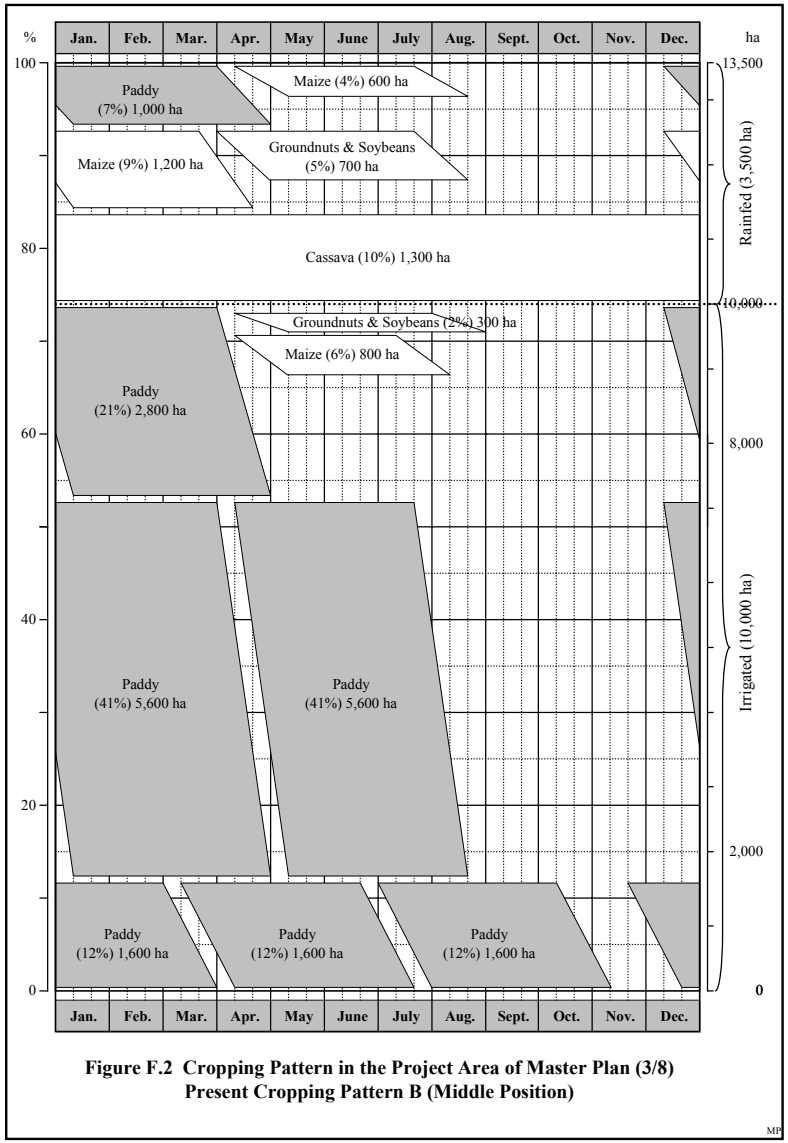


Figure F.2 Cropping Pattern in the Project Area of Master Plan (3/8)
Present Cropping Pattern B (Middle Position)

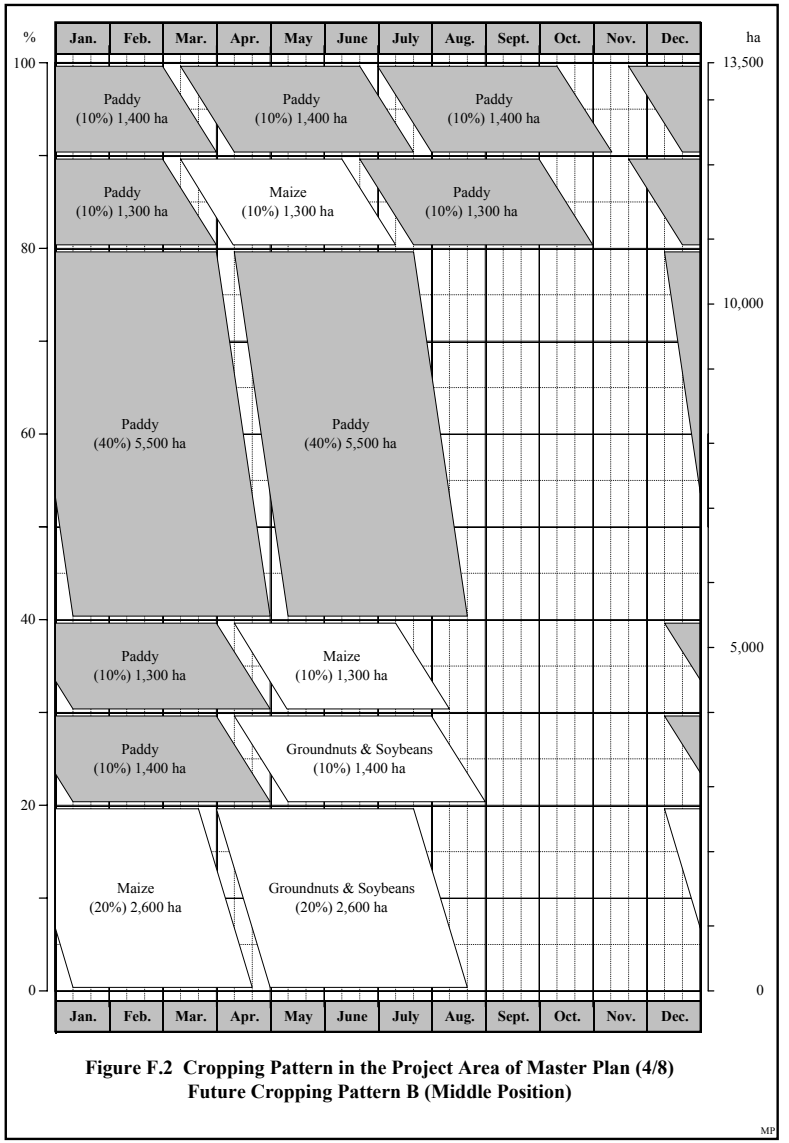


Figure F.2 Cropping Pattern in the Project Area of Master Plan (4/8)
Future Cropping Pattern B (Middle Position)

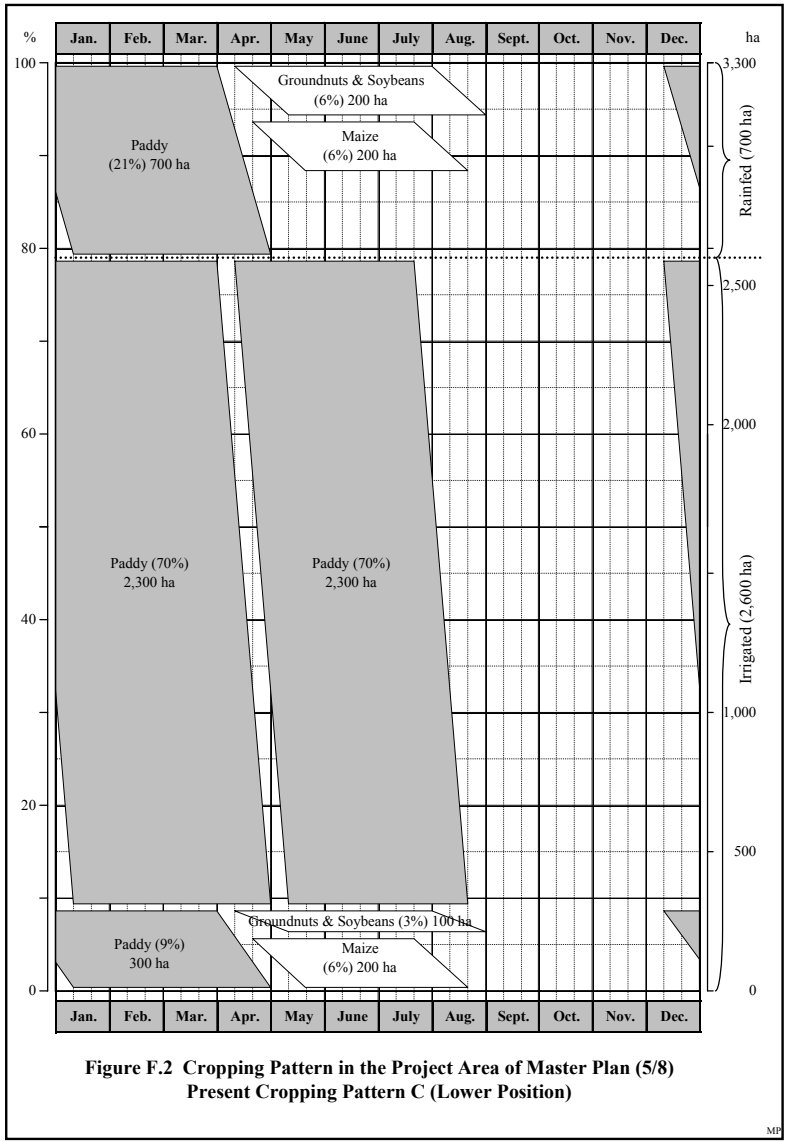


Figure F.2 Cropping Pattern in the Project Area of Master Plan (5/8)
Present Cropping Pattern C (Lower Position)

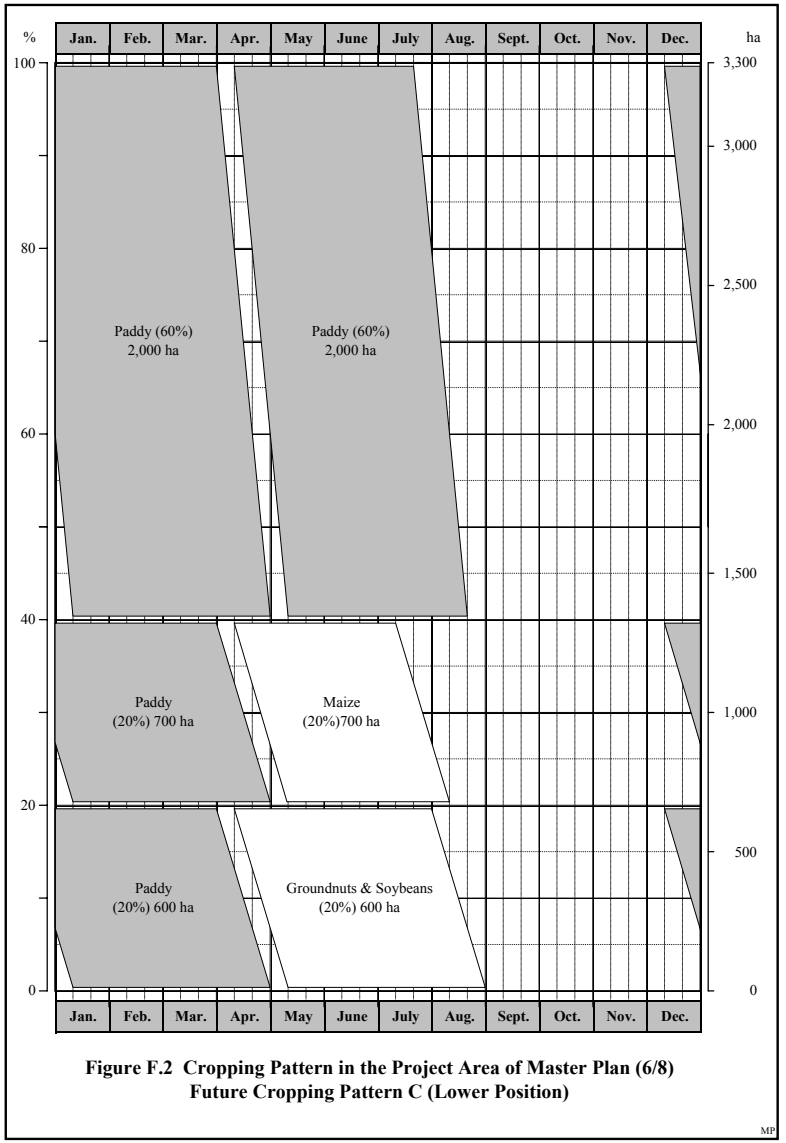


Figure F.2 Cropping Pattern in the Project Area of Master Plan (6/8)
Future Cropping Pattern C (Lower Position)

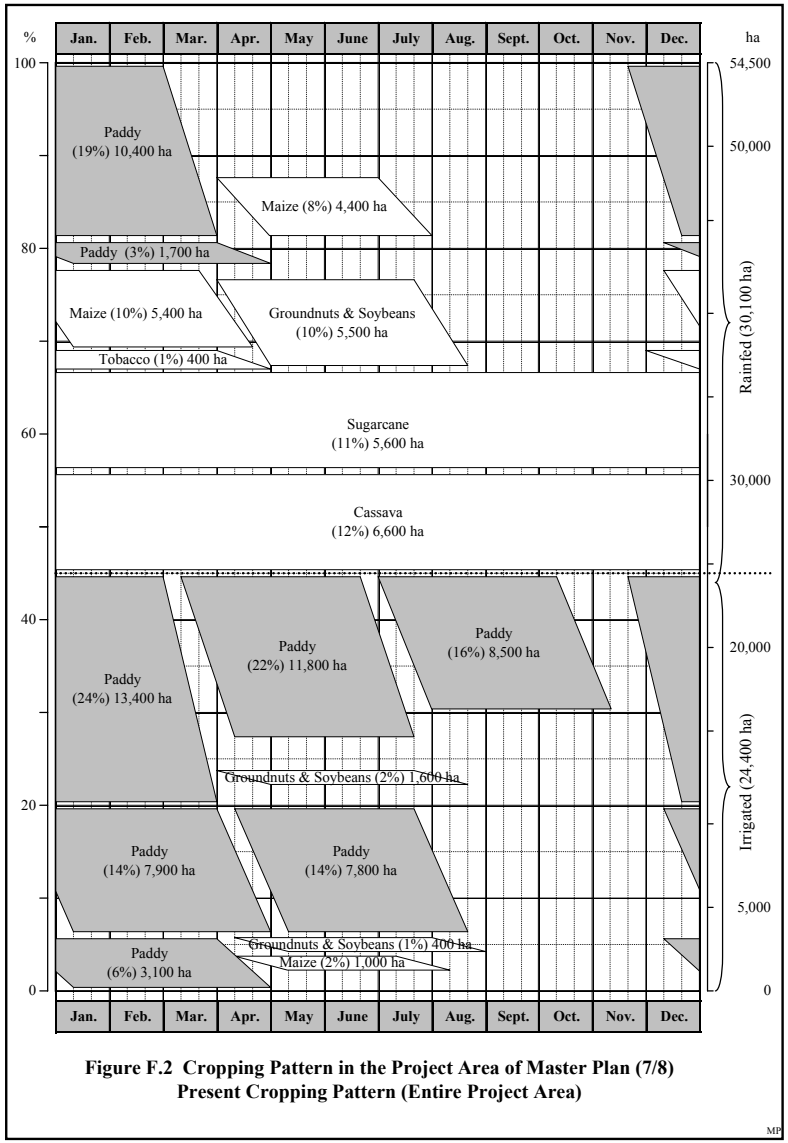


Figure F.2 Cropping Pattern in the Project Area of Master Plan (7/8)
Present Cropping Pattern (Entire Project Area)

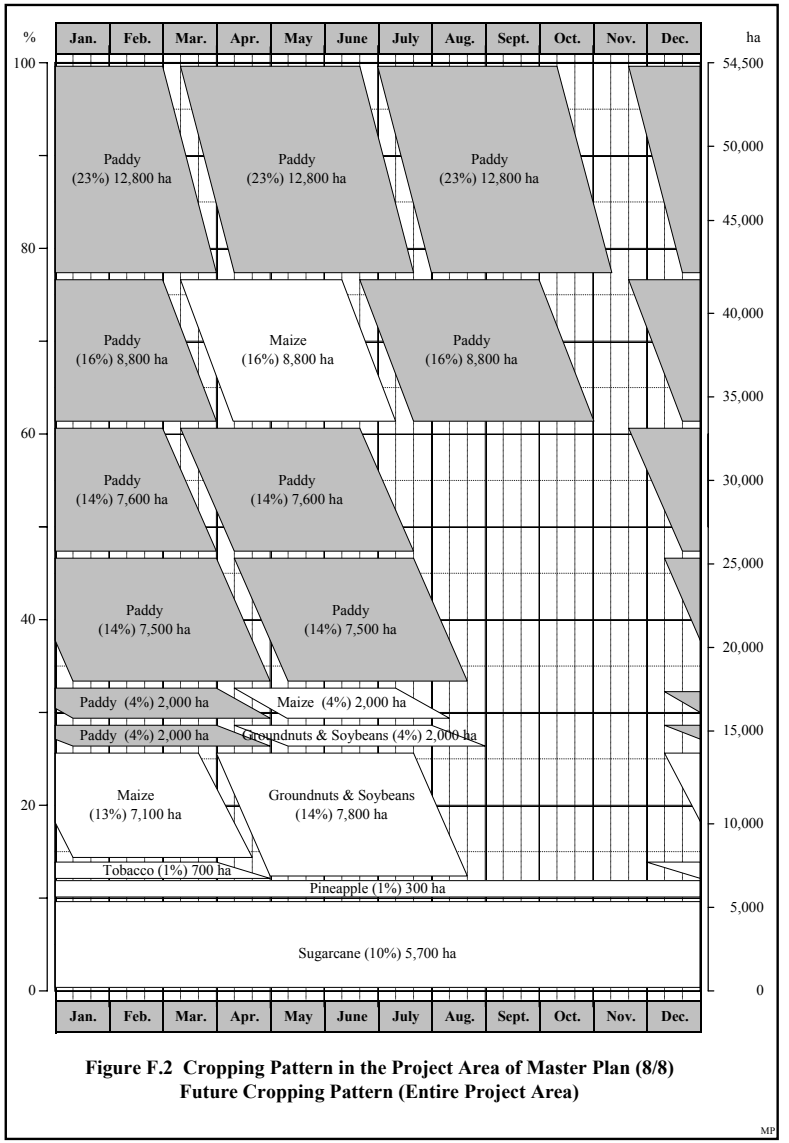


Figure F.2 Cropping Pattern in the Project Area of Master Plan (8/8)
Future Cropping Pattern (Entire Project Area)

Appendix G

Flood Control Plan

Appendix G
Flood Control Plan

Table of Contents

Page

List of Figures

Page

Appendix G Flood Control Plan

1 MANNING'S ROUGHNESS COEFFICIENT

1.1 Dap Da River

The value of Manning's roughness coefficient of the present Dap Da River is estimated at 0.030 with the judgment of the present river condition including the river bed material and river bank, and the results of non-uniform flow water level calculation with some combinations of discharge and roughness coefficient as shown in Figures G.1 and G.2.

1.2 Tan An River

The value of Manning's roughness coefficient of the present Tan An River is estimated at 0.030 with the judgment of the present river condition including the river bed material and river bank, and the results of non-uniform flow water level calculation with some combinations of discharge and roughness coefficient as shown in Figures G.3 and G.4.

1.3 Kone River

The value of Manning's roughness coefficient of the present Kone River is estimated at 0.035 for low water channel and 0,050 for high water channel, with the judgment of the present river condition including the river bed material and river bank, and the result of non-uniform flow water level calculation as shown in Figures G5, and the result of the non-uniform water level calculation for the 1987 flood compared with the observed water level of the said flood at Cay Muong as shown in Figure G.6.

2 DISCHARGE CARRYING CAPACITIES

2.1 Dap Da River

Discharge carrying capacity of the Dap Da River is estimated by water level calculation in non-uniform flow by using the Manning's roughness coefficient estimated in the above. The water level calculation results are shown in Figure G.7.

2.2 Go Cham River

Discharge carrying capacity of the Go Cham River is estimated by water level calculation in non-uniform flow by using the Manning's roughness coefficient estimated in the above. The water level calculation results are shown in Figure G.8.

2.3 Tan An River

Discharge carrying capacity of the Tan An River is estimated by water level calculation in non-uniform flow by using the Manning's roughness coefficient estimated in the above. The water level calculation results are shown in Figure G.9.

2.4 Kone River

Discharge carrying capacity of the Kone River is estimated by water level calculation in non-uniform flow by using the Manning's roughness coefficient estimated in the above. The water level calculation results are shown in Figure G.10.

3 METHODOLOGY OF DETERMINATION OF SIDE OVERFLOW WEIR DIMENSIONS

(1) Basic equation

Basic equations used for the calculation of dimensions of side overflow weir are the continuity equation and motion equation as follows:

$$\frac{dQ}{dx} = -\frac{2\sqrt{2g}}{3}\mu h^{\frac{2}{3}}$$

$$\frac{dH}{dx} = \frac{i - \frac{Q^2}{C^2RA^2} + \frac{\alpha Q^2}{gA^3}\frac{\partial A}{\partial x} + \frac{m\alpha qQ}{gA^2}}{1 - \frac{\alpha Q^2}{gA^3}\frac{\partial A}{\partial H}}$$

Here,

Q: Discharge of the main stream (m^3/s)

x: Distance along the main stream (m)

g: Gravity (m/sec^2)

μ: Overflow coefficient

h: overflow depth (m)

H: Water level of the main stream (m)

i: slope of river-bed

C: Chezy coefficient

R: Hydraulic radius (m)

A: flow area (m^2)

m: Discharge coefficient

q: Overflow discharge (m^3/s)

α: Energy correction coefficient

(2) Procedure

- given condition:

1) Longitudinal and cross sectional profiles of the main stream

2) Longitudinal and cross sectional profiles of the overflow weir

3) Discharge rating curve at the downstream end of the overflow reach

4) Discharge hydrograph at the upstream end of the overflow reach

- calculation:

1) assume flood discharge at the downstream end of the said reach at time t, and by using the said equations of continuity and motion, the upstream discharge is calculated

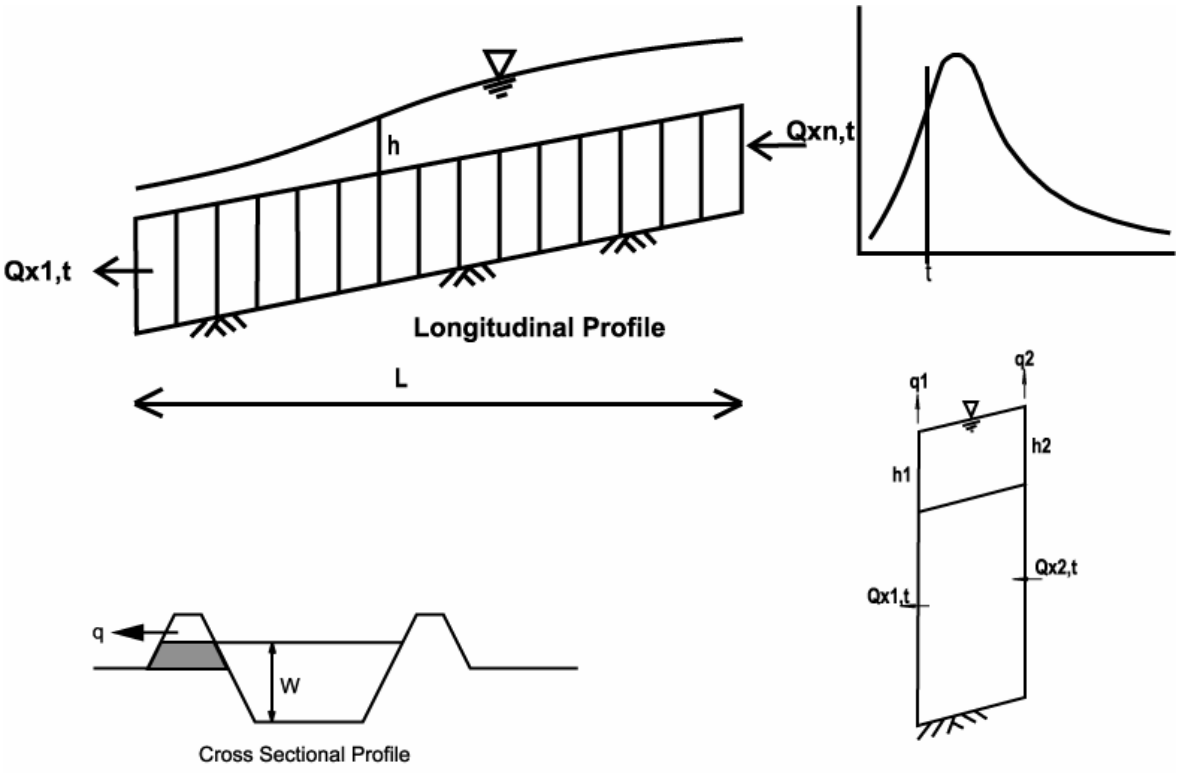
2) if the calculated discharge at the upstream end is different from the given flood discharge at time t, the assumption of the discharge at the downstream end is made again.

3) the said procedure is repeated until the same discharge is obtained between the given flood discharge at time t and the calculated discharge through the equations based on the

downstream discharge at time t.

4) This procedure is conducted for the whole time period of flood discharge hydrograph.

5) The length and the height of the side overflow weir are assumed until the downstream food hydrograph becomes the planned design discharge distribution.



4 FREEBOARD OF DYKE

The freeboard as the elevation difference between the design high water level and the elevation of design dyke crown used in the present study is as follows:

Design Discharge (m^3/s)	Freeboard (m)
< 200	0.6
200 <…..< 500	0.8
500 <…..< 2,000	1.0
2,000 <…..< 5,000	1.2
5,000 <…..< 10,000	1.5
10,000 <	2.0

5 PROBABLE FLOOD PEAK DISCHARGE

Probable flood peak discharges with safety margin for various return periods used for the inundation analysis are as follows:

P	Early Flood	Major Flood	Late Flood
50%	212	2,973	429
20%	457	4,695	1,143
10%	664	5,838	2,033
5%	900	6,841	2,997
2%	1,231	8,043	4,655
1%	1,521	8,922	6,229

P	Early Flood	Major Flood	Late Flood
50%	138	1,945	198
20%	299	3,073	747
10%	434	3,821	1,330
5%	589	4,472	1,960
2%	805	5,261	3,043
1%	994	5,832	4,075

P: occurrence probability per year

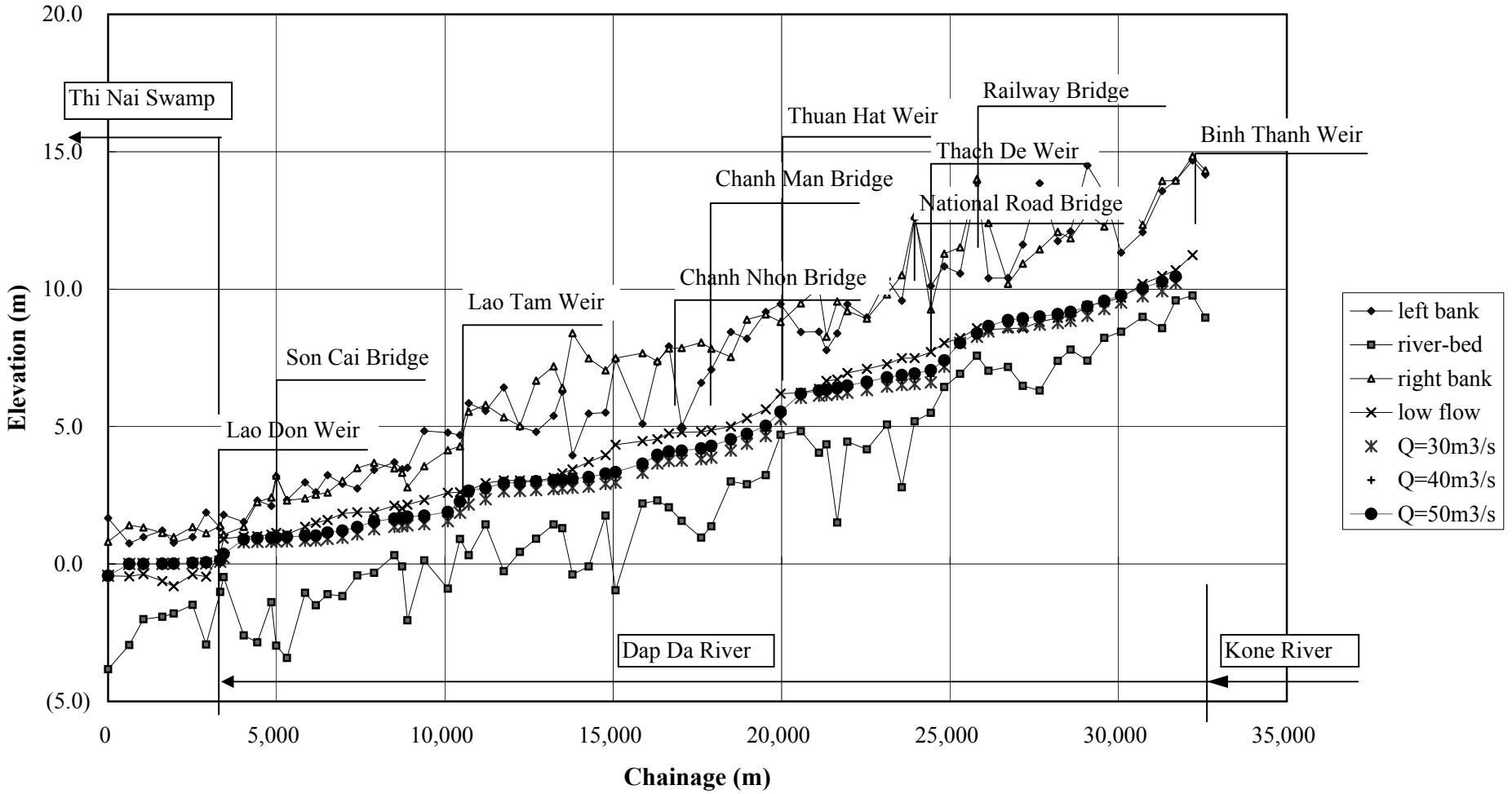


Figure G.1 Longitudinal Profile of Water Level of Dap Da River with Roughness Coefficient of 0.025

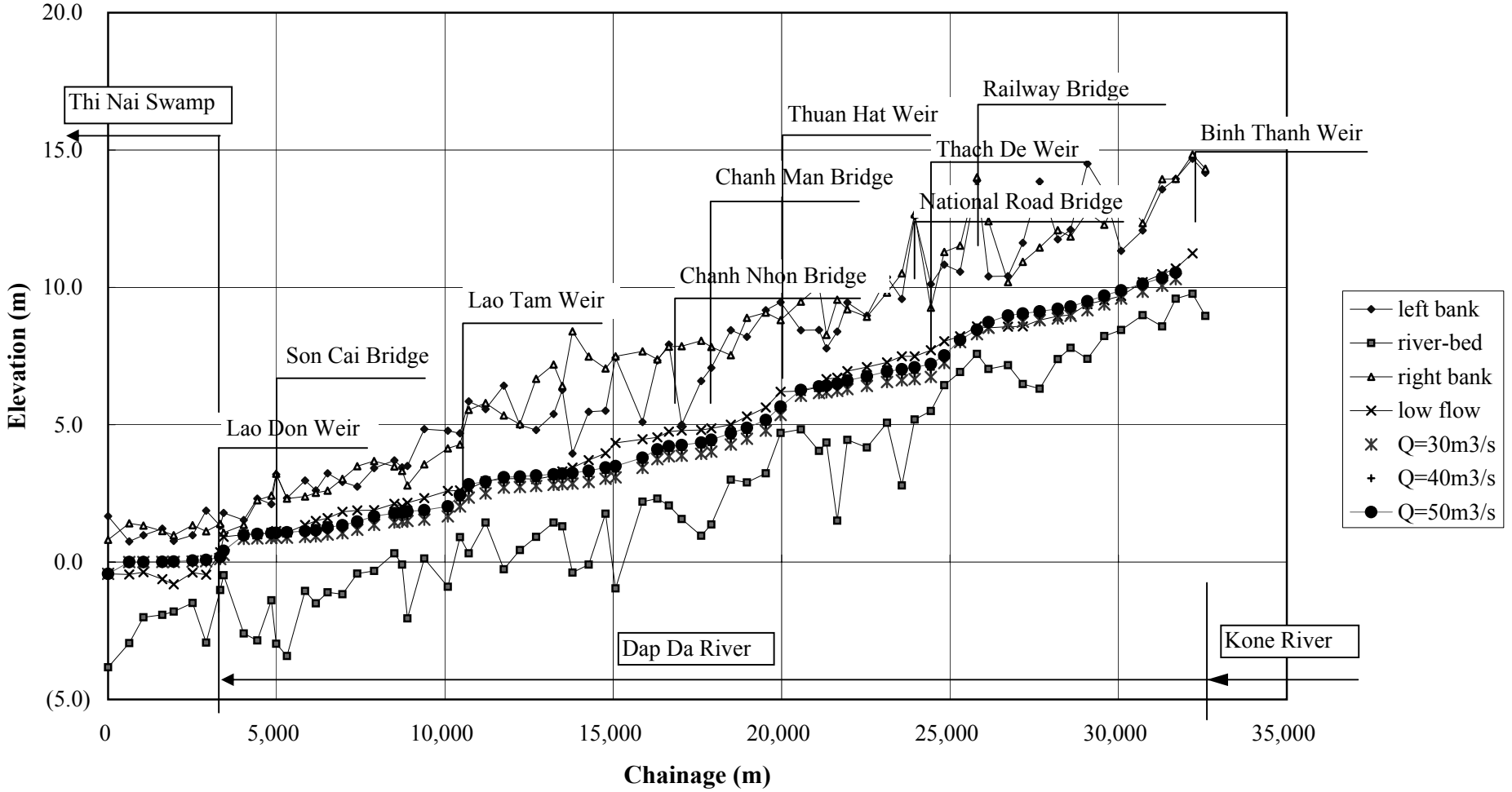


Figure G.2 Longitudinal Profile of Water Level of Dap Da River with Roughness Coefficient of 0.030

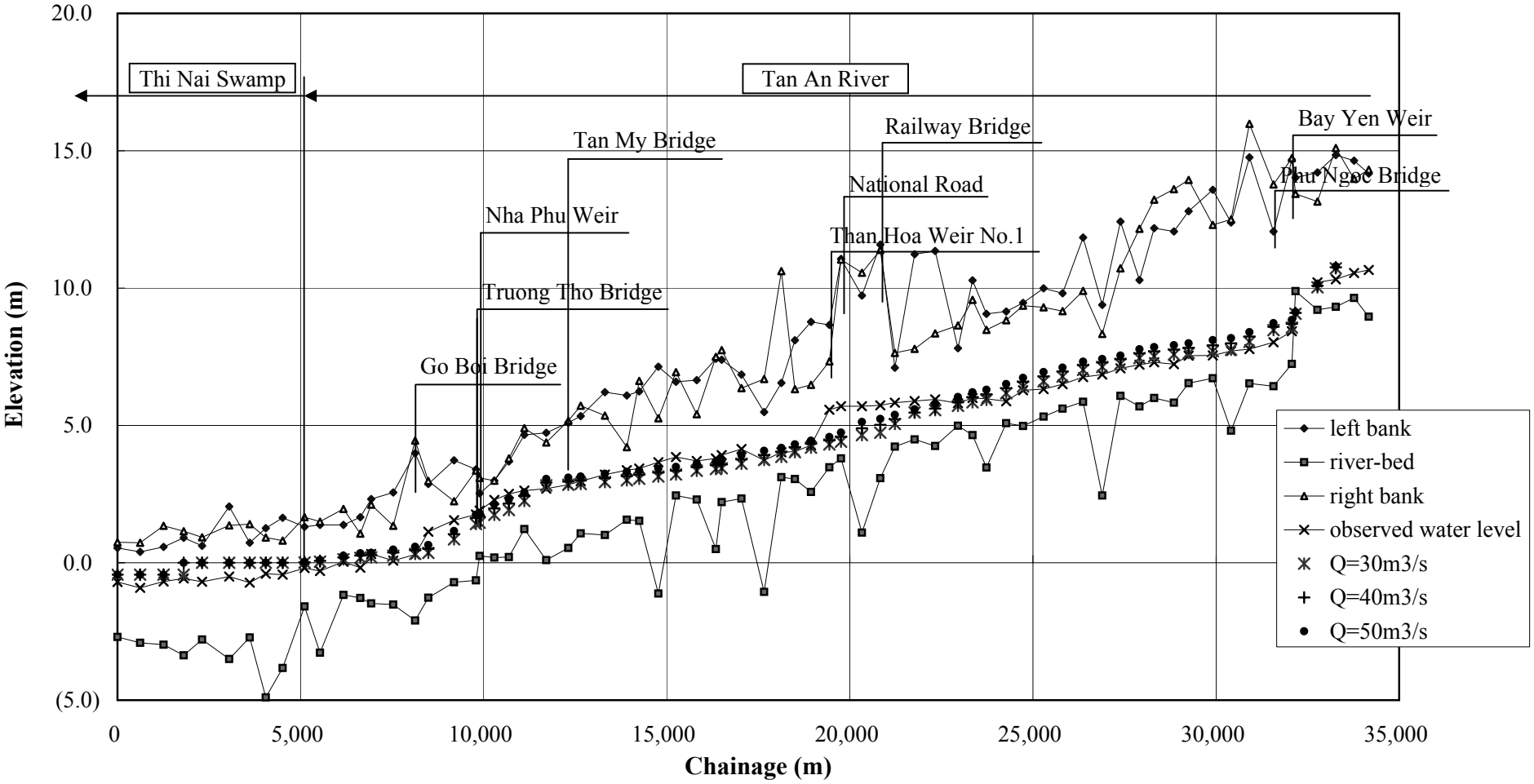


Figure G.3 Longitudinal Profile of Water Level of Tan An with Roughness Coefficient of 0.025

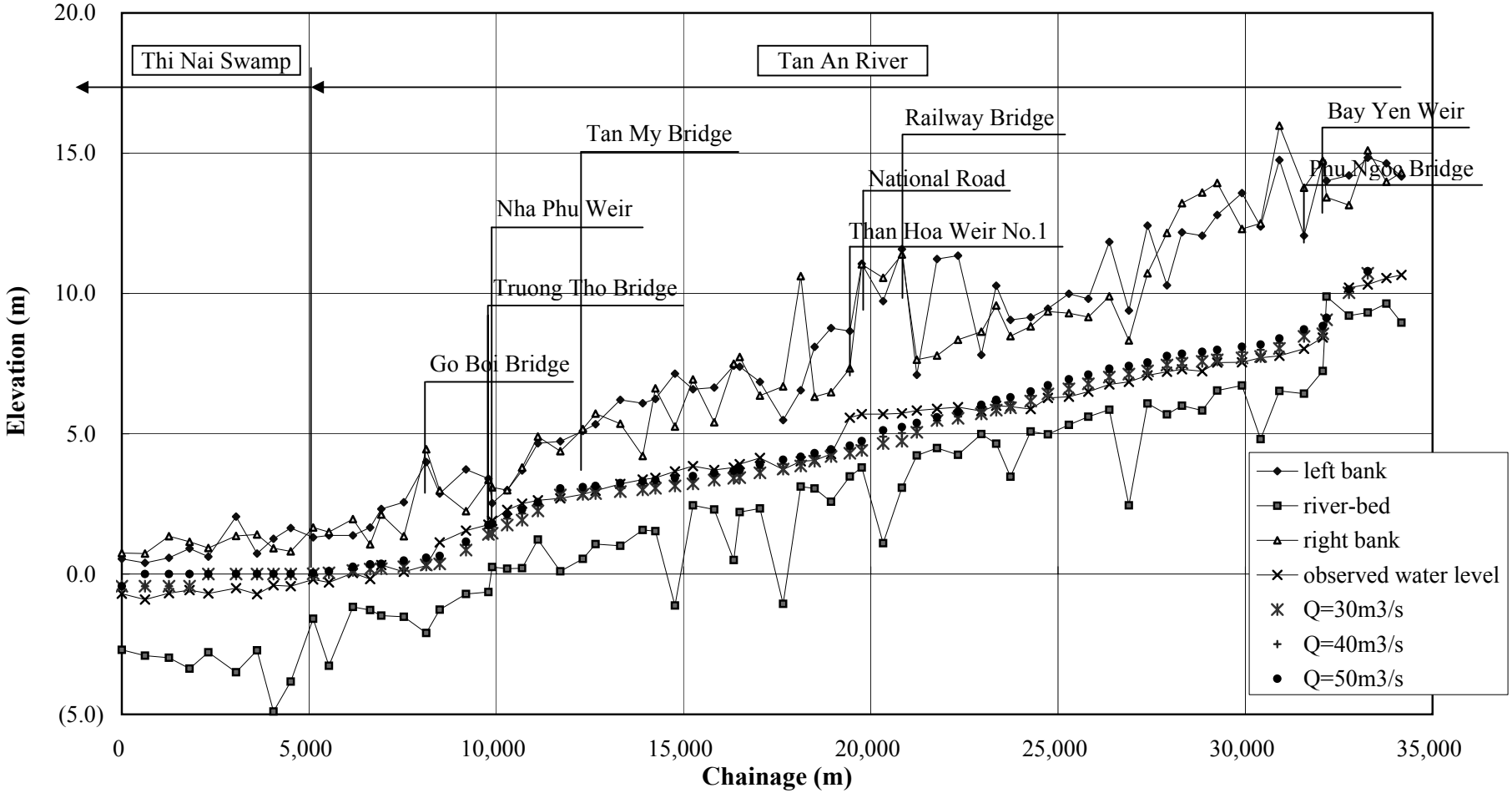


Figure G.4 Longitudinal Profile of Water Level of Tan An River with Roughness Coefficient of 0.030

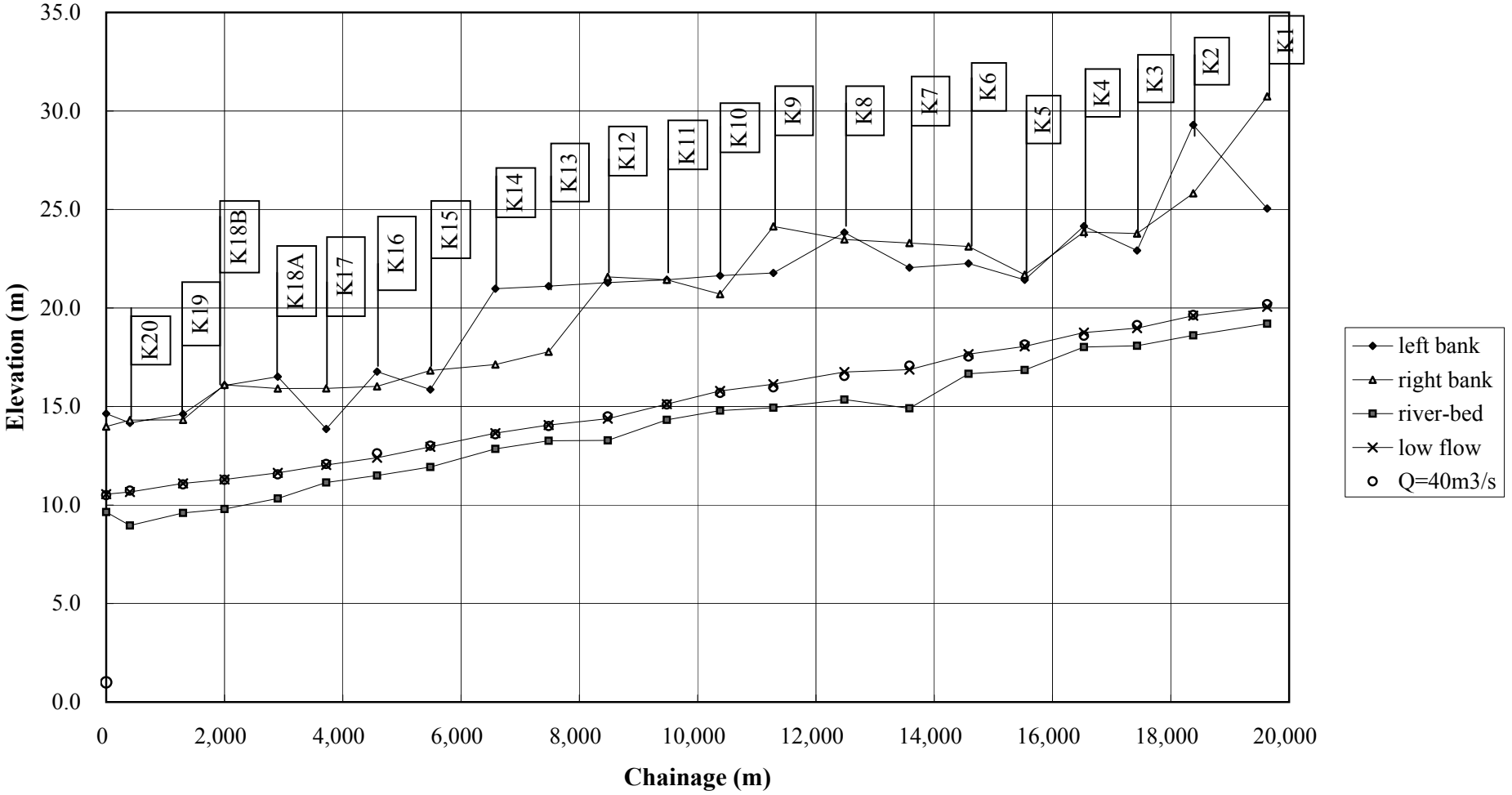


Figure G.5 Longitudinal Profile of Kone River with Roughness Coefficient of 0.035 for Low Water Channel

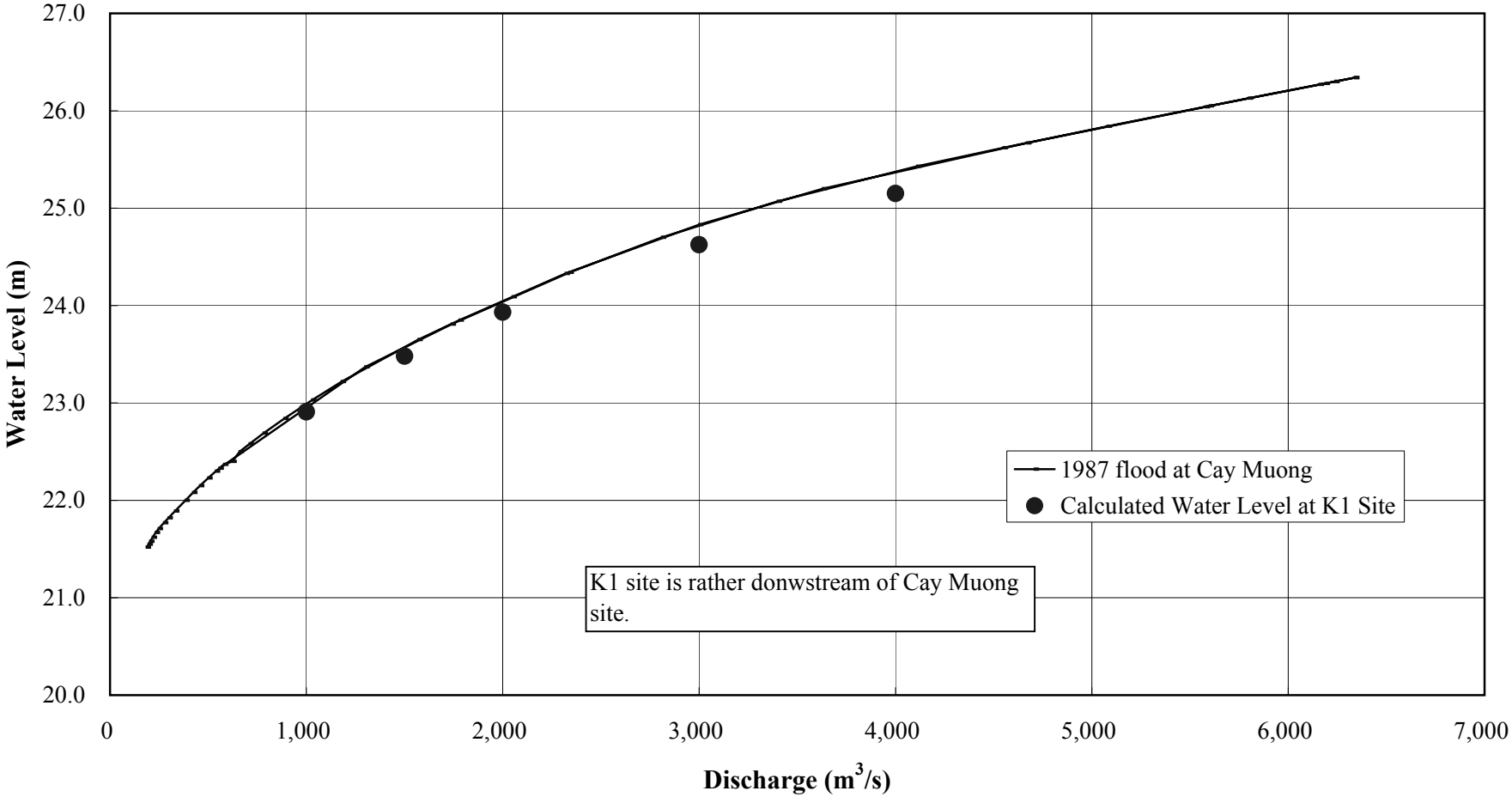


Figure G.6 Comparison of Water Level between Observed Water Level and Calculated Water Level at Cay Muong

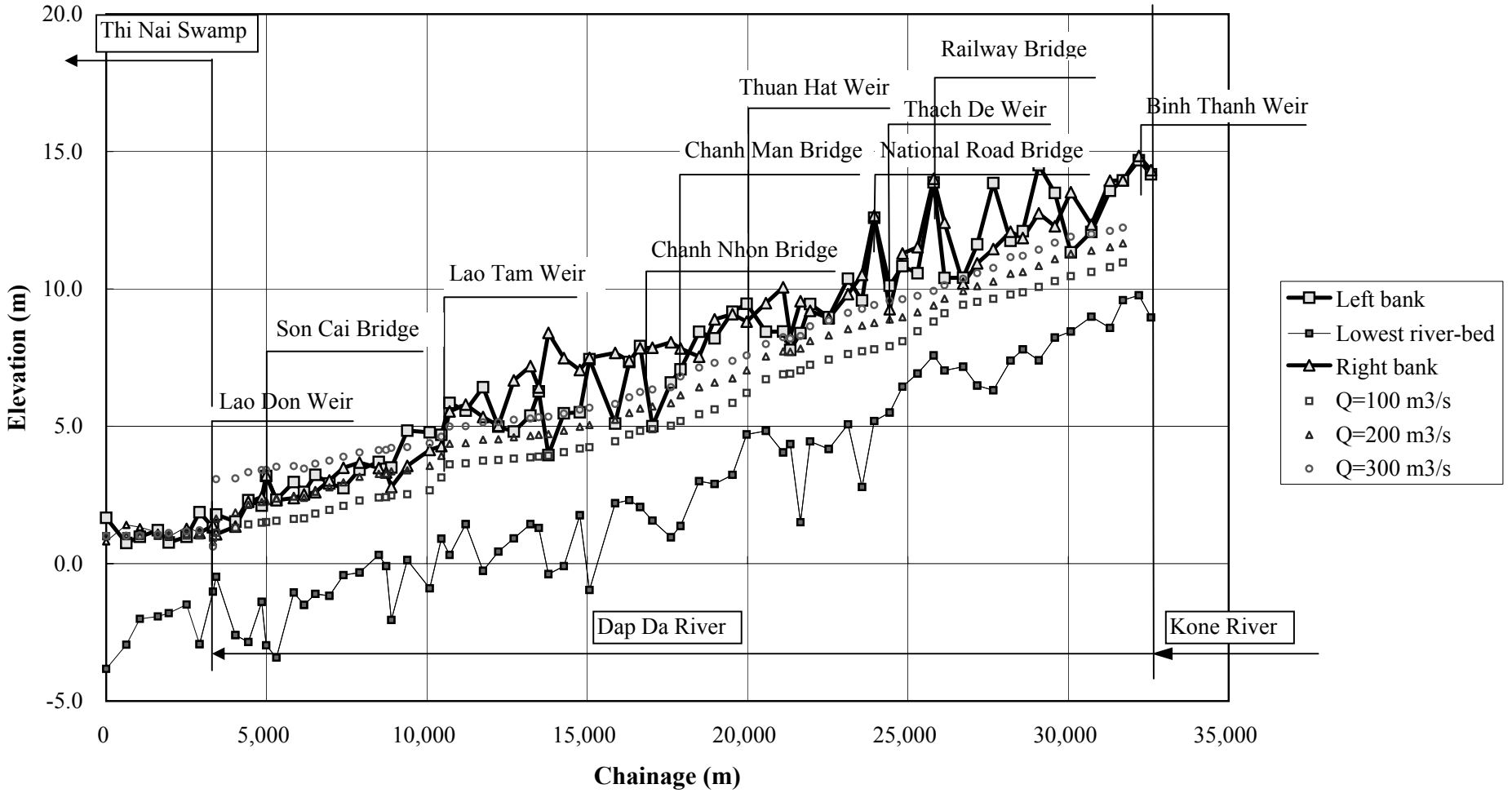


Figure G.7 Longitudinal Profile of Calculated Water Level of Dap Da River

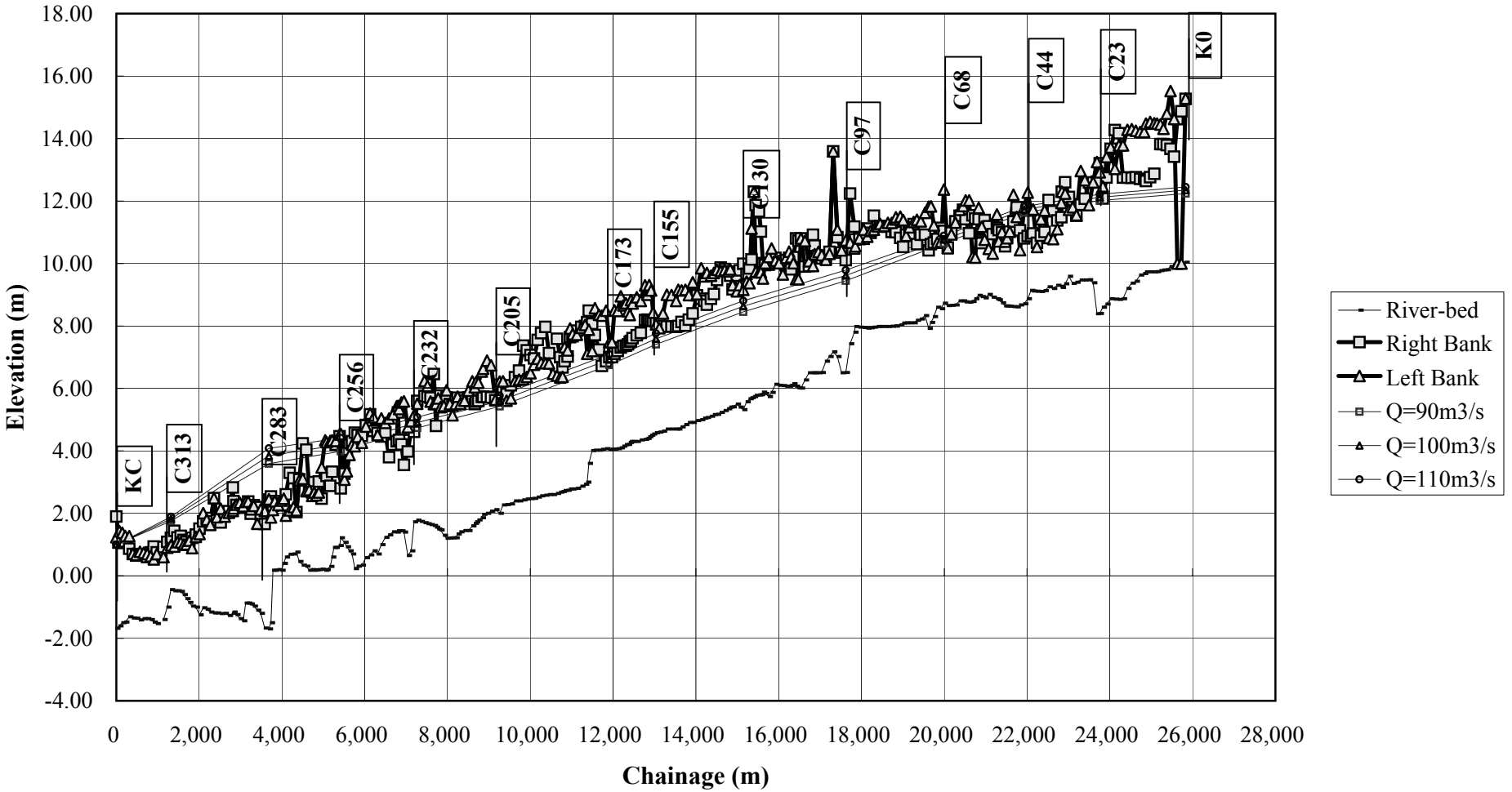


Figure G.8 Longitudinal Profile of Calculated Water Level of Go Cham River

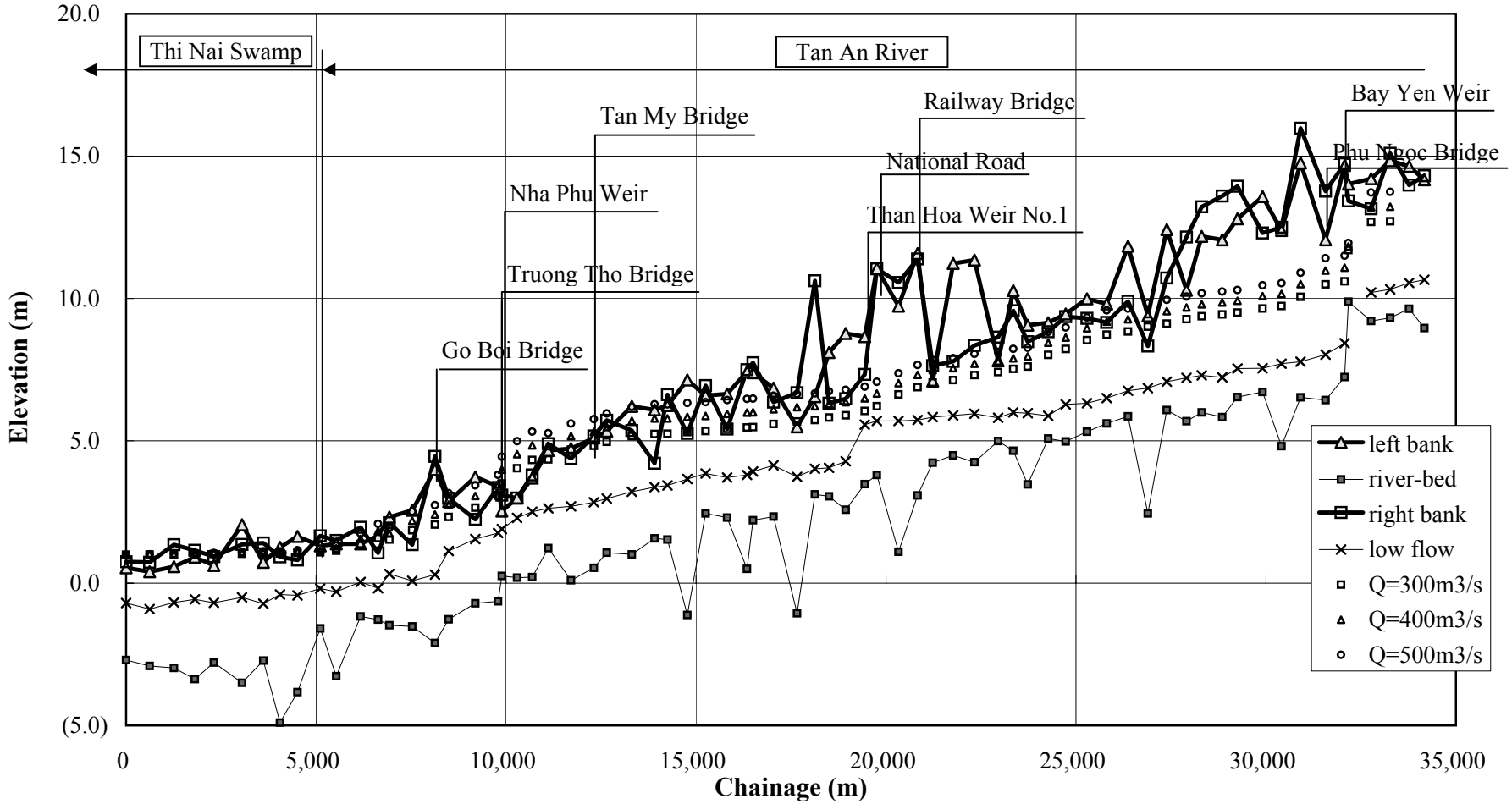


Figure G.9 Longitudinal Profile of Calculated Water Level of Tan An River

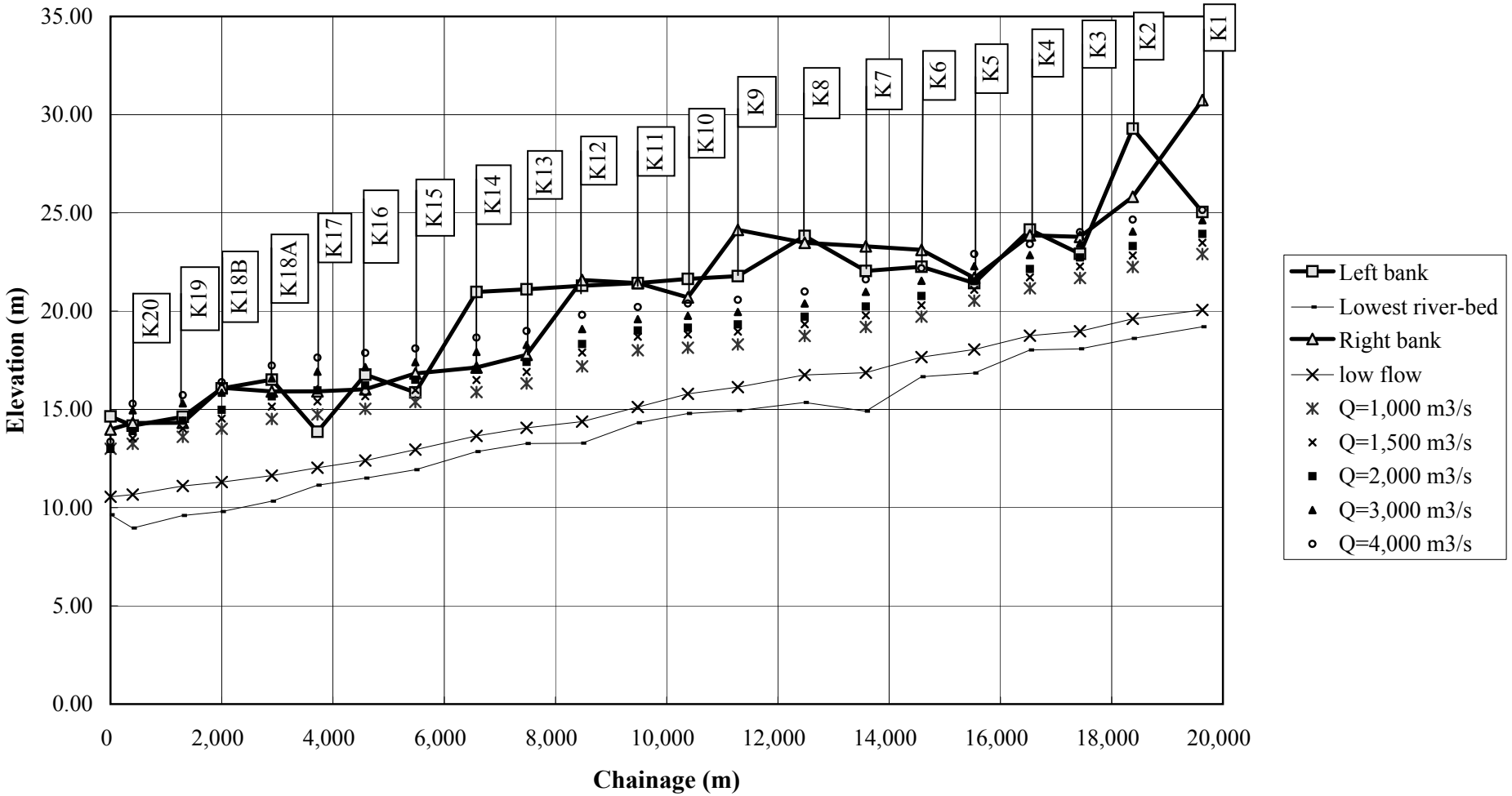


Figure G.10 Longitudinal Profile of Calculated Water Level of Kone River

Appendix H

Construction Schedule and Cost Estimate

Appendix H
Construction Schedule and Cost Estimate

Table of Contents

List of Tables

Page

List of Figures

Page

Appendix H Construction Schedule and Cost Estimate

1 CONSTRUCTION PLAN OF PROPOSED MAJOR FACILITIES

1.1 Basic Conditions and Consideration for Preparation of Implementation Program

Basic conditions and consideration for implementation program are prepared on the basis of the following conditions:

(1) Workable Days

The average annual rainfall is 1,900 mm in the Kone-Ha Thanh-La Tinh river basin, 70 to 77 % of it concentrates in the rainy season from September to December and topographical condition is favorable to get the northwest monsoon. The dry season extends from January to August with a hot dry and rainfall is scarce amounting to 23 to 30 % of the annual rainfall. The average annual air temperature ranges between 42.1 deg.C to 15 deg.C. Hottest months is from June to August. The mean annual humidity is 71-80 %.

Workable days for such earthworks as embankment, excavation and hauling, and concrete works are considered to be dominated by the weather conditions, especially rainfall. Therefore, the rainy days in the study area are examined by using the rainfall record at Vinh Kim Observation from 1991 to 2000.

The annual workable days are estimated assuming that the works are to suspend on Sundays, National holidays and rainy days.

(A) Earthworks

Suspended days due to rainfall	:	113.5	days
Sunday	:	52.0	days
Holiday	:	8.0	days
Workable day	:	191.5	days
Total	:	365.0	days
Annual average workable day	:	16.0	days per month
Rainy season (Sep.-Dec.)	:	8.0	days per month
Dry season (Jan.-Aug.)	:	20.0	days per month

(B) Concrete Works

Suspended days due to rainfall	:	87.0	days
Sunday	:	52.0	days
Holiday	:	8.0	days

Workable day	:	218.0	days
Total	:	365.0	days
Annual average workable day	:	18.2	days per month
Rainy season (Sep.-Dec.)	:	12.0	days per month
Dry season (Jan.-Aug.)	:	21.0	days per month

Detailed workable day analysis is shown in Tables H.1 and H.2.

(2) Working Hours

Daily working hours are assumed to be 8 hours. 1 shift work will be adopted all works in principle. However the tunnel and dam works are applied by 2 shifts works due to limited schedule and urgency.

(3) Labor Forces

Skilled and common labors for the works of proposed facilities will be required from the project area and surrounding area of the project, Quy Nhon, Danang, Hochi Minh and Hanoi cities. Especially, major works are earthmoving, dredging, concrete works, tunnel, dam, hydropower plant, pipeline, pumps, mechanical and electrical works and other related works. Number of foremen, operators, drivers, maintenance mechanics, skill labors, installation mechanics, electricians, plumbers, etc. will be required. Also some foreign foremen and instructors will be necessary for the construction works of proposed facilities.

(4) Construction Materials

Major construction materials required for the proposed facilities are earth, sand, concrete aggregate, rubble stone, cement, reinforcement steel bar, steel sheet piles, water stop, steel materials, reinforced concrete pipes, steel pipes, fuel and lubricant, etc. and these materials are available in Quy Nhon, Da Nang, Ho Chi Minh and Hanoi cities.

Some construction materials such as floaters, rockbolt, admixture, steel rib, valves and fittings, rods and bits, steel forms, spare parts and electrical and mechanical materials are imported from the overseas market.

(5) Construction Equipment

Major construction equipment for the proposed facilities such as backhoe, crawler loader, wheel loader, dump truck, bulldozer, tire roller, road roller, truck crane, vibration hammer, concrete pump car, truck mixer, etc. are available in Ho Chi Minh and Hanoi cities.

Special equipment for the proposed facilities comprising dredging equipment, drill jumbo, low bed dump truck, muck loader, shotcrete equipment, heavy dump truck, large capacity wheel loader, tower crane, vibrator, soil compactor, concrete plant, cement silo, aggregate

plant, etc. will be imported and re-exported after the completion of the proposed facilities.

(6) Spoil Area

The spoil area to accommodate the surplus materials from the various excavation sites of the proposed facilities is taken into account. Especially the Dinh Binh reservoir project, Van Phong weir and canal systems anticipate to produce a large amount of surplus materials. Thus the planning of spoil area is indispensable.

1.2 Implementation Program of the Proposed Facilities

(1) Execution Body

The Kone River Basin Development in Binh Dinh Province will be implemented by the Department of Agriculture and Rural Development (DARD) and other Government Agencies under the Peoples Committee of Binh Dinh Province and Ministry of Agriculture and Rural Development (MARD).

(2) Project Execution Method

All the project works will be executed on a contract basis. Proposed permanent facilities and the temporary construction facilities including construction equipment, materials and labors required for the works will be made by the contractors to be selected through the international or local competitive bidding.

(3) Construction Schedule

(i) Pre-construction Program

Pre-construction activities consisting of preparation of bidding document, the financial arrangement and the land acquisition are necessitated before the commencement of construction for the proposed facilities, and it is assumed that 2.0 years for the financial arrangement, 1.0-1.5 years for the detailed design for all sectors and 3.5 years for the land acquisition.

Construction Period

The construction period for the proposed facilities are presumed as follows:

Multipurpose Dam	
- Dinh Binh Reservoir Project	5.0 years
Flood Control Facilities	
- Thi Nai Swamp	2.3 years
- Dap Da River Improvement	5.0 years
- Go Cham River Improvement	3.3 years
- Tan An River Improvement	5.0 years
- Nam Yang River Improvement	2.3 years
- Ca My River Improvement	1.3 years
Irrigation and Drainage Facilities	
- Van Phong Weir	4.5 years
- Rehabilitation Works of Existing Weirs (8 weirs)	
7 weirs	5.0 years
1 weir (Loc Giang)	3.0 years
- Construction Works of New Weirs (1 weir)	9.0 years
- Construction Works of New Earthfill Dam (11dams)	
1 earthfill dams (Phu Tai)	3.0 years
10 earthfill dams	9.0 years
- Existing Reservoirs to be Rehabilitated (18 reservoirs)	3.0 years
- Construction of New Pumping Station (6 places)	5.0 years
- Improvement of Existing Function (24,400 ha)	
15,700 ha	5.0 years
8,700 ha	3.0 years
- Rehabilitation and Improvement for Non-Function Area (6,700 ha)	
3,200 ha	5.0 years
3,500 ha	3.0 years
- Construction for New Development Area (25,600 ha)	
20,000 ha	5.0 years
2,600 ha	3.0 years
3,000 ha	9.0 years
Domestic and Industrial Water Supply	
- Raw Water Intakes and Pre-treatment Units (4 nos)	
2 nos	2.5 years
2 nos	2.5 years
- Booster Pumping Stations and Ancillaries (4 nos)	
2 nos	2.5 years
2 nos	2.5 years

- Elevated Storage Reservoirs, 1,000 m3 (7 nos)	
4 nos	2.5 years
3 nos	2.5 years
- Primary Transmission Mains, D300-D800 mm (25 km)	
12.5 km	2.5 years
12.5 km	2.5 years
- Tertiary Network, D50-D100 mm (90 km)	
45.0 km	2.5 years
45.0 km	2.5 years
- Metered House Connections (50,000 nos)	
25,000 nos	2.5 years
25,000 nos	2.5 years

The construction periods include mobilization, preparatory works, preparation of shop drawings, civil and building works, fabrication, installation, test run and training.

(4) Overall Implementation Schedule

The overall implementation schedule including financial arrangement, employment of consultants, land acquisition and compensation including resettlement, survey and investigation, detailed design works, prequalification of bidders, bidding and construction of all facilities is shown in Figures H.1 to H.3.

(5) Operation and Maintenance Organization

The operation and maintenance (O&M) of the Dinh Binh reservoir project shall be undertaken by Irrigation Management Company. The most essential functions required are reservoir operation for flood control, irrigation, domestic and industrial water supply, hydropower generation and pushing back of saline water.

As of the each facility in the project area, the O&M shall be carried out by the following agencies and organizations depending on the type of facilities:

O&M Body	Type of Facilities
-Irrigation Management Company	- Major river/ creek network including intakes along rivers - Irrigation canals and appurtenant structures - Pumping stations (large & small scale) - Drainage sluices (large & small scale)
- Cooperatives / farmers groups	- Pumping stations (some small scale) - Ponds - On-farm irrigation ditches - Drainage sluice (small scale) - Drainage dikes - Tidal wave protection dikes
- Flood Control & Dike Management Department	- Dikes along main rivers and tributaries - Tidal wave protection dikes
- Binh Dinh Water Supply Company (Urban Area) - Cooperative (Rural Area)	- Domestic Water Supply
- Vietnam Electricity Company, Branch Office No. 3	- Hydropower Station and Appurtenant

The Department of Agriculture and Rural Development (DARD) shall supervise the O&M activities of the Irrigation Management Company.

2 COST ESTIMATE OF PROPOSED MAJOR FACILITIES

2.1 Basic Conditions

(1) Price Level and Exchange Rate

The construction cost is estimated based on the price level of December, 2001 and the applied foreign exchange rates are as shown below:

US$ 1.00 = VND 15,068

J. Yen 100 = VND 12,212

As of December 3, 2001

(2) Physical Contingency

The physical contingency is provided to cope with the unforeseen physical conditions. The physical contingency is assumed to be 10 % for the sum of construction cost, resettlement cost, engineering service cost and administration cost and 5 % for the sum of plant cost.

(3) Price Contingency

The price escalation is given with the rate of 4.9 % per annum in an average considering of the consumer price index in Vietnam from 1995 to 2000.

(4) Value Added Tax

Value Added Tax (VAT) is estimated at 5 % of total construction cost, engineering cost, administration cost and price escalation.

2.2 Direct Construction Cost

(1) General Items

General items consist of insurance and contractor's preparatory works. Insurance includes the insurance of works and contractor's equipment, third party insurance and insurance for accident or injury to workmen. Contractor's preparatory works comprise providing engineer's temporary offices, first-aid station, providing accommodations and vehicles for engineer, contractor's temporary buildings, water supply system, electric power supply system, telecommunication system, sewerage and drainage system, temporary access roads and contractor's testing laboratory.

General cost is estimated at 5 to 10 % of total construction cost considering the nature of works.

(2) Unit Prices

The unit prices for the major work items are prepared referring to the collected cost data

from the completed project or on-going project or feasibility study report on Dinh Binh Reservoir Project.

The unit prices for each work item consist of labor cost, material cost, equipment cost and contractor's overhead expenses and profit.

2.3 Indirect Construction Cost

(1) Resettlement Cost

Resettlement Cost for Dinh Binh reservoir project is reported in the feasibility report, HEC-1.

Total number of affected household is 587 households with 2,932 people.

Total resettlement cost is estimated at 134,656 million VND on the basis of the feasibility report comprising compensation cost, support for removal and settlement, support for production, construction of public facilities, development of infrastructure, project management and project preparation cost.

Unit average investment cost per household is 229 million VND.

Resettlement cost for irrigation and drainage facilities is also reported in the feasibility report, HEC-1

Total number of affected household is 713 households

Total resettlement cost is estimated at 79,294 million VND on the basis of the feasibility report comprising Van Phong weir, Van Phong canal, Vinh Thanh canal, Ha Thanh canal and La Tin.

Unit average investment cost per household is 111.2 million VND.

Resettlement cost for flood control plan is estimated on the basis of the feasibility report, HEC-1.

Total number of affected household is 248 households consisting of 88 households for Dap Da river, 58 households for Go Cham river and 102 households for Tan An river.

Total resettlement cost is estimated at 27,580.5 million VND of which:

- Dap Da River 9,786.6 million VND
- Go Cham River 6,450.3 million VND
- Tan An River 11,343.6 million VND

Unit average investment cost per household is 111.2 million VND.

(2) Engineering Service Cost

The engineering service cost is estimated to be 10 % of total construction cost comprising 5 % of detailed design and 5 % of construction supervision.

(3) Administration Cost

The cost for the project administration by the Government office is assumed to be 3 % of total construction and resettlement cost.

2.4 Project Cost

The project cost consists of direct cost and indirect cost. The direct construction cost comprises the general items, civil works, building works, mechanical and electrical works. The indirect cost includes the resettlement, engineering service, administration, price contingency and physical contingency. The total project cost for each alternative plan are estimated as follows:

Alternatives	Total Project Cost	
	(million VND)	(million USD)
I-1 & I-2	10,659,884	707.5
II-1 & II-2	10,856,777	720.5
III-1 & III-2	11,059,103	733.9

Note : The above project costs indicate the case that the water supply to the La Tinh River basin is included.

2.5 Disbursement Schedule

The disbursement schedule of the project cost for each alternative plan is estimated taking into account of the construction time schedule. The annual disbursement schedule of the project cost is shown in Tables H.3 to H.13.

Table H.1 Average Annual Workable Days (Earthwork), Kone River

Data period: 1991- 2000

Daily Rainfall (mm)	Number of Rainy Days according to Rainfall Depth													Suspended Day due to Rainfall	Actual Waiting Days
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total		
Less than 3mm	28.0	26.6	29.6	26.6	22.2	23.7	24.0	25.2	18.8	17.6	17.6	21.7	281.6	0.0	0.0
3.1 - 5.0 mm	0.6	0.1	0.1	0.6	0.9	0.9	1.6	0.7	1.6	1.2	2.0	1.0	11.3	0.5	5.7
5.1 - 10.0 mm	1.2	0.4	0.7	0.6	1.8	2.0	1.8	1.7	2.6	2.6	2.3	1.5	19.2	1.0	19.2
10.1-20.0 mm	0.6	0.4	0.3	0.5	2.8	1.4	1.2	1.7	2.7	3.4	1.9	1.9	18.8	1.0	18.8
20.1 - 50.0 mm	0.6	0.4	0.2	1.5	2.7	1.2	1.8	1.6	3.2	3.2	3.1	2.6	22.1	1.5	33.2
50.1 - 100.0 mm	0.0	0.1	0.1	0.2	0.6	0.8	0.6	0.1	1.0	1.7	1.2	1.4	7.8	2.5	19.5
100.1 - 240.0 mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.1	1.7	0.9	3.8	4.0	15.2
More than 240 mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.4	5.0	2.0
Total	31.0	28.0	31.0	30.0	31.0	30.0	31.0	31.0	30.0	31.0	30.0	31.0	365.0	-	113.5

Station : Vinh Kim

HT-1

Suspended Day	3.0	1.7	1.6	4.2	10.6	7.7	8.0	6.4	13.8	21.1	20.7	14.9	113.5
Sunday	4.0	4.0	5.0	4.0	4.0	5.0	4.0	5.0	4.0	4.0	5.0	4.0	52.0
Holiday	1.0	3.0	0.0	1.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	8.0
Working day	23.0	19.3	24.4	20.9	15.4	17.4	19.0	19.6	11.2	6.0	4.4	11.1	191.5

Annual workable days	:	191.5	192.0	days/year	16.0 days/month
Rainy season September-Decer	:	8.2	8.0	days/month	
Dry season	:	19.9	20.0	days/month	

Table H.2 Average Annual Workable Days (Concrete Work), Kone River

Data period: 1991- 2000

Daily Rainfall (mm)	Number of Rainy Days according to Rainfall Depth													Suspended Day due to Rainfall	Actual Waiting Days
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total		
Less than 3 mm	28.0	26.6	29.6	26.6	22.2	23.7	24.0	25.2	18.8	17.6	17.6	21.7	281.6	0.0	0.0
3.1 - 5.0 mm	0.6	0.1	0.1	0.6	0.9	0.9	1.6	0.7	1.6	1.2	2.0	1.0	11.3	0.0	0.0
5.1 - 10.0 mm	1.2	0.4	0.7	0.6	1.8	2.0	1.8	1.7	2.6	2.6	2.3	1.5	19.2	0.0	0.0
10.1-20.0 mm	0.6	0.4	0.3	0.5	2.8	1.4	1.2	1.7	2.7	3.4	1.9	1.9	18.8	1.0	18.8
20.1 - 50.0 mm	0.6	0.4	0.2	1.5	2.7	1.2	1.8	1.6	3.2	3.2	3.1	2.6	22.1	2.0	44.2
50.1 - 100.0 mm	0.0	0.1	0.1	0.2	0.6	0.8	0.6	0.1	1.0	1.7	1.2	1.4	7.8	2.0	15.6
100.1 - 240.0 mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.1	1.7	0.9	3.8	2.0	7.6
More than 240 mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.4	2.0	0.8
Total	31.0	28.0	31.0	30.0	31.0	30.0	31.0	31.0	30.0	31.0	30.0	31.0	365.0	-	87.0

Station : Vinh Kim

Suspended Day	1.8	1.4	0.9	3.9	9.4	5.4	6.0	5.1	11.3	15.8	14.3	11.7	87.0
Sunday	4.0	4.0	5.0	4.0	4.0	5.0	4.0	5.0	4.0	4.0	5.0	4.0	52.0
Holiday	1.0	3.0	0.0	1.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	8.0
Working day	24.2	19.6	25.1	21.1	16.6	19.6	21.0	20.9	13.7	11.2	10.7	14.3	218.0

Annual workable days	:	218.0	218.0 days/year	18.2 days/month
Rainy season September-Decembe	:	12.5	12.0 days/month	
Dry season	:	21.0	21.0 days/month	

Table H.3 Disbursement Schedule for Dinh Binh Reservoir Project

Dam Crest EL. 95.3 m, Alternatives I-1& I-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. Direct Construction Cost																					
(1) General Items	31,585						31,585														
(2) Main Works																					
1) Concrete Dam	297,554						74,389	74,389	74,389	74,389											
2) Related Works	33,232						8,308	8,308	8,308	8,308											
3) Relocation Road	61,941				30,970	30,970															
Sub-total	392,728				30,970	30,970	82,697	82,697	82,697	82,697											
(3) Hydromechanical and Hydroelectrical Plant	32,189								10,622	10,622	10,944										
(4) Hydropower Plant																					
1) Main Works	63,220									31,610	31,610										
2) Hydropower Plant	68,790										68,790										
Sub-total	132,010									31,610	100,400										
(5) Transmission Line	29,971										29,971										
Total of 1	**618,483**				**30,970**	**30,970**	**114,282**	**82,697**	**93,319**	**124,929**	**141,316**										
Equivalent to US$	41.0				2.1	2.1	7.6	5.5	6.2	8.3	9.4										
2. Indirect Construction Cost																					
(1) Resettlement Cost	128,243		37,191	37,191	37,191	16,672															
(2) Engineering Cost & Administration Cost	52,645				8,423	7,370	7,370	7,370	7,370	7,370	7,370										
(3) Price Escalation (4.9 % / Year)	326,101		3,734	5,739	16,150	14,865	40,444	35,824	46,945	71,188	91,211										
(4) Physical Contingency (Civil:10 %. Plant:5%	106,000		4,092	4,293	9,273	6,988	16,210	12,589	14,232	19,818	18,504										
Sub-total of 2	**612,988**		**45,017**	**47,223**	**71,037**	**45,895**	**64,024**	**55,783**	**68,548**	**98,376**	**117,086**										
Equivalent to US$	40.7		3.0	3.1	4.7	3.0	4.2	3.7	4.5	6.5	7.8										
Total of 1 & 2	**1,231,472**		**45,017**	**47,223**	**102,008**	**76,865**	**178,305**	**138,480**	**161,867**	**223,305**	**258,402**										
Equivalent to US$	81.7		3.0	3.1	6.8	5.1	11.8	9.2	10.7	14.8	17.1										
3. VAT (5 %)	**48,770**		**0**	**0**	**2,385**	**2,435**	**8,105**	**6,295**	**7,382**	**10,174**	**11,995**										
Equivalent to US$	3.2		0.0	0.0	0.2	0.2	0.5	0.4	0.5	0.7	0.8										
Total of 1 to 3	**1,280,242**		**45,017**	**47,223**	**104,393**	**79,300**	**186,410**	**144,774**	**169,248**	**233,479**	**270,397**										
Equivalent to US$	85.0		3.0	3.1	6.9	5.3	12.4	9.6	11.2	15.5	17.9										

Note:

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

(2) Price level; As of Year 2001

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

Table H.4 Disbursement Schedule for Dinh Binh Reservoir Project

Dam Crest EL. 100.3 m, Alternatives 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. Direct Construction Cost																				
(1) General Items	39,354						39,354													
(2) Main Works																				
1) Concrete Dam	370,745						92,686	92,686	92,686	92,686										
2) Related Works	41,407						10,352	10,352	10,352	10,352										
3) Relocation Road	77,177				38,588	38,588														
Sub-total	489,329				38,588	38,588	103,038	103,038	103,038	103,038										
(3) Hydromechanical and Hydroelectrical Plant	32,189								10,622	10,622	10,944									
(4) Hydropower Plant																				
1) Main Works	63,220									31,610	31,610									
2) Hydropower Plant	68,790										68,790									
Sub-total	132,010									31,610	100,400									
(5) Transmission Line	29,971										29,971									
Total of 1.	**722,854**				**38,588**	**38,588**	**142,392**	**103,038**	**113,660**	**145,270**	**141,316**									
Equivalent to US$	48.0				2.6	2.6	9.4	6.8	7.5	9.6	9.4									
2. Indirect Construction Cost																				
(1) Resettlement Cost	134,656		39,050	39,050	39,050	17,505														
(2) Engineering Cost & Administration Cost	65,594				10,495	9,183	9,183	9,183	9,183	9,183	9,183									
(3) Price Escalation (4.9 % / Year)	373,905		3,921	6,026	18,586	17,639	50,392	44,636	57,274	83,109	92,323									
(4) Physical Contingency (Civil: 10 %, Plant:5%)	123,153		4,297	4,508	10,672	8,292	20,197	15,686	17,481	23,225	18,797									
Total of 2	**697,309**		**47,268**	**49,584**	**78,803**	**52,619**	**79,772**	**69,504**	**83,938**	**115,517**	**120,304**									
Equivalent to US$	46.3		3.1	3.3	5.2	3.5	5.3	4.6	5.6	7.7	8.0									
Total of 1 & 2	**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 (5 %)	**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	1	1	1	1	1									
Total of 1 to 3	**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									

Note:

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

(2) Price level; As of Year 2001

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

Table H.5 Disbursement Schedule for Dinh Binh Reservoir Project

Dam Crest EL. 105.3 m, Alternatives III-1& III-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. Direct Construction Cost																					
(1) General Items	47,347						47,347														
(2) Main Works																					
1) Concrete Dam	446,045						111,511	111,511	111,511	111,511											
2) Related Works	49,817						12,454	12,454	12,454	12,454											
3) Relocation Road	92,852				46,426	46,426															
Sub-total	588,714				46,426	46,426	123,965	123,965	123,965	123,965											
(3) Hydromechanical and Hydroelectrical Plant	32,189								10,622	10,622	10,944										
(4) Hydropower Plant																					
1) Main Works	63,220									31,610	31,610										
2) Hydropower Plant	68,790										68,790										
Sub-total	132,010									31,610	100,400										
(5) Transmission Line	29,971										29,971										
Total of 1	**830,232**				**46,426**	**46,426**	**171,312**	**123,965**	**134,588**	**166,198**	**141,316**										
Equivalent to US$	55.1				3.1	3.1	11.4	8.2	8.9	11.0	9.4										
2. Indirect Construction Cost																					
(1) Resettlement Cost	141,067		40,910	40,910	40,910	18,339															
(2) Engineering Cost & Administration Cost	78,917				12,627	11,048	11,048	11,048	11,048	11,048	11,048										
(3) Price Escalation (4.9 % / Year)	423,056		4,107	6,313	21,080	20,486	60,627	53,701	67,901	95,373	93,468										
(4) Physical Contingency (Civil:10 %, Plant:5%)	140,780		4,502	4,722	12,104	9,630	24,299	18,872	20,823	26,731	19,098										
Sub-total of 2	**783,820**		**49,519**	**51,945**	**86,721**	**59,503**	**95,974**	**83,621**	**99,772**	**133,152**	**123,614**										
Equivalent to US$	52.0		3.3	3.4	5.8	3.9	6.4	5.5	6.6	8.8	8.2										
Total of 1 & 2	**1,614,051**		**49,519**	**51,945**	**133,147**	**105,929**	**267,286**	**207,587**	**234,360**	**299,350**	**264,930**										
Equivalent to US$	107.1		3.3	3.4	8.8	7.0	17.7	13.8	15.6	19.9	17.6										
3. VAT (5 %)	**65,410**		**0**	**0**	**3,575**	**3,650**	**12,149**	**9,436**	**10,677**	**13,631**	**12,292**										
Equivalent to US$	4.3		0.0	0.0	0.2	0.2	0.8	0.6	0.7	0.9	0.8										
Total of 1 to 3	**1,679,461**		**49,519**	**51,945**	**136,722**	**109,579**	**279,436**	**217,022**	**245,037**	**312,981**	**277,221**										
Equivalent to US$	111.5		3.3	3.4	9.1	7.3	18.5	14.4	16.3	20.8	18.4										

Note:

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

(2) Price level; As of Year 2001

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

Table H.6 Disbursement Schedule for Flood Control Facilities

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. Direct Construction Cost																				
(1) General Items	33,330											33,330								
(2) Thi Nai Swamp																				
1) Sea Dyke	29,471											11,052	14,736	3,684						
2) Improvement of Sluice Gates	110,326											41,372	55,163	13,791						
3) Improvement of Spillway	2,011											754	1,006	251						
4) New Construction of Spillway	1,677											629	838	210						
Sub-total	143,485											53,807	71,743	17,936						
(3) Dap Da River																				
1) Dyke	48,599											7,776	10,206	10,206	10,206	10,206				
2) Bridges	44,233											7,077	9,289	9,289	9,289	9,289				
3) Side Overflow Spillway	6,852											6,852								
4) New Construction of Sluice Gates	43,499											6,960	9,135	9,135	9,135	9,135				
5) Bank Protection Works	11,245											1,799	2,362	2,362	2,362	2,362				
6) Reconstruction of Irrigation Weir	40,756											15,284	20,378	5,095						
Sub-total	195,184											45,747	51,369	36,086	30,991	30,991				
(4) Go Cham River																				
1) Dyke	8,540											2,135	2,818	2,818	769					
2) Bridges	14,311											3,578	4,723	4,723	1,288					
3) Side Overflow Spillway	1,909											1,909								
4) New Construction of Fixed Weir	12,404											4,652	6,202	1,551						
5) Reconstruction of Irrigation Weir	6,202											2,326	3,101	775						
6) Bank Protection Works	10,003											2,501	3,301	3,301	900					
Sub-total	53,369											17,100	20,145	13,167	2,957					
(5) Tan An River																				
1) Dyke	68,651											10,984	14,417	14,417	14,417	14,417				
2) Bridges	37,729											6,037	7,923	7,923	7,923	7,923				
3) Side Overflow Spillway	6,839											6,839								
4) New Construction of Sluice Gates	84,277											13,484	17,698	17,698	17,698	17,698				
5) Improvement of Irrigation Weir	35,440											13,290	17,720	4,430						
6) Bank Protection Works	12,644											2,023	2,655	2,655	2,655	2,655				
Sub-total	245,580											52,658	60,413	47,123	42,693	42,693				
(6) Nam Yang River																				
1) Dyke	6,709											2,516	3,354	839						
2) Bridges	8,782											3,293	4,391	1,098						
3) New Construction of Sluice Gate	1,739											1,739								
4) Bank Protection Works	6,155											2,308	3,078	769						
Sub-total	23,385											9,856	10,823	2,706						
(7) Ca My River																				
1) Dyke	1,039											779.0	259.7							
2) Bank Protection Works	3,270											2,452.5	817.5							
Sub-total	4,309											3,232	1,077							
(8) Kone River																				
1) Groyne	1,288											965.8	321.9							
Sub-total	1,288											966	322							
Total of 1	699,931											216,696	215,892	117,018	76,641	73,684				
Equivalent to US$	46.5											14.4	14.3	7.8	5.1	4.9				
2. Indirect Construction Cost																				
2.1 Resettlement Cost	27,580							7,998	7,998	7,998	3,585									
2.2 Engineering Cost	69,993									11,199	9,799	9,799	9,799	9,799	9,799	9,799				
2.3 Administration	21,825							2,619	2,401	2,401	2,401	2,401	2,401	2,401	2,401	2,401				
2.4 Price Escalation (4.9 % / Year)	652,057							4,223	4,848	11,621	9,683	158,512	176,871	111,442	84,727	90,129				
2.5 Physical Contingency (10 %)	147,139							1,484	1,525	3,322	2,547	38,741	40,496	24,066	17,357	17,601				
Total of 2	**918,595**							**16,324**	**16,772**	**36,541**	**28,016**	**209,452**	**229,567**	**147,708**	**114,284**	**119,930**				
Equivalent to US$	61.0							1.1	1.1	2.4	1.9	13.9	15.2	9.8	7.6	8.0				
Total of 1 & 2	**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 (5 %)	**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 of 1 to 3	**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				

Note :

(1) Cost data sources; Supplementary Feasibility Report, No.123C-10-T1BS by HEC 1, On-going drainage project by JBIC Loan 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 H.7 Disbursement Schedule of Irrigation and Drainage Facilities

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. Direct Construction Cost																				
1.1 General Items	73,631						64,059				9,572									
1.2 Van Phong Weir																				
(1) Main Works	148,726						18,591	37,182	37,182	37,182	18,591									
(2) Mechanical and Electrical Works	2,122								531	1,061	531									
Sub-total	150,849						18,591	37,182	37,712	38,243	19,121									
1.3 Rehabilitation works of Existing Weirs																				
(1) 7 Weirs	69,020						13,804	13,804	13,804	13,804	13,804									
(2) 1 Weir (Loc Giang)	8,080						2,667	2,667	2,747											
Sub-total	77,100						16,470	16,470	16,551	13,804	13,804									
1.4 Construction Works of New Weir																				
(1) 1 Weir	1,595										175	175	175	175	175	175	175	175	191	
1.5 Construction Works of New Earthfill Dams																				
(1) 1 Earthfill Dam (Phu Tai)	33,449						11,038	11,038	11,373											
(2) 10 Earthfill Dams	98,548										10,840	10,840	10,840	10,840	10,840	10,840	10,840	10,840	11,826	
Sub-total	131,997						11,038	11,038	11,373		10,840	10,840	10,840	10,840	10,840	10,840	10,840	10,840	11,826	
1.6 Existing Reservoirs to be Rehabilitated																				
(1) 18 Reservoirs	56,334						18,590	18,590	19,153											
1.7 Construction of New Pumping Station																				
(1) 6 places	27,850						5,570	5,570	5,570	5,570	5,570									
1.8 Improvement of Existing Function																				
(1) 15,700 ha	104,405						20,881	20,881	20,881	20,881	20,881									
(2) 8,700 ha	57,855						19,092	19,092	19,671											
Sub-total	162,260						39,973	39,973	40,552	20,881	20,881									
1.9 Rehabilitation and Improvement for Non-Function Area																				
(1) 3,200 ha	38,000						7,600	7,600	7,600	7,600	7,600									
(2) 3,500 ha	41,563						13,716	13,716	14,131											
Sub-total	79,563						21,316	21,316	21,731	7,600	7,600									
1.10 Construction for New Development Area																				
(1) 17,800 ha	541,120						108,224	108,224	108,224	108,224	108,224									
(2) 2,600 ha	79,040						26,083	26,083	26,874											
(3) 3,000 ha	91,200										10,032	10,032	10,032	10,032	10,032	10,032	10,032	10,032	10,944	
Sub-total	711,360						134,307	134,307	135,098	108,224	118,256	10,032	10,032	10,032	10,032	10,032	10,032	10,032	10,944	
Total of 1	**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**	**22,961**	
Equivalent to US$	97.7						21.9	18.9	19.1	12.9	13.7	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	
2. Indirect Construction Cost																				
(1) Resettlement Cost	79,294		22,995	22,995	22,995	10,308														
(2) Engineering Cost	147,254				9,822	9,822	9,822	9,822	9,822	9,822	9,822	9,822	9,822	9,822	9,822	9,822	9,822	9,822	9,748	
(3) Administration	46,555		2,737	2,737	2,737	2,737	2,737	2,737	2,737	2,737	2,737	2,737	2,737	2,737	2,737	2,737	2,737	2,737	2,756	
(4) Price Escalation (4.9 % / year)	912,413		2,584	3,971	7,498	6,179	113,858	118,133	140,010	111,319	133,964	23,273	26,060	28,984	32,051	35,268	38,643	42,183	48,435	
(5) Physical Contingency (10 %)	265,805		2,832	2,970	4,305	2,905	45,633	41,514	44,031	31,820	35,234	5,688	5,967	6,259	6,566	6,888	7,225	7,579	8,390	
Total of 2	**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**	
Equivalent to US$	96.3		2.1	2.2	3.1	2.1	11.4	11.4	13.0	10.3	12.1	2.8	3.0	3.2	3.4	3.6	3.9	4.1	4.6	
Total of 1 & 2	**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**	
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	
3. VAT (5 %)	**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**	
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	
Total of 1 to 3	**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**	
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	

Note:

(1) Cost data sources; Feasibility study report, executive summary, Stage 2, No. 444C-05-TT2 (HEC-1), Survey Report for Irrigation Sector, JBIC Loan No.VN VI-8 and Feasibility Study Report, No.123C-06-T1 by HEC 1

(2) Price level; As of Year 2001 (3) Exchange rate; US$ 1.0 = VND 15,068 = ¥ 123.39

Table H.8 Disbursement Schedule of Domestic and Industrial Water Supply for Kone River Basin

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. Direct Construction Cost																				
(1) General Items	138,353						69,177										69,177			
(2) Raw Water Intakes and Pre-treatment Units	143,401							35,850	35,850									35,850	35,850	
(3) Booster Pumping Stations and Ancillaries	539,278							134,820	134,820									134,820	134,820	
(4) Elevated Storage Reservoirs	44,465							11,116	11,116									11,116	11,116	
(5) Pipelines (Primary, secondary and tertiary Mains)	656,385							164,096	164,096									164,096	164,096	
(6) Metered House connections	480,113							39,849	39,849	39,849	39,849	39,849	39,849	39,849	39,849	39,849	39,849	39,849	41,770	
Sub-total	**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**	
Equivalent to US$	132.9						4.6	25.6	25.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	7.2	25.6	25.7	
2. Indirect Construction Cost																				
(1) Resettlement Cost	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
(2) Engineering Cost	138,353				8,301	15,219	15,219	15,219	15,219						8,301	15,219	15,219	15,219	15,219	
(3) Administration Cost	41,506				2,490	4,566	4,566	4,566	4,566						2,490	4,566	4,566	4,566	4,566	
(4) Price Escalation (4.9 % / Year)	1,850,733				2,276	5,346	29,576	161,293	189,066	21,442	24,446	27,596	30,901	34,368	48,296	62,581	148,112	509,000	556,434	
(5) Physical Contingency (10 %)	403,259				1,307	2,513	11,854	56,681	59,458	6,129	6,429	6,745	7,075	7,422	9,894	12,222	27,692	91,452	96,387	
Sub-total	**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**	
Equivalent to US$	161.5				1.0	1.8	4.1	15.8	17.8	1.8	2.0	2.3	2.5	2.8	4.6	6.3	13.0	41.2	44.6	
Total (1+2)	**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**	
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	
3. VAT (5 %)	**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**	
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	3.2	
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**	
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	

Note:

(1) Cost Data Source; On-going water supply project by JBIC Loan

(1) Price level; As of Year 2001

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

Table H.9 Summary of Disbursement Schedule for Kone River Basin

Alternative I-1 & I-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	618,483				30,970	30,970	114,282	82,697	93,319	124,929	141,316									
(2) Indirect Construction Cost	612,988		45,017	47,223	71,037	45,895	64,024	55,783	68,548	98,376	117,086									
Sub-total	1,231,472		45,017	47,223	102,008	76,865	178,305	138,480	161,867	223,305	258,402									
Equivalent to US$	81.7		3.0	3.1	6.8	5.1	11.8	9.2	10.7	14.8	17.1									
(3) VAT	48,770		0	0	2,385	2,435	8,105	6,295	7,382	10,174	11,995									
Equivalent to US$	3.2		0.0	0.0	0.2	0.2	0.5	0.4	0.5	0.7	0.8									
Total	**1,280,242**		**45,017**	**47,223**	**104,393**	**79,300**	**186,410**	**144,774**	**169,248**	**233,479**	**270,397**									
Equivalent to US$	85.0		3.0	3.1	6.9	5.3	12.4	9.6	11.2	15.5	17.9									
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	13	13				
(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	1	1				
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	13				
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	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	
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	
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	
(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	
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	
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**	
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	
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	
(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	
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	
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	
(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	
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	3.2	
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**	
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	
5. Total																				
(1) Direct Construction Cost	4,792,948		0	0	30,970	30,970	513,374	752,875	766,791	359,100	386,985	277,593	276,789	177,915	137,538	134,581	130,074	406,780	410,613	
(2) Indirect Construction Cost	5,416,754		76,165	79,897	132,769	105,490	297,288	482,071	550,230	318,186	357,735	285,313	312,129	237,299	234,441	269,232	254,016	682,558	741,935	
Sub-total of 1 to 4	**10,209,702**		**76,165**	**79,897**	**163,740**	**136,460**	**810,660**	**1,234,946**	**1,317,020**	**677,287**	**744,720**	**562,906**	**588,918**	**415,214**	**371,980**	**403,815**	**384,090**	**1,089,337**	**1,152,548**	
Equivalent to US$	677.6		5.1	5.3	10.9	9.1	53.8	82.0	87.4	44.9	49.4	37.4	39.1	27.6	24.7	26.8	25.5	72.3	76.5	
(3) VAT of 1 to 4	450,182		151	158	3,798	4,490	36,849	55,575	59,302	30,195	33,811	25,586	26,769	18,874	16,908	18,356	17,458	49,516	52,389	
Equivalent to US$	29.9		0.0	0.0	0.3	0.3	2.4	3.7	3.9	2.0	2.2	1.7	1.8	1.3	1.1	1.2	1.2	3.3	3.5	
Total of 1 to 4	**10,659,884**		**76,316**	**80,055**	**167,538**	**140,950**	**847,509**	**1,290,521**	**1,376,322**	**707,482**	**778,531**	**588,492**	**615,687**	**434,088**	**388,888**	**422,171**	**401,548**	**1,138,853**	**1,204,937**	
Equivalent to US$	707.5		5.1	5.3	11.1	9.4	56.2	85.6	91.3	47.0	51.7	39.1	40.9	28.8	25.8	28.0	26.6	75.6	80.0	

Table H.10 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	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	
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	
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	
(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	
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	
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**	
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	
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	
(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	
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	
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	
(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	
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	3.2	
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**	
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	
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	
(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	
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**	
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	
(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	
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	
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**	
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	

Table H.11 Summary of Disbursement Schedule for Kone River Basin

Alternative III-1 & III-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	830,232				46,426	46,426	171,312	123,965	134,588	166,198	141,316									
(2) Indirect Construction Cost	783,820		49,519	51,945	86,721	59,503	95,974	83,621	99,772	133,152	123,614									
Sub-total	1,614,051		49,519	51,945	133,147	105,929	267,286	207,587	234,360	299,350	264,930									
Equivalent to US$	107.1		3.3	3.4	8.8	7.0	17.7	13.8	15.6	19.9	17.6									
(3) VAT	65,410		0	0	3,575	3,650	12,149	9,436	10,677	13,631	12,292									
Equivalent to US$	4.3		0.0	0.0	0.2	0.2	0.8	0.6	0.7	0.9	0.8									
Total	**1,679,461**		**49,519**	**51,945**	**136,722**	**109,579**	**279,436**	**217,022**	**245,037**	**312,981**	**277,221**									
Equivalent to US$	111.5		3.3	3.4	9.1	7.3	18.5	14.4	16.3	20.8	18.4									
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	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	
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	
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	
(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	
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	
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**	
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	
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	
(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	
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	
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	
(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	
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	3.2	
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**	
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	
5. Total																				
(1) Direct Construction Cost	5,004,697		0	0	46,426	46,426	570,404	794,143	808,060	400,369	386,985	277,593	276,789	177,915	137,538	134,581	130,074	406,780	410,613	
(2) Indirect Construction Cost	5,587,586		80,667	84,619	148,453	119,098	329,238	509,909	581,454	352,962	364,263	285,313	312,129	237,299	234,441	269,232	254,016	682,558	741,935	
Sub-total of 1 to 4	**10,592,281**		**80,667**	**84,619**	**194,879**	**165,524**	**899,641**	**1,304,053**	**1,389,513**	**753,332**	**751,248**	**562,906**	**588,918**	**415,214**	**371,980**	**403,815**	**384,090**	**1,089,337**	**1,152,548**	
Equivalent to US$	703.0		5.4	5.6	12.9	11.0	59.7	86.5	92.2	50.0	49.9	37.4	39.1	27.6	24.7	26.8	25.5	72.3	76.5	
(3) VAT of 1 to 4	466,822		151	158	4,988	5,705	40,893	58,716	62,597	33,652	34,108	25,586	26,769	18,874	16,908	18,356	17,458	49,516	52,389	
Equivalent to US$	31.0		0.0	0.0	0.3	0.4	2.7	3.9	4.2	2.2	2.3	1.7	1.8	1.3	1.1	1.2	1.2	3.3	3.5	
Total of 1 to 4	**11,059,103**		**80,818**	**84,777**	**199,867**	**171,229**	**940,534**	**1,362,769**	**1,452,110**	**786,984**	**785,356**	**588,492**	**615,687**	**434,088**	**388,888**	**422,171**	**401,548**	**1,138,853**	**1,204,937**	
Equivalent to US$	733.9		5.4	5.6	13.3	11.4	62.4	90.4	96.4	52.2	52.1	39.1	40.9	28.8	25.8	28.0	26.6	75.6	80.0	

Table H.12 Disbursement Schedule of Irrigation and Drainage Facilities for Kone River Basin

- Without La Tinh -

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. Direct Construction Cost																				
1.1 General Items	66,655						57,989				8,665									
1.2 Van Phong Weir																				
(1) Main Works	148,726						18,591	37,182	37,182	37,182	18,591									
(2) Mechanical and Electrical Works	2,122								531	1,061	531									
Sub-total	150,849						18,591	37,182	37,712	38,243	19,121									
1.3 Rehabilitation works of Existing Weirs																				
(1) 6 Weirs	56,731						11,346	11,346	11,346	11,346	11,346									
(2) 1 Weir (Loc Giang)	8,080						2,667	2,667	2,747											
Sub-total	64,811						14,013	14,013	14,093	11,346	11,346									
1.4 Construction Works of New Weirs																				
(1) 1 Weir	1,595										175	175	175	175	175	175	175	175	191	
1.5 Construction Works of New Earthfill Dams																				
(1) 1 Earthfill Dam (Phu Tai)	33,449						11,038	11,038	11,373											
(2) 10 Earthfill Dams	98,548										10,840	10,840	10,840	10,840	10,840	10,840	10,840	10,840	11,826	
Sub-total	131,997						11,038	11,038	11,373		10,840	10,840	10,840	10,840	10,840	10,840	10,840	10,840	11,826	
1.6 Existing Reservoirs to be Rehabilitated																				
(1) 18 Reservoirs	56,334						18,590	18,590	19,153											
1.7 Construction Works of New Pumping Station																				
(1) 6 places	27,850						5,570	5,570	5,570	5,570	5,570									
1.8 Improvement of Existing Function																				
(1) 12,700 ha	84,455						16,891	16,891	16,891	16,891	16,891									
(2) 8,700 ha	57,855						19,092	19,092	19,671											
Sub-total	142,310						35,983	35,983	36,562	16,891	16,891									
1.9 Rehabilitation and Improvement for																				
Non-Function Area																				
(1) 3,200 ha	38,000						7,600	7,600	7,600	7,600	7,600									
(2) 3,500 ha	41,563						13,716	13,716	14,131											
Sub-total	79,563						21,316	21,316	21,731	7,600	7,600									
1.10 Construction for New Development Area																				
(1) 14,500 ha	440,800						88,160	88,160	88,160	88,160	88,160									
(2) 2,600 ha	79,040						26,083	26,083	26,874											
(3) 3,000 ha	91,200										10,032	10,032	10,032	10,032	10,032	10,032	10,032	10,032	10,944	
Sub-total	611,040						114,243	114,243	115,034	88,160	98,192	10,032	10,032	10,032	10,032	10,032	10,032	10,032	10,944	
Total of 1	**1,333,002**						**297,333**	**257,934**	**261,228**	**167,810**	**178,401**	**21,048**	**21,048**	**21,048**	**21,048**	**21,048**	**21,048**	**21,048**	**22,961**	
Equivalent to US$	88.5						19.7	17.1	17.3	11.1	11.8	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	
2. Indirect Construction Cost																				
(1) Resettlement Cost	69,396		20,125	20,125	20,125	9,021														
(2) Engineering Cost	133,300				8,891	8,891	8,891	8,891	8,891	8,891	8,891	8,891	8,891	8,891	8,891	8,891	8,891	8,891	8,824	
(3) Administration	42,072		2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,491	
(4) Price Escalation (4.9 % / year)	832,788		2,269	3,487	6,641	5,509	102,629	107,113	127,093	96,411	116,412	22,446	25,134	27,954	30,912	34,015	37,270	40,684	46,811	
(5) Physical Contingency (10 %)	241,056		2,487	2,609	3,813	2,590	41,133	37,641	39,969	27,559	30,618	5,486	5,755	6,037	6,332	6,643	6,968	7,310	8,109	
Total of 2	**1,318,611**		**27,354**	**28,695**	**41,943**	**28,485**	**155,126**	**156,119**	**178,426**	**135,334**	**158,394**	**39,297**	**42,254**	**45,355**	**48,609**	**52,022**	**55,603**	**59,359**	**66,235**	
Equivalent to US$	87.5		1.8	1.9	2.8	1.9	10.3	10.4	11.8	9.0	10.5	2.6	2.8	3.0	3.2	3.5	3.7	3.9	4.4	
Total of 1 & 2	**2,651,613**		**27,354**	**28,695**	**41,943**	**28,485**	**452,459**	**414,053**	**439,654**	**303,144**	**336,796**	**60,345**	**63,301**	**66,403**	**69,657**	**73,070**	**76,651**	**80,406**	**89,196**	
Equivalent to US$	176.0		1.8	1.9	2.8	1.9	30.0	27.5	29.2	20.1	22.4	4.0	4.2	4.4	4.6	4.8	5.1	5.3	5.9	
3. VAT (5 %)	**116,468**		**136**	**143**	**688**	**722**	**20,566**	**18,821**	**19,984**	**13,779**	**15,309**	**2,743**	**2,877**	**3,018**	**3,166**	**3,321**	**3,484**	**3,655**	**4,054**	
Equivalent to US$	7.7		0.0	0.0	0.0	0.0	1.4	1.2	1.3	0.9	1.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	
Total of 1 to 3	**2,768,081**		**27,490**	**28,838**	**42,632**	**29,206**	**473,026**	**432,874**	**459,639**	**316,923**	**352,105**	**63,088**	**66,179**	**69,422**	**72,823**	**76,392**	**80,135**	**84,061**	**93,250**	
Equivalent to US$	183.7		1.8	1.9	2.8	1.9	31.4	28.7	30.5	21.0	23.4	4.2	4.4	4.6	4.8	5.1	5.3	5.6	6.2	

Note:

(1) Cost data sources; Feasibility study report, executive summary, Stage 2, No. 444C-05-TT2 (HEC-1), Survey Report for Irrigation Sector, JBIC Loan No.VN VI-8 and Feasibility Study Report, No.123C-06-T1 by HEC 1

(2) Price level; As of Year 2001 (3) Exchange rate; US$ 1.0 = VND 15,068 = ¥ 123.39

Table H.13 Disbursement Schedule for Flood Control Facilities

Without New Spillway

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. Direct Construction Cost																				
(1) General Items	33,330											33,330								
(2) Thi Nai Swamp																				
1) Sea Dyke	29,471											11,052	14,736	3,684						
2) Improvement of Sluice Gates	110,326											41,372	55,163	13,791						
3) Improvement of Spillway	2,011											754	1,006	251						
Sub-total	141,808											53,178	70,904	17,726						
(3) Dap Da River																				
1) Dyke	48,599											7,776	10,206	10,206	10,206	10,206				
2) Bridges	44,233											7,077	9,289	9,289	9,289	9,289				
3) Side Overflow Spillway	6,852											6,852								
4) New Construction of Sluice Gates	43,499											6,960	9,135	9,135	9,135	9,135				
5) Bank Protection Works	11,245											1,799	2,362	2,362	2,362	2,362				
6) Reconstruction of Irrigation Weir	40,756											15,284	20,378	5,095						
Sub-total	195,184											45,747	51,369	36,086	30,991	30,991				
(4) Go Cham River																				
1) Dyke	8,540											2,135	2,818	2,818	769					
2) Bridges	14,311											3,578	4,723	4,723	1,288					
3) Side Overflow Spillway	1,909											1,909								
4) New Construction of Fixed Weir	12,404											4,652	6,202	1,551						
5) Reconstruction of Irrigation Weir	6,202											2,326	3,101	775						
6) Bank Protection Works	10,003											2,501	3,301	3,301	900					
Sub-total	53,369											17,100	20,145	13,167	2,957					
(5) Tan An River																				
1) Dyke	68,651											10,984	14,417	14,417	14,417	14,417				
2) Bridges	37,729											6,037	7,923	7,923	7,923	7,923				
3) Side Overflow Spillway	6,839											6,839								
4) New Construction of Sluice Gates	84,277											13,484	17,698	17,698	17,698	17,698				
5) Improvement of Irrigation Weir	35,440											13,290	17,720	4,430						
6) Bank Protection Works	12,644											2,023	2,655	2,655	2,655	2,655				
Sub-total	245,580											52,658	60,413	47,123	42,693	42,693				
(6) Nam Yang River																				
1) Dyke	6,709											2,516	3,354	839						
2) Bridges	8,782											3,293	4,391	1,098						
3) New Construction of Sluice Gate	1,739											1,739								
4) Bank Protection Works	6,155											2,308	3,078	769						
Sub-total	23,385											9,856	10,823	2,706						
(7) Ca My River																				
1) Dyke	1,039											779.0	259.7							
2) Bank Protection Works	3,270											2,452.5	817.5							
Sub-total	4,309											3,232	1,077							
(8) Kone River																				
1) Groyne	1,288											965.8	321.9							
Sub-total	1,288											966	322							
Total of 1	698,254											216,067	215,053	116,808	76,641	73,684				
Equivalent to US$	46.3											14.3	14.3	7.8	5.1	4.9				
2. Indirect Construction Cost																				
2.1 Resettlement Cost	27,580							7,998	7,998	7,998	3,585									
2.2 Engineering Cost	69,825									11,172	9,776	9,776	9,776	9,776	9,776	9,776				
2.3 Administration	21,775							2,613	2,395	2,395	2,395	2,395	2,395	2,395	2,395	2,395				
2.4 Price Escalation (4.9 % / Year)	650,625							4,221	4,846	11,604	9,666	158,056	176,199	111,236	84,700	90,099				
2.5 Physical Contingency (10 %)	146,806							1,483	1,524	3,317	2,542	38,629	40,342	24,021	17,351	17,595				
Total of 2	**916,612**							**16,315**	**16,763**	**36,487**	**27,964**	**208,856**	**228,712**	**147,428**	**114,221**	**119,865**				
Equivalent to US$	60.8							1.1	1.1	2.4	1.9	13.9	15.2	9.8	7.6	8.0				
Total of 1 & 2	**1,614,866**							**16,315**	**16,763**	**36,487**	**27,964**	**424,923**	**443,765**	**264,236**	**190,863**	**193,549**				
Equivalent to US$	107.2							1.1	1.1	2.4	1.9	28.2	29.5	17.5	12.7	12.8				
3. VAT (5 %)	**71,353**							**183**	**176**	**1,043**	**982**	**19,315**	**20,171**	**12,011**	**8,676**	**8,798**				
Equivalent to US$	4.7							0.0	0.0	0.1	0.1	1.3	1.3	0.8	0.6	0.6				
Total of 1 to 3	**1,686,219**							**16,498**	**16,939**	**37,530**	**28,946**	**444,238**	**463,936**	**276,247**	**199,538**	**202,347**				
Equivalent to US$	111.9							1.1	1.1	2.5	1.9	29.5	30.8	18.3	13.2	13.4				

Note :

(1) Cost data sources; Supplementary Feasibility Report, No.123C-10-T1BS by HEC 1, On-going drainage project by JBIC Loan 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

Figure H.1 Overall Implementation Schedule for Dinh Binh Reservoir Project (Concrete Dam)

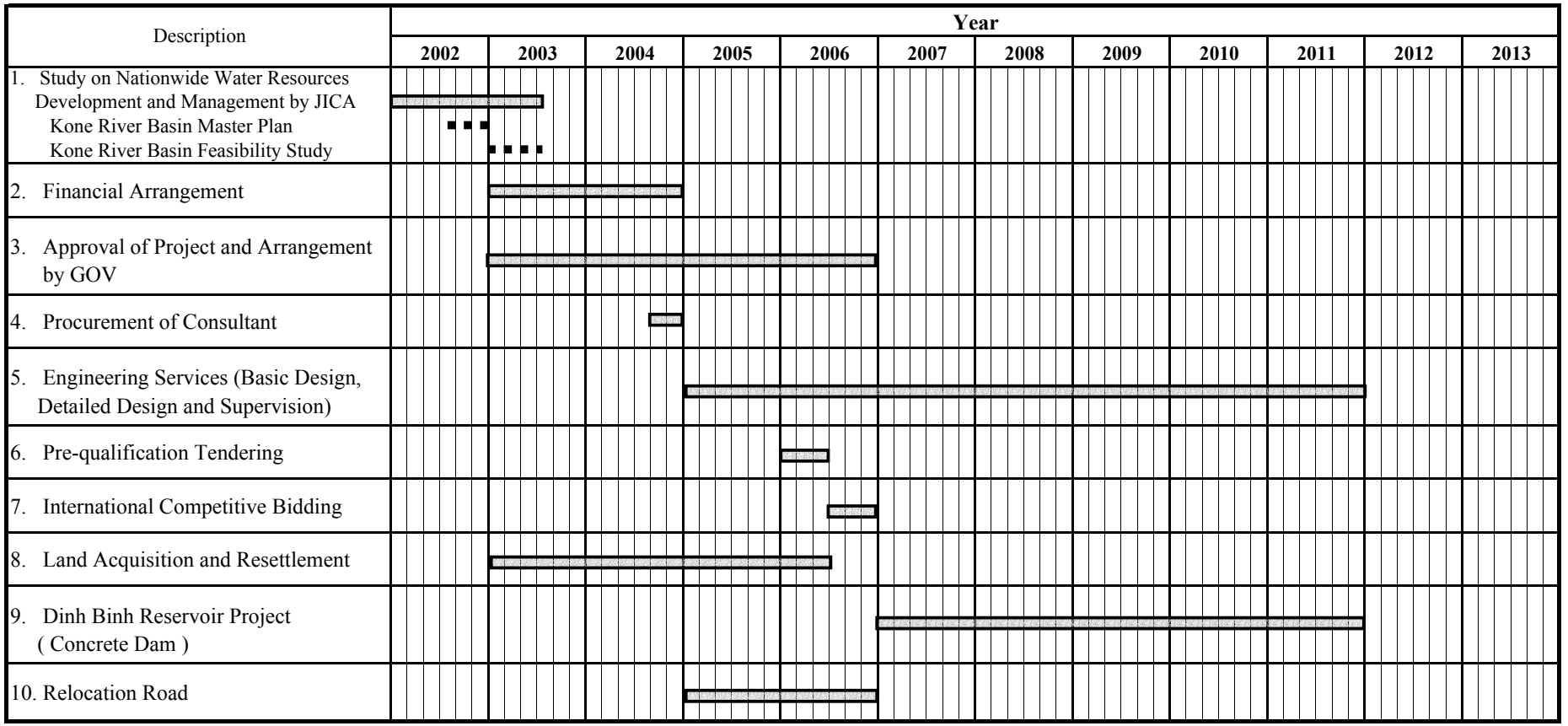
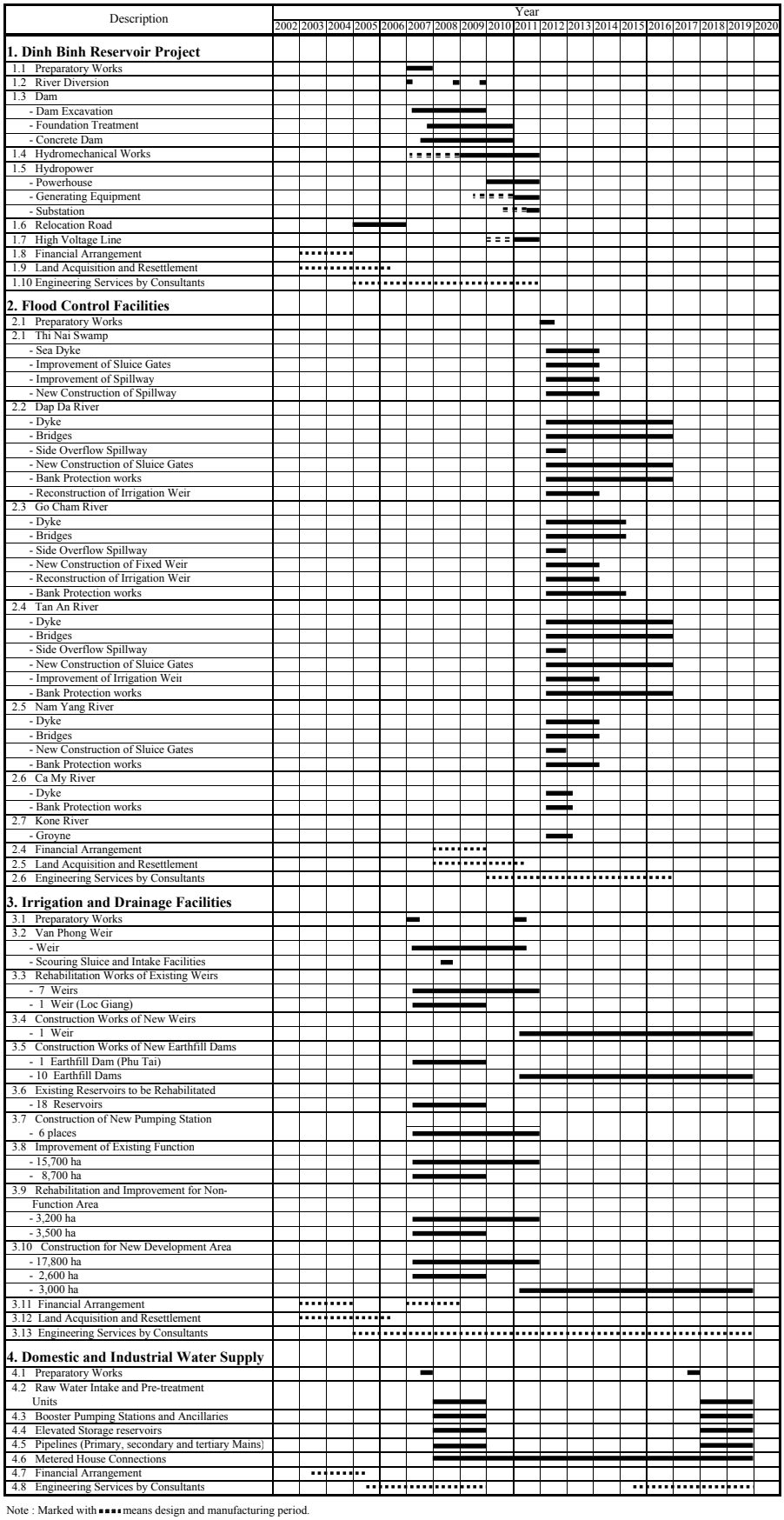
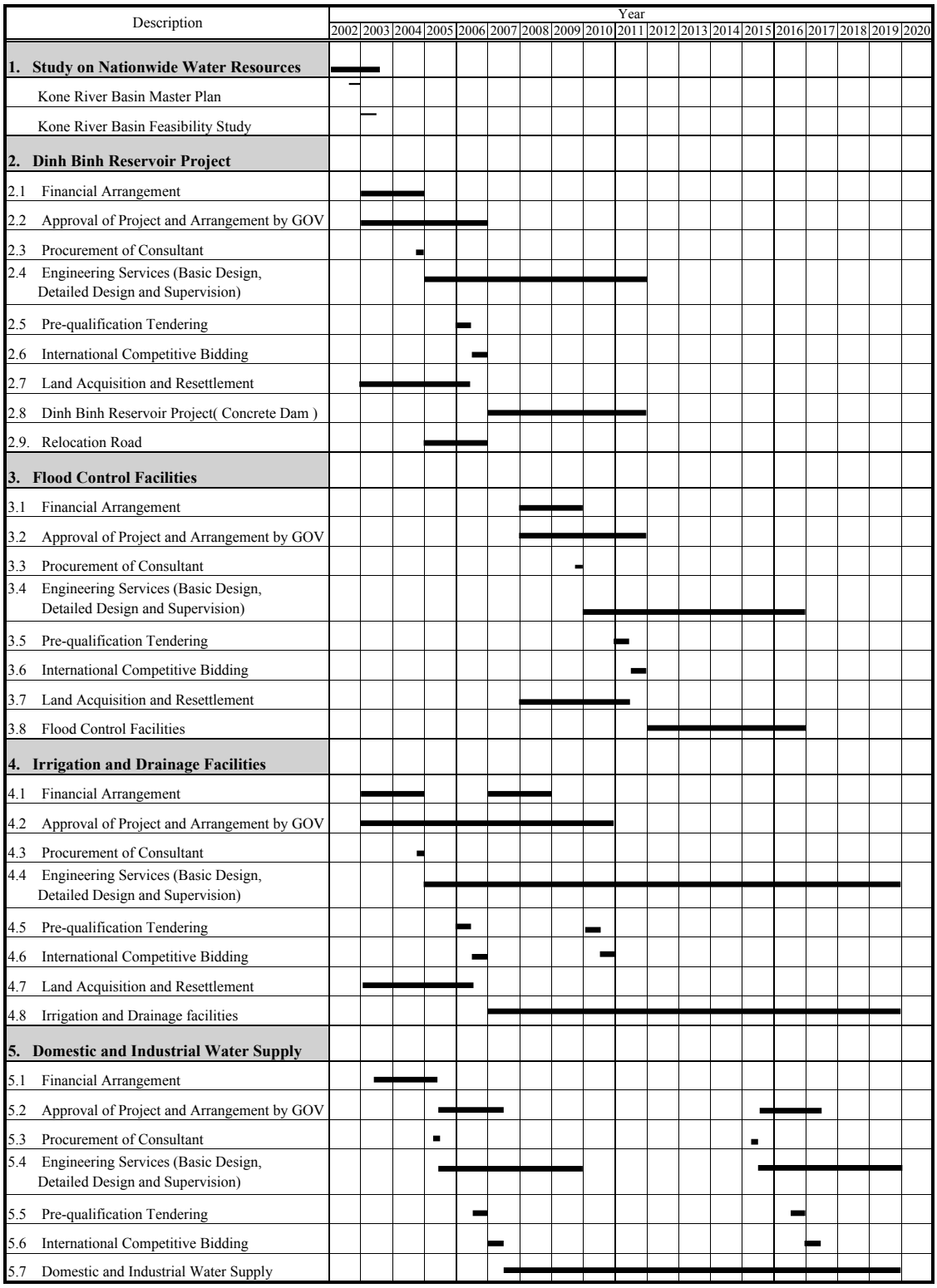


Figure H.2 Overall Implementation Schedule by Facility



Note : Marked with ▪▪▪▪ means design and manufacturing period.

Figure H.3 Overall Implementation Schedule by Sector



Appendix I

Initial Environmental Examination

Appendix I
Initial Environmental Examination

Table of Contents

List of Tables

Appendix I Initial Environmental Examination

1 PROJECT DESCRIPTION OF THE MASTER PLAN AND SCREENING

The components involved in the Master Plan are listed in Table I.1 including their sizes and dimensions. The Master Plan is composed of 6 schemes: 1) Dinh Binh Multipurpose Reservoir, 2) Agricultural Development Plan, 3) Domestic and Industrial Water Supply, 4) Flood Control and bank erosion Protection Plan, 5) Rural Development Plan, and 6) Water Resources Management Plan. Each scheme consists of the several components or projects, and the result of screening on the components/projects is shown in Table I.1.

Among the components/projects, the following was selected as those necessary for initial environmental examination (IEE):

- Dinh Binh Multipurpose Reservoir including the quarry site development,
- Agricultural Development Plan which includes the irrigation system development plan and agricultural input,
- Domestic/industrial water plant and water supply system as Domestic and Industrial Water Supply Plan, and
- River improvement as Flood Control and Bank Erosion Protection Plan.

The remaining components/projects of the Master Plan were screened out for further examination, because it is expected that the negative impacts on environment will be insignificant as shown in Table I.2. However, supposing that the scale and/or characteristics of the components screened out here would be revised/changed, the additional discussion on environmental examination would be necessary.

2 METHODOLOGY OF EXAMINATION

2.1 Environmental Elements to be Examined

The environmental impacts will be examined for the following environmental elements, referring to the JICA Environmental Consideration Guideline:

1) Physical environment
   - Topography (including sedimentation);
   - Geology (including mineral and soil);
   - Groundwater;
   - Air quality;
   - Water quality (including eutrophication); and
   - Noise and vibration.
2) Ecological environment
   - Forest and vegetation;
   - Terrestrial flora and fauna;
   - Aquatic flora and fauna;
   - Ecology of Thi Nai swamp; and
   - Protected area.
3) Social environment
   - Resettlement and land acquisition;
   - Ethnic minority;
   - Change or split of communities;
   - Economic activities (including fishery);
   - Fishery in Thi Nai swamp;
   - Transportation system (including fluvial navigation);
   - Historical and cultural heritage;
   - Landscape and recreational spot; and
   - Health, sanitation, and construction waste.

Regarding physical environment elements, such elements as 'Soil contamination' and 'Odor' have been deleted because the Master Plan components are not such projects that emit pollution, toxic, hazardous, or odor gases or substances. 'Meteorology' has also been deleted because the magnitude of the impact on meteorology is apparently clear to be minor. 'Water regime (river flow regime)' has been deleted because the change of water regime is supposed to be discussed in Main Report Volume IV Sub-Section 7.4 Flood Control Plan although the secondary impacts that are to be attributed to the change of water regime will be discussed in respective elements.

'Land subsidence' has also been deleted because land subsidence is strongly related to

groundwater condition and, therefore, it should be discussed together with groundwater. The issue on 'Soil erosion' is supposed to be discussed in the element of 'Geology.'

Regarding ecological environmental elements, such elements as 'Forest and Vegetation,' and 'Ecology of Thi Nai Swamp' have been picked up for an independent item to be discussed because these elements hold an important function for the formation of environment in the Kone and the Ha Thanh rivers basin.

Regarding social environmental elements, 'Change of split of communities,' and 'Fishery in Thi Nai swamp' have been picked up for an independent item to be discussed because these environmental elements are important in terms of social viewpoint in the Kone and Ha Thanh rivers basin and Master Plan components might cause impacts on them.

2.2 Impact Magnitude

Examination of impacts on each environmental element was conducted comprehensively, considering the following criteria:

- Positive or negative,
- Nature of impact such as reversibility, possibility to avoid and duration,
- Spatial extent of the impact, and
- Population of affected people or wild life.

The impact magnitude was judged by orderly scale as follows:

- Major positive impact (+/O),
- Minor positive impact (+/Δ),
- Impacts is none or negligibly small (X),
- Magnitude of impact is not clear (?O/Δ),
- Minor negative impact (-/Δ),
- Major negative impact (-/O), and
- Neutral/Whether positive or negative depends on the design of structures (+-)

The examination was not undertaken based on any single evaluation criterion mentioned above, but was done comprehensively taking into account all the criteria.

2.3 Period to be Examined

The examination was done within the time range as the following:

- Pre-construction or preparation stage (P),
- Construction stage (C), and
- Operation and maintenance stage (O/M).

3 DESCRIPTION OF CONCEIVABLE IMPACTS AND SCOPING

Conceivable impacts of the schemes involved in the Master Plan on environment are summarized in Tables I.3 and I.4. The relationship between project components and environmental elements are shown in Table I.5, with giving the magnitude of the conceivable impacts.

The conceivable impacts by the Master Plan are described by each environmental element hereinafter. However, supposing that the scale and/or characteristics of the components discussed here would be revised/changed, or that a particular findings on environmental status in the basins would be pointed out, the additional discussion on environmental examination would be necessary.

3.1 Conceivable Impacts on Physical Environment

Impacts on topography including sedimentation: Project components involved in the Mater Plan hold structural measures. Therefore, they will bring about the following impacts:

- Possibility of slope failure;
- Change of bed load condition caused by regulation of discharge;
- Sedimentation in the backwater section of Dinh Binh reservoir;
- Sedimentation of eroded material in downstream area; and
- Modification of topographic feature of Kone river.

These impacts will be caused by Dinh Binh reservoir development, quarry site development, river improvement and Van Phong weir construction for irrigation development. For most of the cases, however, it is difficult to evaluate the magnitude or possibility of these impacts to occur at this stage. Hence, these impacts are to be studied further in detail in the EIA Study at the next phase, 2-3.

Impacts on Geology including mineral and soil: Similar to the impacts on topography, the implementation of the Master Plan would spawn the following impacts on geology:

- The possibility of soil erosion during construction stage;
- The possibility of disturbance of mining activity in the Kone river basin; and
- The possibility of inducement of earthquake when water stored in the reservoir.

Major impacts on geology would be caused by Dinh Binh reservoir development and quarrying activity for construction materials, because they will hold large amount of earth works and, therefore, the modification of geology. However, it is difficult to evaluate the magnitude or possibility of these earth related impacts. Accordingly, they are to be studied in detail in the EIA Study.

Groundwater: The impacts on groundwater accompanied with the implementation of the Master Plan will be the following forms:

- Groundwater level lowering caused by excavation work;
- Groundwater level rising due to water storage in Dinh Binh reservoir, or water dam-up at Van Phong weir; and
- Groundwater level lowering spawned in the case of over-pumping of groundwater at domestic/industrial water plant.

Similar to the former cases of impacts on topography and geology, it is difficult to evaluate the magnitude or possibility of these impacts on groundwater specifically at the phase of the Master Plan formulation. The further study is to be done at the EIA Study.

Among these possible impacts, however, the third one, i.e., the impact on groundwater related to domestic/industrial water plant, are not to be adopted for impact assessment study, because the groundwater development plan for the water supply has already been studied fully by Binh Dinh Water Supply & Drainage Company (WS & DA) under the Asian Development Bank (ADB) loan project. The study was done based on the geophysical condition and determined a safe yield of 25,000 m^3/day.

Air quality: The impacts on air quality caused by the implementation of the Master Plan will be the following:

- Air pollution, or emission gas from construction machinery and transportation vehicles;
- Dust from earth work site and during transportation of construction materials; and
- The possibility of air pollution caused by agrochemicals.

The issue on emission gas and dust for the first two cases has the nature that the impact are inevitable as far as the projects are implemented. However, it will be confined only within the construction stage; hence, the problem can be thought as not significant. The possibility of air pollution caused by the agrochemicals, on the other hand, will not be considered as significant, because the usage volume of agrochemicals, in general, are not such that will bring about the air pollution as far as normal usage is maintained. Beside, the consciousness of the local farmers for proper usage of agrochemicals has been improved owing to the training on IPM Program. Thus, the impacts on air pollution are not to be studied further in the next phase.

Water quality: The impacts on water quality caused by the implementation of the Master Plan will be the following:

- Turbid/alkaline water flow from construction site, especially from earth work site or concrete work site when raining;

- The possibility of eutrophication in Dinh Binh reservoir;
- The possibility of water pollution in the Kone river at its minimum maintenance flow after irrigation water is acquired; and
- The possibility of water pollution caused by the agrochemicals.

These impacts of water quality are thought to be significant and the proper countermeasures are needed for its mitigation, although some of them are not clear on its magnitude of the impacts. Therefore, these impacts will be studied more in detail in the EIA Study.

Noise and vibration: This impact will be brought about by construction machinery and transportation vehicles during construction stage. Similar to air pollution and dust problems, the impact is inevitable as far as the projects are implemented. However, this impact will be limited to occur within construction stage and, therefore, it is not thought as significant. Accordingly, the impact on noise and vibration will not be studied further in the EIA study.

3.2 Conceivable Impacts on Ecological Environment

Forest and Vegetation: The conceivable impacts on forest and vegetation caused by the implementation of the Master Plan will be the following:

- Clearance of the forest on construction work sites; and
- Submergence of the forest and vegetation.

Clearance of the forest will be done at Dinh Binh dam site, quarry site, the area for river improvement works. The submergence of the forest will be brought about inside the Dinh Binh reservoir. In terms of virginity or wilderness of the forest to be cleared or submerged, the impact is not thought to be significant, although both of these would further generate the impacts on the flora and fauna. The further impacts on flora and fauna will be studied more at respective sections in the EIA Study at the next phase. Therefore, the impacts on the forest and vegetation itself will not be studied in the EIA Study.

Terrestrial ecology: The issues of terrestrial flora and fauna caused by the implementation of the Master Plan will be the following:

- Impacts on plants community and habitat disturbance of terrestrial fauna; and
- Modification of plants community and/or that of habitat of terrestrial fauna.

These issues will be caused by the Dinh Binh reservoir development, quarry site and irrigation system development. The magnitude of impacts is not necessarily clear at this phase and the impacts will be studied in detail in the EIA Study.

Aquatic Ecology: The issue of aquatic ecology caused by the implementation of the Mater Plan will be the following:

- Habitat disturbance of aquatic biota at construction stage; and

- Modification of aquatic biota at the operation and maintenance stage.

These impacts will be caused by the Dinh Binh reservoir development, quarry site development, river improvement, and irrigation system development. The magnitude of these impacts is thought to be significant because most of the project components are supposed to cause strong modification of river area and its environment although some of them are not clear at this phase. Therefore, this issue will be studied in detail in the EIA Study.

Ecology of Thi Nai Swamp: The impacts on the ecology of Thi Nai Swamp caused by the implementation of the Master Plan will be the following:

- Discharge of turbid water into the swamp;
- Modification of river flow regime and discharge into the swamp; and
- Possibility of the change of nutrient condition in the swamp.

The first impact of the three will occur only at the construction stage of river improvement work, and is not thought to be significant, for the period of the construction work executed at river channels near the swamp, or estuary, is confined within a limited period. This is because the further the distance between the river improvement work site and the swamp become, the less the impacts of turbid water discharge affect on the ecology of the swamp, for the suspended solids deposit as the river water runs. On the other hand, the magnitude of the impacts of the latter two is not clear at this phase. Accordingly, the impact will be studied in detail in the EIA Study at the next phase.

Protected Area: There is one nature reserve: Kong Cha Rang. The nature reserve is located in the uppermost area of the Kone river basin and the area is far enough from the area of the Binh Dinh reservoir and from the site for the other project components. Therefore, it is thought that the implementation of the project will bring about no impacts on Kong Cha Rang nature reserve.

3.3 Conceivable Impacts on Social Environment

In the following, the conceivable impacts with negative direction are discussed, and overall environmental examination including positive impacts is enumerated in Table I.4.

Land acquisition and resettlement: The land acquisition and resettlement is considered to be unavoidable due to the implementation of the following components:

- Dinh Binh reservoir,
- Quarry,
- River improvement,
- Irrigation system, and
- Domestic/industrial water plant, and

- Water supply plan.

The latter two components of the six are not expected to bring about significant magnitude of impacts of land acquisition and resettlement, then these are not to be studied in EIA stage.

On the other hand, the components of the first, third, and fourth of the six will cause the major impacts on land acquisition and resettlement including set-back type shifting. Whereas the magnitude of impact due to the second component is not clear. Therefore, the impacts caused by these four components are to be studied in the EIA study.

Ethnic minority: The Bana group inhabits the upstream area of the Kone river basin, and their living space includes the planned reservoir area of Dinh Binh dam. Dinh Binh reservoir development will oblige them to be resettled, and would bring about the change of their life style or social status. Thus, the impacts on ethnic minority are to be studied in the EIA study.

Change or split of communities: Dinh Binh reservoir development will cause the change of the communities i) within the planned reservoir area, and ii) within the recipient communities of relocatees from the reservoir area. Thus, this impact is to be studied in the EIA study.

Fishery in Thi Nai swamp: The impact factors on the fishery activities in Thi Nai swamp accompanied by the implementation of the Master Plan will be the following:

- Discharge of turbid water into the swamp,
- Modification of river flow regime and discharge into the swamp, and
- Possibility of water discharge polluted by agro-chemical residue.

The first impact of the three will occur only at the construction stage of river improvement work. This impact is not thought to be significant, since the period of construction work at river channel near the swamp or estuaries is limited. Therefore, this impact will not be studied in the next EIA stage.

On the other hand, the magnitude of the impacts of the latter two is not clear, thus these two impacts will be studied in the next EIA stage.

Transportation system including fluvial navigation: The conceivable impacts on fluvial navigation would be caused by i) appearance of obstacles such as dam and weir, and ii) construction work within the river channels of dam, weir, and river improvement. However, the fluvial navigation does not play an important role in the Kone river basin due to the poor condition, and impacts on navigation can be mitigated by the other transportation means such as roads even if disturbance would occur.

Regarding the land transportation, the replacement of the existing roads and railway is

expected due to the reservoir development and river improvement. Although the inconvenience by the replacement work is expected, it will be confined only within the construction stage. And, the regional/local condition and system of land transportation will not be changed from those before the replacement. Moreover, a specific factor such as increment of generated/concentrated traffic volume is not expected which would induce the traffic impediment after the completion of the projects.

Accordingly, the impact is not to be studied in the EIA study.

Cultural/historical heritage: There is a possibility of the impact on the cultural/historical heritage due to the river improvement components, since many heritages designated by State are located in the delta area of the Kone river. However, the magnitude of the impact is not clear. Thus this issue is to be studied in the EIA stage.

Landscape: The impacts on the landscape due to the implementation of the Master Plan will be caused mainly by the construction works which will change the topographic condition. The expected construction works are ones concerning i) Dinh Binh dam, ii) quarry, iii) river improvement, iv) irrigation system, v) domestic/industrial water plant, and vi) water supply system. Among these, the scales of the construction work of ii), v), and vi) will be limited to the local areas, then the impacts on landscape are thought to be small. Regarding iv), although the work volume such as main canal would be somewhat large, the linear type project will not concentrate the topographic change in the confined area. Therefore, the impacts on the landscape due to ii), iv), v) and vi) are not to be studied in EIA stage.

On the other hand, the topographic changes due to the construction work of i) and iii) are expected to be large, thus, the impacts on landscape due to these two components is to be studied in EIA stage.

Health, sanitation, and construction waste: The impacts on health, sanitation and construction waste by the implementation of the Master Plan will be the following:

- Probable deterioration of health/sanitary condition due to the labor force mobilization during construction stage,
- Increment of potential risk of water-borne diseases near Dinh Binh reservoir area, and
- Generation of construction waste due to the Dinh Binh dam and quarry.

The possibility of deterioration of health/sanitary condition at the construction sites can be mitigated by giving basic education and primary aid to the labors, and by equipping the temporarily sanitary devices on the camp sites.

According to the officials of Department of Health of Binh Dinh province, there are no records of increment of the outpatients of water-borne diseases such as malaria or dengue induced by the reservoir development in the Kone river basin. Thus the potential risk of

water-borne diseases is considered to be insignificant.

The construction waste generated through the dam construction is estimated at 0.4~0.5 million m^3, according to the Feasibility Study on Dinh Binh reservoir (HEC-1, 2000), and this volume is not considered to be huge. Moreover, the safety of spoil bank can be ensured by adequate management such as drain installation and compacting.

Therefore, the impact on health, sanitation and construction waste will be insignificant or mitigatable, and it is not to be studied further in EIA stage.

3.4 Scoping and Selection of Items Necessary for EIA

Based on the results of the examination of the conceivable impacts caused by the implementation of the Master Plan, the following is a summary of the scoping, showing the environmental elements and issues to be studied in the EIA Study at phase 2-3 and basic policy of the examination of the environmental impacts.

Impacts on Physical environment:

Environmental Element	Issue to be studied	IEE result		Basic policy of examination
		Stage	Magni -tude	
Topography	Possibility of slope failure.	C	?O/Δ	Examination based on the geologic condition, design of the planned structure and earthwork.
	Change of bed load condition due to regulation of discharge.	O/M	?O/Δ	Examination based on plan of discharge regulation and similar existing cases.
	Modification of topographic feature of rivers.	C	-/O	Examination based on dimension and design of river improvement.
	Sedimentation in backwater section in Dinh Binh reservoir	O/M	?O/Δ	Examination based on current water quality and runoff discharge of Kone river
	Sedimentation of eroded materials from quarry site in downstream area.	O/M	?O/Δ	Examination based on planned mitigation measurement.
Geology	Possibility of soil erosion	C	?O/Δ	Examination based on soil condition, design of the planned structure and earthwork
	Possibility of inducement of earthquake	O/M	?O/Δ	Examination based on results of existing study on similar cases.
	Possibility of disturbance of mining	O/M	?O/Δ	Examination based on the area and condition of existing mining and design of reservoir area and quarry site.
Groundwater	Change of groundwater level	C & O/M	?O/Δ	Examination based on water level of existing groundwater and design of earthwork and planned structure.
	Possibility of groundwater contamination by agricultural input	O/M	?O/Δ	Examination based on cultivation pattern and volume of agrochemicals usage.
Water Quality	Turbid/alkaline water flow	C	-/O	Examination based on planned civil works and planned mitigation measurement.
	Possibility of eutrophication in Dinh Binh reservoir	O/M	?O/Δ	Examination based on similar cases of existing reservoir.
	Possibility of water pollution in rivers	O/M	?O/Δ	Examination based on the plan of river maintenance flow.

Remark O: Negative major impact is conceivable.
Δ: Negative minor impact is conceivable.
? O/Δ: Magnitude of impact is not clear.
P: Pre-construction stage, C: Construction stage, OM: Operation and Maintenance stage.

Impacts on Ecological Environment:

Environmental Element	Issue to be studied	IEE result		Basic policy of examination
		Stage	Magni -tude	
Terrestrial Ecology	Impacts on plants community and habitat disturbance of terrestrial fauna.	C	?O/Δ	Examination based on planned civil works of Dinh Binh dam, quarry site development and existing terrestrial flora and fauna.
	Modification of plants community and habitat disturbance of terrestrial fauna.	O/M	?O/Δ	Examination based on dimension and design of Dinh Binh dam, and existing terrestrial flora and fauna.
Aquatic Ecology	Habitat disturbance of aquatic flora and fauna.	C	-/O	Examination based on planned civil works of Dinh Binh dam, quarry site development, river improvement and Van Phong weir, and existing aquatic flora and fauna.
	Modification of habitat of aquatic flora and fauna.	O/M	? O/Δ	Examination based on dimension and design of Dinh Binh dam, river improvement and Van Phong weir, and existing aquatic flora and fauna.
	Possibility of impacts on aquatic fauna by agricultural input	O/M	? O/Δ	Examination on cultivation pattern and volume of agrochemicals usage.
Ecology of Thi Nai Swamp	Change of nutrient condition of the swamp and consequent impacts on flora and fauna	O/M	? O/Δ	Examination based on planned regulation of water discharge and maintenance flow, and existing flora and fauna in the swamp.
	Possibility of water pollution by agriculture input	O/M	? O/Δ	Examination on cultivation pattern and volume of agrochemicals usage.

Remark O: Negative major impact is conceivable.
Δ: Negative minor impact is conceivable.
?O/Δ: Magnitude of impact is not clear.
P: Pre-construction stage, C: Construction stage, OM: Operation and Maintenance stage.

Impacts on Social Environment

Environmental element	Issues to be studied	IEE result		Basic policy of examination
		Stage	Magni-tude	
Land acquisition and resettlement	Nos. of HHs, property and land affected by Dinh Binh reservoir.	P	O	Examination based on the condition of residential and cultivated area, design of the project.
	Nos. of HHs, property and land affected by quarry.	P	? O/Δ	- ditto -
	Nos. of HHs, property and land affected by river improvement.	P	O	- ditto -
	Nos. of HHs, property and land affected by irrigation system.	P	O	- ditto -
Ethnic minority	Change of social condition and life style of Bana group due to Dinh Binh reservoir.	P	O	Examination based on the current social/living condition of Bana, planned mitigation measures, and similar cases.
Change or split of communities	Possibility of change of the communities condition in Dinh Binh reservoir area and recipient area of relocatees.	P	O	Examination based on the current social/living condition of related communities, planned mitigation measures, and similar cases.
Fishery in Thi Nai swamp	Possibility of damage to fishery due to modification of river flow regime by reservoir, river improvement, irrigation system.	OM	?O/Δ	Examination based on the current fishery status in the swamp, planned regulation of water discharge and maintenance flow, and examination result of ecology of swamp.
	Possibility of damage to fishery due to water inflow polluted by agro-chemicals.	OM	?O/Δ	Examination based on planned farming pattern, agro-chemical usage, and examination result of ecology of swamp.
Cultural/historical heritage	Possibility of damage to heritage due to river improvement.	C	?O/Δ	Examination based on the existing distribution of heritage in delta area, and design of the project.
Landscape	Change of landscape due to Dinh Binh reservoir.	C	O	Examination based on scale of construction work (i.e. topographic change), and design of the project.
	Change of landscape due to river improvement.	C	O	Examination based on scale of construction work (i.e. topographic change), and design of the project.

Remark O: Negative major impact is conceivable.
Δ: Negative minor impact is conceivable.
? O/Δ: Magnitude of impact is not clear.
P: Pre-construction stage, C: Construction stage, OM: Operation and Maintenance stage.

Table I.1 Summarized Description of Master Plan and Screening

Major Components	Type		Outline of Features		Screening
	New	Improv. /Rehab.	Scale, etc.	Characteristic	
a. Dinh Binh Multipurpose Reservoir					
a-1 Dinh Binh reservoir development	O		309 MCM (Gross of SWL)	Active storage of 293 MCM, reservoir area of approx. 17 km^2 at FWL of EL 98 m, Dam Crest of EL about 100 m, Concrete gravity type.	to be evaluated
a-2 Quarry site development	O		1.4 MCM	Rock, sand, and soil exploitation as concrete materials.	to be evaluated
b. Agricultural Development Plan					
b-1 Irrigation system dev. incl. Van Phong weir and drainage plan	O	O	54,500 ha	Van Phong irrigation system with installation of weir of concrete fixed type, Vinh Thanh, Ha Thanh, and La Tinh iriigation system develop., Improv./rehabili./develop. of functional facilities, Inclusion of develop. of small-scale reservoir and pond schemes.	to be evaluated
b-2 Agricultural input		O	approx. 2 times increase	Usage of agro-chemicals and fertilizer in line with irrigation system development.	to be evaluated
c. Domestic and Industrial Water Supply Plan					
c-1 Domestic/industrial water plant	O		348thou. m^3/day	Development of urban/rural domestic and industrial water supply plant.	to be evaluated
c-2 Water supply system	O		(ditto)	Development of distribution system of domestic/industrial water.	to be evaluated
d. Flood Control and Bank Erosion Protection Plan					
d-1 River improvement	O	O	Approx. 90 km (figured on Dap Da, Tan An, and Go Cham)	Improv./rehabili. of existing flood control system of the delta area, widening of cross section at the stretches near estuaries of Dap Da, Tan An, and Go Cham rivers. Dredging of Nam Yang and Cay My rivers. Heightening of sea dyke.	to be evaluated
e. Rural Development Plan					
e-1. Rural roads development	O	O	Basinwide	Rural road improvement by concrete paved	screen out
e-2. Rural electrification	O	O	Basinwide	Access to the national grid or other sources	screen out
e-3. Rural water supply	O	O	Basinwide	Access to fresh water	screen out
f. Water Resources Management Plan					
f-1. Water use management plan	O	O	Basinwide	Development of system for proper water distribution, monitoring, etc.	screen out
f-2. Flood control management plan	O	O	Basinwide	Development of flood warning and communication system, watershed management, etc.	screen out
f-3. River environment management plan	O	O	Basinwide	Development or improvement of monitoring system for water quality of rivers and reservoirs, etc.	screen out
f-4. Management plan on operation and maintenance	O	O	Basinwide	Development of integrated operation system of dam group, ets.	screen out
f-5. Administrative management plan		O	Basinwide	Establishment of water management committee, etc.	screen out

Table I.2 Description on the Components Screened Out from IEE

Components [1/]	Description of Basis to be Screened Out
e. Rural Development Plan	
e-1. Rural roads development	- The purpose of the plan is to improve the inter-communal or communal roads for local use. - The concrete pavement is proposed with 3 m wide. - Traffic volume passing through the rural roads will be small. - The environmental impact by the above is expected to be negligibly small.
e-2. Rural electrification e-3. Rural water supply	- The purposes of these plans are to improve of accessibility to electricity and safe water in rural areas. - No environmental impact by the above is expected.
f. Water Resources Management Plan	
f-1. Water use management plan f-2. Flood control management plan f-3. River environment management plan f-4. Management plan on operation and maintenance f-5. Administrative management plan	- These plans mainly consist of soft components. - No environmental impact by the above programs/activities is expected.

1/: Components screened out in Table I.1.

Table I.3 Conceivable Impacts of Master Plan Components on Natural Environment

Impact Factors/Activities	Stages*	Conceivable Impacts	Impact Magnitude**
(1) Dinh Binh Reservoir development	P	No negative impacts	×
	C	Possibility of slope failure/soil erosion during dam construction	?○/△
		Air pollution from construction machinery and transportation vehicles	-/△
		Turbid/alkaline water flow from construction site to downstream area	-/○
		Noise form construction machinery and transportation vehicles	-/△
		Clearance of forest vegetation	-/△
		Impacts on plants community and habitat disturbance of terrestrial fauna	?○/△
		Habitat disturbance of aquatic flora and fauna	-/○
	O/M	Change of bed load condition caused by regulation of discharge	?○/△
		Sedimentation in the backwater section in Dinh Binh reservoir	?○/△
		Possibility of inducement of earthquake	?○/△
		Possibility of disturbance of mining activity	?○/△
		Change of groundwater level around reservoir	?○/△
		Possibility of eutrophication in Dinh Binh reservoir	?○/△
		Submergence of forest vegetation	-/△
		Modification of plants community and of habitat of terrestrial fauna	?○/△
		Modification of habitat of aquatic flora and fauna	?○/△
		Possibility of change of nutrient condition in Thi Nai Swamp	?○/△
(2) Quarry	P	No negative impacts	×
	C	Possibility of slope failure/soil erosion around quarry sites	?○/△
		Dust generation from quarry sites	-/△
		Turbid water flow from quarry sites to downstream area	?○/△
		Noise form machinery at quarry site and transportation vehicles	-/△
		Vegetation clearance on quarry site	?○/△
		Modification of plants community and of habitat of terrestrial fauna	?○/△
		Modification of habitat of aquatic flora and fauna	?○/△
	O/M	Possibility of slope failure/soil erosion during dam construction	?○/△
		Sedimentation of eroded material in downstream area	?○/△
(3) River Improvement	P	No negative impacts	×
	C	Modification of river topographic feature of rivers	-/○
		Possibility of change of groundwater level along river channel	?○/△
		Air pollution from construction machinery and transportation vehicles	-/△
		Turbid/alkaline water flow from river improvement works sites	-/○
		Noise form construction machinery and transportation vehicles	-/△
		Clearance of forest vegetation	-/△
		Habitat disturbance of aquatic flora and fauna	-/○
		Discharge of turbid water into Thi Nai Swamp	-/△
	O/M	Possibility of change of groundwater level	?○/△
		Modification of habitat of aquatic flora and fauna	?○/△
		Modification of river flow regime and discharge into Thi Nai Swamp	?○/△
(4) Irrigation system development	P	No negative impacts	×
	C	Possibility of slope failure along Van Phon irrigation weir	?○/△
		Air pollution from construction machinery and transportation vehicles	-/△
		Turbid water flow from construction site to downstream area	-/○
		Noise form construction machinery and transportation vehicles	-/△
		Possibility of forest vegetation clearance	-/△
		Habitat disturbance of terrestrial fauna	-/△
		Habitat disturbance of aquatic flora and fauna	-/○
	O/M	Change of groundwater level around irrigation weir	?○/△
		Possibility of water pollution in river where irrigation water is acquired	?○/△
		Modification of habitat of aquatic flora and fauna around irrigation weir	?○/△
		Modification of river flow regime and discharge into Thi Nai Swamp	?○/△
(5) Agriculture input	P	No negative impacts	×
	C	No negative impacts	×
	O/M	Possibility of groundwater contamination with agrochemicals	?○/△
		Possibility of air pollution with agrochemicals	-/△
		Possibility of water pollution in rivers/ponds with agrochemicals	?○/△
		Possibility of impacts on aquatic fauna by water pollution	?○/△
		Possibility of impacts on aquatic fauna by water pollution	?○/△
(6) Domestic/industrial water plant construction	P	No negative impacts	×
	C	No negative impacts	×
	O/M	No negative impacts	×
(7) Water supply system development	P	No negative impacts	×
	C	No negative impacts	×
	O/M	No negative impacts	×

* P: Pre-construction stage, C: Construction stage, O/M: Operation and Maintenance stage

** (+/○) Major positive impact, (+/△) Minor positive impact, (-/△) Minor negative impact, (-/○) Major negative impact), (×) Minimal impact or negligible impact, (?○/△) Not clear, +- Whether positive or negative depends on design of structures.

Table I.4 Conceivable Impacts of Master Plan Components on Social Environment

Impact Factors/Activities	Stages*	Conceivable Impacts	Impact Magnitude**
(1) Dinh Binh Reservoir development	P	Land acquisition and resettlement at dam site and in reservoir area	-/○
		Change of social condition and life style of ethnic minority	-/○
		Change of existing communities in reservoir area and resettled area	-/○
	C	Inducement of change of economic activities of local residents	+-/○
		Disturbance of fluvial navigation by dam structure	-/△
		Change of landscape due to topographic change	-/○
		Probable deterioration of health/sanitary condition by labor force mobilization	-/△
		Generation of construction waste such as excavated soil/rock	-/△
	O/M	Inducement of fishery activity using reservoir area	+/○
		Possibility of change of fishery condition in Thi Nai swamp by flow regime modification	?○/△
		Disturbance of fluvial navigation by dam structure	-/△
		Change of landscape due to appearance of reservoir	+-/○
		Potential risk increment of water-borne diseases near new water body	-/△
(2) Quarry	P	Possibility of land acquisition and resettlement	?○/△
	C	Inducement of change of economic activities of local residents	+-/○
		Change of landscape due to topographic change by earth work	-/△
		Probable deterioration of health/sanitary condition by labor force mobilization	-/△
		Generation of construction waste such as excavated soil/rock	-/△
	O/M	No negative impacts	×
(3) River Improvement	P	Land acquisition and resettlement due to dyke installation	-/○
	C	Inducement of change of economic activities of local residents	+-/○
		Discharge of turbid water into fishing/aquaculture zone of Thi Nai Swamp	-/△
		Disturbance of fluvial navigation by construction work	-/△
		Possibility of damage on historical/cultural heritage by dyke installation	?○/△
		Change of landscape due to change of river topography	-/○
		Probable deterioration of health/sanitary condition by labor force mobilization	-/△
	O/M	Enhancement of economic activities induced by flood control	+/○
		Possibility of change of fishery condition in Thi Nai swamp by flow regime modification	?○/△
		Change of condition of fluvial navigation	+-/△
(4) Irrigation system development	P	Land acquisition and resettlement due to canal/weir installation	-/○
	C	Inducement of change of economic activities of local residents	+-/○
		Disturbance of fluvial navigation by weir	-/△
		Change of landscape due to topographic change	-/△
		Probable deterioration of health/sanitary condition by labor force mobilization	-/△
	O/M	Enhancement of economic activities induced by increment of agriculture production	+/○
		Possibility of change of fishery condition in Thi Nai swamp by flow regime modification	?○/△
		Disturbance of fluvial navigation by weir	-/△
(5) Agriculture input	P	No negative impacts	×
	C	No negative impacts	×
	O/M	Possibility of impacts on fishery condition in Thi Nai swamp by water pollution	?○/△
		Potential risk increment of health hazard by agro-chemical use	-/△
(6) Domestic/industrial water plant	P	Land acquisition and resettlement due to plant installation	-/△
	C	Change of landscape due to topographic change	-/△
	O/M	Enhancement of economic activities induced by industrial water supply	+/○
		Improvement of health/sanitary condition by domestic water supply	+/○
(7) Water supply system development	P	Land acquisition and resettlement due to supply system installation	-/△
	C	Change of landscape due to topographic change	-/△
	O/M	Enhancement of economic activities induced by industrial water supply	+/○
		Improvement of health/sanitary condition by domestic water supply	+/○

* P: Pre-construction stage, C: Construction stage, O/M: Operation and Maintenance stage

** (+/○) Major positive impact, (+/△) Minor positive impact, (-/△) Minor negative impact, (-/○) Major negative impact
(×) No or negligible impact, (?○/△) Not clear, +- Neutral; Whether positive or negative depends on design of structures

Table I.5 Result of IEE and Scoping

Components (*1)	Environmental Evaluation (*2)																				
	Dinh Binh Reservoir			Quarry			River Improvement			Irrigation System (*4)			Agriculture Input			Domestic/industrial Water Plant			Water Supply System		
Environmental Elements (*3)	P	C	OM	P	C	OM	P	C	OM	P	C	OM	P	C	OM	P	C	OM	P	C	OM
I. NATURAL ENVIRONMENT																					
I-1. Physical Environment																					
Topography including sedimentation	X	?O/Δ	? O/Δ	X	? O/Δ	? O/Δ	X	-/O	X	X	? O/Δ	X	X	X	X	X	X	X	X	X	X
Geology incl. mineral and soil	X	? O/Δ	? O/Δ	X	? O/Δ	? O/Δ	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Groundwater	X	? O/Δ	? O/Δ	X	X	X	X	? O/Δ	? O/Δ	X	X	? O/Δ	X	X	? O/Δ	X	X	X	X	X	X
Air quality	X	-/Δ	X	X	-/Δ	X	X	-/Δ	X	X	-/Δ	X	X	X	-/Δ	X	X	X	X	X	X
Water quality including eutrophication	X	-/O	? O/Δ	X	? O/Δ	X	X	-/O	X	X	-/O	? O/Δ	X	X	? O/Δ	X	X	X	X	X	X
Noise and vibration	X	-/Δ	X	X	-/Δ	X	X	-/Δ	X	X	-/Δ	X	X	X	X	X	X	X	X	X	X
I-2. Ecological Environment																					
Forest and vegetation	X	-/Δ	-/Δ	X	-/Δ	X	X	-/Δ	X	X	-/Δ	X	X	X	X	X	X	X	X	X	X
Terrestrial ecology	X	? O/Δ	? O/Δ	X	? O/Δ	X	X	X	X	X	-/Δ	X	X	X	X	X	X	X	X	X	X
Aquatic ecology	X	-/O	? O/Δ	X	? O/Δ	X	X	-/O	? O/Δ	X	-/O	? O/Δ	X	X	? O/Δ	X	X	X	X	X	X
Ecology of Thi Nai swamp	X	X	? O/Δ	X	X	X	X	-/Δ	? O/Δ	X	X	? O/Δ	X	X	? O/Δ	X	X	X	X	X	X
Protected area	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
II. SOCIAL ENVIRONMENT																					
Land acquisition and resettlement	-/O	X	X	? O/Δ	X	X	-/O	X	X	-/O	X	X	X	X	X	-/Δ	X	X	-/Δ	X	X
Ethnic minority	-/O	-/O	-/O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Change or split of communities	-/O	-/O	-/O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Economic activities including inland fishery	X	+-/O	+/O	X	+-/O	X	X	+-/O	+/O	X	+-/O	+/O	X	X	X	X	X	+/O	X	X	+/O
Fishery in Thi Nai swamp	X	X	? O/Δ	X	X	X	X	-/Δ	? O/Δ	X	X	? O/Δ	X	X	? O/Δ	X	X	X	X	X	X
Transportation system including fluvial navigation	X	-/Δ	-/Δ	X	X	X	X	-/Δ	+-/Δ	X	-/Δ	-/Δ	X	X	X	X	X	X	X	X	X
Cultural/historical heritage	X	X	X	X	X	X	X	? O/Δ	X	X	X	X	X	X	X	X	X	X	X	X	X
Landscape	X	-/O	+-/O	X	-/Δ	X	X	-/O	X	X	-/Δ	X	X	X	X	X	-/Δ	X	X	-/Δ	X
Health, sanitation, and construction waste	X	-/Δ	-/Δ	X	-/Δ	X	X	-/Δ	X	X	-/Δ	X	X	X	-/Δ	X	X	+/O	X	X	+/O

Remarks

(*1): Major components of the Master Plan to be examined.

(*2): Each applicable item is marked with the following classifications.

+/O: First part before "/" shows the direction of impacts and last part after "/" shows the magnitude of impacts.

O: Major Δ: Minor X: None or negligibly small ?O/Δ: Not Clear

+: Positive -: Negative +-: Neutral/Whether positive or negative depends on design of structures

(*3): Environmental Elements were selected based on JICA Environmental Consideration Guideline.

(*4): "Irrigation System" includes Van Phong weir development.

P: Pre-construction stage C: Construction stage OM: Operation and Maintenance stage